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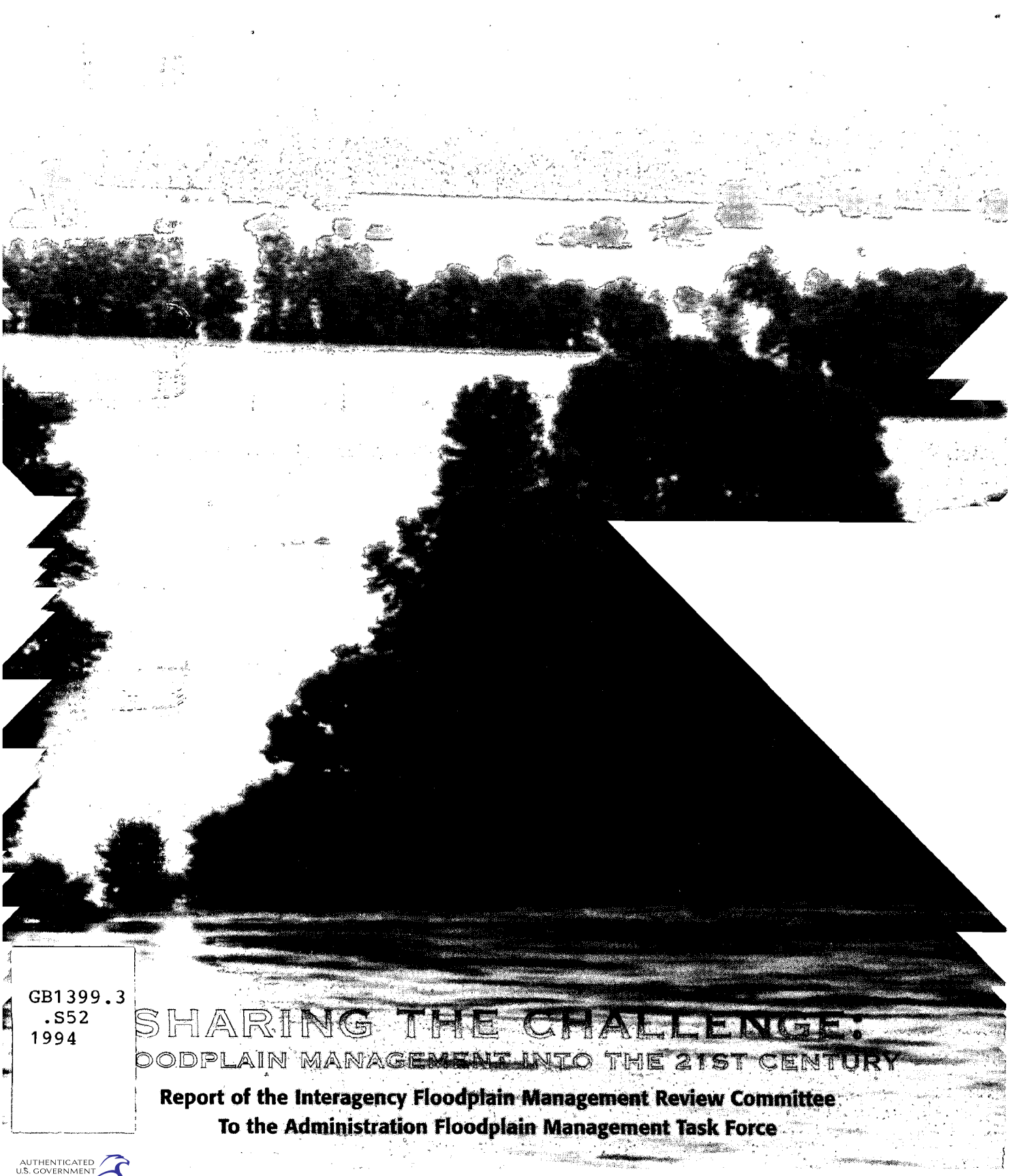

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SHARING THE CHALLENGE:
FLOODPLAIN MANAGEMENT INTO THE 21ST CENTURY

Report of the Interagency Floodplain Management Review Committee
To the Administration Floodplain Management Task Force

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THE FLOOD

Then God, our Lord, hindered the work with a mighty flood of the great river, which at that time – about the eighth or tenth of March [of 1543] -- began to come down with an enormous increase of water: Which in the beginning overflowed the wide level ground between the river and cliffs; then little by little it rose to the top of the cliffs. Soon it began to flow over the fields in an immense flood, and as the land was level without any hills there was nothing to stop the inundation.

...The flood was 40 days in reaching its greatest height, which was the 20th of April, and it was a beautiful thing to look upon the sea where there had been fields, for on each side of the river the water extended over twenty leagues of land, and all this area was navigated by canoes, and nothing was seen but the top of the tallest trees...

...By the end of May the river had returned within its banks.

Garciliaso de la Vega describing the DeSoto Expedition
On the banks of the Mississippi River near Tunica, Mississippi
History of Hernando DeSoto, Lisbon, 1605

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WASHINGTON, D,C.
JUNE 1994

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EXECUTIVE OFFICE OF THE PRESIDENT
INTERAGENCY FLOODPLAIN MANAGEMENT REVIEW COMMITTEE
WASHINGTON, D.C. 20503

June 30, 1994

TO: The Administration Floodplain Management Task Force
T. J. Glauthier, Associate Director, Office of Management and Budget
Kathleen McGinty, Director, White House Office of Environmental Policy
James R. Lyons, Assistant Secretary of Agriculture for Natural Resources

SUBJECT: Final Report

Forwarded herewith for your consideration is, *Sharing the Challenge: Floodplain Management into the 21st Century*, the final report of the Interagency Floodplain Management Review Committee.

In January 1994 you assigned the Review Committee the mission to delineate the major causes and consequences of the 1993 Midwest flooding; to evaluate the performance of existing floodplain management and related watershed management programs. The review Committee also was to make recommendations to the Task Force on changes in current policies, programs, and activities of the federal government that most effectively would achieve risk reduction, economic efficiency, and environmental enhancement in the floodplain and related watersheds.

The report provides the Review Committee's findings and recommendations for action. The thesis of the report is straightforward. Floods will continue to occur. The goals for floodplain management are clear. The means to carry out effective floodplain management exist today but need improvement and refocusing. It is now time to organize a national effort to conduct effective and efficient floodplain management. It is time to share responsibility and accountability for accomplishing floodplain management among all levels of government and with the citizens of the nation.

I would emphasize that the report represents the views of the Review Committee and is based on its research and interactions with federal, state and local officials, businesses, interest groups, and individuals in and outside the upper Mississippi River Basin. It does not necessarily represent the views of the agencies represented on the Review Committee or the views of the Administration. It is now up to the Administration to determine which of the recommendations and actions should be implemented on what schedule.

The Review Committee appreciates the support and guidance that you provided over the past six months as well as the opportunity to participate in such an interesting and important endeavor.

Gerald E. Galloway
Brigadier General, U.S. Army
Executive Director

Thanks

The Review Committee acknowledges with deep appreciation the assistance and thoughtful advice received from many federal, state, and local agencies, organizations, and individuals contacted during the course of this review. The collective wisdom, insights and experiences of these many people provided the Review Committee with an understanding of the problems and challenges of both living in and managing the floodplain. The Review Committee owes a debt of gratitude to those who set up and facilitated the public outreach sessions and the visits to flood affected areas. There will never be a substitute for seeing the problem area or talking to someone who has been through a flood.

Far too many people contributed to the effort to name them all individually. Because of their special contributions, however, the Review Committee would like to give special thanks to several groups and individuals. The leadership of the Administration Floodplain Management Task Force -- T. J. Glauthier, Associate Director, Office of Management and Budget; Kathleen McGinty, Director, White House Office for Environmental Policy; James R. Lyons, Assistant Secretary of Agriculture for Natural Resources -- gave the Committee its charge and guided it along its path. Kathryn Way, White House Domestic Policy Council assisted in coordinating efforts with the states. Bruce Long, OMB, and Will Stelle, White House Office for Environmental Policy provided both expertise and day-to-day shepherding of Committee activities. Mark Schaefer, White House Office of Science and Technology Policy, assisted with SAST. Ray Clark, Patti Leppert-Slack and Kathleen Gallagher, Council on Environmental Quality, provided substantive insights and moral and administrative support. The White House Council of Economic Advisors sponsored Economics Advisory Group with Erik Lichtenberg, Chair; Jon Goldstein, USFWS; Jim Schaub, USDA; Peter Kuch, EPA; Robert Stearns, Department of the Army; and Norm Starler, OMB, served as an invaluable sounding board. Margaret Siegel, the National Governors Association, facilitated contacts with the flood-affected and other interested states. Connie Hunt, the World Wildlife Fund, sponsored three in-basin workshops on use of the floodplain. Chris Brescia, MARC 2000, facilitated access to the agriculture and river communities. W. H. Klingner and John Robb, Upper Mississippi Flood Control Association, provided entry to the many levee and drainage districts of the basin. Tom Waters, the Missouri Levee and Drainage District Association, offered a steady stream of information about the Missouri River levee situation. The Universities Council on Water Resources, Duane Baumann, gathered a team of distinguished academicians -- Ray Burby, Shirley Laska, Luna Leopold, Mary Fran Myers, Leonard Shabman, and Gilbert White -- to provide their views on floodplain management. Doug Plasencia and Larry Larson, Association of State Floodplain Managers, and Jon Kusler, Association of State Wetland Managers, shared their experiences and opened their files and their membership to the Review Committee. The nine flood state governors and their representatives facilitated and guided the Committee's extensive contacts within the states: Al Grosboll, Don Vonnahme and Maureen Crocker, Illinois; General Harold (Tommy) Thompson and LTC Tom Tucker, Iowa; Cindy Luxem, Kansas; Todd Johnson and Jim Franklin, Minnesota; Jerry Uhlman and Jill Friedman, Missouri; Dayle Williamson and Brian Dunnigan, Nebraska; Dave Sprynczynatyk and Jeff Klein, North Dakota; Gary

Whitney, South Dakota; Lee Conner and Diane Kleiboer, Wisconsin. Holly Stoerker, Upper Mississippi River Basin Association, and Richard Oppek, Missouri River Basin Association invited the Review Committee to participate in the meetings of the Associations and shared their years of experience.

Throughout the study process, the Review Committee benefited from the advice and information provided by many members of Congress, by their staff members, and by the key committee staffs.

The Review Committee would also like to thank the many Washington and basin based organizations that provided assistance and advice, especially the American Farm Bureau Federation, the American Society of Civil Engineers, the Association of State Flood and Stormwater Managers, the Association of American State Geologists, the Environmental Defense Fund, the Illinois Farm Bureau Federation, the McKnight Foundation, the National Association of Conservation Districts, the National Corn Growers Association, the National Waterways Conference, the National Wildlife Federation, the Natural Disaster Coalition, the Nature Conservancy, and the Sierra Club.

The individuals within federal agencies who served as advisors on agency activities and as focal points to facilitate information exchange with the Review Committee deserve special note: Army, John Zirschky; DOI, Michelle Altemus and Russ Earnest; USDA, Tom Hebert, Oleta Fitzgerald, and Eric Olsen; EPA, Dick Sanderson and David Davis; FEMA, Dick Moore, Dick Krimm, Jane Bullock, Morrie Goodman, and Martha Braddock; HHS, RADM Frank Young; HUD, Truman Goins; DOT, Susan Gaskins; DOL, Ed Flynn; NWS, Eugene Stallings; and USACE, MG Stan Genega, Hugh Wright, and Jerry Peterson.

