

A Status Report on the Nation's Floodplain Management Activity

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**Prepared for the
Interagency Task Force
on Floodplain Management**

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PROJECT DESCRIPTION

AN ASSESSMENT OF THE NATION'S PROGRAM FOR FLOODPLAIN MANAGEMENT

SPONSORED BY

THE FEDERAL INTERAGENCY TASK FORCE ON FLOODPLAIN MANAGEMENT

Under the auspices of the Federal Interagency Task Force on Floodplain Management¹, the Tennessee Valley Authority (TVA) in March 1987 contracted² to undertake an assessment of the Nation's floodplain management activities. The project involves two phases. Phase I involves development of a Status Report on the Nation's Program for Floodplain Management as described in the 1986 report A Unified National Program for Floodplain Management (UNP). Phase II is devoted to assessing the effectiveness of existing floodplain management activities, with particular attention to the strategies and tools for floodplain management described in the UNP, and developing recommendations to improve the effectiveness of floodplain management.

BACKGROUND AND CONTEXT FOR INITIATION OF THE PROJECT: The current national program for floodplain management is described in the 1986 Unified National Program. The concept of the UNP was first presented in 1966 by a Presidential Task Force on Federal Flood Control Policy. This Task Force examined the status and evaluated the effectiveness of the nation's floodplain management program as it existed prior to 1966. It concluded that the program (largely one of flood control through construction of protective structural works) was ineffective. A more balanced program to consist of both structural and nonstructural measures was recommended.

The Task Force presented its findings and recommendations to the President who transmitted the UNP report to the Congress as House Document No. 465. This landmark report laid out the concept of a unified national program for floodplain management and recommended various actions for implementing such a program. Subsequently, the UNP was expanded, detailed and modified in 1976, 1979 and most recently in 1986.

The UNP outlines a conceptual framework for floodplain management that includes a set of general principles and working principles that should be applied to both flood loss reduction and protection/restoration of floodplain natural values. The UNP also identifies types of floodplain management strategies and tools that may be employed by Federal, state and local governments and by the private sector, and makes recommendations for Federal, state and local governments regarding implementation of the principles, strategies and tools. Much progress has been made over the last 20 years in advancing the state of floodplain management and establishing a more balanced management effort that includes both structural and nonstructural approaches. Despite the progress,

¹ Funding agencies include the Bureau of Reclamation, Corps of Engineers, Environmental Protection Agency, Federal Emergency Management Agency, Soil Conservation Service, Tennessee Valley Authority, and U.S. Geological Survey.

² L.R. Johnston Associates is the prime contractor. The Contractor's Project Team includes Leslie A. Bond Associates, J.A. Kusler Associates and the ~~Association of State Floodplain Managers.~~

there remains a widespread view that inappropriate floodplain development continues at an unacceptable level, that flood losses continue to mount and natural values of floodplains continue to be lost, and that some aspects of floodplain management programs are ineffective or even counterproductive. There is, however, little hard data to support these concerns and therefore no sound basis exists for making decisions regarding improvements in individual programs or the total program of floodplain management in the nation.

A multitude of conferences and publications in the last several years have described various aspects of the nation's floodplains and the programs, strategies, and tools for floodplain management. Nevertheless, a comprehensive Status Report and an evaluation of the effectiveness of floodplain management is still needed.

SCHEDULE: Work on the first phase of the project began in April 1987. An interim draft of the Status Report will be available in the summer of 1988. This interim draft will be widely distributed for comment and subsequently updated and revised. Work on the second phase of the project began in April 1988 and will be completed in September 1989.

MAJOR ACTIVITIES DURING THE SECOND PHASE: The second phase of the project--the Effectiveness Evaluation--will seek to involve a broad and representative segment of the floodplain management community. Several mechanisms will be employed to obtain input from representatives of the following sectors: governmental, environmental, development, and academic.

One mechanism for obtaining input is through participation in conferences and workshops. The Association of State Floodplain Managers 12th Annual Conference in Nashville, TN on May 16-19, 1988 will be the first conference used to obtain feedback from floodplain management professionals. A segment of the Plenary Session and 10 workshops will be devoted to the Assessment project. Following the conference, each participant will be provided a copy of the Interim Status Report and invited to review the report and provide comments to the Task Force and its contractor. There will be similar participation at the Association of State Wetland Managers' National Symposium on "Urban Wetlands and Riparian Habitat", June 26-29 in Oakland, CA. There will also be participation in one coastal oriented conference during 1988 or early 1989, and additional conference participation may occur.

Other methods of obtaining input for the effectiveness evaluation include: establishment of an expert review committee; at least one meeting with representatives from professional and non-profit organizations involved in various aspects of floodplain management; interviews with knowledgeable individuals; soliciting comments on the Interim Status Report other interested individuals; and literature review.

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CHAPTER 1: FLOODS AND FLOODPLAINS

Although flooding is common in all 50 states, the type and frequency of flooding vary considerably from state to state and geographically within each state. Flooding occurs along major rivers and small streams, in coastal areas and along the margins of some lakes, as well as in numerous "unique" flooding areas. Although a floodplain may be defined and identified in several ways as a natural geologic feature or from a regulatory perspective, the 100-year floodplain standard represents the definition most commonly used for management purposes in the U.S. today.

- o Floodplain Areas. There is no "official" estimate of the total U.S. land area subject to flooding. Estimates by WRC, SCS, and FEMA are based on different geographic areas and procedures. The most widely reported figure is WRC's 1977 estimate that 7% (178.8 million acres) of total U.S. land area is subject to flooding. SCS and FEMA estimates are both considerably higher: SCS in 1982 estimated about 14% of nonfederal rural land (excluding Alaska, including Caribbean) is floodprone; in 1987 FEMA estimated a total of about 162 million acres (including Alaska, excluding Caribbean) to be floodplain in identified floodprone communities.
- o Riverine Flooding. Overbank flooding of rivers and streams is the "classic" flood event, and the most common type of flooding in the U.S. Hundreds of riverine floods occur annually, but there is no readily available estimate of the actual number of floods of a particular magnitude or return frequency that occur in any given year.
- o Coastal Flooding and Erosion. Coastal flooding and erosion may result from hurricanes, other coastal storms and occasional tsunamis, as well as sea level rise and shoreline retreat. It is a serious problem along all of the Nation's coasts, although the frequency and magnitude of flooding varies considerably.
- o Fluctuating Lake Levels. Lake level fluctuations, which can be caused by both natural and man-induced events, may be short-term or long-term. While short-term (daily or seasonal) fluctuations in lakes throughout the U.S. are a well recognized occurrence, long-term lake level fluctuations are a less well-recognized phenomenon which can cause high water and subsequent flooding problems that may last for years. Long-term fluctuations and related flooding problems are most pronounced on the Great Lakes and other glacial lakes.
- o Unique or High-Risk Flooding Areas. Unique or high risk flooding areas include: areas behind unsafe or inadequate levees, areas below unsafe dams, alluvial fans, meandering channels, flash flooding areas, mudflow areas, ground fallow areas subject to liquefaction, ground fallow areas subject to subsidence, and ice jam flooding. In unique flood situations, damages often exceed those caused by clear water flooding, due to the unexpectedness of flooding, the high velocity of flood waters, the large amounts of debris carried by flood waters and other factors.

