

# A Unified National Program for Flood Plain Management

United States Water Resources Council  
2120 L Street, N.W.  
Washington, D.C. 20037

July, 1976



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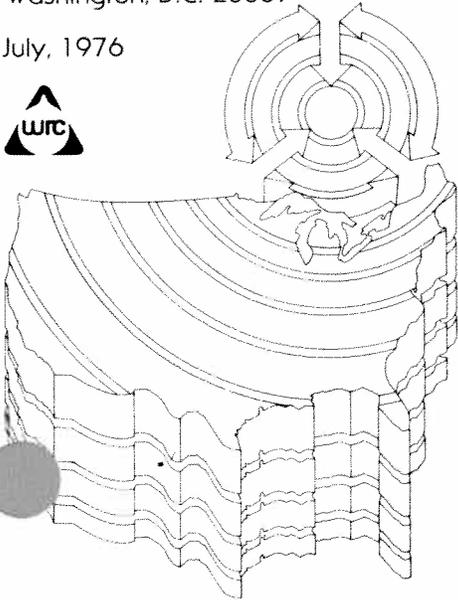
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# UNITED STATES WATER RESOURCES COUNCIL

SUITE 800 • 2120 L STREET, N.W. WASHINGTON, D.C. 20037

JUL - 8 1976

Dear Mr. President:

In response to Section 1302(c) of the National Flood Insurance Act of 1968 (P. L. 90-448), I am pleased to commend to you for transmission to the Congress the report "A Unified National Program for Flood Plain Management." The report sets forth a conceptual framework and recommends Federal and State actions for a continuing unified program of planning and action at all levels of government to reduce flood losses through flood plain management. The report has benefited from the advice and suggestions of the Standing State Advisory Committee to the Water Resources Council and recognized authorities in the field of flood plain management. The Council has approved the report and adopted its recommendations.

Recommendations for cost sharing are not addressed in this report since they have been considered in the recently completed report transmitted to you pursuant to Section 80(c), the Water Resources Development Act of 1974 (P. L. 93-251).

In addition, I am pleased to commend to you a revision of Executive Order 11296--Flood Hazard Evaluation, updating the original Executive order to reflect recent legislation and to implement "A Unified National Program for Flood Plain Management" at the Federal level.

Respectfully,

Thomas S. Kleppe  
Chairman

The President  
The White House  
Washington, D. C. 20500

Enclosures

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MEMBERS: SECRETARIES OF INTERIOR, AGRICULTURE, ARMY, COMMERCE, HOUSING AND URBAN DEVELOPMENT, TRANSPORTATION; ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY; CHAIRMAN, FEDERAL POWER COMMISSION - OBSERVERS: ATTORNEY GENERAL; DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET; CHAIRMEN, NATIONAL COMMISSION ON ENVIRONMENTAL QUALITY, TENNESSEE VALLEY AUTHORITY, RIVER BASIN COMMISSIONS, BASIN INTERAGENCY COMMITTEES.

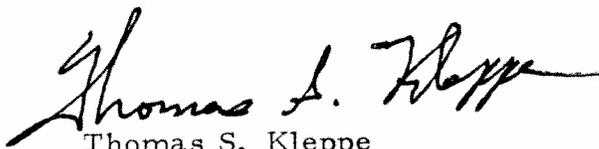


## FOREWORD

A growing public awareness that our Nation's natural resources are limited has spurred recent legislative strides providing new tools for management of our natural resources and especially the flood plain lands and the associated problem of flood losses. However, these new tools have not yet become fully effective, largely because they have not been harnessed into a coordinated effort. The time is at hand to emphasize coordinating and strengthening of existing programs rather than new legislative proposals for flood plain management.

I believe that this report will mark a major stride toward achieving the difficult goal of unified flood plain management. A conceptual framework is provided to guide Federal, State, and local decisionmakers toward a balanced consideration of alternative goals, strategies, and tools. Recommendations for improving and coordinating flood plain management within each level of government and between levels of government should draw specific programs into a comprehensive, integrated effort. The Nation should realize greater satisfaction in the utilization of flood plain lands and a reduction in losses caused by the ravages of floods.

I support the approach in this report calling for cooperative flood plain management action on a partnership basis with Federal assistance, State responsibility, and local management. I believe that the Federal Government should lead by example in implementing the recommendations of this document.



Thomas S. Kleppe  
Chairman

## PREFACE

Section 1302(c) of the National Flood Insurance Act of 1968 (Public Law 90-448, 82 Stat. 476) stipulated that "the objectives of a flood insurance program should be integrally related to a unified national program for flood plain management and . . . the President should transmit to the Congress for its consideration any further proposals necessary for such a unified program, including proposals for the allocation of costs among beneficiaries of flood protection." Subsequently, the Director, Office of Management and Budget, requested that the Council prepare the recommendations suggested by Section 1302(c). This report contains the Council's findings and recommendations.

Building upon existing studies and the recommendations of the Flood Damage Reduction Panel of the 1975 National Conference on Water, this report seeks wise decisions and management of the Nation's flood plains to reduce flood losses. A conceptual framework is set forth to provide guidance for the decision-making process of Federal, State, and local officials. Strategies and tools for flood loss mitigation are presented in detail. Actions are recommended to facilitate the coordination of management programs dispersed among all levels of government. Cost sharing recommendations have not been addressed herein because they are considered in the recently completed report to the President pursuant to Section 80(c), the Water Resources Development Act of 1974 (P. L. 93-251). Recommendations for new Federal legislation were deemed inappropriate in view of the conclusion that emphasis should be placed upon strengthening implementation of the management tools available through existing legislation.

For their contributions to this report, we are indebted to a large number of public officials, private consultants, and agency staff members. Although these persons are too numerous to mention, this report would not exist without their individual constructive and dedicated efforts.



Warren D. Fairchild  
Director

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## CHAPTER I

### DIGEST AND RECOMMENDATIONS

Background. Responding to the magnitude and continued rise of the Nation's annual flood losses, the Congress has enacted legislation providing new tools to cope with flood risk and has called for "A Unified National Program for Flood Plain Management" (P.L. 90-448, Section 1302). Replying to the Congressional directive, this report (1) sets forth a conceptual framework for flood plain management, (2) identifies available management strategies and tools for reducing flood losses to an acceptable level, (3) assesses the implementation capability of existing Federal and State agencies and programs, and (4) makes recommendations for achieving "A Unified National Program for Flood Plain Management."

Conceptual Framework. The conceptual framework (Chapter III) contains general and working principles that relate riverine, coastal, and other flood plains with the (1) total natural system of which they are a part, (2) total social system of which they are a part, (3) potential for flood losses associated with their uses, and (4) legal program responsibilities of each level of government. The conceptual framework is developed from and based on accepted, broad national objectives for water and related land resource planning. It recognizes that wise use of the Nation's flood plains must be attended by (1) consistent and explicit concern for flood loss reduction, (2) a balanced view that in general seeks neither abandonment of flood plains nor their full development, and (3) careful consideration of all relevant factors and the weighing of all reasonable alternatives. The conceptual framework fills a void previously hindering consistent articulation of programs functioning at all levels of government.

Management Strategies and Tools. The means and tools (Chapter IV) for flood loss reduction are organized around three strategies directed at modifying (1) susceptibility to flood damage, (2) the impacts of flooding, and (3) flooding itself. Each of the means is comprised of a wide variety of tools that

range from land acquisition, land use and development regulations, and floodproofing to flood control works. Each of these tools is evaluated to assist in appropriate selection of the means to mitigate flood losses while achieving the desired management goals. The array of tools and means available is deemed generally adequate for an effective unified national program for flood plain management.

Implementation. Assessment of the institutional framework (Chapter VI) for implementing a unified program recognizes the primary initiating role of local government but focuses upon Federal and State regulatory and supportive roles concluding that many of the necessary facets of a framework exist and have been functioning at all levels of government, but not in a coordinated manner. Effective implementation of a unified national program requires of all levels of government (1) a renewed commitment to existing policies that contribute to a unified national program for flood plain management, (2) appropriate rearrangement of priorities in existing organizational and operational policies, and (3) a continuous coordination effort.

Recommendations. The recommendations which follow are directed toward recognition and acceptance of the conceptual framework at all levels of government and should provide the basis for achieving the institutional coordination necessary for carrying through a unified national program for flood plain management.

Serious and immediate consideration should be given to the following action recommendations by decisionmakers at and in the appropriate levels and branches of government. Success in effectuating Federal level recommendations depends upon followup by all Federal agencies, but responsibility falls most heavily upon those with extensive programs affecting utilization of the flood plain, especially the Departments of Agriculture, Army, Commerce, Housing and Urban Development, Interior, and Transportation, the Environmental Protection Agency, the Federal Power Commission, the Tennessee Valley Authority, and the Water Resources Council. Lead responsibility or action required is directed to one or more of the agencies named or to

a proposed interagency Flood Plain Management Technical Committee under the auspices of the Water Resources Council. Success in effectuating State level recommendations depends upon followup by each State acting within its own legal and institutional frameworks. Appropriate cooperation and support from the concerned Federal agencies are also important.

A. Federal Level Recommendations

Actions are required to establish coordination at the national level for flood plain management activities, specifically for research, data collection, and information dissemination; strengthening of management tools; and support of State programs. (Pertinent pages are noted in parenthesis.)

1. Establish a Flood Plain Management Technical Committee (VI-15) under the auspices of the Water Resources Council to:
  - a. Coordinate flood plain management programs to facilitate communication and encourage consistency among Federal programs. (VI-5)
  - b. Provide continuing evaluation of flood plain management activities with periodic reporting to the public and to the Congress on progress toward implementation of "A Unified National Program for Flood Plain Management." (VI-8)
  - c. Establish a mechanism whereby State officials can report periodically on the status of flood plain management programs and the use of Federal resources in their programs. (VI-7, 8)
  - d. Establish a mechanism for a periodic (as necessary) national conference/workshop of Federal, State, local, and regional officials for the purpose of fostering coordination of flood plain management activities. (VI-11)
  - e. Publish a flood plain management handbook describing in detail the available Federal programs for use by State and local officials in implementing the conceptual framework for a unified national program. (VI-10)

- f. Assess the need for and identify the level of detail for flood plain data relating to the interrelationship land, water and related resources, and environmental values. (VI-10)
  - g. Develop and promote standards for the collection, analysis, and reporting of experienced flood loss data and projected flood loss data. (VI-10)
  - h. Provide overall assistance and guidance for State program development and liaison with the responsible State flood plain management offices. (VI-4)
2. Accelerate flood plain and hazard studies and dissemination of information to State and local users through:
- a. Coordination of community flood insurance studies. RESPONSIBILITY - Federal Insurance Administration. (V-7, VI-8, 9)
  - b. Flood plain information and hazard studies. RESPONSIBILITY - Corps of Engineers, U.S. Geological Survey, National Oceanic and Atmospheric Administration, Soil Conservation Service, and Tennessee Valley Authority. (V-9)
  - c. Flood plain management and assistance programs. RESPONSIBILITY - Corps of Engineers, Soil Conservation Service, and Tennessee Valley Authority. (VI-9)
  - d. Provision and interpretation of detailed soil survey data to assist in tentative identification of flood-prone areas and in planning appropriate uses of flood plains, especially in rural areas. RESPONSIBILITY - Soil Conservation Service. (VI-9)
3. Standardize the techniques for collection and analyses of hydrologic data, especially regionalizing streamflow characteristics so that recorded data may be applied at ungauged sites. RESPONSIBILITY - Water Resources Council - Hydrology Committee. (VI-10, 11)

4. Improve the flood forecasting system to include--but not be limited to--real-time data collection, forecast preparation and dissemination, and public education in the use of the system's products. RESPONSIBILITY - The National Oceanic and Atmospheric Administration should take the lead. (IV-9, 13, VI-9, 10)
5. Increase social research on flood plain occupancy, hazard perception and response consonant with an earlier recommendation in House Document 465. RESPONSIBILITY - The Office of Water Research and Technology should take the lead. (V-5, VI-12)
6. Centralize flood plain data sources at the State level. RESPONSIBILITY - The Federal Insurance Administration and the U.S. Geological Survey should take the lead. (VI-10)
7. Revise Executive Order 11296 -- Flood Hazard Evaluation - to formalize the relationship to the National Flood Insurance Program. RESPONSIBILITY - The Water Resources Council should take the lead. (VI-2)
8. Assure that all programs for water, land, and related resources be in harmony with the precepts of "A Unified National Program for Flood Plain Management" as enunciated in this report. RESPONSIBILITY - All Federal agencies. (VI-2, 4)
9. Require appropriate flood plain management programs and regulations or control measures as a prerequisite to Federal expenditures for the modification of flooding or the impact of flooding. RESPONSIBILITY - All Federal agencies. (IV-10, VI-8)
10. Support cost sharing policies that facilitate achievement of a desirable mix of structural and nonstructural approaches to flood hazard adjustment. RESPONSIBILITY - All Federal agencies. (V-8, 9, VI-13)