During the preparation of any report, invaluable assistance is provided by the individuals who go beyond 'the call of duty.' The Review Committee would like extend its thanks to Paul Alberti, Don Barnes, Whalen Blair, Patti Cogdell, Gary Dyhouse, Mary Lou East, Brian Hyde, George Johnson, Jim Kazel, Stuart Kasden, John Kerr, David Lawson, Andy Manale, Kermit Mann, David May, John McShane, Jeanne Melanson, Mark Merritt, Matt Miller, Marty Reuss, Kyle Schilling, Josephine Scott, Eugene Stakhiv, Kevin Tonat, Nancy Yeager, Chet Worm, Larry Zensinger, and Don Zochi.

Thanks are due to the National Park Service, the USACE, the USDA and the Missouri Department of Conservation for the photographs used in the report.

While the above groups and individuals have provided much valuable advice, the Review Committee bears sole responsibility for all views expressed in this report.

SHARING THE CHALLENGE: FLOODPLAIN MANAGEMENT INTO THE 21st CENTURY

The Report of the Interagency Floodplain Management Review Committee

ABSTRACT

June 1994

The Midwest Flood of 1993 was a significant hydrometeorological event. In some areas it represented an unusual event; in most others, however, it was just another of the many that have been seen before and will be seen again. Flood flows similar to those experienced by most of the Midwest can occur at any time. During the decade ending in 1993, average annual flood damages in the United States exceed $3 billion. Flood damages are a national problem.

Excessive rainfall, which produced standing water, saturated soils, and overland flow, caused major damages to upland agriculture and some communities. In turn, runoff from this rainfall created, throughout the basin, flood events that became a part of the nation's 1993 TV experience. Damages overall were extensive: between $12 billion and $16 billion that can be counted, and a large amount in unquantifiable impacts on the health and well-being of the population of the Midwest.

Human activities in the floodplains of the Midwest over the last three centuries have placed people and property at risk. Local and federal flood damage reduction projects were constructed to minimize the annual risk, and, during the 1993 flood, prevented nearly $20 billion in damages. Some of these programs, however, attracted people to high risk areas and created greater exposure to future damages. In addition, flood control, navigation, and agricultural activities severely reduced available floodplain habitat and compromised natural functions upon which fish and wildlife rely.

Over the last 30 years the nation has learned that effective floodplain management can reduce vulnerability to damages and create a balance among natural and human uses of floodplains and their related watersheds to meet both social and environmental goals. The nation, however, has not taken full advantage of this knowledge. The United States simply has lacked the focus and the incentive to engage itself seriously in floodplain management. The 1993 flood has managed to focus attention on the floodplain and has provided the incentive for action.

The Interagency Floodplain Management Review Committee proposes a better way to manage the floodplains. It begins by establishing that all levels of government, all businesses and all citizens have a stake in properly managing the floodplain. All of those who support risky behavior, either directly or indirectly, must share in floodplain management and in the costs of reducing that risk. The federal government can lead by example; but state and local governments must manage their own floodplains. Individual citizens must adjust their actions to the risk they face and bear a greater share of the economic costs.

The Review Committee supports a floodplain management strategy of, sequentially, avoiding inappropriate use of the floodplain, minimizing vulnerability to damage through both structural and nonstructural means, and mitigating flood damages when they do occur.

By controlling runoff, managing ecosystems for all their benefits, planning the use of the land and identifying those areas at risk, many hazards can be avoided. Where the risk cannot be avoided, damage minimization approaches, such as elevation and relocation of buildings or construction of reservoirs or flood protection structures, are used only when they can be integrated into a systems approach to flood damage reduction in the basin. When floods occur, impacts on individuals and communities can be mitigated with a flood insurance program that is funded by those who are protected. Full disaster support for those in the floodplain is contingent on their participation in these self-help mitigation programs. Measures that

internalize risks reduce the moral hazard associated with full government support.

To ensure a long-term, nationwide approach to floodplain management, the Review Committee proposes legislation to develop and fund a national Floodplain Management Program with principal responsibility and accountability at the state level. It also proposes revitalization of the federal Water Resources Council to better coordinate federal activities, limited restoration of some basin commissions for basin-wide planning, and issuance of a Presidential Executive Order requiring federal agencies to follow floodplain management principles in the execution of their programs.

The upper Mississippi River Basin includes both individually authorized federal flood damage reduction projects and levees built by local groups and individuals. This pattern of development is unique and requires a unique approach. The Review Committee proposes a plan to identify and evaluate the needs of the basin, to ensure the integrity of a flood damage reduction system that meets the needs of the basin, and to restore natural floodplain functions on appropriate lands.

The nation knows where to go with floodplain management and how to get there. This report provides a map showing the shortest route to success. The nation now must take the actions required to do so.

REPORT OF THE INTERAGENCY FLOODPLAIN MANAGEMENT REVIEW COMMITTEE
to the
ADMINISTRATION FLOODPLAIN MANAGEMENT TASK FORCE

EXECUTIVE SUMMARY

The time has come to face the fact that this Nation can no longer afford the high costs of natural disasters. We can no longer afford the economic costs to the American taxpayer, nor can we afford the social costs to our communities and individuals.

James L. Witt
Director, Federal Emergency Management Agency
Testimony before Congress, October 27, 1993

FLOODPLAINS AND THE NATION

The upper Mississippi and Missouri rivers and their tributaries have played a major role in the nations's history. Their existence was critical to the growth of the upper Midwest region of the United States and fostered the development of major cities and a transportation network linking the region to the rest of the world. The floodplains of these rivers provide some of the most productive farmland in the country. They offer diverse recreational opportunities and contain important ecological systems. While development of the region has produced significant benefits, it has not always been conducted in a wise manner. As a result, today the nation faces three major problems:

First, as the Midwest Flood of 1993 has shown, people and property remain at risk, not only in the floodplains of the upper Mississippi River Basin, but also throughout the nation. Many of those at risk do not fully understand the nature and the potential consequences of that risk; nor do they share fully in the fiscal implications of bearing that risk.

Second, only in recent years has the nation come to appreciate fully the significance of the fragile ecosystems of the upper Mississippi River Basin. Given the tremendous loss of habitat over the last two centuries, many suggest that the nation now faces severe ecological consequences.

Third, the division of responsibilities for floodplain management among federal, state, tribal and local governments needs clear definition. Currently, attention to floodplain management varies widely among and within federal, state, tribal and local governments.

The Interagency Floodplain Management Review Committee proposes a better way to manage the nation's floodplains. This report not only describes the nature and extent of the 1993 flooding and government efforts to cope with the event but also presents a blueprint for change. This blueprint is directed at both the upper Mississippi River Basin and the nation as a whole. Its foundation is a sharing of responsibilities and accountability among all levels of government, business,and private citizens. It provides for a balance among the many competing uses of the rivers and their floodplains; it recognizes, however, that all existing

activities in the floodplain simply cannot be discarded as inappropriate. Implementing this approach, the Review Committee believes, will bring about changes necessary to reduce flood vulnerability to both the infrequent major flood events and the more frequent smaller ones. Implementation also will reduce the environmental, social, and economic burdens imposed by current conditions on both public and private sectors.

SHARING THE CHALLENGE - FEDERAL, STATE, TRIBAL AND LOCAL GOVERNMENTS, BUSINESSES, CITIZENS

Since passage of the Flood Control Act of 1936, the federal government has dominated the nation's flood damage reduction efforts and, as a result, the nation's floodplain management activity. Structural programs were deemed important and were also the principal sources of funds for any efforts to stem the rising tide of flood losses. In recent years, the federal government has begun to support nonstructural approaches. Many states, tribes, and local governments have developed and carried out floodplain management efforts that both reduced flood damages and enhanced the natural functions of floodplains. In carrying out these programs, however, they have been hampered by uncoordinated and conflicting federal programs, policies, regulations and guidelines that have hindered efficient floodplain management. Some state and local governments have not been as active in floodplain management. With the federal government assuming the dominant role and funding most ecosystem restoration, flood damage reduction, and flood recovery activities, the incentive has been limited for many state, tribal and local governments, businesses, and private citizens to share responsibility for making wise decisions concerning floodplain activity. Now is the time to:

- Share responsibility and accountability for accomplishing floodplain management among all levels of government and with all citizens of the nation. The federal government cannot go it alone nor should it take a dominant role in the process.

- Establish, as goals for the future, the reduction of the vulnerability of the nation to the dangers and damages that result from floods and the concurrent and integrated preservation and enhancement of the natural resources and functions of floodplains. Such an approach seeks to avoid unwise use of the floodplain, to minimize vulnerability when floodplains must be used, and to mitigate damages when they do occur.

- Organize federal programs to provide the support and the tools necessary for all levels of government to carry out and participate in effective floodplain management.

COMMITTEE FINDINGS:

In conducting the review, the Committee divided its findings into two areas: the Midwest Flood of 1993, and Federal, State, Tribal, and Local Floodplain Management.

The Midwest Flood of 1993

In reviewing the Midwest Flood of 1993, the Committee found that:

- The Midwest Flood of 1993 was a hydrometeorological event unprecedented in recent times. It was caused by excessive rainfall that occurred throughout a significant section of the upper Mississippi River Basin. The damaging impacts of this rainfall and

related runoff were felt both in upland areas and in the floodplains. Pre-flood rainfall saturated the ground and swelled tributary rivers. Subsequent rains quickly filled surface areas, forcing runoff into the lower lands and creating flood conditions. The recurrence interval of the flood ranged from less than 100 years at many locations to near 500 years on segments of the Mississippi River from Keithsburg, Illinois, to above St. Louis, Missouri, and on segments of the Missouri River from Rulo, Nebraska, to above Hermann, Missouri. At 45 U.S. Geological Survey (USGS) gaging stations, the flow levels exceeded the 100-year mark. The duration of the flood added to its significance. Many areas were under water for months.

- Rainfall and floods like the 1993 event will continue to occur. Floods are natural repetitive phenomena. Considering the nation's short history of hydrologic record-keeping as well as the limited knowledge of long-term weather patterns, flood recurrence intervals are difficult to predict. Activities in the floodplain, even with levee protection, continue to remain at risk.

- The loss of wetlands and upland cover and the modification of the landscape throughout the basin over the last century and a half significantly increased runoff. Most losses occurred prior to 1930, but some are related to more recent drainage, flood damage reduction, and navigation development. Although upland watershed treatment and restoration of upland and bottomland wetlands can reduce flood stages in more frequent floods (25 years and less), it is questionable whether they would have significantly altered the 1993 conditions.

- Human activity throughout the basin has caused significant loss of habitat and ecosystem diversity. Flood damage reduction and navigation works and land use practices have altered bottomland habitat adversely.

- The costs to the nation from the flood were extensive. Thirty-eight deaths can be attributed directly to the flood and estimates of fiscal damages range from $12 billion to $16 billion. Agriculture accounted for over half of the damages. More than 70 percent of the crop disaster assistance payments were made to counties in upland areas where ground saturation prevented planting or killed the crop. Nearly 50 percent of the approximately 100,000 homes damaged, suffered losses due to groundwater or sewer backup as opposed to riverine flooding. Flood response and recovery operations cost the nation more than $6 billion. In addition many costs can not yet be quantified. Impacts on businesses in and out of the basin have not been calculated. Tax losses to governments are unknown. The impacts of the flood on the population's physical and mental wellbeing are just being identified and are of concern.