CHAPTER 2: FLOODPLAIN RESOURCES AND VALUES

Many of the Nation's most prominent landscape characteristics are associated with floodplains, as are many of our most valuable natural and cultural resources. Not all floodplains are characterized by the same natural and beneficial values, and efforts to protect the natural resources values of floodplains have not always been given the same weight and attention as efforts to reduce flood damages. The natural resources values of floodplains are threatened by a variety of man's activities.

Wetlands and floodplains are not synonymous but wetlands are perhaps the most prominent and familiar of floodplain resources. It has been estimated that wetlands cover a little more than 3 million acres or about 3% of the continental U.S. Although wetlands represent only a portion of over-all floodplain acreage, essentially all coastal wetlands and most inland wetlands occur within floodplains. As a result, most of the values ascribed to wetlands can be considered as floodplain values as well.

Much work in recent years has been directed toward assessing wetlands functions and values and has resulted in tabulations of wetlands acreage and other statistics pertaining to the extent and quality of wetland resources. Relatively less attention has been directed toward quantitative assessments of other floodplain resources and values, and a comparable level of statistical knowledge has yet to be developed specifically for floodplains.

- o Water Resources Values. The water resources values of natural floodplain systems include natural flood and erosion control, water quality maintenance and maintenance of groundwater supply and balance. Natural flood control values include reduction of flood velocities, flood peaks and wind and wave impacts. Natural floodplain systems can serve to reduce or avoid the environmental and economic costs associated with structural flood control works. Natural floodplain systems also serve to protect the physical, biological and chemical integrity of water. In addition, undisturbed floodplains can contribute to the maintenance of groundwater supply and balance by facilitating the infiltration and storage of water, for example.
- o Living Resources and Habitat Values. Coastal and riverine floodplains provide habitat for many and diverse populations of plants and animals, as well as sources of energy and nutrients for organisms in adjacent and downstream ecosystems. Floodplains are especially important and productive sources of energy and nutrients in large part because they contain the elements of both terrestrial and aquatic ecosystems. Among the most valuable of habitats are floodplain wetlands and riparian floodplain ecosystems.
- o Cultural Resources Values. The cultural resources values of floodplains are many and include those values associated with the harvest of natural products (agricultural, aquacultural and forestry uses), as well as historical/archeological, scientific and recreation/open space values. Floodplains along larger rivers are often prime agricultural lands because of their flat terrain, abundant water supplies and rich alluvial soils periodically replenished by flooding. Inland floodplains are also sources of commercial timber and a variety of natural crops. Most of the Nation's earliest archaeological and cultural resources sites are found in floodplains

CHAPTER 3: FLOODPLAIN DEVELOPMENT AND FLOOD LOSSES

The large-scale modification of floodplains in the U.S. has resulted in a major increase in land area available for economic development and use. Floodplain development and modification, however, has also resulted in high costs in terms of flood-caused loss of life, personal suffering and inconvenience as well as economic losses. Although floods annually claim more lives and cause greater economic losses than any other type of natural disaster, accurate data on the actual extent of annual flood losses remains unavailable.

- o Floodplain Development. Several studies have attempted to assess the extent of floodplain development in the U.S. A 1977 WRC assessment estimated that 3.5 to 5.5 million acres of floodplain land are in urban use. A recent study conducted for FEMA examined 16,700 floodprone communities to estimate property at risk. The communities studied were found to occupy a total of over 160 million acres and in 1983 included approximately 16.8 million households at risk and \$758 billion in property at risk. Although development in floodplains has occurred throughout the Nation's history, rapid urbanization and increasing population in coastal regions and arid regions of the southwest in recent years have resulted in a significant increase in the amount of developed floodplain lands and the population and property at risk to flooding.
- o Impacts of Development on Natural and Beneficial Values of Floodplains. Increasing development of floodplain lands has had dramatic effects on the natural values associated with floodplains. It is estimated that approximately 54% of the original wetland acreage in the U.S. has been destroyed since the European settlement of the country. In addition, millions of acres of indigenous, woody riparian habitat have been destroyed or degraded.
- o Historic Losses from Floods. Although statements of ever-increasing flood losses are common, these reports should be examined within the context of the overall national economy. For example, by examining annual flood losses in relation to GNP, large fluctuations (in dollars of flood losses as a percentage of GNP) from year to year are evident, but there appears to be no significant trend of a decrease or increase in relative flood losses. Despite problems in evaluating relative flood losses, information has been compiled on major flood events and there are several estimates of overall historic flood losses, as well as estimates of losses from particular types of flood events. There is, however no comprehensive record of past flood damages in the U.S.
- o Future Floodplain Development. Perhaps the greatest impacts on the Nation's floodplains come from the development of new housing, the development of new industrial and commercial facilities and the provision of flood control for existing development. Some implications for the future of floodplain management can be drawn from projections of growth in these areas. Two facets of new construction which will most affect future flood damages are development of flood prone areas and the impact of development on watershed hydrology and stream hydraulics.

CHAPTER 4: HISTORY OF FLOOD CONTROL AND FLOODPLAIN MANAGEMENT

The history of floodplain management in the U.S. reflects an evolution in federal government policy regarding flood control in general and in the roles of federal, state and local governments in controlling flood losses. This history has been affected by broader national trends and attitudes with respect to urban growth and development, government spending, expanding technology and recognition of the complexity and interrelationship of issues related to land and water use.

- o 1900-1960: The Structural Era. Prior to 1965, government actions related to flooding were primarily in response to significant or catastrophic events and involved structural solutions to flood problems. The Flood Control Act of 1917 marks the beginning of direct federal commitment to flood control. During this period, the major federal agencies involved in flood control efforts were the Corps of Engineers, the TVA, the Bureau of Reclamation and the Soil Conservation Service. These agencies focused primarily (but not exclusively) on the construction of structural flood control measures. Although the emphasis during the first half of the century was on structural means to control floods and on federal financing, the need for a broader approach to flood control became apparent and the concept of comprehensive floodplain management was initiated.
- o 1960's: A Turning Point. During the 1960's, in recognition of ever-increasing flood losses and accelerating disaster relief costs, major steps were taken to redefine federal policy and approaches to flood control. The growing recognition of the need for alternative approaches to flood loss reduction was also reflected in state government actions, and to a more limited extent, in local attempts to deal with flood hazards in a more comprehensive manner. The most significant step toward a more unified federal policy came in 1966 with publication of House Document 465, "A Unified National Program for Managing Flood Losses." Establishment of the National Flood Insurance Program and passage of the National Environmental Policy Act were also significant.
- o 1970-1980: The Environmental Decade. During the 1970's, both the policy framework and management tools for floodplain management changed significantly. Numerous "environmental" laws and programs at the federal and state levels, as well as specific water policy initiatives, opened the way for a much broader perspective on floodplains and a more comprehensive approach to their management. During this period, more state and local governments became involved in floodplain management through participation in the NFIP, multi-purpose planning programs and many "innovative", smaller projects.
- o 1980's: Maturing of Floodplain Management. While numerous legislative and policy initiatives in the 1970's provided the broad planning framework for floodplain management, in the 1980's more attention has been given to putting policies and programs into effect. The federal government has assumed more of a coordinating role, while state and local governments have adopted a more primary role in establishing floodplain management strategies appropriate to their jurisdictions.