11. Provide support activities to States as they exercise their primary role in flood plain management. RESPONSIBILITY - All Federal agencies.
  - a. Provide basic information and interpretative analysis for use by State and local agencies and their programs as available. (VI-4)
  - b. Furnish support for improving programs and capabilities to implement them at the State level as authorized by statute. (VI-4)
  - c. Work through the State in dealing with local entities to assure consistent administration of flood plain management activities. (VI-4)

B. State Level Recommendations

1. Enact enabling legislation specifically addressing flood plain management programs and regulation in those States where such legislation does not exist or is inadequate for the purpose. (VI-7, 16)
2. Establish or designate a single State agency (or another effective mechanism of coordination) to assure responsibility for flood plain management and to issue State standards as flood plain management guides for State agencies and local entities. (VI-6)
  - a. Maintain liaison with a designated Federal coordinating body. See Federal Recommendation A-1-h. (VI-4, 6)
  - b. Establish a program that would annually assess coordination and the establishment of priorities and budgets related to flood plain management. See Federal Recommendations A-1-c and A-1-h. (VI-7)
  - c. Maintain an assessment of the status of local flood plain regulation. See Federal Recommendation A-9. (VI-7)

3. Develop an information program to supplement Federal efforts to inform the public and local decisionmakers about flood hazards and flood plain management.
    - a. Establish a centralized flood plain data source. See Federal Recommendation A-6. (VI-10)
    - b. Publish a flood plain management document to supplement the proposed Federal handbook by describing in detail State programs and regulations for use by local officials in implementing "A Unified National Program for Flood Plain Management." See Federal Recommendation A-1-e. (VI-10)
  4. Improve management tools by applying the concepts of Federal Executive Order 11296 (Flood Hazard Evaluation, or its successor order) to all State agencies and programs. (VI-7)
  5. Support regional, substate and local entities in implementing their flood plain management activities.
    - a. Provide information, technical assistance, and financial support for improving management activities. (VI-6)
    - b. Develop review procedures to evaluate proposed changes in local flood plain management regulations and ordinances. (V-6)
- C. Federal-Interstate Compact Commission Recommendations
1. Coordinate and support State and Federal programs for flood plain management. (VI-5)

## CHAPTER II

### BACKGROUND AND SETTING

With the advent of the Bicentennial the United States stands at the threshold of a unique opportunity for realizing a unified national program for flood plain management. The stage for this opportunity was set a decade earlier in the perceptive, seminal findings and recommendations of A Unified National Program for Managing Flood Losses, House Document 465. <sup>1/</sup> Subsequent legislative actions and programs have set in place at the various levels of government the array of tools necessary to meet not only the challenge of rising flood losses but also the embracing need for sound flood plain management. Realization of the unprecedented opportunity at hand is contingent upon the statement and implementation of a conceptual framework articulating the separate responsibilities and programs of the Federal, State, local, and intermediary levels of government. The conceptual framework and recommendations contained herein are directed at this objective.

- Flood plain management is concerned with the future role of the flood plain as an integral part of a community and of a total river, shore, or coastal system. The list of flood plain uses and hence management purposes is long, including provision for recreation, fish and wildlife habitat, navigation, municipal and industrial water supply, to name a few, and it is marked by frequent incompatibility. However, with each use, flood losses are an ever present consideration as are the consequences of adjustment to these losses. Thus, the focus of flood plain management is a wise choice among uses competing for a limited number of locations, many of which are subject to serious harm from flooding and for which the consequences of various adjustments to flooding must be anticipated.

<sup>1/</sup> Task Force on Federal Flood Control Policy. A Unified National Program for Managing Flood Losses, House Document 465, 89th Congress, 2nd Session, U. S. Government Printing Office, Washington, D. C., 1966.

Although coastal and riverine flood plains include only about 7 percent of the Nation's total area, they are indicative of a widespread natural hazard affecting an estimated 22,000 communities. Flood plains have been and continue to be under pressure for change to more intensive uses, and today they contain a disproportionate amount of the urbanized land in many parts of the country. Pressure to intensify flood plain use is increasing as accessible undedveloped lands near urban areas are becoming less abundant. At the same time, the value of flood plains as an environmental resource is being increasingly recognized.

The present state of flood plain development derives from the period in which expediency was the norm. Flood losses have been a conscious concern only during and shortly after a flood experience. The normal reaction to flood loss has been to attempt to control or modify the flood and hence to continue to favor decisions based on expediency. However, the public has become increasingly concerned about flood plain development decisions, the rising exposure to flood losses, and the resultant public costs of some of these decisions. These costs have several facets: those measured as flood losses and the costs of protective works and disaster relief; those assessed as threats to life and health; those associated with a loss of the unique environment that flood plains provide. Conversely, there may be an economic cost from not utilizing flood plains to produce income.

It was the concern for rising flood losses that focused national attention on flood plain management through the publication of House Document 465. This document emphasized the fact that flood damage continues to grow having exceeded \$1 billion yearly, even though over \$7 billion had been spent for flood control works during the previous 30-year period. The customary sequence of events generally continues to be (1) flooding, (2) flood losses, (3) disaster relief, (4) flood control projects attempting to modify the flood potential through provisions for storing, accelerating, blocking, or diverting flood waters, (5) renewed encroachment onto the flood plain, (6) flooding, (7) flood losses, (8) disaster relief, (9) more projects,

(10) more encroachment, etc. Although the construction of dams, levees, and channel projects has saved many lives and prevented billions of dollars of damage, protective works alone can not keep pace with the increasing flood losses.

In his letter of August 10, 1966, transmitting House Document 465, the President said that we can and must reduce flood losses. He also stated: "The key to the problem lies, above all else, in the intelligent planning for the State and local regulation of use of lands exposed to flood hazard." Noting that the Nation would continue to support established programs for essential flood control works, the President said that "[+] o hold the Nation's toll of flood losses in check and to promote wise use of its valley lands requires new and imaginative action" (emphasis added). At the same time, the President issued Executive Order 11296 - Flood Hazard Evaluation, directing Federal agencies to evaluate flood hazards prior to funding new construction or the purchase or disposal of lands.

In the following decade, significant new Federal legislation affected the role of State and local governments in flood plain management. Federally subsidized flood insurance was made available in return for community exercise of flood plain regulation. Funds were made available for flood disaster preparedness planning. Federal planning, technical assistance and construction grants were made available to States in return for areawide waste treatment facility planning; and financial assistance was made available for defining and enforcing permissible land and water uses in the coastal zone. A Federal permit system was utilized to monitor more closely dredge and fill activity, which often affects flood plains. Federal cost sharing was extended in principle to "non-structural" measures directed primarily at flood loss reduction. Water resource planning principles and standards moved toward a more consistent evaluation of federally funded management measures. The requirement of environmental impact statements forced consideration and public display of alternative plans affecting flood plain use. In net effect, State and local governments were urged to exercise their flood plain

management prerogatives with new Federal incentives, regulatory tools, and a comprehensive management philosophy.

The philosophy of flood plain management has matured to include explicit recognition that conditions at one flood plain location are generally interdependent with locations and events elsewhere in the river or coastal system, and in the total community of which the flood plain is a part. Thus multiple purpose management has replaced single-purpose management, even though flood losses and threats to life and health remain top priority concerns. Evaluation of alternative flood loss reduction strategies has replaced a predisposition to rely unquestionably upon physical structures for flood protection. Consideration of alternative intensities of flood plain utilization has replaced automatic assumptions that all flood plains should be developed to their highest intensity or that flood loss reduction is the only public concern. Current philosophy of flood plain management indicates a need for a unified program which embodies the balanced evaluation of alternative purposes, management strategies, and intensities of utilization and is consistently sensitive to flood hazard and the need to work toward keeping flood losses at an acceptable level.

For all practical purposes, the public interest in flood plain management is the same as for other land and water resource planning. It includes concern for (1) economic efficiency, (2) environmental quality, (3) individual safety, peace of mind and social well-being in general, and (4) economic and environmental health of regions and localities. No one of these concerns has an inherent priority over any other, and achieving the optimum level for even two simultaneously is highly improbable. Preliminary management plans in this context may in fact be alternatives, some emphasizing one concern while others respond to various combinations of two or more concerns. The time frame--near future or long-range--for flood plain management and the need for flexibility are also important to a program's composition and achievement. A balance should be sought.

In a practical sense, decisionmakers should test the likely consequences of certain actions and assess their findings in terms of the stated concerns. The assessment should not be confined to the flood plain but should encompass a larger area which will provide a basis for evaluating the actions to be taken in the flood plain. Because the flood hazard has three aspects--flooding, susceptibility to flooding, and the impact of flooding on the individual and community--the hazard can best be reduced by modifying each aspect to the extent feasible. Possible adjustments to flood hazards range from a wholly non-structural program to almost complete flood control. Both extremes are unusual and neither is necessarily desirable. A more effective approach is to balance a combination of strategies to meet the problems of a particular situation.

Implementation of a unified national program for flood plain management depends on successfully meeting several problems. The more serious problems are (1) Fragmented and uncoordinated responsibility for flood plain management. This leads to lack of consistency among public programs designed to meet flood problems within and between areas and those nonflood related plans designed to meet the other needs of the areas. This fragmentation also contributes to inadequately conceived measures to solve flood problems; adverse effects are produced; resources that the public values are destroyed; and costs are generated that are as undesirable as the damages that they attempt to relieve. (2) Over reliance upon public investment to solve all problems. There has been a growing national tendency to seek solutions to individual problems in the flood plain through public investment without other actions. This trend has developed from an overreliance upon the Flood Control Act of 1936 and subsequent legislation. Emphasis must be placed upon recognizing the appropriate responsibility of all levels of government and of individuals concerned. (3) Inability to resolve conflicts of private property rights with State and national interests. This tends to prevent implementation of even judicious land use regulations enacted in the public interest. Procedures must be developed to emphasize the balance between the public interest and private property rights.

"A Unified National Program for Flood Plain Management" calls for continuing efforts that seek to reduce and keep flood losses at acceptable levels while recognizing flood plain values through wise use of water, land, and related resources. The program includes planning, research, education, legislation, regulation, administration, construction, and operation and maintenance activities. In the following chapters, the conceptual framework of a unified national program is presented and a system described in which the program can operate.

## CHAPTER III

### CONCEPTUAL FRAMEWORK FOR FLOOD PLAIN MANAGEMENT

This chapter presents a conceptual framework within which public and private flood plain policies should be formulated if a unified national program of flood plain management is to be implemented. This basic framework provides decision-makers with a management perspective that encourages a comprehensive assessment of alternative flood plain uses. Moreover, recognition should foster the judicious selection and application of the many available tools to promote harmonious flood plain use.

The conceptual framework consists of both general and working principles. Aspects of these principles may overlap, reflecting the complex web of interdependencies among land, water, atmosphere, and man's activities both off and on flood plains.

#### A. General Principles

1. The Federal Government has a fundamental interest in how the Nation's riverine, coastal and other flood plains are managed, but the basic responsibility for regulating flood plains generally lies with the State and local governments.
2. The flood plain, a definite area of interrelated water and land, must be considered in the context of total community, regional, and national planning and management.
3. Flood loss reduction is commonly viewed as an objective in itself. Flood losses must be reduced to and kept within acceptable levels. However, flood loss reduction must be viewed in the larger context of flood plain management, which includes other aspects of economic efficiency, environmental quality, and the quality of life, notably health and safety.