- Flood damage reduction projects and floodplain management programs, where implemented, worked essentially as designed and significantly reduced the damages to population centers, agriculture, and industry. It is estimated that reservoirs and levees built by the U.S. Army Corps of Engineers (USACE), prevented more than $19 billion in potential damages. Large areas of Kansas City and St. Louis were spared the ravages of the flood, although several suburbs suffered heavy damages. Watershed projects built by the Soil Conservation Service saved an estimated additional $400 million. Land use controls required by the National Flood Insurance Program (NFIP) and state floodplain management programs reduced the number of structures at risk throughout the basin.

- Many locally constructed levees breached and/or overtopped. Frequently, these events resulted in considerable damage to the land behind the levees through scour and deposition.

- Flooding during the 1993 event would have covered much of the floodplains of the main stem lower Missouri and upper Mississippi rivers whether or not levees were there. Levees can cause problems in some critical reaches by backing water up on other levees or lowlands. Locks and dams and other navigation related structures did not raise flood heights. For more frequent floods -- less flow -- navigation dikes may cause some minor increase in flood heights.

Federal, State, Tribal and Local Floodplain Management

The Review Committee examined the structure of current federal programs, relationships among federal, state, tribal and local governments, the performance of various programs during and after the flood, and the after action reports stemming from these activities. The Review Committee reached the following conclusions:

- The division of responsibilities for floodplain management activities among and between federal, state, tribal, and local governments needs to be clearly defined. Within the federal system, water resources activities in general and floodplain management in particular need better coordination. State and local governments must have a fiscal stake in floodplain management; without this stake, few incentives exist for them to be fully involved in floodplain management. State governments must assist local governments in dealing with federal programs. The federal government must set the example in floodplain management activities.

- The National Flood Insurance Program (NFIP) needs improvement. Penetration of flood insurance into the target market -- floodplain occupants -- is very low, 20-30 percent. Communities choosing not to participate in the NFIP continue to receive substantial disaster assistance. Provision of major federal disaster assistance to those without insurance creates a perception with many floodplain residents that purchase of flood insurance is not a worthwhile investment. The mapping program is underfunded and needs greater accuracy and coverage. Some requirements within the program that vary from disaster to disaster need stabilization.

- The principal federal water resources planning document, *Principles and Guidelines,* is outdated and does not reflect a balance among the economic, social, and environmental goals of the nation. This lack of balance is exacerbated by a present inability to quantify, in monetary terms, some environmental and social impacts. As a result, these impacts are frequently understated or omitted. Many critics of *Principles and Guidelines* see it as biased against nonstructural approaches.

- Existing federal programs designed to protect and enhance the floodplain and watershed environment are not as effective as they should be. They lack support, flexibility and funding, and are not well coordinated. As a result, progress in habitat improvement is slow.

- Federal pre-disaster, response, recovery and mitigation programs need streamlining but are making marked progress. The nation clearly recognized the aggressive and caring response of the government to the needs of flood victims, but coordination problems that developed need to be addressed. Buyouts of floodprone homes and damaged lands made considerable inroads in reducing future flood losses.

- The nation needs a coordinated strategy for effective management of the water resources of the upper Mississippi River Basin. Responsibility for integrated navigation, flood damage reduction and ecosystem management is divided among several federal programs.

- The current flood damage reduction system in the upper Mississippi River Basin represents a loose aggregation of federal, local, and individual levees and reservoirs. This aggregation does not ensure the desired reduction in the vulnerability of floodplain activities to damages. Many levees are poorly sited and will fail again in the future. Without change in current federal programs, some of these levees will remain eligible for post-disaster support. Levee restoration programs need greater flexibility to provide for concurrent environmental restoration.

- The nation is not using science and technology to full advantage in gathering and disseminating critical water resources management information. Opportunities exist to provide information needed to better plan the use of the floodplain and to operate during crisis conditions.

COMMITTEE RECOMMENDATIONS

The Review Committee developed recommendations in consonance with the proposed goals:

- To ensure that the floodplain management effort is organized for success, the President should:

  Propose enactment of a Floodplain Management Act which establishes a national model for floodplain management, clearly delineates federal, state, tribal, and local responsibilities, provides fiscal support for state and local floodplain management activities, and recognizes states as the nation's principal floodplain managers;

  Issue a revised Executive Order clearly defining the responsibility of federal agencies to exercise sound judgement in floodplain activities; and

  Activate the Water Resources Council to coordinate federal and federal-state-tribal activities in water resources; as appropriate, reestablish basin commissions to provide a forum for federal-state-tribal coordination on regional issues.

- To focus attention on comprehensive evaluation of all federal water project and program effects, the President should immediately establish environmental quality and national economic development as co-equal objectives of planning conducted under the *Principles and Guidelines*. *Principles and Guidelines* should be revised to accommodate the new objectives and to ensure full consideration of nonstructural alternatives.

- To enhance coordination of project development, to address multiple objective planning, and to increase customer service, the Administration should support collaborative efforts among federal agencies and across state, tribal, and local governments.

- To ensure continuing state, tribal and local interest in floodplain management success, the Administration should provide for federal, state,tribal, and/or local cost-sharing in pre-disaster, recovery, response, and mitigation activities.

- To provide for coordination of the multiple federal programs dealing with watershed management, the Administration should establish an Interagency Task Force to develop a coordination strategy to guide these actions.

- To take full advantage of existing federal programs which enhance the floodplain environment and provide for natural storage in bottomlands and uplands, the Administration should:

  Seek legislative authority to increase post-disaster flexibility in the execution of the land acquisition programs;

  Increase environmental attention in federal operation and maintenance and disaster recovery activities;

  Better coordinate the environmentally-related land interest acquisition activities of the federal government; and

  Fund, through existing authorities, programmatic acquisition of needed lands from willing sellers.

- To enhance the efficiency and effectiveness of the National Flood Insurance Program, the Administration should:

  Take vigorous steps to improve the marketing of flood insurance, enforce lender compliance rules, and seek state support of insurance marketing;

  Reduce the amount of post-disaster support to those who were eligible to buy insurance but did not to that level needed to provide for immediate health, safety, and welfare; provide a safety net for low income flood victims who were unable to afford flood insurance;

Reduce repetitive loss outlays by adding a surcharge to flood insurance policies following each claim under a policy, providing for mitigation insurance riders, and supporting other mitigation activities;

Require those who are behind levees that provide protection against less than the standard project flood discharge to purchase actuarially based insurance;

Increase the waiting period for activation of flood insurance policies from 5 to 15 days to avoid purchases when flooding is imminent;

Leverage technology to improve the timeliness, coverage, and accuracy of flood insurance maps; support map development by levies on the policy base and from appropriated funds because the general taxpayer benefits from this program; and

Provide for the purchase of mitigation insurance to cover the cost of elevating, demolishing, or relocating substantially damaged buildings.

- To reduce the vulnerability to flood damages of those in the floodplain, the Administration should:

Give full consideration to all possible alternatives for vulnerability reduction, including permanent evacuation of floodprone areas, flood warning, floodproofing of structures remaining in the floodplain, creation of additional natural and artificial storage, and adequately sized and maintained levees and other structures;

Adopt flood damage reduction guidelines based on a revised *Principles and Guidelines* which would give full weight to social, economic, and environmental values and assure that all vulnerability reduction alternatives are given equal consideration; and

Where appropriate, reduce the vulnerability of population centers and critical infrastructure to the standard project flood discharge through use of floodplain management activities and programs.

- To ensure that existing federally constructed water resources projects continue to meet their intended purposes and are reflective of current national social and environmental goals, the Administration should require periodic review of completed projects.

- To provide for efficiency in operations and for consistency of standards, the Administration should assign principal responsibility for repair, rehabilitation, and construction of levees under federal programs to the U.S. Army Corps of Engineers.

- To ensure the integrity of levees and the environmental and hydraulic efficiencies of the floodplain, states and tribes should ensure proper siting, construction, and maintenance of non-federal levees.

- To capitalize on the successes in federal, state, tribal, and local pre-disaster, response, recovery, and mitigation efforts during and following the 1993 flood and to streamline future efforts, the Administration should:

Through the NFIP Community Rating System, encourage states and communities to develop and implement floodplain management and hazard mitigation plans;

Provide funding for programmatic buyouts of structures at risk in the floodplain;

Provide states the option of receiving Section 404 Hazard Mitigation Grants as block grants;

Assign the Director of the Federal Emergency Management Agency responsibility for integrating federal disaster response and recovery operations; and

Encourage federal agencies to use non-disaster funding to support hazard mitigation activities on a routine basis.

• To provide integrated, hydrologic, hydraulic, and ecosystems management of the upper Mississippi River basin, the Administration should:

Establish upper Mississippi River Basin and Missouri River Basin commissions to deal with basin-level program coordination;

Assign responsibility, in consultation with the Congress, to the Mississippi River Commission (MRC), for integrated management of flood damage reduction, ecosystem management, and navigation on the upper Mississippi River and tributaries; expand MRC membership to include representation from the Department of the Interior; assign MRC responsibility for development of a plan to provide long-term control and maintenance of sound federally built and federally supported levees along the main stems of the Mississippi and Missouri rivers; this support would be contingent on meeting appropriate engineering, environmental,and social standards.

Seek authorization from the Congress to establish an Upper Mississippi River and Tributaries project for management of the federal flood damage reduction and navigation activities in the upper Mississippi River Basin;

Establish the upper Mississippi River Basin as an additional national cross-agency Ecosystem Management Demonstration Project; and

Charge the Department of the Interior with conducting an ecosystems needs analysis of the upper Mississippi River Basin.

• To provide timely gathering and dissemination of the critical water resources information needed for floodplain management and disaster operations, the Administration should:

Establish an information clearing house at USGS to provide federal agencies and state and local activities the information already gathered by the federal government during and following the 1993 flood and to build on the pioneering nature of this effort; and

Exploit science and technology to support monitoring, analysis, modeling, and the development of decision support systems and geographic information systems for floodplain activities.

STRUCTURE OF THE REVIEW

Throughout the spring, summer, and fall of 1993, the people of the United States were faced each night with pictures of the devastation wrought on the midwestern United States by the Great Flood of 1993. For nearly six decades, the nation had labored to reduce the impacts of floods, yet the toll in lives lost, homes damaged, and property destroyed was enormous. Why had this happened? What caused the flood? Had human intervention over time exacerbated the situation? What should the nation be doing to prevent a repetition? To answer these questions, the Administration Floodplain Management Task Force, part of the Administration Flood Recovery Task Force headed by Secretary of Agriculture Mike Espy, established the Interagency Floodplain Management Review Committee, a group of 31 professionals assigned to federal agencies with responsibilities in the water resources arena.

The Review Committee conducted its activity from January through June 1994 in Washington and throughout the Midwest. Working through the offices of the governors of the nine flood-affected states, the Review Committee met with state and local officials and visited over 60 locations. The Review Committee also made extensive contacts with federal agencies, interest groups, members of Congress and their staffs and numerous private citizens who expressed an interest in the flood. A part of the Review Committee, the Scientific Assessment and Strategy Team, chartered in

November 1993 by the White House, conducted its activities at the EROS Data Center in Sioux Falls, South Dakota, where it developed a major data base of flood and basin information.