CHAPTER 5: A UNIFIED NATIONAL PROGRAM FOR FLOODPLAIN MANAGEMENT

A conceptual framework for a unified national program was set forth in 1976 in A Unified National Program for Floodplain Management, prepared by the U.S. Water Resources Council. This document was later revised and updated in 1979 by WRC and again in 1986 by FEMA to reflect changes in relevant policies, legislation and institutional arrangements, as well as progress in approaches to floodplain management.

- o House Document 465. House Document 465 was prepared in 1966 by the Task Force on Flood Control Policy in response to mounting national flood losses. The report included a number of recommendations for specific government actions to check these losses, including improvement of knowledge about the flood hazard, coordination and planning of new developments on the floodplain, provision of technical services to managers of floodplain property and improved federal flood control policy. H.D. 465 recommended the establishment of a unified national program emphasizing reorientation and strengthening of federal agency programs under existing authorities and the division of federal, state, local and individual responsibility for implementation.
- o A Unified National Program for Flood Plain Management, 1976. Ten years after H.D. 465 focused attention on the need for a new approach to managing flood losses, the Water Resources Council submitted A Unified National Program for Flood Plain Management to the President. This document provided the framework within which federal, state and local agencies could formulate effective policies and implement floodplain management activities. The 1976 document expanded on the ideas embodied in H.D. 465, provided a conceptual framework of general and working principles and set forth management "strategies" and various "tools" for implementing the national program.
- o 1979 Revisions to the Unified National Program. The 1976 Unified National Program was affected by several executive level actions, including Executive Orders on floodplain management and wetlands protection and the President's 1978 Water Policy Initiatives. The Federal Interagency Floodplain Task Force updated and refined the 1976 program in a report submitted in September 1979. A major area of change involved incorporating considerations of the natural values of floodplains into the program. The conceptual framework for floodplain management was refined to address protection of natural floodplain values as well as flood loss reduction. Also, working principles were expanded regarding floodplain use, flood loss reduction and natural floodplain values, and the strategies and tools were expanded to include those for managing natural values.
- o 1986 Unified National Program for Floodplain Management. In 1982, responsibility for the Unified National Program was assigned to the Federal Emergency Management Agency. The Interagency Task Force on Floodplain Management, operating under FEMA, submitted an updated Unified National Program in March 1986. The 1986 report reflected changes in federal legislation relevant to floodplain management as well as the results of major studies undertaken since completion of the 1979 report. Reflecting the increasing capability of state and local floodplain management, the report included more specific recommendations regarding the federal role in supporting state and local initiatives.

CHAPTER 6: ADVANCES IN BASIC KNOWLEDGE OF FLOOD HAZARDS AND FLOODPLAIN VALUES

During the last 20 years, major progress has been made in both understanding and measuring many of the basic processes and values needed for effective floodplain management. In some cases, entirely new techniques, such as satellite-remote sensing, have been developed to aid understanding or measurement. In other cases, techniques and processes long in existence have been refined or introduced into widespread use.

- o Climate and Climate Change. Climate research has revealed little change in mean climate factors over the past 500 years or so, but has shown that significant short-term variations are common. Recent research has resulted in projections of world-wide atmospheric warming expected to result in accelerated sea level rise and other climatic changes with significant implications for floodplain management.
- o Weather and Flood Forecasting. Technological advancements have resulted in greatly improved weather observation capability and significantly improved short-term weather and flood forecasts, although long-range forecasts are still largely experimental. Hurricanes can now be tracked accurately, though forecasting hurricane movement remains problematic. Precipitation forecasts for large-scale storms have improved and flood forecasting for large river basins is generally quite accurate. Precipitation and flood forecasts for local storms remains a problem, though recent developments in automated flash flood warning systems hold great promise.
- o Hydrology and Hydraulics. Rapid advances in computer technology have made possible the widespread use of hydrologic models for predicting flooding. New models for both riverine and coastal areas have been developed and the increased power of microcomputers has increased the potential applications of these models.
- o Resource Mapping. Major progress has been made in resource mapping critical to floodplain management. For example, the USGS has prepared topographic maps for essentially all of the Nation at a scale of 1:24,000. At the end of FY 1987, the SCS had mapped soils on just over 1.5 billion acres (about 2/3 of U.S. land area, excluding Alaska). Since initiation of the NFIP in 1968, floodplain maps as part of the flood insurance program have been prepared for over 18,600 communities. This mapping is supplemented by state and local efforts to provide greater detail, or cover additional areas. In 1974, the National Wetlands Inventory was established to provide scientific information on the extent and characteristics of the Nation's wetlands, and now covers 35 percent of the lower 48 states and 8 percent of Alaska.
- o Wildlife and Habitat. Research has greatly expanded scientific understanding of the functioning of riparian and estuarine habitats and the importance of these systems as life support for innumerable species of wildlife, including many threatened or endangered species. Major efforts have been focused on procedures for determining the functional values of wetlands.
- o Water Quality. Improved technology for measuring concentrations of pollutants in water has greatly expanded our understanding of the extent of water pollution. Understanding the effects of these pollutants on fish and wildlife, as well as humans, has also increased, but to a lesser extent.

CHAPTER 7: THE MANAGEMENT FRAMEWORK

Following the release of H.D. 465 in 1966, numerous changes have occurred in the management context for floodplain management. Some of these changes-- notably the NFIP--have been the direct result of initiatives to implement a recommendation of H.D. 465. Many more have occurred as a result of other factors such as major federal legislation. Important influences on floodplain management in the period from 1965 to 1987 include:

- o Function of the U.S. Water Resources Council from its creation in 1965 until it was dismantled in 1982.
- o Floodplain Management Executive Order 11296 in 1966 and EO 11988 in 1977.
- o Executive Order 11990, for protection of wetlands, in 1977.
- o National Flood Insurance Program in 1968.
- o Wild and Scenic Rivers Act of 1968.
- o National Environmental Policy Act of 1969.
- o Clean Water Act of 1972 as amended.
- o Coastal Zone Management Act of 1972 as amended in 1980.
- o National Dam Inspection Act of 1972.
- o Endangered Species Act of 1973 as amended.
- o Water Resources Development Act of 1974.
- o The creation of the Federal Emergency Management Agency in 1979.
- o Coastal Barrier Resources Act of 1982.
- o Bureau of Reclamation Reorganization in October 1987.

CHAPTER 8: REGULATORY AND DESIGN STANDARDS

Floodplain regulatory and design standards provide a means for uniform application and review of projects, and also provide a limited measure of effectiveness. Two types of standards are generally employed: specified standards which set some clearly identified limit or requirement, and performance standards which generally require that some goal be achieved, but allow for flexibility in how the goal is attained. Both types of standards are used in floodplain management. States and communities frequently adopt more stringent standards than apply nationally.

- o NFIP Standards. The NFIP has established a number of nationwide standards, including:

The 100-Year Flood and 100-Year Floodplain. The 100-year flood standard was adopted as part of the NFIP regulations and has subsequently been adopted by states and floodprone communities throughout the U.S. The 100-year base flood was formally established as a standard for use by federal agencies under E.O. 11988 in 1977.

Regulatory Floodway. As incorporated into the NFIP, the regulatory floodway must be delineated so that it can pass the 100-year base flood without increasing the water surface elevation within the regulatory floodway by more than one foot at any point.

Coastal Flood Elevations. The coastal velocity zone (V-zone) represents the distance inland from the shoreline over which storm surge can support a three-foot wave height--the wave height judged capable of causing structural damage. Base flood elevations in areas subject to coastal surge are based on the storm surge elevation plus the estimated wave crest elevation.