4. Sound flood plain management embodies:

- a. The goals of wise use, conservation, development, and utilization of interrelated land and water resources to serve objectives of economic efficiency, environmental quality, and social well-being as consonant with responsibilities assigned to respective levels of government by law.
- b. Future needs and the role of the flood plain in the context of both the physical and socioeconomic systems of which it is a part. An image of the expected and desired future is prerequisite to appropriate selection of implementing means and tools.
- c. All alternative strategies for alleviating flood losses evaluated individually and in combination for modifying (1) the characteristics of flooding, (2) the susceptibility of people and their property to flood damage, and (3) consequences of flooding for the individual, the community, and the Nation.
- d. Accounting for (1) public and private, economic, social, and environmental benefits and costs, and (2) inter-related impacts that are likely to result from actions taken both within and outside the jurisdiction of local governmental units--for example, hydrologic land-water, environment, technological, economic, legal, and social impacts.
- e. Motivation of decisionmaking individuals, through use of positive and negative incentives, using such management tools as insurance and tax rates, grants withheld, cost sharing ratios, and standards for manmade or altered improvements to prevent increasing a flood hazard.

- f. Coordination of (1) agency programs at and among all levels of government, (2) agencies charged with regulation (monitoring the actions of public and private decisionmakers for conformance with prescribed standards) and those charged with planning (evaluation and selection among alternative courses of action within the context of goals and priorities), (3) agencies charged with different functional areas of flood plain management such as water quality and water supply, (4) agencies charged with predisaster and postdisaster responsibilities, and (5) agency program elements for citizen participation.
- g. Evaluation of the flood plain management effort through a continuous program of monitoring and periodic reporting to the public.

## B. Working Principles

### 1. Definitions

- a. Flood plains are areas adjoining a river, stream, watercourse, ocean or lake, or other body of standing water that have been or may be covered by floodwater.
- b. Flood hazard is the potential for inundation and involves the risk to life and/or damage to property.
- c. Flood evaluation includes such factors as flood area and depth, velocities and pressures, rates of rise and duration, seasonality and probability of occurrence, and probable load of debris and pollutants.
- d. Serious flood conditions as a planning base are usually identified with a so-called "100-year flood" -- which means the flood with the 1 percent chance of being equalled or exceeded in a given year. The adoption

of such a standard helps to assure a degree of uniformity in program guidelines. However, planning must recognize that severe loss is possible from larger floods of less frequency and that serious loss is still possible from floods of greater frequency. Determining factors include onsite considerations such as valley shape, level of development, and purpose of planning.

- e. Flood disaster assistance includes developing comprehensive preparedness and assistance plans, program capabilities, and organization of State and local governments to alleviate the impacts of disastrous floods. It may include maximum hazard reduction, avoidance and mitigation measures, as well as plans for assistance to individuals, businesses, and State and local governments following such disasters.

## 2. General Statements

- a. Complete control of floods is practically never realized -- residual flooding will almost always remain a threat.
- b. A variety of means, including regulatory tools adopted at national, State and/or local levels, is needed to reduce flood losses and serve other aspects of flood plain management. (See Chapter IV.)
- c. Priorities for implementing alternative actions must consider the immediate and long-run problems of developed and undeveloped flood plains in urbanized as well as rural areas.
- d. Existing and new development should be treated differently. Appropriate modification of the flood hazard should be considered for much of the existing development, whereas additional development and new uses should be carefully regulated to assure the harmonious development of flood plains consistent with the hazards present.

- e. Flood characteristics are likely to change as development and land use changes take place in the watershed either on or away from the flood plain. Actions taken in a flood plain area can affect flood characteristics in other areas; conversely, actions taken outside the area can affect flood characteristics in an area.
- f. Flooding on developed flood plains produces economic losses not only in the properties inundated but also in areas serving, served by, or reached through a given flood plain.
- g. Flooding constitutes a threat to life, health, property and peace of mind that should be considered in planning flood plain use.
- h. An acceptable degree of hazard differs with type of use. Selected uses are or can be made harmonious with certain flood characteristics.
- i. Capital and operating costs of flood plain management programs ought to be shared equitably among the beneficiaries with a minimum of shifting costs from the individual to the public and from local and State to Federal agencies.
- j. Aesthetic and other intangible attributes of flood plains have important social and economic values.
- k. Wildlife habitats and open areas in undeveloped and partially developed flood plains constitute an important environmental resource which is becoming increasingly scarce. Opportunities should be considered to improve, protect and preserve such natural amenities whenever practical.

1. Flood-prone riverine and tidal areas with high velocity flows and/or wave action present special problems which require more restrictive regulation, especially regarding construction, than those appropriate for other flood plains.
  
- m. Water quality constitutes an important environmental attribute. All actions affecting flood plains should be evaluated for possible effects on water quality.

## CHAPTER IV

### STRATEGIES AND TOOLS FOR ACHIEVING FLOOD LOSS REDUCTION

At a period when the Nation is particularly aware of allocating scarce resources among urgently competing needs, public and private decisions affecting flood plains must give explicit consideration to the hazards for life and property. Flood hazard problems must be evaluated in the context of all alternative strategies. This may be achieved by application of the following approaches singly or in combinations (1) modifying the susceptibility to flood damage and disruption, (2) modifying the floods themselves, and (3) modifying the flood impact on the individual and the community.

However, the obligation to evaluate flood hazards fully must not be permitted to obscure the necessity to give environmental values of flood plains the full consideration. If contemporary flood plain managers overlook environmental values, they may be judged deficient, as were their predecessors for being strongly predisposed toward flood control measures.

Because the land and water resources of the flood plain and the flood related problems and needs are highly varied, different strategies must be used to achieve desired objectives in different settings. Within these strategies are a large variety of options or "tools" for producing desired uses or changes in uses of the flood plain. Each situation is different, but the basic objectives of flood plain management cannot be realized without also achieving an acceptable level of direct or indirect impacts of flood losses on the individual and the community. In almost every community, some combination of strategies and tools is required to achieve the desired management objectives.

Although these strategies and associated tools for flood plain management may be used to guide public and private decision-makers, there is a prerequisite and perhaps less obvious challenge to understand the overall area needs and goals in

identifying the likely role of the flood plain. It requires formulation of assumptions about the future development of the area and region. It also requires sensitivity to impacts beyond the immediate consequences of an action. For example, flood-modifying works frequently fail to account for indirect social costs and environmental values destroyed; both represent costs passed on to the public. Appropriate selection from the following strategies and tools is predicated on these understandings.

#### A. Modify Susceptibility to Flood Damage and Disruption

This strategy is expressed as actions to avoid dangerous, uneconomic, undesirable, or unwise use of the flood plain. Implementation of the strategy to modify the susceptibility to flood damage rests largely with the non-Federal sector. Included are restrictions in the mode and the time of day and/or season of occupancy; in the ways and means of access; in the pattern, density, and elevation of structures and in the character of their materials (structural strength, absorptiveness, solubility, corrodibility); in the shape and type of buildings and in their contents; and in the appurtenant facilities and landscaping of the grounds. Changes may also pertain to interdependencies between flood plains and the surrounding areas not subject to flooding, especially regarding utilities and commerce.

Implementing tools include land use regulations, development and redevelopment policies, floodproofing, disaster preparedness and response plans, and flood forecasting and warning. Some of these tools are more suitable to developed flood plains and others to undeveloped flood plains; some are more suitable to urban than to rural areas. Because the use and awareness of these tools have been rather limited in the past, they are emphasized here.

##### 1. Flood Plain Regulations

Flood plain regulations are efficient tools for modifying future susceptibility to damage on flood plains that are not fully developed. By providing direction to growth and change, they

are particularly well-suited to preventing the costly decisions that have been all too characteristic of flood plain occupancy. Land use regulation requires individuals to recognize the general welfare when making decisions. Because extensive legal treatment of flood plain regulations and their adoption is given in three recent studies, 1/ only the essential ideas are presented here. A combination of regulatory tools is necessary to control the development in flood plains and regulatory tools are frequently utilized in combination with other techniques.

Land use regulations can be applied effectively only by State and community action; they are increasingly required under ongoing Federal programs as a prerequisite to other assistance. In reality, flood plain regulations are only another aspect of the policy power already broadly employed. The costs to the community of delineating the area to be regulated and of administering workable regulations are characteristically small in relation to the flood damage problem. Administration of flood plain regulations adds only a small increment where other ordinances are already being administered. To some degree, individual opportunity foregone is a cost of all police power actions. The net economic cost, i. e., reflecting externality costs, of reducing the intensity of use may be large or small. This cost depends on the availability of alternatives to a flood plain location. Regulations must be based on suitable data and must be equitably applied and should permit reasonable use of the land (not necessarily highest economic return). Nonconforming uses can be handled by recognition in the ordinance, by amortization provisions that lead to removal over a predetermined period, or by purchase.

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1/ Water Resources Council, Regulation of Flood Hazard Areas, Vols. 1 and 2, 1972-73; Federal Insurance Administration, "Statutory Land Use Control Enabling Authority in the Fifty States" (Mimeo), 1975; and Corps of Engineers, "Flood Plain Regulations for Flood Plain Management," 1976.

The regulatory aspects of flood plain management programs are sensitive to political pressures for change in favor of individuals, but they can be effective when equitably reinforced at all governmental levels. Several types of police power regulation are in use at some State or local levels to regulate land uses in flood hazard areas. A brief discussion of these tools follows.

a. State Regulations for Flood Hazard Areas

A variety of State level regulations for land use in flood hazard areas have been enacted. (Also see pages VI-7, 8.) In some States general legislation establishes flood plain regulatory programs which provide the basic framework of guidelines and provisions for local implementation. Under these programs States provide advice, assistance, and model ordinance provisions which may be incorporated into local regulations compatible with statewide objectives and standards. Generally, State programs require a permit from a technically staffed State agency for specified proposed uses that would interfere with the channel or flood plain capacity for passing a flood.

For these regulations, floodway or encroachment line standards are most significant. Many State boards of health regulate the use of private and public waste disposal systems. Some health boards prohibit private systems in areas subject to high ground water or flooding. Flood plain management, wetland management, and coastal zone management often have common objectives and reinforce each other.

b. Local Regulations for Flood Hazard Areas

The principal local control of flood hazard areas is through zoning, subdivision regulations, building and housing codes, and sanitary codes with specific flood hazard provisions.

(1) Zoning divides a government unit into specified areas for the purpose of regulating (a) the use of structures and land, (b) the height and bulk of structures, and (c) the size of lots and density of use. Because the regulations differ from local entity to entity, zoning may be used to set special standards

for land uses in flood hazard areas including specification of minimum floor elevations. Flood plain zoning may be single district, two-district, or multi-district, but single and two-district are the most common (i. e., "floodway" and "flood fringe").

Administration of ordinances that recognize encroachment lines and/or a floodway is simplified in that among proposed uses, only specified open space uses are permitted within the encroachment and/or floodway unless an exception has been granted. These ordinances also may provide for amortization and attrition of existing nonconforming uses in the floodway. Because floodways are the channel and adjacent portion of the flood plain, they are high hazard areas and are an important consideration in riverine areas. Generally, the floodway limits are designed so that the few permissible encroachments will not cause a prescribed maximum increase in stage for a specific frequency flood (usually the 100-year flood) at any location along the stream. The permissible maximum increase is often one foot but in some locations zero increase is permitted. For the flood fringe areas (the flood plain outside the floodway), ordinances generally require provisions for floodproofing, typically that first floors be at least as high as the design flood or regulatory flood level (usually at or above the 100-year flood).

Although the floodway as such does not apply in coastal areas, there is a parallel for high hazard coastal and lakeshore areas where the major forces of tides and waves come into play and where the erosional changes are at a maximum during flooding.

(2) Subdivision regulations guide the division of large parcels of land into smaller lots for the purpose of sale or building. Often the community's jurisdiction is extended beyond its boundaries by subdivision-enabling legislation. This extension provides coverage usually unavailable through zoning.

Subdivision regulations guide the process of land division to assure that lots are suitable for intended use without putting a

disproportionate burden on the community. They also control improvements such as roads, sewers, water, and recreation areas. Subdivision regulations with special reference to flood hazard often require (a) installation of adequate drainage facilities, (b) showing the location of flood hazard areas on the plat; (c) encroachment zoning on flood plain areas; (d) "determination of the most appropriate means of elevating a building above the regulatory flood height in accord with sound engineering practice," and (e) placement of streets and public utilities relative to selected flood protection elevation.