The report of the Review Committee includes an action plan delineating proposed responsibilities and timelines for execution of the recommendations, a fiscal impact statement, and the preliminary report of the Scientific Assessment and Strategy Team.

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INTRODUCTION

The time has come to face the fact that this Nation can no longer afford the high costs of natural disasters. We can no longer afford the economic costs to the American taxpayer, nor can we afford the social costs to our communities and individuals.

James L. Witt
Director, Federal Emergency Management Agency
Testimony before Congress, October 27, 1993

Throughout the spring, summer, and fall of 1993, the people of the United States were faced with pictures of the devastation wrought on the Midwest by what became known as "The Great Flood of 1993." For nearly six decades, the nation had labored to reduce the impacts of floods, yet within a few months tens of thousands of homes were damaged, and the lives of hundreds of thousands of Americans disrupted. Acre upon acre of some of the nation's richest farmland lay fallow. Why did this happen? What caused the flood? Did human intervention over the years exacerbate the situation? What should the nation be doing to prevent a repetition of the 1993 event? The Administration Floodplain Management Task Force, a part of the Clinton Administration's Flood Recovery Task Force, headed by Secretary of Agriculture Mike Espy, established the Interagency Floodplain Management Review Committee to seek answers to these questions and to make recommendations.

The charter of the Review Committee (see Appendix A) assigns it the mission to:

- Delineate the major causes and consequences of the 1993 flooding;

- Evaluate the performance of existing floodplain management and related watershed management programs; and

- Make recommendations to the Task Force on changes in current policies, programs, and activities of the federal government that would most effectively achieve risk reduction, economic efficiency, and environmental enhancement in the floodplain and related watersheds.

The Review Committee consisted of federal engineers and physical, social, and biological scientists who contributed technical and institutional knowledge in the fields of flood damage-reduction and river basin ecosystem management. Of the 31-member Review Committee, 15 members were located in Washington, D.C., and 16 formed the Scientific Assessment and Strategy Team (SAST), which operated from the Earth Resources Observation System (EROS) center at Sioux Falls, South Dakota. The SAST was chartered by the White House in November 1993 "to provide scientific advice and assistance to officials responsible for making decisions with respect to flood recovery in the upper Mississippi River Basin." It was incorporated into the Review Committee in January 1994 to serve as its research arm for scientific analysis. For a full listing of Review Committee members and their parent agencies, see Appendix B.

The Review Committee began its work in January 1994, focusing on federal agency briefings and consultations with other levels of government to gain a better understanding of the complex intergovernmental system of responsibilities and decisionmaking in

WHAT IS A FLOODPLAIN?

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

Estimates of the extent of the nation's floodplains vary according to the areas measured. In 1977 the U.S. Water Resources Council estimated that floodplains comprise about 7 percent, or 178.8 million acres of the total area of the United States and its territories.

During the 1993 flood, floodplains along the upper Mississippi and Missouri Rivers became part of the rivers when they were inundated by river stages exceeding channel capacity or the design elevations of flood-control levees or when the levees failed or overtopped.

Adapted, in part, from the draft 1994 Unified National Program for Floodplain Management.

floodplain management. This initial effort was followed by discussions in the nine Midwest states most affected by the flood. Review Committee members met with the governors and their representatives, state flood recovery and mitigation task forces, staffs of relevant congressional committees, staffs of congressional members from the flood states, and interest groups at the national, regional, and local level. In March the Review Committee shifted its focus to outreach visits in the Midwest communities and areas affected by the flood. During this phase of review, the Review Committee visited over 60 communities where county, city, and other local officials and citizens assembled to provide information and insights. The Review Committee asked those contacted to share their candid opinions about the best use of flood hazard areas, their visions of the future, and how that vision was changed by the 1993 flood. They were asked about hazard mitigation, floodplain management, and the emergency response plans of the flood-affected communities, with particular regard to whether such plans were useful during or after the flood. All were asked to critique the strengths and weaknesses of federal programs and policies as presently structured, and to discuss what federal and state roles should be in long-term management of floodplains.

Throughout the review process, a steady stream of letters arrived from organizations, interest groups, state and local officials,and from individuals offering information, personal viewpoints, and advice, all of which the Review Committee greatly appreciated.

Following visits to the Midwest, the Review Committee formulated an array of floodplain management options, briefs of which were presented to the Administration Floodplain Management Task Force, congressional interests, federal agencies, state officials, and interest groups. Meetings to review the options were held in Washington, D.C.; Kansas City, Missouri; Springfield, Illinois; and Minneapolis, Minnesota. The Review Committee then developed its recommendations.

FLOODPLAIN MANAGEMENT

Floodplain management is a decisionmaking process whose goal is to achieve appropriate use of the nation's floodplains. Appropriate use is any activity or set of activities compatible with the risk to natural resources (natural and beneficial functions of floodplains) and human resources (life and property).

The history of the nation's floodplain activity is as old as the nation itself and is well chronicled in *An Assessment Report: Floodplain Management in the United States,* prepared in 1992 for the Federal Interagency Floodplain Management Task Force

GOOD NEWS

Although the flood of 1993 ultimately caused major damages throughout the upper Mississippi River Basin, many elements of structural and nonstructural flood damage reduction systems put in place by federal, state, and local governments over the years did work and prevented billions of dollars in damages.

During the flood the outreach from all over the country and the world to those suffering the effects of the flooding was most impressive. Thousands filled and stacked sandbags to hold weakening levees; others worked day after day to help clean the homes and businesses of people they had never met. Dry communities adopted those in need. Contributions to assist flood victims poured in from people in many nations. Federal, state, and local disaster teams worked around the clock, month after month, to mitigate damages and suffering. Those who were recipients of this assistance will never forget this demonstration of true caring. While the Review Committee report will not address all of these successes, they should not be forgotten.

SHARING THE CHALLENGE

Today the nation faces three major problems in floodplain management:

- As the Midwest Flood of 1993 has shown, people and property remain at risk, not only in the floodplains of the upper Mississippi River Basin but also throughout the nation. Many of those at risk neither fully understand the nature and the potential consequences of that risk nor share fully in the fiscal implications of bearing that risk. Over the last thirty years, average annual riverine flood damages have exceeded $2 billion. Over the last ten, they have been over $3 billion. Between 1988 and 1992, the Federal Emergency Management Agency has expended nearly $200 million each year in flood recovery activities.[1]

- Only in recent years has the nation come to appreciate fully the significance of the fragile ecosystems of the upper Mississippi River Basin. Given the tremendous loss of habitat over the last two centuries, many suggest that we now face severe ecological consequences.

A lot of great things have been done that prevented damages and mitigated the damages that did occur... we can't lose sight of this.

Terry Brandstad
Governor of Iowa
February 16, 1994

- The division of responsibilities for floodplain management among federal, state, tribal, and local governments is not clearly defined. As a result, attention to floodplain management varies widely among and within federal, state, tribal, and local governments.

This report provides the Review Committee's findings and recommendations for action. Part I (Chapters 1-3) discusses the flood event and its impacts as well as the effects of human intervention, over time, on the nature of this flood. It also provides insights into the potential for recurrence of the event. Part II (Chapters 4-9) provides a blueprint for the future -- a consensus view of floodplain management for the 21st century. Part III addresses the residual problems with floodplain management in the upper Mississippi River Basin. Part IV (Chapters 11-15) highlights needs in the fields of research, science, and technology; discusses the economic impacts of the report's findings and recommendations; converts the general actions proposed in Chapters 5 to 11 into specific tasks for accomplishment and summarizes the report.

The report contains conclusions, actions, and recommendations. Conclusions represent the Committee's evaluation of its research or analysis related to the Flood of 1993 and its consequences. The Review Committee identified specific approaches required to move forward in floodplain management as actions. Actions may involve resource commitments beyond an agency's baseline posture. Recommendations address problems that the Review Committee believes merit attention; however, the solutions to these problems can be accomplished within agency resources, existing programs, or cooperative efforts.

The thesis of this report is straightforward. The tools to carry out effective floodplain management exist today but need improvement. The goals are clear. It is now time to organize a national effort to conduct effective and efficient floodplain management. It is time to share responsibility and accountability for accomplishing floodplain management among all levels of government and with the citizens of the nation. Working together, the nation's public and private sectors can accomplish the mission.

A MESSAGE FROM ELIZABETH

Dear General Galloway:

My name is Elizabeth Darabcsek. I am eleven years old and in the 5th grade at Christ Prince of Peace School.

I read your article in the news paper and was interested. I thought I could help.

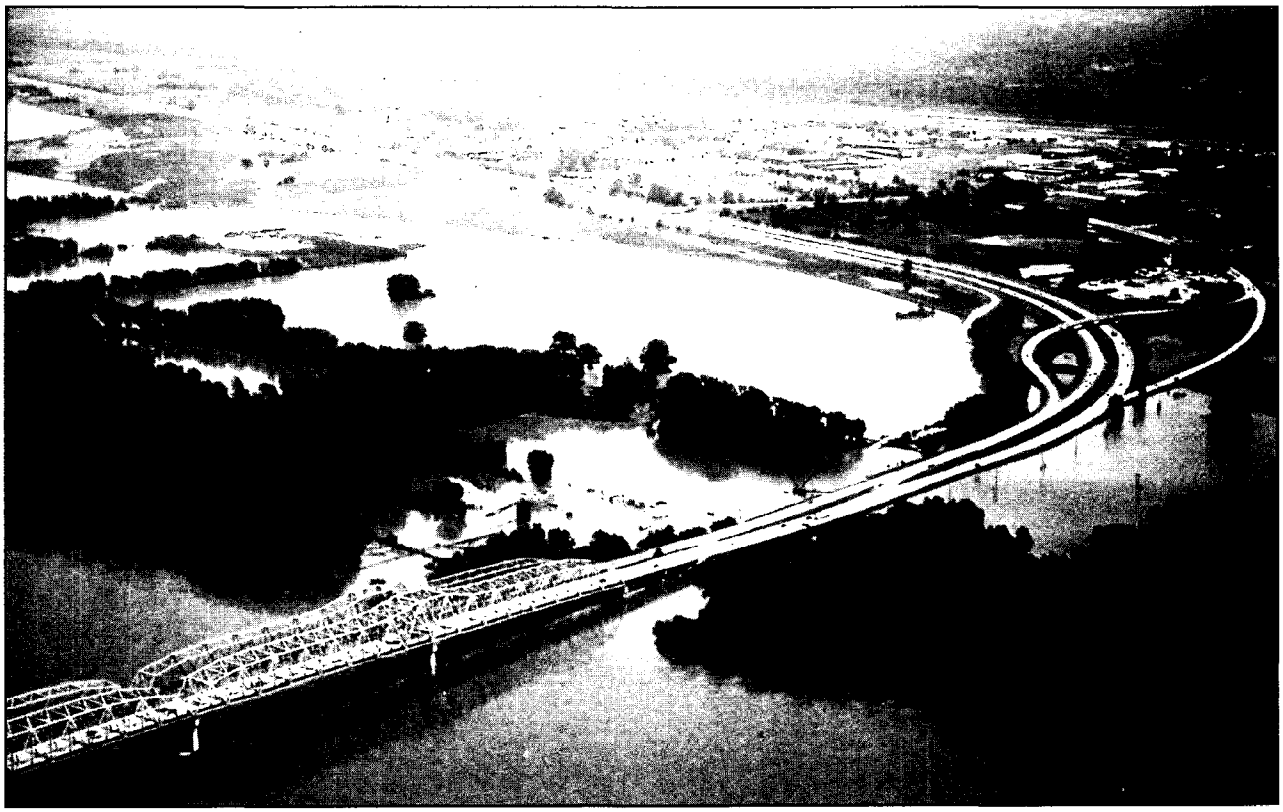
I did a science fair project on floods. I tested levees, back to nature and something I made up, it was a small levee by the river and a larger one a little farther back. The little one held most of the water but not all. The water that was not held back from the small levee would then stay in the space between the big and little levee. The land between the two levees could be used as farm land or other things that could not be badly damaged by a big flood. The damaged levee could be used as the levee in the front (the smaller levee). Therefore, we would only have to build one new levee. This information may not help you, but I wanted you to know that I am trying to help protect our cities too.