Elevation of Structures. Under the NFIP, residential structures must be elevated (including basement) to or above the 100-year base flood level. Non-residential structures may be elevated above the 100-year base flood level or "floodproofed" to resist damage from flooding.

- o Shoreline Setbacks. Several states have established requirements for development to be set back a specified distance from the shoreline, particularly in coastal areas. These standards are generally based on estimated erosion rates or protection of natural features.
- o Flood Protection Structures. Most structural measures for flood control are designed to a 100-year flood standard, with appropriate freeboard or other safety factors added. Major structures may be designed to a standard project flood or probable maximum flood.
- o Natural Values Protection. In addition to shoreline setbacks to protect natural features, several national standards have been established to protect natural values, including: water quality standards--both instream standards and discharge standards; wetlands classification and delineation standards; and "tolerable" rates of soil erosion from agricultural lands.

CHAPTER 9: FLOODPLAIN MANAGEMENT AND THE COURTS

Litigation concerning government flood loss reduction measures takes two principal forms: "constitutional" challenges to floodplain regulations and other loss reduction measures; and "liability suits" initiated by those suffering flood losses as a result of incorrectly designed, maintained or administered flood loss reduction measures.

The legality of various public flood hazard reduction measures and the threat of successful claims for damages against government agencies for such measures are of concern to floodplain managers at all levels of government. This concern has developed as a result of many court decisions in the last two decades holding government agencies liable for actions which increased flood damages. It is also the result of a number of lawsuits challenging the constitutionality of land use regulations, culminating in three U.S. Supreme Court decisions in 1987 which were widely reported in the press and have been the subject of a great deal of discussion and interpretation.

- o Keystone Bituminous Coal Association v. DeBenedictis. In this case, the Supreme Court upheld a Pennsylvania statute prohibiting coal mining which could cause the subsidence of residences or public buildings, and held that there was no taking of coal company-owned property because of the public health, safety and welfare issues involved. This decision would suggest that the Court was willing to give even more support to health and safety-related land use regulations than formerly.
- o First Evangelical Lutheran Church v. County of Los Angeles. The Supreme Court's decision in this case held that if building moratoria adopted by the county after a severe flood was a taking of private property, temporary damages should be awarded to the landowners who had been prevented from rebuilding a damaged structure. This decision was widely misinterpreted as holding that floodplain regulations in general were unconstitutional. The Court, in fact, carefully stated that it was not deciding the constitutionality of the regulations and held only that, as a matter of law, temporary damages would be available if a taking was determined.
- o Nolan v. California Coastal Commission. In this case, the Court held that the Coastal Commission's requirement that a property owner convey a beach access easement as a condition to granting the owner a permit for a new structure was a taking. The Court did not disapprove the nature of the condition but rather felt that the Commission had not adequately demonstrated that the condition substantially advanced state interests. The Court emphasized the need for a regulatory agency to show a reasonable nexus between a regulation and stated goals.

From a constitutional perspective, floodplain managers can continue to have confidence that performance-oriented floodplain regulations of all sorts (building codes, subdivision regulations, zoning) will be upheld in the courts despite severe restrictions that may affect private property owners in some instances. Certain guidelines should be followed in formulating these regulations, however, to lessen the risk of constitutional challenge. From a liability perspective, floodplain managers should have confidence that carefully thought-out flood loss reduction measures will generally reduce community and state liability.

CHAPTER 10: PERCEPTION, AWARENESS AND RESPONSE

Local perception of flood hazard--by both government agencies and floodplain residents--is related to such factors as previous experience with flooding, the extent of development in the floodplain and the existence of structural flood control measures. A community's response (or an individual's) to the perceived risk may depend on the seriousness of the flood problem in relation to other community problems, attitudes about land use management measures and other factors.

- o Recognition of Flood Risk and Vulnerability. Most people discount the probability of loss from infrequently occurring flood events. Although local officials recognize that property loss from flooding may be serious, it is usually not viewed as critical or even serious in relation to other community problems.

Individual perception of risk by floodplain residents may be quite different than that of local officials. Even if the flood risk is known, the advantages of a floodplain location may outweigh the disadvantages, or homeowners may be more concerned with the effects of floodplain regulations on resale values than with potential flood damages.

Present efforts to inform and educate individuals about their risk and vulnerability to flooding are clearly not entirely adequate. Consequently, some regulatory measures have been employed to force awareness or response. Floodplain regulations may force community awareness, and requirements for flood insurance provide at least some level of awareness for most individuals. In some jurisdictions, realtors must alert potential buyers if a property is located within a flood hazard area.

Terminology may also be an obstacle to adequate awareness of flood hazard. Terms such as the 100-year flood, regulatory floodway, floodproofing and mitigation may be poorly understood or misinterpreted by many floodplain residents and community officials.

- o Response to Flood Warnings. Response to flood warnings has generally improved as a result of newer and better communications systems. While sirens and door-to-door alerts are still part of the warning mechanism in many communities, cable television, radio, automatic telephone dialers and other mechanisms now provide for earlier warnings than previously possible. Improved communications are not without problems. Particularly in coastal areas, hurricane warnings may not be taken seriously if past storms proved to be of less intensity at particular areas than forecast.
- o Awareness of Floodplain Natural Values. Awareness of natural values associated with floodplains is more widespread now than 15 to 20 years ago. Many are aware of the importance of preserving wetlands, protecting endangered species and maintaining water quality. Yet this awareness does not necessarily translate into actions that will preserve or restore these values, particularly if some restriction of individual property rights is involved.

CHAPTER 11: MODIFYING SUSCEPTIBILITY TO DAMAGES AND DISRUPTION

Nonstructural measures to modify an individual's or community's susceptibility to flood damages and disruption have been the major focus of flood loss reduction efforts over the past 20 years--supplanting structural flood control measures.

- o Floodplain Regulations. As a result of participation in the NFIP, close to 20,000 communities have adopted at least minimal floodplain regulations. Many states and communities have adopted more stringent regulations than required by the NFIP.
- o Development and Redevelopment Policies. E.O. 11988 is the major policy at the federal level concerning development and redevelopment in floodplains. It firmly establishes the 100-year floodplain as the area to be concerned with. Most states have developed similar policy through executive order or legislation. At the federal level, there has been limited use of acquisition of undeveloped land in order to avoid flood losses. More common is acquisition of flood damaged properties to permanently remove them from the floodplain. This type of action is undertaken principally through Section 1362 of the NFIP, and often in combination with other federal, state and local funding sources.
- o Disaster Preparedness. Growing concern over a cycle of floodplain development, disastrous flooding and rebuilding to pre-flood conditions has prompted initiatives to undertake mitigation actions after a flood. In an effort to improve opportunities for post-disaster mitigation, emphasis has recently been placed on preparation of pre-disaster plans that can allow a community to take advantage of the "window of opportunity" for mitigation perceived to exist following a disastrous flood.
- o Disaster Assistance. A great variety of financial assistance programs are available to provide relief to individuals, businesses and governmental jurisdictions following a major flood. These programs are available as grants, loans and other forms of assistance such as unemployment assistance and tax relief.
- o Floodproofing. Significant research into effective floodproofing measures has been conducted in recent years. Effective construction practices have been identified for new residential and nonresidential development in coastal and riverine areas. Methods for retrofitting existing structures have also been researched and documented.
- o Flood Forecasting/Warning/Emergency Plans. Development of automated flood warning systems that employ near real-time collection of precipitation and streamflow data hold great promise for increasing warning time and reducing losses in remote locations and areas subject to flash flooding. Problems in implementing and maintaining these systems have developed, and as yet there is limited experience with these systems during actual floods.