(3) Building codes regulate neither the location nor the type of development; rather, they control certain aspects of building design, materials, and construction materials. Building codes can reduce flood damages to structures by setting specifications to (a) prevent flotation of buildings by suitable anchorage, (b) establish minimum regulatory flood levels, (c) require electrical outlets and equipment to be above regulatory flood levels or to be appropriately floodproofed, (d) restrict use of materials that deteriorate when wetted, and (e) require an adequate structural design, one that can safely withstand the effects of water pressure and flood velocities. General floodproofing requirements (as performance standards) are sometimes included in flood plain zoning ordinances rather than in building codes. On the other hand, codes may be used to prevent flood damage to below-ground spaces in areas beyond the regulatory area but still within the zone of sewer backup and flood-elevated groundwater.

(4) Housing codes, like building codes, set minimum standards for construction, but they also set minimum standards for maintenance of structures. These may be used to require repair of flood-damaged structures in a manner that will ensure the safety of occupants and prevent blight.

(5) Sanitary and well codes establish minimum standards for waste disposal and water supply. Sanitary codes commonly prohibit onsite waste disposal facilities such as septic tank systems in areas of high groundwater and flood hazards. Sometimes elevation or floodproofing requirements are

established for public sewer systems. Well codes often establish special floodproofing requirements for facilities located in flood hazard areas.

(6) Other regulatory tools are available to reduce flood losses and promote sound management of flood-prone lands. Special statutes might require that sellers or real estate brokers disclose flood hazards on marketed lands. For example, the HUD program for Interstate Land Sales Registration now requires that natural hazards be included in the statement filed with HUD and that such information be made available to the purchaser or potential purchasers. Official maps might be more widely used to reduce land acquisition costs by designating areas where structural development is planned for reservoirs, dikes, levees, parks, or other public uses.

## 2. Development and Redevelopment Policies

Other public actions not necessarily employing the police power can modify susceptibility to flood damage and guide development in a manner that takes account of the flood hazard and the natural characteristics of the flood plain. Such actions may be applied at the local, State, and Federal levels through the design and location of utilities and services, through policies of open space acquisition and easement, and through redevelopment or permanent evacuation. These measures are normally required in any viable community, but in this context they should reflect the flood hazard.

a. Design and Location of Services and Utilities reduce flood loss potentials by guiding private and public developments (hence public services and utilities) to nonflood or low risk areas. Local governments can exercise discretion in extending roads or sewer and water mains into flood hazard areas. Locating public facilities such as libraries, schools, post offices, and other government buildings away from the flood hazard area not only lessens the possibility of flood damages to such buildings but prevents them from otherwise encouraging private development in areas prone to flooding.

b. Land Rights Acquisition and Open Space Use lessen the potential for flood losses and their consequences. Land is purchased directly, or control is purchased through easements or development rights, for the purpose of precluding future uses incompatible with flood management programs. In the short run, acquisition may be a costly substitute for regulation but the best tool in certain circumstances; for example, the total social and economic cost of residential development usually is prohibitive in areas subject to the 10-year flood. If the purchase is for a specific nonflood-related purpose, such as for public use areas, acquisition is the only approach. In some situations, easements are being used to continue agricultural use of the land. Regulations cannot be used to change ownership from private to public.

c. Redevelopment and Renewal offer tools for improving flood plain areas blighted for reasons that may or may not include exposure to flooding. Usually the motives for renewal are broader than just flood damage reduction, and the principles of flood plain management can be employed to good effect in the process. Disaster assistance, urban renewal, economic development, and new communities as well as flood insurance support should be coordinated in such situations. The opportunities for and justification of renewal should not be overlooked. They may help to achieve at least some of the objectives by eliminating economic inefficiency and by creating improved environment.

d. Permanent Evacuation, like renewal, of which it may in fact be part, is likely to be less common than other tools except perhaps for small, isolated sectors of nonconforming uses. To the extent permitted by statute, Federal agencies should provide encouragement for relocation from floodways and perilous flood-prone areas, leaving such areas for open space uses. It is important that the opportunities that do exist are not overlooked. In some instances, permanent evacuation of flood plain areas may be the only economically feasible alternative. At a minimum, this tool provides a means of evaluating the options for using other tools.

### 3. Disaster Preparedness and Response Planning

Preparedness plans provide for disaster mitigation, warning, emergency operations, rehabilitation, and recovery. Activities included are training, postdisaster evaluations, review and coordination of Federal, State, and local disaster preparedness programs, and research. Success of this planning is closely associated with the degree to which individuals, States, and local governments protect themselves by obtaining insurance coverage to supplement or replace government assistance. Recovery planning includes long-range as well as immediate recovery programs. Such plans usually involve the designation by the mayor or county executive of a coordinating officer to work with State and Federal program officials.

### 4. Floodproofing

Floodproofing can provide for development in lower risk flood plain areas by keeping damage within acceptable limits. It can be chosen by an individual, a community, or State or Federal agency for existing structures and/or new construction.

Floodproofing consists of modifications of structures, their sites, and building contents to keep water out or reduce effects of water entry. Such adjustments can be installed when buildings are under construction or during remodeling or expansion of existing structures. Floodproofing may be permanent (e. g., bricked-in openings) or it may be contingent on some action at the time of flood. To meet National Flood Insurance Program criteria, floodproofing of structures should protect against the "100-year flood." The adjustment may be by elevation (fill or open work such as piling), by appropriately constructed ring dikes or their equivalent, or by waterproofing (closure, seals, pumps, valves or pipes, etc.), or other measures.

Like other methods of adjusting to floods, floodproofing has limitations. It can generate a false sense of security, and residual losses may be very high. A primary purpose of floodproofing structures is to reduce property losses and to provide for early return to normalcy after floods have receded

rather than for continued occupancy. Only very substantial and self-contained structures should be occupied during a flood. Unless correctly used, floodproofing can increase unwise use of flood plains. Applied to structurally unsound buildings, it can result in more damage than would occur without floodproofing. The application of economic criteria is more likely to justify floodproofing for commercial structures than for residential structures. Usually it is applied to individual structures, but unless it is also applied to means of access, it is only partially effective. Access ways should be passable at least in floods up to the magnitude used in setting floodproofing elevations. Floodproofing should never protect some property owners while aggravating the hazard for others.

#### 5. Flood Forecasting and Warning Systems and Emergency Plans

Flood forecast systems have been established for the major river systems in the United States. These systems provide information on the time of occurrence and magnitude of flooding to be expected. On major rivers where the flood crest moves slowly, warnings are provided several days to a few weeks in advance of the event. For smaller tributaries, warning times decrease to a matter of a few hours and probably not more than a day or two at a maximum. On short headwater streams with steep channel gradients, flash flood warnings may be possible only a few hours or less in advance of the event. Community warning systems can be established for such conditions, but the short interval available for warning and response demands even tighter advance planning and preparedness than is required for areas with longer warning periods.

The effectiveness of flood warnings depends upon the effectiveness of their dissemination to the public, the time available, and the actions taken in response. At a minimum, local officials, police, fire and rescue squads, and radio and TV stations are notified. Warnings must be effectively presented. A previously developed plan for emergency action is essential.

As the length of the warning period decreases, the opportunity for emergency action diminishes accordingly. In many cases contingency and emergency floodproofing and the removal of goods and inhabitants are possible with sufficient warning, but flash floods may permit only the evacuation of inhabitants.

#### B. Modify Flooding

The traditional strategy of modifying floods through the construction of dams; dikes, levees, and floodwalls; channel alternations; high flow diversions and spillways, and land treatment measures has repeatedly demonstrated its effectiveness for protecting property and saving lives, and it will continue to be a strategy of flood plain management. However, in the future reliance solely upon a flood modification strategy is neither possible nor desirable. Although the large capital investment required by flood modifying tools has been provided largely by the Federal Government, sufficient funds from Federal sources have not been and are not likely to be available to meet all situations for which flood modifying measures would be both effective and economically feasible. Another consideration is that the costs of maintaining and operating flood control structures fall upon local governments except for major Federal reservoirs with flood control storage.

Flood modifications acting alone leave a residual flood loss potential and they can encourage an unwarranted sense of security leading to inappropriate use of lands in the areas that are directly protected and often in adjacent areas. For this reason, measures to modify possible floods should usually be accompanied by measures to modify the susceptibility to flood damage and particularly by land use regulations.

Flood modifying tools permit changes in the volume of runoff in the peak stage of the flood, in the time of rise and duration, in the extent of the area flooded, in the velocity and depth of flood waters, and consequently in the amount of debris and pollutants that floods carry.

## 1. Dams and Reservoirs

Storage of flood waters in reservoirs causes the broadest range of flood-modifying effects such as reduction in flood flow rate, extent of area flooded, timing, etc. Except in the area immediately downstream from the dam, however, storage may not provide as high a degree of relief from flood damage in specific areas as may be achieved by other more localized tools. Flood storage reservoirs may function alone, in groups, or with other tools. Release of water detained by dams may be at a fixed rate, or it may be varied to accommodate changing downstream conditions during a flood. Dams and reservoirs also have potential for wide multiple-purpose uses that more localized measures may not achieve. In some already well-developed valleys, storage provides the only significant means of reducing the flood damage potential for widespread areas short of removing the potential for damage from the flood plain.

In addition to the large areas of land that they occupy, reservoirs may also modify stream behavior and habitat in both beneficial and adverse ways. These facilities may reduce or contribute to downstream erosion, and sediment accumulation in the reservoir is sometimes a problem for long-term effectiveness. Currently there is no non-Federal cost sharing for flood protection on the major multipurpose reservoirs, which provide widespread flood reduction benefits.

## 2. Dikes, Levees, and Floodwalls

Dikes, levees, and floodwalls protect a portion of the flood plain from flooding, up to a design level. These works may have adverse as well as beneficial effects. They can increase the height of the flood immediately upstream from the wall, and they may increase problems across stream and downstream by reducing the availability of valley areas for overbank flood-water storage. Their appeal lies in their direct and specific results. Sometimes emergency dikes are built following a flood forecast; although they may be effective for the emergency, they should not be considered permanent measures.

Dikes, levees, and walls cannot feasibly be built high enough to prevent all levels of flooding, and the consequences of overtopping and failure may be grave. Dikes, levees, and walls may require expensive pumping facilities to handle the storm water collecting behind them. They can cut off river views and access and are not generally as adaptable to multiple-purpose uses as are reservoirs. Experience shows that levees often have to be increased in height if channel aggradation takes place or if originally planned upstream storage reservoirs are never built because of loss of the site to development or for lack of public support for their construction.

### 3. Channel Alterations

In some situations channel alterations may be the only feasible structural tool for reducing the area flooded. Because channel alterations accelerate the quantity and/or velocity of flow through an area, they may increase the flood impacts on downstream reaches. Enlarging a channel and shortening its course disturbs the stream regimen and in turn the existing ecology. To assure proper channel functioning, snagging and clearing operations may be necessary. Maintenance costs may be high unless the channel and stream banks are stable. Use of concrete or stone when necessary for stabilization increases construction costs and may be aesthetically undesirable in some locations.

### 4. High Flow Diversions and Spillways

High flow diversions typically redirect excess flows away from developed areas using natural or artificially constructed by-pass channels or conduits. Physical opportunities for application of flood flow diversions are limited. Where such measures can be employed, they may be least objectionable from an environmental standpoint if they minimize the destruction of the land-water interface in the natural channel. However, in some circumstances, such diversion may sharply alter downstream flow patterns and discharges, thereby producing unwanted environmental effects. Where communities are not adequately protected from flooding by diversion, additional measures may be required.

## 5. Land Treatment Measures

Land treatment measures modify floods by increasing infiltration rates and decreasing the runoff rate and volume. Measures include vegetative cover, runoff interceptors and diversions, small detention and erosion control structures, and terraces. They are effective in small headwater areas and function in combination with other measures to ameliorate flood conditions in larger watersheds. In most respects, land treatment measures produce changes in the broad range of flooding effects, although they become less effective as flood size increases. They can be especially important in reducing erosion and the resulting amount of sediment carried downstream.

## 6. On-Site Detention Measures

Whereas land treatment measures are appropriate primarily in non-urban areas, onsite detention measures provide temporary storage of urban runoff waters, extending the period of runoff with the intent of reducing flood peaks. These measures may take the form of earthen or paved holding areas integral to or adjacent to the site. A growing number of urban communities are including onsite detention requirements in land development ordinances. Effective implementation of these measures includes providing for continuous maintenance, determining the drainage area to be served by a single structure, and determining the effects of detention on the timing of runoff in different segments of the watershed.