Sincerely,
Elizabeth Darabcsek

P.S. Just to tell you, I won first place for my project out of the whole 5th grade.

ENDNOTE

1. Federal Interagency Floodplain Management Task Force. ***Floodplain Management in the United States: An Assessment Report***. (Washington, DC: FIFMTF,1992. USACE and NWS. U.S. Army Corps of Engineers, ***Annual Flood Damage Report to Congress for Fiscal Year 1993***, Prepared by the USACE Engineering Division in cooperation with the National Weather Service Office of Hydrology, (Washington, DC: USACE, April 1994); Federal Emergency Management Agency, "Disaster Payment Report," (Washington, DC: FEMA, May 1994).



Part I

THE FLOOD

Chapter 1

THE FLOOD OF 1993

I have visited the Midwest states affected by the '93 Flood many times. Each time I have come away saddened by the enormous loss. I have never seen such devastation. On the other hand, I have never witnessed such tremendous courage as that displayed by individuals who are beginning to rebuild their lives.

Mike Espy
Secretary of Agriculture
Chair, Flood Recovery Task Force
November 10, 1993

Floods are a function of the location, intensity, volume, and duration of rainfall and snowmelt. Other factors include the characteristics of a region's topography, its land-cover conditions, and the capacity of its floodplain to convey or store water. In 1993 a singular combination of these factors resulted in one of the most costly flood disasters in U.S. history. This chapter surveys the damages prevented and the record damages reported in the 1993 flooding of the upper Mississippi River Basin. It also addresses the response and recovery costs for affected towns, cities, and states and for the nation.

THE BASIN

The upper Mississippi River Basin is physiographically, ecologically, and climatologically diverse. Physiographically it ranges from the Rocky Mountains to the Ozark Plateau to the Glaciated Plains and central lowlands. Climatologically it ranges from the semi-arid basins and plains of eastern Colorado and Wyoming to the humid-temperate margins of the Great Lakes. Geographic analysis divides this region into 70 terrain units defined by distinct combinations of physical, geologic, soil, ecological, climate, and land-use characteristics. Each unit is subject to different combinations and intensities of hydrologic and geomorphic processes. Individual areas respond differently to storm events and land treatments.

The Mississippi River rises at the outlet of Lake Itasca in the lake and forest country of north-central Minnesota and empties into the Gulf of Mexico in the marshy delta just below Head-of-Passes, Louisiana. Over its journey of 2,320 miles, the Mississippi River falls 1,463 feet and drains 1.25 million square miles (sq. mi.) or 41 percent of the land area of the 48 contiguous United States. That portion of the Mississippi River drainage lying above its confluence with the Ohio River and referred to as the upper Mississippi River Basin is the focus of this report. It is in this basin where the deluge of rain and consequent record flooding occurred during the spring, summer, and fall of 1993.

Draining all or part of 13 states, the upper Mississippi River Basin encompasses approximately 714,000 square miles. It comprises 57 percent of the total Mississippi River Basin and 23 percent of the area in the contiguous United States. From its source at Lake Itaska, Minnesota, to its confluence with the Ohio River at Cairo, Illinois, the Mississippi River courses a distance of 1,366 miles. Its principal tributary is the Missouri River, which drains 529,300 sq. mi. above its mouth at St Louis, Missouri, including 9,700 sq. mi. in Canada.

UPPER, LOWER, MIDDLE?

Lending confusion to a discussion of the Mississippi River and its drainage basin is the fact that hydrologists divide the basin, including tributary basins, into two parts: the upper and the lower; and the river into three reaches -- the upper, middle, and lower. Division between the upper basin and lower basin is at Cairo (above the mouth of the Ohio River). For the Mississippi River itself, the reach upstream from St. Louis is called the upper Mississippi River (upper Miss.), the reach between St. Louis and Cairo is the middle Mississippi River (middle Miss.), and the reach downstream from Cairo is called the lower Mississippi River (lower Miss.).

Other major tributaries include the Minnesota, Wisconsin, Iowa, Des Moines, and Illinois rivers, all of which drain watersheds greater than 10,000 sq. mi. in area (Figure 1.1).

The Missouri River, which drains all or part of ten states and 74 percent of the upper Mississippi River Basin, contributes only 42 percent of the long-term average annual flow of the Mississippi River at St. Louis. The Missouri River does contribute the most sediment in the upper Mississippi River Basin. Hydrologically the Missouri River Basin is divided into upper and lower portions with demarcation at Sioux City, Iowa. The upper and lower basins contain 314,600 sq. mi. and 214,700 sq. mi. respectively.

Runoff from the upper basin is controlled in great measure by regulation of six large dam and reservoir projects on the main stem Missouri River operated by the U.S. Army Corps of Engineers (USACE). The drainage area (279,400 sq. mi.) above Gavins Point Dam, the dam furthest downstream, encompasses about 90 percent of the upper Missouri River Basin and over 50 percent of the total Missouri River Basin area. The amount of water that runs off the upper basin annually averages 24.6 million acre-feet.[1]

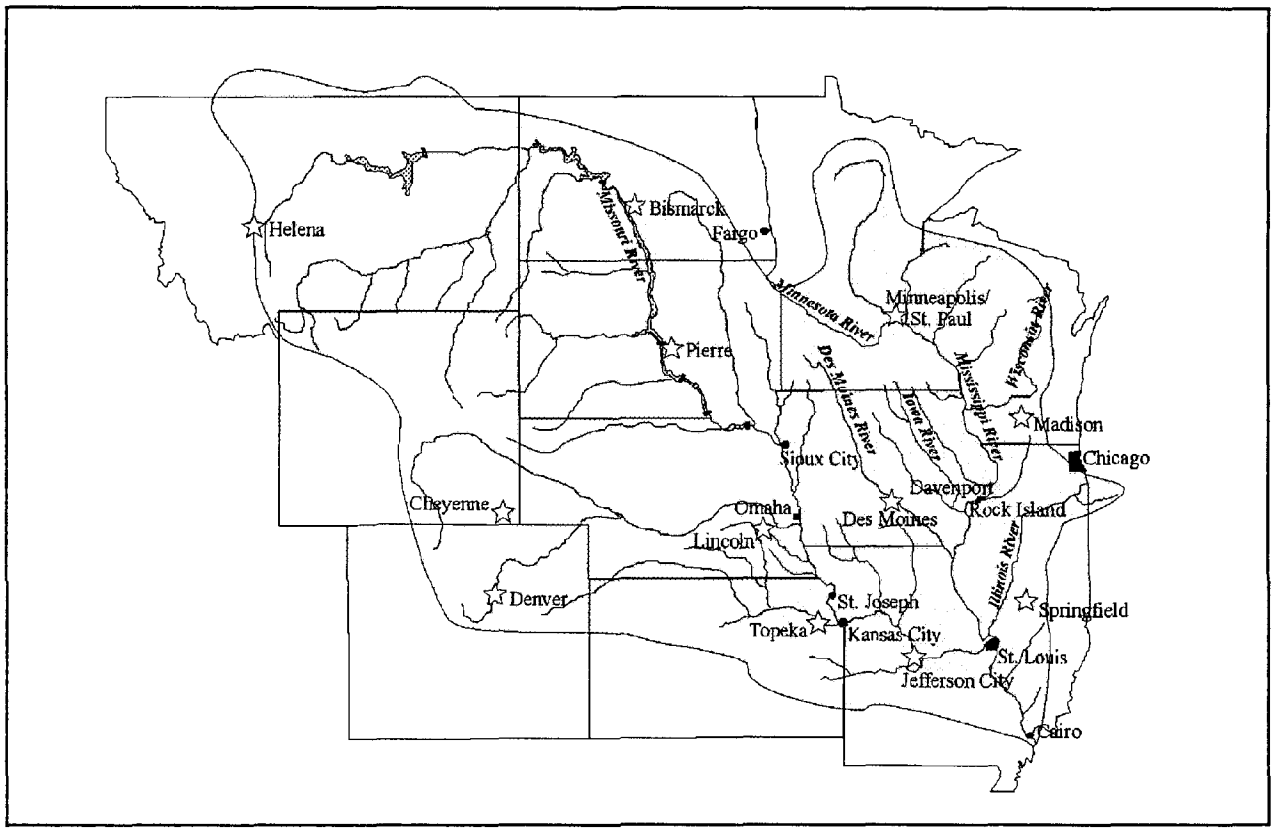
History of Development

The upper Mississippi River valley was settled by European immigrants during the 18th and 19th centuries. By 1824 early steamboat travel and commerce created a demand for navigation improvements. Urban and rural populations continued to grow, creating an increased demand for forest lumber resources and agricultural products. Most early urban settlements were located on or near rivers to be close to water supplies and transportation arteries. By the late 1800s, settlers had cleared and drained many wetlands for agriculture and planted higher floodplain

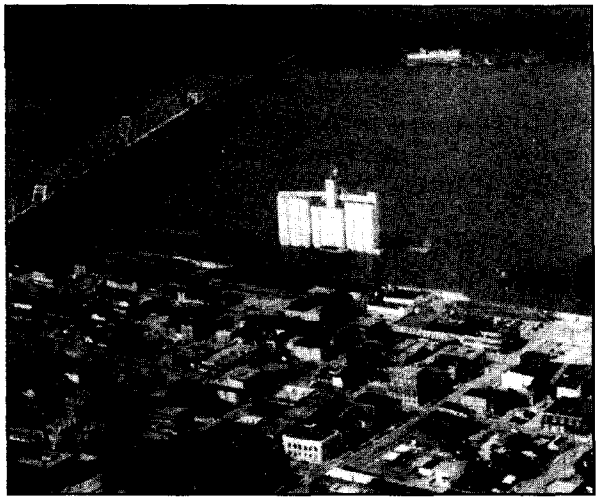
VOLUMES OF WATER

When quantifying large volumes of water, a measuring unit as small as a gallon results in numbers in the billions or trillions and makes perception difficult. Water engineers and scientists have adopted a larger unit and, therefore, employ smaller, somewhat more readily envisioned numbers. That unit is the acre-foot and represents the volume of water standing one foot deep over an area of one acre. Thus the mean annual volume of water that runs off the upper Missouri River Basin can be expressed as 25 million acre-feet rather than 8,145,720,000,000 gallons.

Figure 1.1 Upper Mississippi River Basin.



areas to crops.[2] Some areas were protected with agricultural levees.



Early development of the basin was closely tied to the river system, and many navigation and local flood-control efforts were installed without federal assistance. By the early 1900s, the basin's fisheries resources were declining as a result of various environmental perturbations, sedimentation, pollution, and water-level fluctuations caused by deforestation and agricultural development. Between 1930 and 1950, extensive modification continued on the main rivers, while upland areas continued to be drained for agricultural purposes. Major urban areas such as St. Louis, Kansas City, and Minneapolis/St. Paul developed as business and industry centers.