CHAPTER 12: MODIFYING FLOODING

Flood control through structural measures is much less common today than 20 years ago. While few large projects are now constructed, a significant number of smaller scale projects are undertaken. Impacts of structural projects on natural values receive far greater attention as a result of NEPA and other environmental legislation. Many communities and floodplain residents still prefer structural measures because they perceive these measures to provide more complete protection, place fewer restrictions on property use and may require less financial outlays by individuals and communities than nonstructural projects.

- o Dams and Reservoirs. Few large dams are now constructed due to a combination of factors, including adverse impacts on natural values, limited number of available sites, high costs, limited federal funding, increased cost sharing requirements, less favorable discount rates and opposition from environmental groups.

Dam safety has emerged as a major issue following a series of disastrous dam failures in the late 1960's and early 1970's. Most states have now mounted dam safety programs focused on inspection, maintenance and regulation, including registration.

- o Dikes/Levees/Floodwalls. These structural measures may be effectively used in both riverine and coastal areas and still enjoy widespread but declining use. They are used much more commonly in some regions of the country than others. The FEMA levee policy, which requires construction to a 100-year standard, apparently has had an impact on construction of privately financed levees, many of which were historically not constructed to a 100-year standard.
- o Channel Alterations. Major channel alterations by dredging, straightening, diversions and use of concrete lining is no longer common. More modest channel alterations on smaller streams are still widely practiced. Use of rip rap and grass lined channels has largely replaced concrete lined channels in most areas.
- o Land Treatment Measures. Primarily applied on agricultural lands, land treatment measures are often employed to control excessive erosion and sedimentation as well as runoff.
- o Onsite Detention Measures. Onsite detention measures, particularly detention basins, have become very popular in some parts of the country. Typically associated with new subdivisions of land, these measures attempt to reduce runoff to predevelopment conditions, thereby eliminating any potential increase in downstream flooding or perhaps actually decreasing downstream flood potential. Potential adverse impacts may occur if decisions on detaining runoff do not take into account conditions throughout the entire watershed. Other problems include lack of provisions for maintenance and inspection of detention basins and control structures.

CHAPTER 13: MODIFYING THE IMPACTS OF FLOODING

A variety of measures can be applied to modify the impacts of flooding on individuals and communities.

- o Information and Education. Information and education efforts are intended to alert people to the risk and vulnerability of flooding and to encourage appropriate action. Federal and state governments and professional organizations have promoted technology transfer between floodplain professionals and government regulators. Workshops, seminars, and conferences as well as the preparation and distribution of technical publications has contributed to information exchange. Education of individuals has proceeded through preparation and distribution of non-technical pamphlets, and self-help publications. Radio and TV announcements, video tapes, neighborhood workshops and other mechanisms are used to inform individuals of flood hazards and assistance available to them following flooding.
- o Flood Insurance. Flood insurance is now available to residents of more than 17,700 communities. In 1986 just over 2 million flood insurance policies were in force under the NFIP, with insurance coverage at approximately \$151 billion. In the same year more than 18,800 claims were paid, totalling almost \$158 million. As part of its effort to increase the insurance base, the FIA recently initiated the "write-your-own" program whereby private insurance companies may directly write flood insurance policies that are still underwritten by the federal government.
- o Tax Adjustments. Tax adjustments are commonly used by states and localities following a flood disaster to provide some relief to flood victims. Typically, individuals may be relieved of paying some portion of property taxes, businesses may be afforded sales tax or other relief, and state governments may compensate local communities for losses in tax and other revenues. The federal government still provides limited tax deductions for casualties, including floods, but these allowances have been reduced with tax reform measures.
- o Flood Emergency Measures. Most communities have developed an emergency preparedness plan, but many have not developed detailed procedures for flood emergencies. Except in the most floodprone communities, specific warning, flood fighting and other emergency measures for neighborhoods subject to flooding have not been prepared. Because of the infrequency of flooding, emergency materials such as sand bags are often not available in needed quantities. Heavy reliance is placed by many communities on the National Guard and other outside assistance.
- o Post Flood Recovery. Traditionally, recovery from floods has meant restoring a community to its pre-flood condition. Efforts to accomplish post flood mitigation have been undertaken, but progress has been limited. Examples of efforts to incorporate mitigation into post-flood recovery include the establishment of post-flood hazard mitigation teams, development of pre-disaster plans for post-flood recovery/mitigation, and efforts to increase the portion of disaster funds that may be used for mitigation.

CHAPTER 14: MANAGING NATURAL AND BENEFICIAL VALUES

Limited preservation and restoration of natural values can be accomplished indirectly through flood loss reduction actions. For the most part, however, efforts to manage floodplain natural values are carried out separately from loss reduction efforts. With the exception of management of some riparian and estuarine resources, natural values management is usually not focused on floodplain natural values, but instead addresses a particular resource throughout its natural range. Private organizations play a greater role in protecting natural values than they do in efforts to reduce flood losses.

- o Regulations. A wide range of regulatory programs have been enacted at federal state and local levels to protect natural values. Examples of regulatory programs include: wetlands protection through the control of dredging and filling; environmental impact review requirements; groundwater and aquifer protection programs; erosion control programs; and permit requirements for discharge of pollutants into surface waters.
- o Development and Redevelopment Policies. Numerous programs at all levels of government establish policies that encourage, but generally do not require, protection of floodplain natural values. The most effective form of protection is to acquire areas that possess particularly important or unique natural values. Acquisition has been widely used, particularly by federal and state governments, to purchase wildlife refuges and parks. Other tools such as purchase of development of rights have been use to protect important farm lands and unique ecosystems. Private organizations have played a major role in identifying and acquiring important ecosystems.
- o Information and Education. Information on the importance and functions of floodplain natural values can receive widespread distribution. Environmental values are widely taught in schools at all levels, and popular television programs reach a wide audience. Additional information is provided by federal and state governments and local environmental organizations.
- o Tax Adjustments. Federal income and estate tax benefits are available to individuals and organizations who donate land and provide easements to governments and eligible non-profit organizations. Existence of these benefits has been a major factor in facilitating private donations of property with valuable wildlife and habitat functions.
- o Administrative Measures. Many kinds of administrative measures may be applied to help protect and restore floodplain natural values. Some of the most important of these measures address the inventory, classification and mapping of wetlands, wildlife, aquifers and other types of natural values. An important new measures links erosion control actions on agricultural lands to federal commodity payments.

CHAPTER 15: SUMMARY AND CONCLUSIONS

- o Status of the Unified National Program. Implementation or substantial progress has been achieved with regard to all but one of the initial recommendations put forth by the 1966 Task Force on Flood Control Policy. The one recommendation on which substantial progress has not been made is that which calls for the collection of more useful flood damage data, including maintenance of a continuing record and special appraisals in census years. Despite concerns that flood losses continue at a high level and are perhaps even increasing, comprehensive data is not available to document the extent of flood losses. Existing data collection efforts are fragmented and inconsistent.