### C. Modify the Impact of Flooding on Individuals and the Community

A third strategy for mitigating flood losses consists of actions designed to assist the individual and the community in the preparatory, survival, and recovery phases of floods. Tools include information dissemination and education, arrangements for spreading the costs of the loss over time, and purposeful transfer of some of the individual's loss to the

community. The distinction between a reasonable and unreasonable transfer of costs from the individual to the community, as described under Regulations, is a key to flood plain management.

#### 1. Information and Education

Flood hazard information is a prerequisite to sound flood plain management. The development of needed technical information and public education, especially of the officials and planners who will have the major task of interpreting and applying it, are essential in an effective flood plain management program. Although available in many forms and from many sources, unfortunately, information is neither of uniform quality nor available for all areas. Vital information includes the hydrology and hydraulics of small, large, and very large floods on the areas subject to inundation, on the flood plain's resource attributes, on the role of the flood plain within its region, and on the potential impact of land use decisions on flood potential. From this information, alternative approaches can be formulated by the responsible government and private decisionmakers. Better information on property at risk and probabilities of various levels of loss can help to translate the hazard into terms that stimulate appropriate local action. Federal, State, and local agencies, and private consultants are all providing this sort of information with major emphasis on the more technical aspects of hydrology and hydraulics provided by the Federal agencies.

#### 2. Flood Insurance

Insurance is a mechanism for spreading the cost of losses both over time and over a relatively large number of similarly exposed risks. Until 1969, insurance against flood loss was generally unavailable. Under the National Flood Insurance Program, initiated in 1968 and significantly expanded in 1973, the Government subsidizes flood insurance for existing property in the flood hazard area in return for enactment and enforcement of flood plain management regulations designed to reduce future flood losses and regulate new development in the designated flood hazard area. A consortium of private companies handles this insurance venture. Under the 1973

legislation, communities must become eligible under the program within one year after identification by the Federal Insurance Administration as having flood-prone areas or risk the denial of Federal financial assistance for buildings and mobile homes in areas identified as being flood prone. To become eligible for participation in the National Flood Insurance Program, communities must agree to adopt and enforce flood plain management regulation consistent with program criteria.

By emphasizing the long-run advantages of wise flood plain use and by providing a mechanism for widespread risk sharing, the National Flood Insurance Program provides persuasive strength and beneficial emphasis to flood plain management. The program presently subsidizes property owners whose location decisions were made before identification of the specific nature and extent of their flood hazard. Its flood plain management provisions should ultimately help reduce flood losses and the dependency upon public support and make continuation of its insurance features manageable through cooperating private insurers. Actuarially determined premium rates required for new buildings provide specific information to potential owners of flood-prone properties about the economic cost of locational decisions and thus serve to discourage unwise construction in hazardous flood plain areas. The success of the Flood Insurance Program ultimately depends upon the speed with which necessary detailed engineering analysis can be carried out to permit communities to be brought into the regular program.

### 3. Tax Adjustments

Tax adjustments at the Federal, State, or local level can play an important role both in influencing decisions about flood plain occupancy and in providing relief to individuals. Tax provisions can be used to encourage appropriate use and discourage inappropriate use. It is highly important that the tax structure recognize the regulatory aspects of the program so that the latter are reinforced, e. g., low density use achieved by regulations can be supported by low tax for such use. Amortization provisions can be applied to nonconforming uses.

Financial relief can be found in provisions for claiming losses in Federal and State income taxes and through special allowances on real estate taxes following a flood.

#### 4. Flood Emergency Measures

Preparation for floods and flood-fighting plans, including contingency and emergency floodproofing, can be completed in anticipation of flooding for areas where flood warning time would permit these actions. Temporary earthen dikes are an example of a successful measure. Flood fighting has been effective in helping communities to survive a flood. But opportunities for successful flood fighting are limited by flood characteristics, the physical nature of some flood problem areas, and the large manpower, supply, and equipment requirements. It should also be recognized that one of the functions of overall flood plain management is to reduce the need for this type of emergency action, which at best is stopgap.

#### 5. Postflood Recovery

Like other aspects of flood plain management, postflood recovery requires a plan. Public facilities and services are restored and aid given to individuals. Aid from public and quasipublic agencies is often in the form of donations of food and clothing or grants and loans (which may be counterproductive if used to rehabilitate damaged structures or property located in high hazard areas). Relief may also be in the form of tax adjustment. Although relief does not directly reduce flood losses, it does reduce the overall loss impact by shortening the period of disruption and by accelerating the return to normalcy. Under the provisions of Public Laws 93-234 (Flood Disaster Protection Act) and 93-288 (Disaster Relief Act of 1974) property owners in a flooded community may be required to purchase and maintain flood insurance as a condition for obtaining Federal financial assistance.

It is essential that plans for postflood recovery recognize opportunities to eliminate submarginal development and proceed with construction in a way that will minimize future flood exposure. Flood disaster and emergency response planning should consider both economic and social disruption and inflated of building costs which may result from a disaster of significant size.

## CHAPTER V

### HOUSE DOCUMENT 465 AND SUBSEQUENT PROGRESS

The purpose of this chapter is to review progress since the 1966 report of the Task Force on Federal Flood Control Policy was published as House Document 465.<sup>1/</sup> A brief summary of Federal flood plain management programs prior to 1966 is presented, followed by discussion of three landmark actions toward a coordinated approach - publication of House Document 465; passage of the National Flood Insurance Act, as amended, and associated legislation; and promulgation of the Water Resources Council's Principles and Standards for Planning Water and Related Land Resources.

#### A. Flood Control Programs prior to 1966

Congressional acceptance of Federal responsibility for flood control began in 1917 following major floods on the Mississippi River and subsequently expanded to nationwide scope and broadened to include hurricane flooding. Beginning with a series of "Flood Control Acts," the Corps of Engineers was assigned responsibility for flood control engineering works and later for flood plain information services. In the early 1930's, Congress created the Tennessee Valley Authority as a regional resource development agency, including flood control through the construction of dams and reservoirs among its duties. In the late 1930's, Congress expanded Bureau of Reclamation authority to build reservoirs for flood control purposes. In the 1940's, the Congress authorized the Department of Agriculture to construct 11 specific authorized projects for flood control, and in the 1950's a nationwide program was authorized for upstream watershed projects.

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<sup>1/</sup> Task Force on Federal Flood Control Policy. A Unified National Program for Managing Flood Losses, House Document 465, 89th Congress, 2nd Session, U. S. Government Printing Office, Washington, D. C., 1966.

Despite these programs and rapidly rising Federal expenditures for flood control, data indicated rapidly rising flood losses. Although the Tennessee Valley Authority had begun to combine zoning and subdivision regulations with engineering works in the 1950's and although the 1960 Flood Control Act authorized the Corps of Engineers to provide States and localities with information needed to regulate flood plain lands, Federal programs relied predominately on engineering works for modifying floods. Thus it was in its review of Federal programs that the Task Force on Federal Flood Control Policy urged a policy that emphasized modification of susceptibility to flooding and the impacts of flooding.

B. House Document 465 - The Foundation

The Presidential Task Force whose recommendations were reported in House Document 465, A Unified National Program for Managing Flood Losses, went a long way toward identifying problems and needs with regard to existing Federal programs and their impact at the State and local levels. The associated Executive Order 11296, issued in August 1966, directed that Federal agencies evaluate the flood hazard before funding construction of new buildings or purchase or disposal of lands. Because of these two documents, progress has been made in alleviating the hazards but other problems identified by the Task Force remain. Further, the Executive order has become dated by enactment of legislation such as the National Flood Insurance Act. These shortcomings were cited in the General Accounting Office report, "National Attempts To Reduce Losses From Floods By Planning For And Controlling The Uses Of Flood-Prone Lands," issued in March 1975.

The Task Force report suggested the need for new planning attitudes and a unified approach for flood plain management, but it stopped short of describing such a framework. Lack of a framework is judged at least partly responsible for the problems related to agency indecision and nonuniform Federal practices. Chapter III of this report attempts to lay out a conceptual framework. A summary of the findings and recommendations of House Document 465 is shown in Exhibit 1. Progress made on

I. SUMMARY OF FINDINGS AND RECOMMENDATIONS

The Nation needs a broader and more unified national program for managing flood losses. Flood protection has been immensely helpful in many parts of the country—and must be continued. Beyond this, additional tools and integrated policies are required to promote sound and economic development of the flood plains.

Despite substantial efforts, flood losses are mounting and uneconomic uses of the Nation's flood plains are inadvertently encouraged. The country is faced with a continuing sequence of losses, protection, and more losses. While flood protection of existing property should receive public support, supplemental measures should assure that future developments in the flood plains yield benefits in excess of their costs to the Nation. This would require a new set of initiatives by established Federal agencies with the aid of State agencies to stimulate and support sound planning at the local government and citizen level.

Statutory Federal policy dealing with cost sharing, land acquisition, and loan authority would need to be modified, but most of the measures would be taken by the Corps of Engineers, the Department of Agriculture, the Department of Housing and Urban Development, the Geological Survey, and the Environmental Science Services Administration under existing authority. Modest additional expenditures over the next 10 years and reorientation of Government effort would greatly reduce flood losses and demands for Federal relief.

The specific actions recommended by the task force may be summarized as follows:

*To improve basic knowledge about flood hazard*

1. A three-stage program of delimiting hazards should be initiated by the Corps of Engineers, the Geological Survey, and other competent agencies.

2. A uniform technique of determining flood frequency should be developed by a panel of the Water Resources Council.

3. A new national program for collecting more useful flood damage data should be launched by the interested agencies, including a continuing record and special appraisals in census years.

4. Research on flood plain occupancy and urban hydrology should be sponsored by the Department of Housing and Urban Development, the Department of Agriculture, and the Geological Survey.

*To coordinate and plan new developments on the flood plain*

5. The Federal Water Resources Council should specify criteria for using flood information and should encourage State agencies to deal with coordination of flood plain planning, and with flood plain regulation.

Category of  
Progress

B

A

C

(1)C

(2)B

B

Category of  
Progress

6. Under the following Federal programs steps should be taken to assure that State and local planning takes proper and consistent account of flood hazard:

B

- Federal mortgage insurance
- Comprehensive local planning assistance
- Urban transport planning
- Recreational open space and development planning
- Urban open space acquisition
- Urban renewal
- Sewer and water facilities

(Many of the necessary coordinating actions were accomplished during final preparation of this report.)

7. Action should be taken by the Office of Emergency Planning, the Small Business Administration, and the Treasury Department and other agencies to support consideration of relocation and floodproofing as alternatives to repetitive reconstruction.

B

8. An Executive order should be issued directing Federal agencies to consider flood hazard in locating new Federal installations and in disposing of Federal land.

A

*To provide technical services to managers of flood plain property*

9. Programs to collect, prepare, and disseminate information and to provide limited assistance and advice on alternate methods of reducing flood losses, including flood plain regulation and floodproofing, should be undertaken by the Corps of Engineers in close coordination with the Department of House and Urban Development, and the Department of Agriculture.

A

10. An improved national system for flood forecasting should be developed by the Environmental Science Services Administration as part of a disaster warning service.

B

*To move toward a practical national program for flood insurance*

11. A five-stage study of the feasibility of insurance under various conditions should be carried forward by the Department of Housing and Urban Development.

A

*To adjust Federal flood control policy to sound criteria and changing needs*

12. Survey authorization procedure and instructions should be broadened in concept.

A

13. Cost-sharing requirements for federally assisted projects should be modified to provide more suitable contributions by State and local groups.

B

14. Flood project benefits should be reported in the future so as to distinguish protection of existing improvements from development of new property.

A

15. Authority should be given by the Congress to include land acquisition as a part of flood control plans.

B

16. Loan authority for local contributions to flood control projects should be broadened by the Congress.

C

the recommendations is categorized as: (A) largely implemented, (B) some progress (often legislated but not implemented), and (C) little or nothing accomplished.

Implementation or progress toward implementation has been achieved on most of these recommendations, but three have had little or no followup, and two remain valid. Recommendation 3 calls for a national program to collect flood damage data but does not clearly specify responsibility. Recommendation 4. (1) calls for expanded research on flood plain occupancy. Recommendation 16 was rendered invalid by revenue sharing and block grant programs.