The Midwest Flood of 1993, one of the most costly

flood events in this nation's history, flooded over 6.6 million acres in the 419 counties in the study area.[3] The damages experienced reflected the land-use and settlement patterns within and adjacent to the floodplain. The floodplains along the main stem Mississippi and Missouri rivers and the major tributaries that were inundated generally are used for agriculture, and most areas are sparsely populated. Throughout most of the area, river towns are protected by urban levees, or they are located primarily on a bluff. Floodwaters thus inundated neighborhoods rather than entire communities. Residences, businesses, and industries did receive extensive damages in bottomland areas and along tributaries near Kansas City and St. Louis. Development in these urban areas, however, is largely in the uplands or protected by urban levees that provided flood protection. As a point of comparison, significantly fewer people were impacted by the Midwest Flood of 1993 than were impacted by the 1927 flood on the lower Mississippi River.

Floodplain land-use patterns. Above Rock Island, Illinois, the Mississippi River valley is relatively narrow and bottomlands are filled to a large extent by navigation pools -- the slack water pools that form behind navigation dams. Most of the remaining floodplain in this area is contained in wildlife refuges with limited agriculture. Along this reach of the river are scattered towns settled during the steamboat era that have developed as market centers and service areas for agricultural hinterlands. Industries were established in many of these towns to take advantage of river navigation and the railroads that later followed the river valleys. Such towns generally have been protected by urban levees or are largely out of the floodplain. Below Rock Island the valley widens out to as much as six miles. The extensive bottomlands in these areas are protected by agricultural levees and used for crops. The leveed areas include farmsteads and a few small farm communities entirely within the floodplain.

Missouri River bottomlands, used predominantly for agriculture, are protected to varying degrees by levees. On the fringes of the bottomlands are small farm communities. In the adjoining uplands a number of larger communities are located on the bluffs above the valley.

Developed floodplains with larger urban areas such as Omaha/Council Bluffs, Kansas City, and St. Louis are largely protected by levees. Near Kansas City and St. Louis, several residential, industrial, and commercial areas are built on floodplains behind levees that overtopped or failed in 1993. Other residential, industrial, or commercial areas were flooded along the larger tributary streams in these urban areas. Rural subdivisions are scattered along the river, many of which began as hunting and fishing camps and evolved into year-around communities. These subdivisions provide inexpensive housing in part because of cheap land, lack of services such as sewer and water, limited land-use controls, and few building requirements.

On the major tributaries, the patterns of development are much the same as along the Mississippi and Missouri main stems, although the bottomlands are narrower with fewer farmsteads. The small towns along these tributaries often have floodprone neighborhoods, but most of the population lives in the adjoining uplands. Table 1.1 includes information on land use and land cover categories for the floodplain and the flood extent for the study area. The estimates of land use and land cover were developed using satellite imagery.

Population trends. In general rural counties declared disaster areas in the nine states affected by the 1993 flood are losing population. No data are available on gain or loss of floodplain populations during this period. The only comparable data from the 1980 Census and the 1990 Census are aggregated by county or community. Population increases that have occurred are generally in the suburban counties of major urban areas such as Minneapolis/St. Paul, Des Moines, Kansas City, and St. Louis. Loss of population in rural areas is the result of farm consolidation, lack of employment opportunities, and improvements in transportation. Fewer farmers mean a lower demand for local goods and services, which has a ripple effect on the local economy. Those who remain on the land drive to larger communities to shop and for many of the services previously provided by farm towns. Such trends, not unlike those occurring throughout the nation, are limiting development pressure within the floodplain. Figure 1.2 shows the population gain or loss by county

Table 1.1 Land Use and Land Cover in the Floodplain and Areal Extent of Flooding in 1993.

Land use/cover category	Floodplain (acres)	Use in floodplain (%)	Flood extent (acres)	Use in flood extent (%)
Urban built-up	518,891	5.0	165,980	2.5
Agriculture	7,073,696	68.8	4,155,830	63.4
Water	933,085	9.1	956,983	14.6
Wetland/forested wetland	1,435,411	13.9	882,174	13.5
Other	321,906	3.1	394,109	6.0
Total	10,282,989		6,555,076	

Source: Federal Emergency Management Agency contract with Earth Satellite Corporation, April 1994.

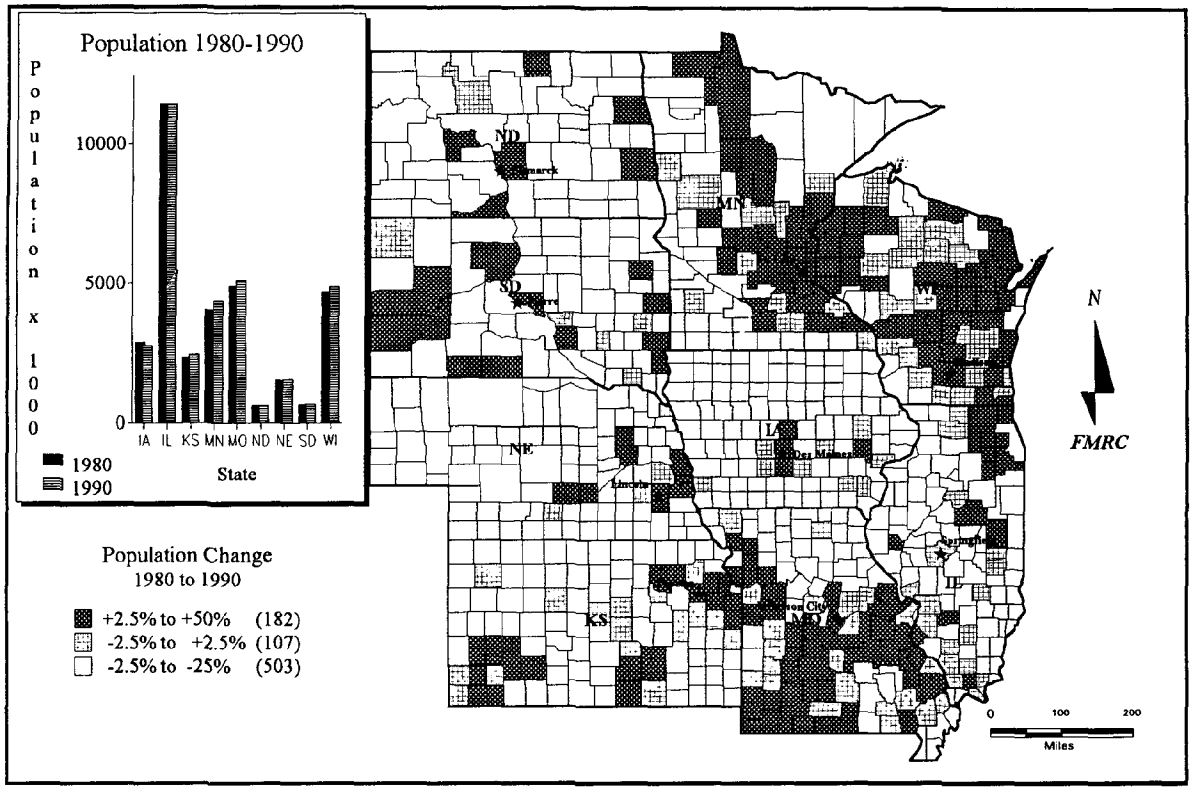
Note: The land use and land cover categories in the table are Anderson Level One used by the U.S. Geologic Survey (Anderson, James R., Ernest E. Hardy, John T. Roach, and Richard E. Witmer, U.S. Geological Survey Professional Paper No. 964, 1976). The floodplain was identified using landform analysis and includes areas protected by levees and areas above the elevation of the 1993 flood. The flood extent is the area flooded and includes some ponding in upland areas not in the geomorphologic floodplain.

in the flood-affected 9-state region between 1980 and 1990.

Population characteristics. The Review Committee found during visits to over 60 communities in the flood-affected region that the floodplain neighborhoods and rural subdivisions tended to be lower income neighborhoods of the community. These neighborhoods appear to have a higher percentage of rental properties, more elderly residents, more young families more people on assistance, and lower value housing. It is common to find homes in the floodplains of these communities that have market values of less than $25,000 and often as low as $10,000 or $5,000.

In part these neighborhoods may be low-income because they contain older housing and because they are floodprone. In many of these communities these floodplain neighborhoods are an important source of affordable housing for low and moderate income families. The U.S. Census data shown in Table 1.2 tend to confirm these observations.[4] The data for the study area, however, is available only by community and by Census Block Group. These geographic areas will generally include both floodplain and upland areas. Demographic differences must be recognized and floodplain policies must be carefully designed to prevent inequities.[5]

Figure 1.2 Population Change, Nine Midwest States, 1980-1990.



Source: U.S. Bureau of the Census

THE FLOOD EVENT

The National Weather Service (NWS) reported that the Flood of 1993 caused at least 38 deaths, severe damages, and extreme hardship for the people of the Midwest. Agricultural damages exceeded 50 percent of the total, but less than 30 percent of such damages were in the floodplains of the main stem rivers. The majority of agricultural damages were in the uplands where the cause was wet soil conditions rather than inundation. The duration of flooding caused people to be driven from their homes and businesses for an extended period. In the major cities, such as St. Louis and Kansas City, damages were prevented by flood-control improvements. In many areas past policies of federal, state, and local governments avoided potential damage by preventing development in the floodplain.

The Flood of 1993 in the Midwest was a hydrometeorological event without precedent in modern times. In terms of precipitation amounts, record river levels, flood duration, area of flooding, and economic losses, it surpassed all previous floods in the United States. During the period from June through September, record and near record precipitation fell on soil already saturated by previous seasonal rainfall and spring snowmelt, resulting in flooding along major rivers and their tributaries in the upper Mississippi River Basin.

Table 1.2 Population Characteristics of the Study Area.

	Upland CBGs	Flood Extent/Floodplain CBGs in MSAs	Flood Extent/ Floodplain CBGs in non-MSAs
Age Over 65	13.4%	10.8%	16.7%
Public Assistance	5.9%	5.7%	6.7%
Per Capita Income	$12,636	$10,635	$10,542
Median Household Income	$27,953	$22,692	$21,249
Mobile Homes	4.8%	10.8%	12.3%

Source: U.S. Bureau of Census, 1990.

Notes: (1) CBGs = Census Block Groups; MSAs = Metropolitan Statistical Areas.
(2) Per capita and median household income are lower for the CBGs within the flood extent. Mobile homes represent a considerably higher percentage of the housing units, another indication of a lower income population.

River levels exceeded flood stage at approximately 500 NWS river forecast points and record flooding occurred at 95 forecast points throughout the flood-affected region.[6] At 45 U.S. Geological Survey (USGS) streamflow gaging stations, the peak discharge rate (flowrate) exceeded that of the 1-percent annual-chance (100-year) flood value.[7] Not only extensive in magnitude and area, the 1993 flood was prolonged in time as evidenced by many locations that remained above flood stage for weeks, with some remaining for as long as five straight months.