While much progress has been made towards implementing the initial recommendations, the national context within which many of these recommendations were framed has changed greatly, and a new set of recommendations to guide future efforts is needed.

As an example of the changed context, the 1979 edition of the UNP added the preservation and restoration of floodplain natural values as a component of floodplain management equal to flood loss reduction. Now, almost 10 years later, only limited progress has been made toward integrating flood loss reduction and natural values management into comprehensive floodplain management efforts. These two aspects of floodplain management remain as largely separate efforts.

Concern with special flood hazard areas such as alluvial fans and areas subject to fluctuating lake levels represents another example of the changing national context for floodplain management. As progress has been made in reducing flood losses in riverine and coastal areas, attention has turned more to areas of special flood hazard. Additional research and management techniques, however, are needed to reduce flood losses and manage natural values in these areas.

- o Application of the Strategies and Tools. Each of the strategies and tools identified in the UNP has been effectively applied to help reduce flood losses or manage floodplain natural values. Over the past 15 years, the primary approach to floodplain management has involved the regulation of floodprone areas. Activities outside the floodplain have received limited attention, even though the impact of these activities on flooding and natural values may be great. Significant progress has been achieved in reducing the damage potential associated with new floodplain development and also in reducing damages to existing floodplain structures. Significantly less progress, however, has been achieved in avoiding floodplain occupancy or in removing inappropriate development.

Regulation, land acquisition, and other tools have proven effective in reducing the rate at which floodplain natural values have been lost. While most large-scale dredging, filling and other potentially destructive practices have been curtailed, small-scale loss or alteration of floodplain natural values continues. The cumulative impacts of these incremental losses is significant. Only minimal progress has been made in restoring floodplain natural values previously lost, and restoration techniques remain poorly understood.

CHAPTER 16: EXPECTED TECHNOLOGICAL CHANGES

Over the past 20 years, technological changes have directly and indirectly affected floodplain management. While future changes can not be predicted with any great certainty, it is expected that technological advancements with equal or greater impacts on floodplain management will continue. These advances are likely to involve:

- o Information Management and Transfer. Recent advances in information management and transfer are expected to continue, possibly at an accelerated pace. Relative to other fields of science and business, the floodplain management profession (and natural resource-related professions in general) have made limited use of available methods for information management and transfer. Expected advances include more rapid dissemination of information throughout the floodplain management community, an increase in direct communication among practitioners and the ability to develop and manipulate very large data bases of resource information and make this information readily available to potential users.
- o Forecasts and Warning. Automated flash flood warning systems are in the early stages of development and application, with technology yet to be perfected. With improvements in technological reliability, additional use of these automated systems will occur. Weather forecasting will also improve with the addition of new and improved remote sensing capabilities and the availability of more real-time data. Installation of new radar equipment and other tools will permit improved precipitation forecasts for small-scale storms and better flood forecasting for small watersheds.
- o Mapping. Mapping technology is expected to improve significantly, primarily through the expanded use of Geographic Information Systems. These systems will be able to combine natural resources data with man-made features to provide comprehensive maps and data bases of geographic areas of concern. GIS-generated maps will be easily manipulated and updated at low cost, thereby overcoming one of the major obstacles in floodplain management today.
- o Monitoring of Floodplains. There is currently only limited application of remote sensing techniques to floodplain management. In the future, however, these techniques should be applied to inventory and mapping of floodplain changes. Higher resolution high altitude photography and other forms of remote sensing should also permit greater accuracy in identifying floodplain activities.

CHAPTER 17: NEW MANAGEMENT APPROACHES AND INITIATIVES

Several new management initiatives are emerging that may play a significant role in future floodplain management efforts. Most of these new initiatives represent a broadening of the traditional role of floodplain management and greater integration of flood loss and natural values protection efforts.

- o Shoreline Erosion. An amendment to the NFIP included in the Housing Act of 1987 provides for an increased role of FIA in reducing shoreline erosion impacts. Shoreline structures in imminent danger of collapse as a result of erosion may receive flood insurance payments before the structure is actually damaged. Structures may be demolished or relocated behind specified setback limits. As a result of this Act, FEMA may be expected to increase its efforts with regard to shoreline erosion, including inventory, monitoring, research, and regulation.
- o River Basin or Watershed Management. Concern over the limited effectiveness of measures focused solely on areas subject to flooding has led to a resurgence of interest in more comprehensive river basin planning.
- o Greenways and River Corridor Programs. Related to increased interest in comprehensive river basin management is a new emphasis on greenways and river corridors. There is a growing belief that future flood loss reduction efforts must be integrated more closely with other community programs, particularly those involving recreation and protection of natural values.
- o Stormwater Management. Traditionally implemented through local programs, stormwater management is now receiving increased attention at state and federal levels. Stormwater management programs in urban areas are beginning to merge with floodplain management programs focused on overbank flooding. The increased federal and state interest is due, in part, to the large number of flood insurance claims (and policies) outside the designated 100-year floodplain.
- o Management of High Risk Areas. Several types of high risk areas recognized for years, have received only limited attention on a national basis. As development encroaches on these areas, the need for further research and technical and management techniques focusing on these areas has become evident.
- o FIA Community Rating System. The Community Rating System concept has generated widespread interest among professionals and communities. Similar to community fire rating programs, this program may have significant impacts on floodplain management, providing increased incentives for additional floodplain management measures and affecting, for example, structural projects developed by the SCS and maintained by communities.
- o Infrastructure Losses. Damages to infrastructure have continued to increase at higher rates than most other types of flood damages. These high losses combined with the aging of the Nation's infrastructure system, demonstrate a need to give greater attention to location of infrastructure in floodplains and to finding the means to pay for damages and repairs.

CHAPTER 18: EFFECTS OF EXTERNAL FACTORS

Future floodplain management efforts will be shaped not only by the decisions of floodplain management professionals and floodplain management objectives, but also by a number of external factors, some of which can be anticipated, while others cannot.

- o Population Growth and Demographic Changes. Current projections indicate major population growth and associated needs for housing, industry and infrastructure are likely to occur in the southwest and southeast. The southwest is generally arid, containing special flood hazards such as meandering channels, mudflows, alluvial fans and extremely fragile riparian ecosystems. The southeast has suffered the greatest flood damages over the past several years and currently exhibits the greatest vulnerability to major flooding.
- o The Economy. Even short-term changes in the world and National economy are largely unpredictable. Events with a major impact on the economy and national economic priorities could affect funding of floodplain management programs. Current trends and outlooks indicate the likelihood of a continued reduction in levels of federal funding, and increased cost sharing with state and local governments for all types of programs and projects.
- o Cataclysmic Events. Volcanic eruptions, a major earthquake, accelerated sea level rise, a major tsunami, cyclical changes in precipitation patterns causing drought or increased flooding and other natural disasters could shift the emphasis and funding of government programs. Few of these events can be planned for except on a contingency basis.
- o Technological changes. Some technological advances, such as improvements in telecommunications, remote sensing and data processing and information management can be anticipated. Other, currently unanticipated advances, may have significant impact on floodplain management activities.
- o Privatization. Some government activities with impacts on floodplain management have been partially or entirely turned over to the private sector. A prominent example is the sale and distribution of remote sensing data from the LANDSAT satellites. At the same time, commercial enterprises have become involved in some traditional government functions while government responsibility continues. One example is the emergence of private weather forecasting services and even private flood forecasting services. Further shifts in the distribution of traditional government/private products and services may be anticipated, but the exact nature of these changes can not be predicted.
- o National Priorities. National priorities, as carried out by government agencies and the private sector, shift with time. For example, in recent years there has been an increase in government funding of earthquake research and a shift of some research emphasis from flood-related to earthquake-related topics.