A direct response to several recommendations is found in the National Flood Insurance Act of 1968 (P. L. 90-448), as amended, and the closely related Flood Disaster Protection Act of 1973 (P. L. 93-234). The collective purpose of these acts is to check the trend toward increasing flood losses. A Federal-private industry insurance program is utilized ultimately to reduce the general taxpayer's burden for relief and the almost sole reliance upon protective works by pooling risks and distributing the burden more equitably. The acts emphasize local flood plain regulation to reduce flood losses.

C. The National Flood Insurance Program - A Regulatory Approach Focused on Long-Term Flood Loss Reduction

The National Flood Insurance Program applies to coastal and riverine flood plains and consists of two phases, emergency and regular programs. Emergency Program rates are subsidized. Regular Program rates are both subsidized and actuarial for residents in those communities which enact and enforce flood plain management and development measure consistent with program regulations.

As many as 22,000 communities could ultimately be enrolled in the National Flood Insurance Program. In Section 2(a) (5) of the Flood Disaster Protection Act of 1973 (P. L. 93-234), the Congress finds that "the Nation cannot afford the tragic losses of life caused annually by flood occurrences, nor the increasing losses of property suffered by flood victims, most of whom are

still inadequately compensated despite the provision of costly disaster relief benefits. "

Section 102(a) of the Act requires the purchase of flood insurance in communities where such insurance is available in connection with any form of Federal "financial assistance" for acquisition or construction located in identified special flood hazard areas (in effect, an FHA-insured or VA-guaranteed loan or a loan for acquisition of improved land for a mobile home, or for building construction [further defined in Section (3) (a) (4)] made by a federally insured bank, savings institution or credit union). Financial assistance is broadly defined as any form of loan, grant, guaranty, insurance, payment, rebate, subsidy, disaster assistance loan or grant, or any form of direct or indirect Federal assistance other than general or special revenue sharing or formula grants made to States. The construction referred to in this section is essentially confined to walled and roofed buildings affixed to a permanent site, including mobile homes.

Communities identified by the Secretary of Housing and Urban Development as flood-prone communities have a one year period in which to enroll in the National Flood Insurance Program or thereafter be denied both Federal financial assistance for acquisition or construction purposes and federally related financing by private lending institutions in identified flood hazard areas.

The provisions of Section 102 mandating the purchase of insurance and Section 202 requiring the participation of flood-prone communities apply only to the identified areas of special flood hazards in those communities. The same is true for the flood plain management measures required by Section 1305 (c) (2). In practice, however, insurance is available to all insurable structures within the entire community, and the flood plain management regulations apply to the areas of special flood hazard but may be applied to all flood plains in the community.

In effect, therefore, except for a few communities which chose to risk the denial of certain Federal financial assistance in the flood hazard areas and those whose flood problems have not yet

been called to HUD's attention, by the end of 1975, most of the Nation's flood-prone communities had been notified and requested to enroll in the National Flood Insurance Program with its mandatory requirements for effective flood plain regulation.

Although only minimal measures are at first required, they are more than most communities had required, and they are a start in the right direction. Once the definitive limits of the area which would be inundated by the 100-year flood and elevations for such a flood have been provided, the participating community must enact and enforce more specific measures to reduce the potential for flood losses. When floodway data are provided and risk zones identified on a flood insurance rate map, the community is required to enact floodway boundaries as encroachment limits, to restrict effectively any development in the floodway, and to regulate carefully development in special high hazard areas for which base flood elevations are provided. These flood plain management requirements are primarily regulatory, as opposed to structural, dealing as they do with land use, public facilities, flood proofing, and construction measures.

In addition, the insurance aspect of the program is a force for flood loss reduction in at least two ways:

1. Once the flood insurance ratemaking study has been prepared, actuarial rates for new construction should indicate to prospective builders and buyers the extent of the hazard that they face and by the cost of insurance discourage building in hazardous areas or at vulnerable elevations. Obviously rate levels can influence building and buying decisions.
2. The requirement that structures which have been substantially damaged, if rebuilt, must be floodproofed and can be insured only at full actuarial rates may discourage both the nonconforming uses of flood plains not otherwise forbidden by ordinance and the repair and reconstruction of structures exposed to flood damage.

Although implementation of the National Flood Insurance Act and related legislation is in an early stage, it is apparent that the rate of progress in defining flood-prone areas and risk zones for the 22,000 potentially eligible communities is crucial to program implementation. Delay in completion of flood insurance studies and the resultant delay of community participation in the Regular Program may permit continued development and building at flood-prone locations and the subsequent "grandfathering" of these high risk developments under subsidized insurance rates. In view of this critical dependence and a legislated 1983 target for completion of the program, all means of accelerating preparation of flood boundary and floodway maps and flood insurance rate maps need to be examined and adopted when appropriate.

D. Principles and Standards for Planning Water and Related Land Resources -- A Planning Approach Focused on Federal Participation in Water Resources Programs

Promulgated in late 1973, the Water Resources Council's Principles and Standards provide guiding principles, standards, and procedures for Federal participation in preparation of comprehensive plans and for formulation and evaluation of Federal and federally assisted water and related land resources programs, projects, and activities. The Principles and Standards were promulgated by the Council with the expectation that they would evolve and change in recognition of the dynamic state of water resource knowledge and methodology. The Principles and Standards designate two objectives (national economic development and environmental quality) against which plans must be formulated and four accounts (national economic development, environmental quality, regional economic development, and social well-being) against which adverse and beneficial effects must be displayed. Individual agency procedures provide detailed methods for application of the Principles and Standards. Most but not all of the major Federal agencies concerned with water resource programs have been developing implementation procedures for Council approval. Although procedural details reflect individual agency missions and sensitivity to local situations, application of the planning approach is becoming more consistent. However, attainment of complete consistency is unlikely because some agencies

are not covered by the Principles and Standards and in the case of the Environmental Protection Agency, Congressionally mandates regulatory standards take a different direction than the Principles and Standards.

Application of the Principles and Standards is a significant step toward consistent and critical evaluation of flood plain management measures, including proposals for costly public works investments like dams and levees. Further improvement in application may be expected after publication of the results from a study of the Principles and Standards and of cost sharing and discount rate policies as mandated by Section 80 of the 1974 Water Resources Development Act (P. L. 93-251). Once this review of the Principles and Standards is complete, it should be possible to develop better evaluation procedures for consistent and objective evaluation of proposals and alternatives.

Improvement in application of the Principles and Standards should also result from implementation of Section 73 of P. L. 93-251, which directs that nonstructural alternatives be considered in surveying, planning, or designing Federal flood protection projects and provides that non-Federal participation shall be comparable to the value of lands which would have been required of non-Federal interests for structural measures (up to a maximum of 20 percent of project cost). This recognition of non-Federal costs should encourage a more balanced evaluation of nonstructural and structural alternatives in the planning process. Similarly, implementation of the authority to purchase high risk, substantially damaged properties as provided under Section 1362 of the National Flood Insurance Act of 1968, as amended, can contribute to the appropriate consideration of nonstructural alternatives.

#### E. Significant Related Legislation

The National Environmental Policy Act (P. L. 91-190) has already appreciably affected flood plain management, and the Coastal Zone Management Act (P. L. 92-583), the Federal Water Pollution Control Act Amendments of 1972 (P. L. 92-500), and the Disaster Relief Act of 1974 (P. L. 93-288) have promise of further significant effects on flood plain management.

The National Environmental Policy Act establishes environmental quality as a national goal and requires preparation of environmental impact statements for proposed Federal projects and programs that may significantly affect the environment. As indicated above, environmental quality is a planning objective for water resource projects. Planning facilitates utilization of strategies for modifying susceptibility to flooding and the impacts of flooding. The requirement for an environmental impact statement forces consideration and public display of alternative actions. When flood plain lands are affected, then explicit consideration is to be given by established flood control agencies to actions other than the traditional engineering works used to modify flooding.

The Coastal Zone Management Act assists States to preserve, protect, develop, and restore coastal resources through a federally approved management program. To participate, each State must submit a plan detailing procedures for dealing with facilities of greater than local concern, including the siting of facilities such as powerplants and flood protection and warning facilities. Explicit definition is required for permissible land and water uses and the means of exercising State control over these uses. With all 30 eligible States participating in the Coastal Zone Management programs, the Nation's coastal flood hazard areas (including those of the Great Lakes) are being subject to State land and water use control procedures.

Section 404 of P. L. 92-500 augments and stimulates activity under the permit system (e. g., as traditionally carried out under Section 10, Rivers and Harbors Act, 1899) applying to any discharge of dredged or fill material in "waters of the United States." Although this has been most closely identified with dredge and fill materials, it also applies to docks, piers, bridges, sewer outfalls, water intakes, and the like if the discharge of dredged or fill material is involved in their construction. Except for bridges, which are now under Coast Guard jurisdiction for permits, the permitting process requires approval by both the State and the Corps of Engineers. Because "waters of the United States" includes most riverine and coastal waters and wetlands, the Act adds new dimensions to flood plain management.

In addition, Section 208 requires an areawide system for planning waste treatment facilities, and Section 209 calls for accelerating preparation of Level B basin plans under the Water Resources Planning Act; both these sections mandate planning coordination at and between levels of government on matters of vital concern to flood plain management.

The Disaster Relief Act of 1974 (P. L. 93-288), which deals with floods as well as other natural disaster, encourages development of disaster preparedness and assistance plans, calls for insurance against disaster losses, especially for public and private nonprofit facilities, and requires land use and construction practices to mitigate natural hazards. The concern of this act with disaster preparedness and prevention relates its planning emphasis to the regulatory approach in the insurance program.

The new land and water planning tools afforded by P. L. 92-583, P. L. 92-500, and P. L. 93-288 offer an opportunity to utilize Federal assistance to strengthen the role of the States, and they challenge the Federal and State governments to coordinate flood plain management activities. The National Environmental Policy Act has already improved the flood plain management decision-making process by requiring consideration of alternative actions for coping with flood risk.

#### F. Summary

House Document 465 made specific recommendations essential to achieving a unified national program of flood plain management. Subsequently, major strides have been made in the addition of the regulatory tools associated with flood insurance and disaster relief, the dredge and fill permit system, and State land and water use requirements of the Coastal Zone Management Act. Major strides in planning procedures have been made through the Water Resources Council's Principles and Standards at the national level, Section 209 (P. L. 92-500) provisions for River Basin Planning at the multistate level, the Coastal Zone Management Act at the State level, and Section 208 (P. L. 92-500) at the substate level. However, development of these tools and procedures has not been matched by operational

coordination of individual programs into a unified national program for flood plain management, as may be seen from the discussion of existing institutions and programs in Chapter VI.

## CHAPTER VI

### IMPLEMENTATION OF A UNIFIED NATIONAL PROGRAM FOR FLOOD PLAIN MANAGEMENT

The purpose of this chapter is to explain how flood plain management can be unified through coordination and utilization of existing institutional and legislative arrangements. Existing institutions and the relevant characteristics of organizational and operational considerations are described: These include information, research, consistent evaluation concepts, and financial assistance.

The chapter concludes that coordination is the weakest component of current management efforts and suggests that at the Federal level a coordinating committee review broad policy interpretations and assist in development of a national plan of priorities regarding flood related programs. It also suggests that responsibility for intrastate matters related to flood plain management rest with the States.

#### A. Coordination of Existing Programs

There is a wide variation in programs dealing with flood plain management. The diffusion of responsibility between levels of government and among agencies results in an approach that is uncoordinated, often fragmented, and sometimes conflicting. This major problem should be met through effective coordination and cooperative development of information and other related technical planning and construction assistance among all concerned interests at the local, State, and Federal levels.

##### 1. Federal Role

Although the major responsibility for regulating flood plain use is non-Federal, the programs of the Federal Government are increasingly influencing flood plain management decisions either directly or indirectly. Specific Federal interests include alleviation or prevention of flood losses and associated disaster relief; wise use, conservation, and development of

agricultural, mineral, and biological resources; utilization of waterways as arteries of commerce; and recreational and aesthetic opportunities of open space.

The effect of fragmentation is notable in regard to Federal - non-Federal relationships as well as within the Federal Government. It is confusing and discouraging to non-Federal interests and leads to indecision and inaction or to "shopping" among Federal agencies for "best" programs as judged by favorable local cost sharing rather than a full consideration of local needs. Although Exhibit 2 is not complete, it indicates the Federal effort is diffused through 28 agencies and 9 program purposes. Other data for urban flood damage reduction activities in FY 1974 show 797 projects involving \$795 million were implemented by 11 agencies operating under 44 different legislative authorities. The fragmentation illustrated in Exhibit 2 has also contributed to inconsistent implementation of flood hazard evaluation requirements by Federal agencies, as noted in a March 1975 General Accounting Office report to Congress, 1/ which cites examples of Federal buildings constructed in high flood hazard locations.