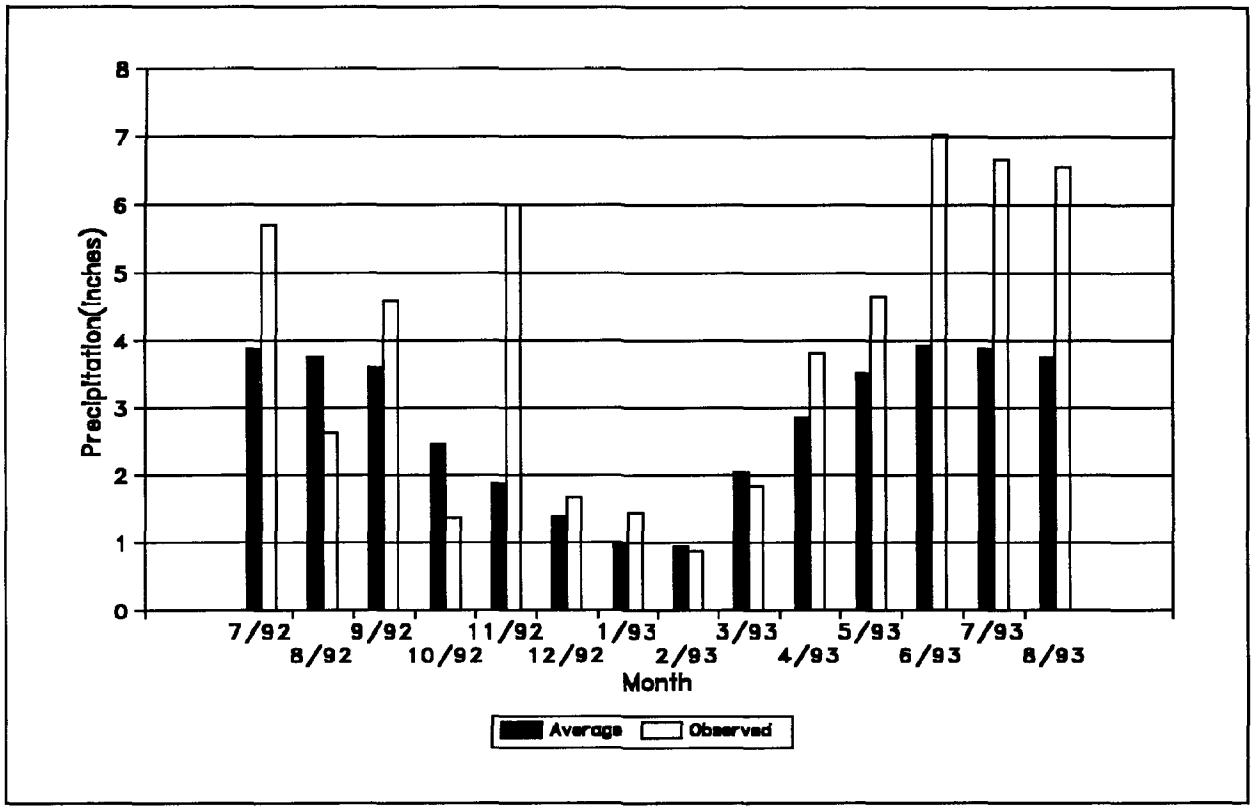
Soil Conditions Prior to the 1993 Flood

The antecedent conditions that gave rise to the Flood of 1993 include, in addition to record rainfalls, wet soil conditions that began in the central Great Plains during the summer of 1992 and rose rapidly with the increasing precipitation and cooling air temperatures of late 1992. July, September, and especially November 1992 were much wetter than normal over the upper Mississippi River Basin. That winter precipitation was near normal, but a wet spring followed. By late March, extremely moist conditions covered much of the region as a result of the wet fall and spring snowmelt runoff.[8] Iowa, which was centrally located in the area of heaviest flooding, experienced the second wettest November - April period in 121 years of record. This period was followed by above-normal precipitation over the upper Mississippi River Basin during April and May (Figure 1.3). The April - June period was the wettest observed in the upper Mississippi River Basin in the last 99 years. Consequently even before the onset of the heavy summer rains, most upper basin soils were saturated, and many streams and rivers were flowing at well above seasonal normal levels.

Rainfall

During much of the summer of 1993, a persistent atmospheric pattern of excessive rainfall occurred across much of the upper Mississippi River Basin.[9] The major river flooding resulted primarily from numerous series of heavy rainfall events from June through late July. The recurrence of heavy rainfall was the direct result of a stable upper-level atmospheric circulation pattern with a deep trough to the west of the upper Mississippi valley and a strong ridge along the East Coast (Figure 1.4). In late July and early August, a change in the upper air circulation pattern brought drier conditions to the Midwest as the trough shifted eastward. Locally heavy thunderstorms generated some additional flooding in parts of the soaked upper Mississippi River Basin during mid-August; however,

Figure 1.3 Average and Observed Monthly Precipitation Totals for the Upper Mississippi River Basin.



Source: U.S. Department of Commerce, NOAA, National Weather Service.[6]

these rains were associated with a typical summertime pattern and not a return to the anomalous and persistent June and July atmospheric conditions.

During the June-August 1993 period, rainfall totals surpassed 12 inches across the eastern Dakotas, southern Minnesota, eastern Nebraska, and most of Wisconsin, Kansas, Iowa, Missouri, Illinois, and Indiana. Over 24 inches of rain fell on central and northeastern Kansas, northern and central Missouri, most of Iowa, southern Minnesota, and southeastern Nebraska. Up to 38.4 inches fell in east-central Iowa. Generally precipitation amounts were 200 to 350 percent of normal from the northern plains southeastward into the central Corn Belt.

Rainfall amounts over the upper Mississippi River Basin during the May-August 1993 period are unmatched in the historical records of the central United States. In July broad areas in the lower Missouri River Basin experienced rainfall amounting to four times normal. The series of storms producing these record rainfalls were remarkable not only in their magnitude but also for their broad regional extent; record wetness existed over 26,000 sq. mi. of the upper Mississippi River Basin. Seasonal rainfall records were shattered in all nine states impacted by the deluge of 1993. Summer rainfall amounts equalled those computed for storm frequencies having 75-year to 300-year recurrence intervals. Figure 1.4 shows the weather pattern that existed in 1993.

INGREDIENTS FOR A MAJOR FLOOD

The following weather facts tell why Iowa flooded in 1993:

Wettest period. Precipitation from January through September 1993 was the greatest amount, 44.5 inches, in 121 years of record; the previous record was 44.2 inches in 1881.

Wettest 12 months. Precipitation from September 1992 through August 1993 was the greatest amount in history, 54 inches; previous record was 49 inches in 1881.

Unusual persistence of rainfall. The Midwest had no previous record for such a sustained period of precipitation.

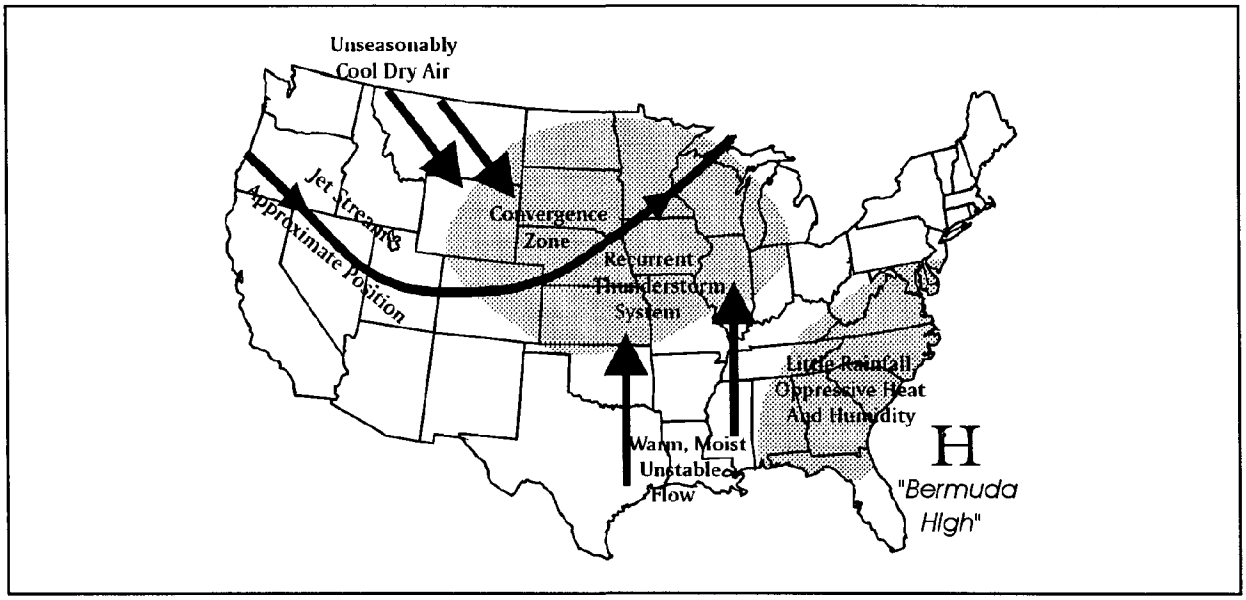
Highest soil moisture. Soil moisture readings in August 1993 were the highest in history.

Cloudiest period. Cloud cover from November 1992 through August 1993 was the greatest for that time period on record.

Lowest evaporation. Evaporation was the lowest in history.

Source: Hillaker, Harry, Iowa State Climatologist, Iowa Department of Agriculture, *Special Summary, Great Iowa Floods, 1993* (Des Moines, Iowa, September 7, 1993).

Figure 1.4 Weather Pattern, June-July 1993.



Source: U.S. Department of Commerce, NOAA, National Weather Service.

River Flow

The deluge across the upper Mississippi River Basin produced record setting peak flowrates and water levels in many tributaries and in the main stem rivers, including a large reach of the upper Mississippi, over the full reach of the middle Mississippi, and over much of the length of the lower Missouri River. Flooding began in the northern portion of the upper Mississippi River Basin in June and then moved southward with the shifting of the storm-producing weather pattern and the travel of the flood flows downstream as summer progressed.

Rainfall was particularly heavy between June 17 and 20 in southwest Minnesota and northwest Iowa, causing record flooding on the Minnesota River. The next major pulse of precipitation occurred from June 23-25. Runoff from these rains combined with flood flows from the Minnesota River to initiate the first flood crest that moved down the upper Mississippi River.

Following a short, dry period, a prolonged siege of heavy precipitation occurred from June 30 to July 11. This included extreme amounts of rainfall on July 9 in Iowa, which produced record flooding on the Raccoon and Des Moines rivers. Just as the crests from these two rivers reached Des Moines, a relatively small, convective pocket dumped several inches of rain on the crests rapidly boosting the river levels and flooding the city's water treatment plant. The intense rainfall during this period also led to record flooding on portions of the lower Missouri River and combined with the crest already rolling down the Mississippi to establish record river stages from the Quad Cities area on the upper Mississippi River downstream to Thebes, Illinois, on the middle Mississippi River.