SECTION II:

INFORMATION FOR CONCURRENT WORKSHOPS ON TUESDAY, MAY 17

ASSOCIATION OF STATE FLOODPLAIN MANAGERS 12TH ANNUAL CONFERENCE

MAY 16-19, 1988 NASHVILLE, TENNESSEE

The first day of the Nashville Conference is largely devoted to assisting the Interagency Task Force on Floodplain Management with its assessment of the Nation's program for floodplain management, including the effectiveness of strategies and tools for reducing flood losses and preserving/restoring floodplain natural values.

During the Plenary session on Tuesday morning, representatives from the Interagency Task Force on Floodplain Management and its study contractor will provide background information on the Unified National Program for Floodplain Management, purposes of the current evaluation, the status of the evaluation to date, and remaining activities to complete the evaluation.

The concurrent workshops in the afternoon are devoted to evaluating selected aspects of floodplain management activities. Each workshop will focus on a specific topic. A workshop moderator and three panelists will provide short presentations followed by discussion among all participants. The following pages list an hypothesis and related questions that will be addressed in each workshop to help guide the discussions. Please use these workshop descriptions to help you decide which of the concurrent workshops you wish to attend.

In addition to addressing these specific questions, each workshop participant, is asked to assist the Interagency Task Force on Floodplain Management by completing a questionnaire to be provided at the beginning of each workshop. Completed questionnaires should be turned in to workshop moderators at the conclusion of each workshop. The questions--listed below--will apply to each workshop:

1. What, in your opinion, are the major impediments to successful implementation of floodplain management measures discussed in this workshop?
2. What actions do you recommend to overcome these impediments?
3. Can you provide examples illustrating application of these measures (innovative approaches/successes/failures).

Please take the time and effort to give a thoughtful response to these questions. Your input is important to the Task Force's evaluation of the effectiveness of the Nation's program for floodplain management.

WORKSHOP # 1 (1:30 - 3:00): NATURAL AND BENEFICIAL VALUES

CONFLICTS BETWEEN FLOOD LOSS REDUCTION AND NATURAL VALUES PROTECTION

Hypotheses: Most floodplain management strategies and tools for flood loss reduction--both structural and nonstructural--are optimized to prevent loss of life and injury to people and to reduce damages to structures, personal property and infrastructure. Few of these strategies and tools effectively serve to either protect or restore floodplain natural values. In fact, many floodplain management strategies and tools actually contribute to loss of floodplain natural values.

Questions: 1. Provide some examples of existing floodplain management tools that illustrate a conflict between flood loss reduction and natural values protection, e.g.:

Floodproofing: Floodproofing of new construction makes it possible to place additional development within floodplains, potentially causing further loss of natural values; retrofitting of existing structures maintains inappropriate development in floodplains, preventing potential restoration of natural values.

Floodways: Designation of narrow floodways in shallow floodplains and on meander belts effectively encourages development in flood fringe areas, and leads to confinement of a naturally moving channel.

Principles and Guidelines for Water Resources Projects. The Principles and Guidelines emphasize a positive benefit/cost ratio and National Economic Development guidelines over Environmental Quality guidelines, resulting in design of structural flood control projects that do not protect floodplain natural values.

2. Are these and other conflicts between loss reduction and natural values protection inevitable? Or, can and should the strategies and tools for flood loss reduction be modified or supplemented to explicitly include protection/restoration of natural values?
3. In what ways can flood loss reduction tools that presently contribute to loss of natural values be modified to strike a better balance between flood loss reduction and natural values protection?

WORKSHOP # 2 (1:30 - 3:00): AWARENESS AND PREPAREDNESS

The Role and Effectiveness of Information and Education
Vs. Mandatory Requirements

Hypothesis: Current information, education and other voluntary approaches are inadequate to cause people to be sufficiently aware of flood risks and to take appropriate preparedness measures. Additional mandatory measures are needed.

- Questions:
1. What is the relative effectiveness of available awareness and preparedness tools? i.e. which are most effective; which are least effective? Why?
 2. To what extent is terminology an obstacle to risk awareness and perception?
 - a. What specific terminology poses problems? e.g. 100-year flood; mitigation; regulatory floodway; floodproofing.
 - b. How can these problems be overcome? Better ways of explaining the terms to the general public; replacement of the term with a more suitable one; eliminating multiple definitions of the same term; etc.
 3. Should floodplain managers use more forced awareness (i.e. regulatory) measures to improve flood risk awareness? e.g. notification of flood risk through real estate brokers.
 4. Where should awareness efforts be focused:
 - a. Local officials
 - b. Floodplain residents
 - c. Other community residents
 5. Are current measures for informing and educating local elected officials of flood risk sufficient, given the high turnover rate that typically occurs?

WORKSHOP # 3 (1:30 - 3:00): LAND USE REGULATIONS

GOING BEYOND NFIP MINIMUMS: STATE AND LOCAL REGULATIONS

Hypothesis: The existing minimum floodplain management regulations required by the NFIP are not stringent enough to adequately regulate floodplains. State and local governments have had to adopt more stringent regulations.

- Questions:**
1. Where state and local governments have adopted more stringent standards or additional requirements than the NFIP minimums, are there data available to show how effective they are:
 - a. In reducing flood damages?
 - b. In protecting natural values?
 2. Should the minimum NFIP regulations be strengthened to incorporate some of the more stringent requirements commonly adopted by state and local governments? Or, should state and local governments continue to be responsible for adopting more stringent requirements in response to local needs?
 3. If NFIP regulations were to be strengthened, which of the state and local regulations that go beyond minimum NFIP regulations have nationwide application and are thereby most suitable for being added to NFIP regulations:
 - a. More stringent standards for existing requirements?
 - b. Additional requirements not presently included in the NFIP minimum regulations?

WORKSHOP # 4 (1:30 - 3:00): POST-FLOOD RESPONSE AND RECOVERY

EFFECTIVENESS OF PRE-DISASTER PLANS FOR POST-DISASTER RECOVERY AND MITIGATION

Hypotheses: While there are examples of good post-flood mitigation, most post-flood efforts are still focused on recovery and only limited attention given to mitigation.

Pre-flood plans for post-flood recovery and mitigation can have only limited effectiveness.

- Questions:
1. Are pre-flood plans for post-flood recovery and mitigation really effective?
 - a. Provide some examples of communities that have actually prepared and used a pre-flood plan for post-flood recovery and mitigation.
 - b. Should plans focus most on recovery or mitigation; or treat both equally?
 - c. Should the plans attempt to be very site specific in identifying post-flood mitigation actions, or should they focus on the process of mitigation in the post-flood period?
 - d. What types of flood situations (combinations of flood risk and vulnerability) demand a high priority for pre-flood plans for post-flood recovery and mitigation? What types of flood situations do not require a high priority for pre-flood plans?
 - e. Should pre-flood plans focus on damages from the 100-year flood, or should they also attempt to address more frequent but less severe flooding?
 2. How real is the "window of opportunity" for mitigation actions, following a flood disaster?
 - a. How severe must the disaster be before the "window" opens? Is there a continuum of gradually increasing opportunity or is there some threshold (extent of damage or other measure) below which the window of opportunity effectively does not exist?
 - b. When does this "window of opportunity" begin and how long does it last?
 - c. What can be done to lengthen the time frame?
 3. Should post-flood financial assistance be more closely linked to:
 - a. existence of pre-disaster plans;
 - b. implementation of mitigation measures with or without a pre-disaster plan?