Because of inadequate coordination, the numerous Federal programs relating to flood plains sometimes work at cross purposes. One example is the postflood rehabilitation of structures in the high hazard or floodway areas when alternative locations were identified in planning programs. Another significant problem is that the policy and corresponding rules for action are so varied that the non-Federal sector is unsure about how the Federal Government is going to respond to a given flood-related situation. These problems need to be addressed. A major step in this direction would be the reflection of basic flood plain management principles in agency policies and procedures.

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1/ "National Attempts to Reduce Losses from Floods by Planning for and Controlling the Uses of Flood-Prone Lands."

Exhibit 2

FEDERAL FLOOD PLAIN  
MANAGEMENT AND RELATE  
PROGRAMS BY AGENCY

Flood Insurance Studies\*

Flood Plain Management Servi

Flood Plain Information Studie  
. and Reports

Riverine  
Coastal

Technical and Planning Servic

Full Program  
Program Elem.

Flood Modifying Construction

Flood Preparedness, Emerge:  
and Recovery

Warning and Forecasting

Research

Open Space

\* Administered by the Feder  
\*\* Land and Water Resources

agricultural, mineral, and biological resources; utilization of waterways as arteries of commerce; and recreational and aesthetic opportunities of open space.

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1/ "National Attempts to Reduce Losses from Floods by Planning for and Controlling the Uses of Flood-Prone Lands."

RURAL FLOOD PLAIN  
MANAGEMENT AND RELATED  
PROGRAMS BY AGENCY

PROGRAMS BY AGENCY	DEPARTMENT OF AGRICULTURE				DEPARTMENT OF THE ARMY	DEPARTMENT OF COMMERCE	National Oceanic and Atmospheric Administration Economic Development Administration Bureau of Economic Analysis	DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE	Public Health Service	DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	DEPARTMENT OF THE INTERIOR	DEPARTMENT OF TRANSPORTATION	SMALL BUSINESS ADMINISTRATION	TENNESSEE VALLEY AUTHORITY	WATER RESOURCES COUNCIL
	Agriculture Research Service	Agriculture Stabilization and Conservation Service	Economic Research Service	Farmers Home Administration Forest Service											
Flood Insurance Studies*	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-
Flood Plain Management Services	-	-	-	-	S	S	-	-	-	-	-	-	-	-	-
Flood Plain Information Studies and Reports															
Riverine	-	-	-	-	S	S	-	-	-	-	-	-	-	-	-
Coastal	-	-	-	-	I	S	S	-	-	-	-	-	-	-	-
Technical and Planning Services**															
Full Program	-	-	-	-	S	S	-	-	-	-	-	-	-	-	-
Program Elem.	-	-	I	G	I	S	S	-	-	-	-	-	-	-	-
Flood Modifying Construction	-	-	G	S	S	-	F	-	-	-	-	-	-	-	-
Flood Preparedness, Emergency, and Recovery	-	F	G	S	S	-	-	S	-	G	-	S	-	G	-
Warning and Forecasting	-	-	-	-	-	-	S	-	-	-	-	-	-	-	-
Research	S	-	S	I	I	S	S	-	-	-	-	-	-	-	-
Open Space	-	-	-	I	S	-	-	-	-	G	-	-	-	-	-

\* Administered by the Federal Insurance Administration through reimbursable technical studies by agency shown.  
\*\* Land and Water Resources.

S. Staff and Funds  
F. Funds  
G. Grants and Loans  
I. Incidental

Exhibit 2

FEDERAL FLOOD PLAIN  
MANAGEMENT AND RELATED  
PROGRAMS BY AGENCY

	DEPARTMENT OF AGRICULTURE					DEPARTMENT OF THE ARMY	DEPARTMENT OF COMMERCE
	Agriculture Research Service	Agriculture Stabilization and Conservation Service	Economic Research Service	Farmers Home Administration	Forest Service	Soil Conservation Service	National Oceanic and Atmospheric Administration
Flood Insurance Studies*	-	-	-	-	-	*	*
Flood Plain Management Services	-	-	-	-	-	S	-
Flood Plain Information Studies and Reports							
Riverine	-	-	-	-	-	S	-
Coastal	-	-	-	-	-	I	S
Technical and Planning Services**							
Full Program	-	-	-	-	-	S	-
Program Elem.	-	-	I	G	I	S	I
Flood Modifying Construction	-	-	-	G	-	S	-
Flood Preparedness, Emergency, and Recovery	-	F	-	G	S	S	-
Warning and Forecasting	-	-	-	-	-	-	S
Research	S	-	S	-	I	I	S
Open Space	-	-	-	-	I	S	-

\* Administered by the Federal Insurance Administration through reimbursement.  
\*\* Land and Water Resources.

IN  
RELATED  
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\*  
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Studies

Services\*\*

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mergency,

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Federal Insurance Administration through reimbursable technical studies by agency shown.

DEPARTMENT OF AGRICULTURE

Agriculture Research Service  
Agriculture Stabilization and Conservation Service  
Economic Research Service  
Farmers Home Administration  
Forest Service  
Soil Conservation Service

DEPARTMENT OF THE ARMY

Corps of Engineers

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration  
Economic Development Administration  
Bureau of Economic Analysis

DEPARTMENT OF HEALTH, EDUCATION,  
AND WELFARE

Public Health Service

DEPARTMENT OF HOUSING AND URBAN  
DEVELOPMENT

Community Planning and Development  
Federal Housing Administration  
Federal Insurance Administration  
Federal Disaster Assistance Administration

DEPARTMENT OF THE INTERIOR

Bureau of Land Management



A primary area of concern is consistent policy regarding housing and related construction grants and loans, and support for public facilities such as roads and sewage systems. Executive Order 11296 - Flood Hazard Evaluation, now reinforced by the National Flood Insurance Program, provides a basis for Federal decisionmaking in construction, land disposal, and in administering grants and loans rather than for area planning. The Executive order should be revised to formalize its relationship to the National Flood Insurance Program, and it should serve as a model from which individual States can strengthen their own management programs.

If a unified national program is to be attained, the Federal agencies should develop consistent policies and activities, including those which would encourage and support the States in developing effective programs of their own. In a practical sense, the Federal role would continue to be strong in information gathering, technical, planning, program criteria, and construction services. Further, Federal agencies should become supportive of State activities. In brief, this support can be identified as actions to:

- provide overall objectives and principles as guidelines for consistent State program development, recognizing that, until the States have acquired the capabilities, direct and widespread Federal guidance may be necessary;
- provide basic information and interpretative analysis for use by all State agencies and their programs;
- provide consistent program action, evaluation, and development criteria;
- provide consistent technical, planning, program criteria, and construction service response through action agencies;
- provide financial support for improving programs and capabilities to implement them at the State level within the limits of available resources, and

-- work through the State in dealing with local entities to ensure consistent administration of flood plain management programs.

a. Federal Coordination

The Water Resources Council, established in 1965, provides a national forum within which water resources planning programs are to be coordinated. Specifically, in regard to "A Unified National Program for Flood Plain Management," the Council can facilitate communication among agencies and encourage consistency among Federal programs. This service has been done most successfully when technical issues are involved as in the case of the flood frequency procedures bulletin prepared by the Interagency Hydrology Committee.

As Exhibit 2 suggests, however, there is a great need for coordination among Federal agencies for all types of programs. Effective coordination of Federal assistance programs encourages State planning and provides a basis for expansion into flood plain management programs.

Based upon Water Resources Council experience with inter-agency technical committees, effective coordination would be greatly facilitated by an interagency Flood Plain Management Technical Committee functioning under the auspices of the Council.

b. Regional Coordination

At the regional level, several institutions can encourage both statewide and interstate planning of flood-related matters. The river basin commissions established under Title II of the Water Resources Planning Act and Federal-interstate compact commissions are significant in this category. Established as permanent regional institutions and composed of Federal and State members, the commissions are in a strategic position to guide, coordinate, and unify both Federal and State programs for managing flood plains. As continuing institutions with full-time professional staff, much can be expected of the

commissions in coordinating the schedules, priorities, and resources necessary to install flood plain management programs in their regions. For example, the New England River Basins Commission is preparing its own flood plain management program and is researching the effectiveness of nonstructural management tools that modify susceptibility to flood damage and disruption. The Delaware and Susquehanna Federal-Interstate Compact Commissions carry out flood plain information and hazard studies. The Tennessee Valley Authority provides a unique high degree of coordination for flood-related activities in its region of the country.

In addition, inter-agency committees and the Federal regional councils can provide a degree of coordination regarding flood-related actions by Federal and non-Federal entities.

## 2. State Role

Although the Federal Government continues to play its traditional coordinating role in interstate problems, the major intrastate coordination role is the States'. The States are vested with the police power which by specific delegations to local government provides the framework within which much of the decisionmaking takes place. State government is near enough to the problems to deal with specifics and yet can handle flood plain problems that transcend community lines. Likewise, multijurisdictional problems not manageable at the local level can usually be resolved at the State level.

The States are in a position to set strategy for coordination of management programs by establishment of statewide standards and by procedures for aggregating local programs into subbasin and basin management programs. At the substate regional level, the State is directly involved in some coordinating activity, for example, by the Office of Management and Budget's A-95 review program and the areawide waste water planning requirements of Section 208, P. L. 92-500. For the National Flood Insurance Program, several Governors have appointed State coordinators who often serve as State coordinators in other water resources programs. They have demonstrated how water resource planning can benefit from State guidance even

though the block grant approach has reduced Federal direction. A single statewide coordinating office is needed in each State to foster vigorous management programs to encourage flood plain management in local and regional comprehensive planning and to maintain liaison with Federal agencies, including the proposed Flood Plain Management Technical Committee.

A few States have vigorous and comprehensive flood plain management programs which recognize the full range of alternatives discussed in the conceptual framework. They have made it possible for communities to undertake flood plain regulation, have established guidelines and standards, and have staffed and funded local and State agencies. Some States have enacted legislation that directs the State to step in, solve problems, and regulate areas if communities are not performing. In many States, the functions of flood plain management and related land and water resources concerns have been consolidated under one department. Among the rest of the States, some have merely enabled communities to adopt flood plain regulations and others have taken no specific actions. In a few of those States that have taken no specific action, the general enabling legislation is often broad enough that zoning and subdivision regulations render specific legislation enabling flood plain regulation unnecessary.

In some States, the legislative basis for flood plain regulation has been present for many years and has stimulated significant action. However, it has only been in recent years that major State regulatory and zoning programs have emerged, some prompted and fostered by Federal programs. Between 1962 and 1975 the number of States with flood plain regulations or equivalent programs grew from fewer than one-fifth to approximately one-half of the States. Enactment of enabling legislation explicitly addressing flood plain regulations in all States where such legislation does not exist should be a primary element in State strategy for coordinating flood plain management programs. This legislation should be buttressed by establishment of a single statewide coordinating office and application of the concepts found in Executive Order 11296 - Flood Hazard Evaluation.

Because of the increased burden that will be assumed by the States under the flood plain management approach, it is apparent that the already thin funding of this activity at the State level will have to be bolstered and that the States will have to establish budgetary priorities supportive of flood plain management. Although some of the increased funding will have to come from State sources, an avenue could be opened for Federal funding through various grant or revenue sharing programs. In all cases, it might be reasonable to expect State planning officials who distribute Federal funds for water and land resources planning to report periodically on the status of flood plain regulation in their States to a Federal coordinating body, such as the proposed Flood Plain Management Technical Committee. Information on the progress of State efforts to improve flood plain management should be reported periodically to the Congress.

### 3. Local Role

Because flood related problems do not honor municipal boundaries, particularly in the delineation of floodways, local management efforts need to be supported by Federal, State, and local standards. Given levels of technical assistance and reinforcement compatible with their local capabilities, it seems apparent that communities and counties can undertake the basic flood plain management role. Some have a separate office to administer this type of effort; others rely on traditional offices such as those of the city engineer, director of public works and zoning administration, or building inspector.