WORKSHOP # 5 (1:30 - 3:00): MULTIOBJECTIVE USES OF FLOODPLAINS

TYING FLOOD LOSS OBJECTIVES TO OTHER COMMUNITY OBJECTIVES

Hypothesis: Community (and state) efforts to implement programs/projects for flood loss reduction on a neighborhood, community or watershed level have often been ineffective, in part because the efforts are viewed as providing special benefits to a limited segment of the community at the expense of the entire community. Floodplain management efforts would be more effective if combined with other community programs, such as recreation, wetlands protection, water quality maintenance, etc.

- Questions:**
1. Provide some examples of successful multiobjective programs that were effective at reducing flood losses.
 2. How important are multiobjective programs to increased floodplain management in the future?
 3. What kinds of community programs provide the greatest potential for joining with flood loss reduction efforts?
 - a. recreation programs
 - b. urban redevelopment initiatives
 - c. environmental quality efforts
 - c. other community programs
 4. How can floodplain management initiatives take advantage of the Greenway concept promoted by the President's Commission on Americans Outdoors?
 5. How can single purpose goals of different community programs be achieved when undertaking multiobjective projects?

WORKSHOP # 6 (3:30 - 5:00): NATURAL AND BENEFICIAL VALUES (Part 2)

SUCCESS IN ACHIEVING FLOOD LOSS REDUCTION AND PROTECTION OF NATURAL VALUES

Hypothesis: While flood loss reduction efforts may often conflict with protection and restoration of floodplain natural values, there are examples of successfully combining these two aspects of floodplain management, and lessons can be learned by examining these efforts.

- Questions:
1. Which floodplain management programs or specific tools (at any level of government) have proven most effective at combining flood loss reduction with protection or restoration of:
 - a. Floodplain natural values?
 - b. Cultural values associated with floodplains? e.g. recreation, agriculture, historic sites.
 2. What makes these programs effective?
 3. How can these programs be made to work effectively at other levels of government and at other locations?
 4. How can flood insurance coordinators, and other floodplain managers concerned primarily with flood loss reduction increase their awareness and understanding of floodplain natural values and incorporate this awareness and understanding into floodplain management practices?

WORKSHOP # 7 (3:30 - 5:00): AWARENESS AND PREPAREDNESS (Part 2)

EFFECTIVENESS AND RELIABILITY OF NEW TECHNOLOGIES

Hypotheses: Community operated automated flood forecasting and warning systems have not yet fulfilled their promise of providing greater reliability, increased warning time and reduced flood losses. To date they have generally been more expensive and less reliable than anticipated, with little proven advantages over previous methods.

Methods for notifying floodplain residents of flooding and actions they can take to reduce flood losses have not been improved to keep pace with the increase in warning time potentially provided by automated flood warning systems.

Community preparedness plans are not kept up-to-date with flood warning technology; communities are not able to respond adequately to the warnings their technicians can provide.

- Questions:**
1. What actual flood experience is available to evaluate the effectiveness of automated flood warning systems?
 2. What measures of effectiveness should be employed to evaluate the effectiveness of automated flood warning systems?
 3. Presumably, not all floodprone communities are good candidates for automated flood warning systems.
 - a. What criteria can be used to identify those communities where an automated flood warning system has high potential for being more effective than a manual system?
 - b. Who should identify high priority communities?
 4. How can flood warning and preparedness for the individual floodplain occupant be improved to keep pace with the new technology for flood forecasting and warning?
 5. How can communities maintain their preparedness plans at a level commensurate with their warning capabilities?

WORKSHOP # 8 (3:30 - 5:00): LAND USE REGULATIONS (Part 2)

GOING BEYOND NFIP MINIMUMS: STATE AND LOCAL REGULATIONS

Hypothesis: The existing minimum floodplain management regulations required by the NFIP are not stringent enough to adequately regulate floodplains. State and local governments have had to adopt more stringent regulations.

- Questions:
1. If NFIP minimum regulations are not strengthened:
 - a. Which more stringent standards and additional requirements should be targeted for encouraging more state and local governments to adopt?
 - b. What is the most effective mechanism(s) for encouraging more state and local governments to adopt additional requirements?
 2. Are specific standards or performance standards generally more effective at achieving objectives? Why?
 3. Should any existing performance standards be changed to specific standards, or specific standards to performance standards?
 4. How can more consistent and effective enforcement of regulations by local communities be accomplished?

WORKSHOP # 9 (3:30 - 5:00): COMBINED STRUCTURAL/NONSTRUCTURAL APPROACHES

IMPROVED INTEGRATION OF STRUCTURAL AND NONSTRUCTURAL MEASURES

Hypothesis: Regional flood control projects offer special opportunities for combining structural and nonstructural measures for flood loss reduction and natural values protection. Yet, most regional projects seem to consist primarily of structural measures combined with required nonstructural regulatory measures, but absent non-regulatory nonstructural measures.

- Questions:**
1. What are some good examples of combined structural/nonstructural floodplain management projects?
 2. What types of flooding problems lend themselves to combined approaches?
 3. Are different approaches needed for rural vs. developed watersheds?
 4. Does the proliferation of the use of detention basins in rapidly developing areas pose a long-term problem due to:
 - a. Adverse cumulative impacts resulting from case-by-case review and approval of projects rather than evaluation of impacts on a watershed basis?
 - b. Safety concerns stemming from lack of operation and maintenance requirements and enforcement authority?
 - c. Degradation of natural values resulting from lack of operation and maintenance requirements and enforcement authority?
 5. What are some of the institutional obstacles to regional (watershed) floodplain management projects posed by the involvement of more than one local government unit? How can they be overcome?
 6. Many state governments have separate offices--and in many cases separate agencies--that deal with nonstructural flood loss reduction, structural flood control, and natural values protection.
 - a. How much of an obstacle does this organization pose in developing integrated structural/nonstructural projects that both reduce flood losses and protect natural values?
 - b. How can these offices work together to develop better floodplain management projects?

WORKSHOP # 10 (3:00 - 5:00): SPECIAL FLOOD HAZARDS

ARE SPECIAL APPROACHES NEEDED FOR SPECIAL FLOOD HAZARDS?

Hypothesis: Most of the existing floodplain management strategies and tools were developed based on more traditional overbank riverine flooding in humid regions of the country. Many of these approaches are inadequate for special flood hazard areas (such as alluvial fans, meandering channels, mudflows, ice jams, and fluctuating lake levels) and may even exacerbate flooding problems.

- Questions:
1. Do special flood hazards really require different approaches from conventional flood hazards?
 2. What are some examples of unexpected adverse impacts associated with application of traditional approaches to floodplain management in special flood hazard areas?
 3. What are some good examples of different approaches to floodplain management in special flood hazard areas that have worked well?
 4. What are the major obstacles to improving management of special flood hazards?
 5. What additional basic research is needed to better understand the natural processes of special flood hazard areas?