In spite of many limiting factors, hundreds of communities have adopted regulations in conjunction with mapping and flood plain information programs of Federal agencies (Exhibit 2), and some have responded to State programs. At the end of 1975, approximately 13,000 communities were enrolled in the National Flood Insurance Program and therefore were committed to adopt and enforce land use and construction measures (primarily for walled and roofed buildings and mobile homes) consistent with National Flood Insurance Program criteria. Of that number, over 600 were in the Regular Program and therefore responsible for application of the full range of required regulatory measures. These same locally enacted regulations are an essential

complement to measures taken to modify flooding and the impacts of flooding if flood plain management is to be effective in mitigating flood losses. The existence of local regulatory programs should be used by Federal and State agencies as a prerequisite to providing financial assistance for locally initiated management programs. The phasing of such requirements into ongoing programs and for currently authorized projects will have to be dealt with by each agency.

County and local adoption of land use and construction controls is not the end of the regulatory process. To assure that these measures are effectively enforced, a compliance effort is needed. The Department of Housing and Urban Development hopes to increase State cooperation in helping communities implement and enforce their flood plain management measures. Furthermore, State programs must be sensitive to changes in local land use planning.

For most flood plain management activities, the local government has the responsibility to initiate application to State and Federal agencies for participation in and assistance from the various programs. The local government must also enact and enforce land and water use regulations and in some cases maintain and operate structures on the flood plain. Thus, to achieve effective flood plain management decisions, local governments must be provided with complete and current information about State and Federal programs, and conversely, State and Federal agencies must be knowledgeable about the goals and decisions of local governments to exercise effective subbasin and basin-wide management activities. Furthermore, to respond adequately to program needs, the Congress and the State legislatures must be provided with information about progress in achieving more effective flood plain management.

#### B. Operational Considerations

The technical and administrative functions of a flood plain management program must give adequate attention to organizational and operational considerations if the program is to be effective. Although these needs are somewhat similar at all levels of government, the existence of differences among the levels

must be acknowledged and resolved by making adequate provision for the requirements of each. For example, at the Federal level, agency policy and legislative support are required; it is also needed at the State level in addition to a strengthening of capabilities in resource planning areas; and at the local level participation in the planning process is required of public officials and local citizens.

#### 1. Information

Effective planning is the key to a unified national program for flood plain management, and planning is based on information. Therefore one of the most important organizational and operational needs is adequate and reliable data in a relevant and usable form.

During the past decade, flood data and flood plain information have been gathered and analyzed at an ever increasing rate, especially through ongoing Federal programs. However, of the estimated 22,000 communities with flood hazards, less than 25 percent to date have been furnished detailed flood and flood-related information by various Federal and State agencies to provide a basis for planning studies. Even when data related to flooding exist, potential users are not always aware of all the information that is available or where to find it. For example, the Soil Conservation Service has prepared detailed soil maps and interpretations for more than 60 percent of the Nation, and this information could be used for determining appropriate uses of flood plains and to assist in tentative or preliminary delineation of flood hazard areas in the absence of engineering evaluations, especially the rural areas. A full range of flood-related technical services and planning guidance is provided by the Corps of Engineers through its flood plain management services program. Similar services are provided by the Soil Conservation Service and for a limited geographical area by the Tennessee Valley Authority. Another example is the flood forecasts and warnings prepared by the National Oceanic and Atmospheric Administration which depend upon public awareness and response to have meaning. Improved information dissemination and utilization are as important as improved data and both are needed.

As recognized in the review of House Document 465, there remains a major deficiency in research and information on flood plain occupancy. Information is needed about the perception of and response to flood risk and about the social effectiveness of flood plain land use and other management tools. Interpretation of the information on flood plain occupancy is closely associated with cultural, biological, and physical data relevant to the interrelationships of land, water resources, and environmental values; the types and specificity of data remain to be determined.

As noted in House Document 465, consistent procedures are needed for reporting both experienced and projected flood losses. Consistent experienced flood loss data compiled on an annual basis, by State, and for specific events such as the 1972 storm Agnes would permit more effective evaluation of current programs to mitigate flood losses. Consistent projected flood loss data would permit more effective evaluation of future conditions and better choices among alternative actions and priorities for resource allocation. These procedures should be coordinated with those utilized in the National Water Assessment.

More information is needed on the hydrology of various drainage basins, the flooding of tributary streams, the impact of development on flooding levels, and simpler methodologies for delineating floodways. Present methods do not permit consistent identification of the recurrence interval of severe floods. Given the brevity of the historical record, some technical consensus is needed.

More information about how to assess flood plain resources and potential uses must be made available to local communities. A flood plain management handbook describing in detail the available Federal programs should be prepared for use by State and local officials in implementing the conceptual framework of Chapter III. Supporting documents describing individual State programs should be prepared to facilitate further information flow to the local level. Within each State there should be a centralized source of flood plain data accessible to local planners and flood plain decisionmakers. A periodic (biennial or as necessary) national conference/workshop of Federal,

State, local, and regional officials should be convened to evaluate and foster coordination of flood plain management activities.

Another problem arises as data are analyzed. Although a uniform approach has been devised for presenting hydrologic and hydraulic data for gauged reaches, streamflow records are available for relatively few locations, and alternative techniques must be employed to develop flood information at ungauged locations. (Similar problems occur with tidal flood data.) Hydrology, however, is not an exact science, and qualified studies for the same site occasionally result in inconsistencies that are difficult to resolve.

All these difficulties interact to compound the information related problems, which in turn frustrate local planning and delay needed programs. These difficulties must be overcome to ensure that required planning information for riverine and coastal areas is obtained and made readily accessible.

Previous chapters have suggested a management approach that emphasizes comprehensive planning. To be effective, however, this approach requires reinforcement by ongoing programs of training and information flows to planners at all levels, and planners in turn must convey information to their constituencies of decisionmakers and citizens. For their part, planners need to give greater emphasis to overall management of the flood plains in the context of community and regional planning and the conceptual framework described herein.

## 2. Research Coordination

A single program of flood plain management research employing modern scientific techniques does not exist, although a great deal of related research has been done. Coordination of research is needed. Of equal importance to the need for coordinated research is the need for a translation of research into operational guidelines. To be effective, a research program requires the full cooperation and support, including funds, of concerned Federal, State, and local interests. In such a program an annual assessment of research priorities would be identified by chief administrators of a coordinating

body in conjunction with officials of State water resource and planning agencies. Research projects to satisfy these needs would be defined by the chief administrators of the coordinating body, and when funded, qualified research agencies and individuals would be selected by appropriate agencies to carry on such research. Surveillance of research programs would be the responsibility of the coordinating body.

Although major Federal water research programs are operated by the Department of Agriculture, Army, Commerce, and Interior and the Environmental Protection Agency, there is a lack of effective coordination. For example, Interior's Office of Water Research and Technology coordinates a nationwide, priority-focused program implemented in part through a network of State research centers, but the program scope involves much more than flood plain management and does not necessarily reflect what is being done in other Federal agencies. The inter-agency Committee on Water Resources Research sets national priorities, which may include flood plain management, but it does not have the capability to coordinate programs.

### 3. Evaluation Guidelines and Analysis of Alternatives

Achievement of the goals of flood plain management requires analysis of all alternative plans prior to selecting a course of action. For major Federal actions the timely analysis of alternative plans is also a requirement of the National Environmental Policy Act. There is a need to apply standard techniques of analysis and evaluation consistently regardless of the level of jurisdiction involved, in order to encourage the development of objective, well coordinated comprehensive plans. These techniques should provide comparability for investment decisions and a full display of all alternatives within the conceptual framework of flood plain management. Their implementation would be instrumental in eliminating inconsistencies in existing public programs and fragmented responsibilities in flood plain management. Full implementation of the Water Resources Council's Principles and Standards for Planning Water and Related Land Resources would facilitate realization of the objectives expressed in this section.

#### 4. Federal Financial Programs

Federal loans and grants (including those which may be used for renewal assistance), cost sharing, and investment programs should act as incentives for sound flood plain management. A consistent national policy is needed to assist State and local government units in fulfilling responsibilities for present and future use of flood plain and related resources. Alleviation of much of the existing inconsistency should emerge from policy and legislative followup to the cost sharing recommendations of the Section 80 Report to the President required by P. L. 93-251.

Although cost sharing is the subject of another report to the Congress, it must be emphasized that cost sharing can have wide-ranging implications for flood plain related investments. Involved are not only the relative proportions of cost sharing and their impact on the number and size of projects and programs permitted under limited budgets but also the question of which tools of flood plain management are to be cost shared. Currently the Federal Government bears a large share of the costs for programs that modify flood and for programs that modify the impact of flooding on communities and individuals.

Given consistent Federal policy as a guide, State governments can develop their own policies for flood plain management that in time would provide guidance to local governments in implementing their programs. Plans and actions for flood plain management would then reflect ecological, environmental, aesthetic, economic, and social considerations in an integrated approach less biased by inconsistent funding and cost sharing opportunities. It would encourage all applicants for grant, loan, and investment programs to give appropriate consideration to all alternatives, provide adequate information regarding each, and specify measures to be taken to ensure that each option will receive a fair and impartial evaluation. Before any proposal could be approved, each project application would be accompanied by plans, specifications, and estimates prepared in sufficient detail to indicate the approach that is to be taken.

Institutional arrangements among Federal, State, and local governments must be coordinated so that respective program

standards and criteria may be satisfied and individual programs can be administered with speed and flexibility. The development and management of programs at State and local levels usually require additional funding. If the Federal Government is to share in this funding, consistent cost sharing practices are also needed.

C. The Current Situation and the Conceptual Framework

An evaluation of the foregoing discussion of institutions, programs, and operational considerations in the context of the statements on sound flood plain management found in the conceptual framework focuses attention squarely upon coordination as the fundamental weakness. Each of the interdependent components of sound flood plain management - goals, future needs, alternative strategies, accounting, motivation, and evaluation - depends upon effective coordination. Institutional arrangements organized to satisfy the objectives and principles of flood plain management are necessary at all levels of government to coordinate and manage the ongoing programs. The problem is to provide institutional arrangements that can effectively exercise the authority and provide the resources needed to carry out the respective responsibilities.

A system that can build on and incorporate the elements of existing institutions has a greater chance for success than would an entirely new set of institutional arrangements. For the most part, the tools of a flood plain management system exist, but the authority to utilize them is dispersed among different levels of government and among various agencies.

1. Intragovernmental Coordination

At each level of government, statutory responsibility for programs integral to flood plain management is often spread across several agencies. Because Federal programs are a common source of funds for State and local programs and States are the primary source of necessary management powers, leadership in coordinating programs at the Federal and State levels is prerequisite to effective coordination among all levels of government.

There are many ways of achieving coordination among agencies at a given level of government. At the Federal level, a Flood Plain Management Technical Committee should be established under the auspices of the Water Resources Council to carry out a continuing evaluation of Federal programs for their consistency and to facilitate communication and encourage coordination of flood plain management activities. General functions of this Committee should include preparation of reports for the Congress and the public on progress toward achieving "A Unified National Program for Flood Plain Management;" developing a national plan of priorities for Federal assistance to State and local governments to assure wise management of the Nation's flood plains; and providing leadership in solving broad problems such as standardization of techniques for data collection, analysis, and dissemination. The housekeeping function for the Committee, including maintaining necessary files and records, providing clerical assistance and meeting space, operating a clearing house for flood plain management and related information, and providing other services, would be provided by the Water Resources Council. A similar coordinating body would provide an appropriate mechanism in some States.

## 2. Intergovernmental Coordination

Given effective coordination of agency programs at the Federal and State levels, the task of coordination between levels of government becomes easier. Functions of the Federal Flood Plain Management Technical Committee described above should include continuous liaison, overall assistance and guidance for program development, and a forum for the participation of multistate regional organizations, the individual States, and local governments.

With active and coordinated Federal participation and support, State planning agencies could provide the necessary means to develop a set of institutional arrangements that can be focused through substate regional organizations and local governments on the flood plains of the Nation. The State, with the legislative authority necessary to initiate the programs, with firsthand knowledge of conditions, and with proximity to the problems, is best situated to assume the lead role of managing and directing

a unified flood plain management program. Institutional arrangements that the States would have to develop are not set forth here. However, to be consistent with flood plain management, Federal support would have to be predicated on institutional arrangements within the State providing for:

- legislative direction to develop a Statewide flood plain management program and to assemble and maintain a flood plain management staff; and
- legislation providing authority for the State to specify a flood plain management program for communities that do not respond in a reasonable time.