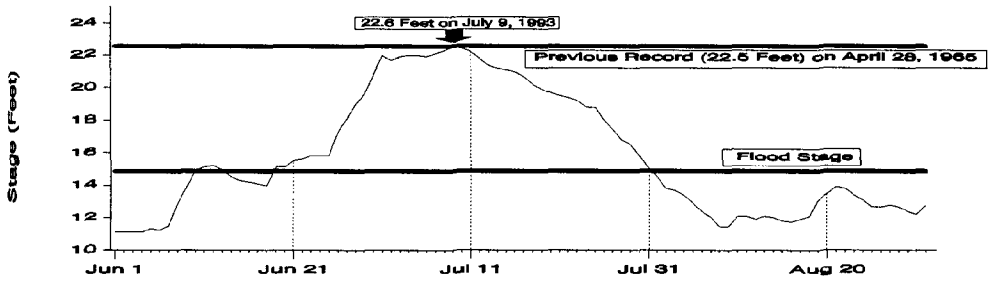
Another major precipitation event occurred from July 21-25. The heaviest rains were focused farther south than the earlier events, with especially heavy rain falling over eastern Nebraska and Kansas, leading to the second major crests on both the Missouri and Mississippi rivers. Hydrographs of river stages (elevations) over time for the Missouri River at Kansas City and the upper Mississippi River at the Quad Cities are shown in Figure 1.5.

The Kansas City graph shows two flood peaks, one caused by the June 30 to July 11 rainfall and the other by rain falling from July 21-25. The Quad Cities graph shows only the single peak from the earlier period. This comparison demonstrates the generally southern focus of this second event. Both peaks are evident on the hydrograph for the Mississippi River at St. Louis (Figure 1.5). While flooding from the latter rainfall period did not extend as far upstream on the Mississippi River, new record river levels occurred at many locations downstream and on much of that portion of the Missouri River that flows through Missouri. Figure 1.6 shows those reaches of main stem and tributary rivers where peak stages exceeded previous record levels and where they reached unusually high but not rcecord levels.

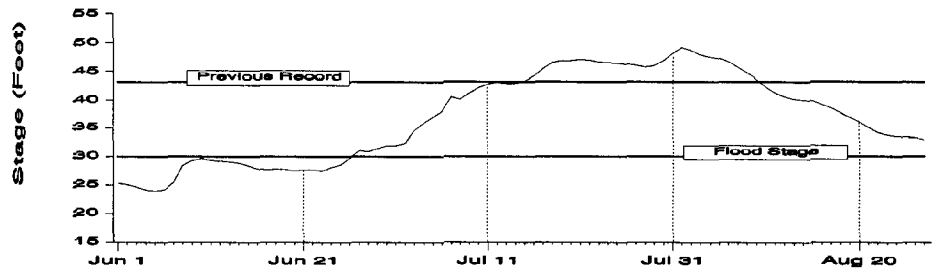
Above normal rains continued to occur over parts of the flood-affected region during August, especially over Iowa where accumulations were twice the normal monthly amount over much of the state. By mid-September, however, rainfall began to diminish and rivers began to recede. Then, at the end of September, a strong system of thunderstorms deposited 1 to 3 inches of rain over the State of Missouri and 7 inches or more from the central part of the state eastward. The consequence was major flash flooding on many tributaries and new flood crests on the lower Missouri and middle Mississippi rivers. Farmlands behind previously breached levees were reflooded and two people drowned in separate incidents. Many roads were washed out and there was much damage to property in Missouri.

Conclusion: ***Wet antecedent soil and swollen river conditions, record rainfall, and significant upland runoff resulted in 1993 flood flows that ranged from below the 100-year up to the 500-year recurrence interval magnitude at many locations.***

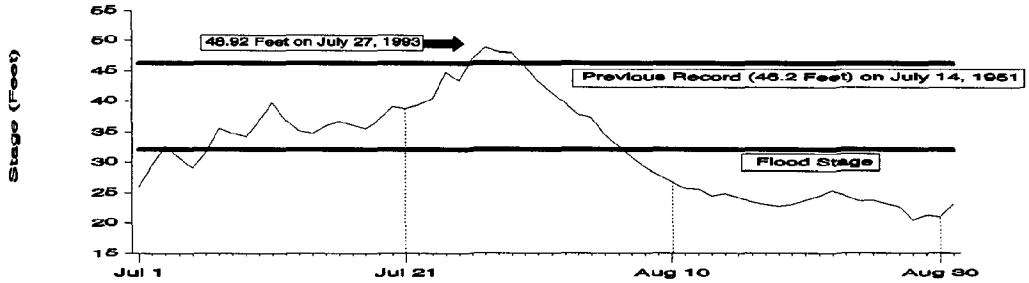
Figure 1.5 Hydrographs for the Mississippi and Missouri Rivers.



Hydrograph for the Mississippi River at Quad Cities.

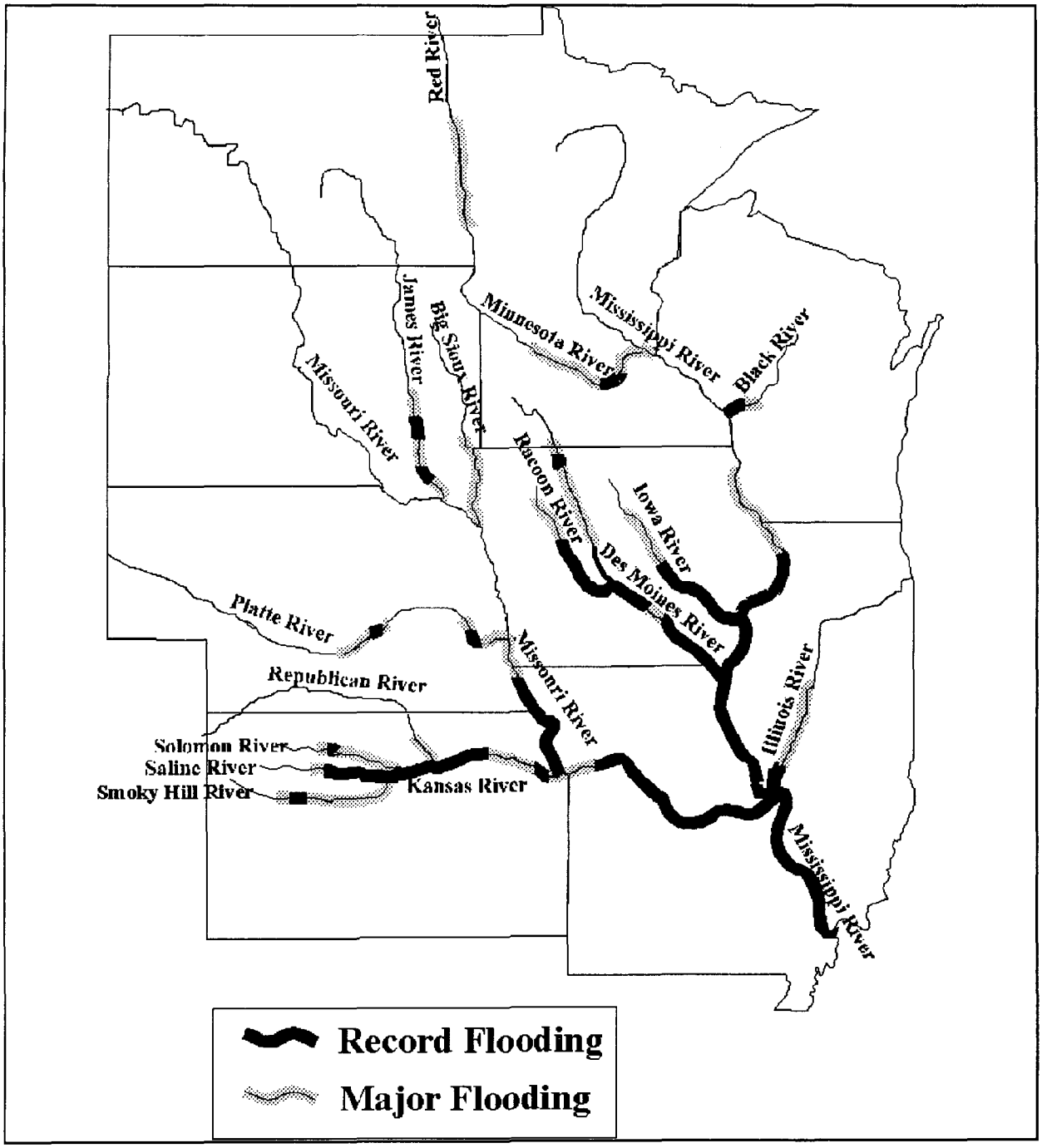


Hydrograph for the Mississippi River at St. Louis.



Hydrograph for Missouri River at Kansas City.

Figure 1.6 Areas Flooded in 1993.



Source; U.S. Department of Commerce, NOAA, National Weather Service. [6]

DAMAGES REPORTED

Estimates of total damages in the Midwest from weather events during 1993 range between $12 billion and $16 billion. Over half of these were agricultural damages to crops, livestock, fields, levees, farm buildings, and equipment. The remaining damages were primarily to residences, businesses, public facilities, or transportation. Much of the agricultural damage occurred in upland areas as the result of wet fields and a short growing season rather than inundation by floodwaters. Similarly a portion of residential and business damages was caused by basement flooding due to high groundwater and sewer back-up in areas outside the floodplain.

The NWS has estimated damages for the Midwest flood at $15.7 billion based on information provided by its field offices.[10] This estimate was based on totals by state, but did not include breakdowns of damage by type. In August 1993 *The New York Times* published an estimate of nearly $12 billion in damages based on information it obtained from state and federal officials.[11] State and federal officials could not assess all damages until floodwaters receded, and the full extent of agricultural damages was not known until after the end of the growing season. Most of the affected states have updated their damage estimates, and the total ranges from $12 billion to $13 billion. The available estimates are summarized in Table 1.3.

The Review Committee developed an estimate of flood damages using federal payments and making assumptions as to what percentage of damages those payments represent. This information indicates that total damages were more than $12 billion with as much as $4 billion to $5 billion of that total being agricultural damages in upland areas.

Table 1.3 Damage Estimates for 1993 Midwest Flooding, in Millions of Dollars.

State	NWS Totals	State Totals	State Agriculture	NY Times Totals	NY Times Agriculture
Illinois	2,640	1,000-2,000	565	1,535	605
Iowa	5,740	>3,400	na	2,200	1,200
Kansas	551	>500	441	574	434
Minnesota	964	1,700	1,500	1,023	800
Missouri	3,430	3,000	1,790	3,000	1,800
Nebraska	295	na	na	347	292
North Dakota	414	600	500	1,500	705
South Dakota	763	596	572	595	595
Wisconsin	904	930	800	909	800
Total	15,701	12,000-13,000	na	11,683	7,231

Sources[12]
Note: "na" means data not available.

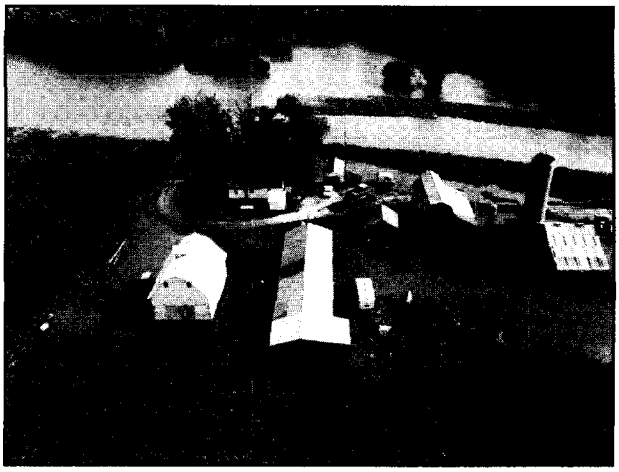
Damage estimates for the Midwest flood show marked inconsistencies. No federal agency is responsible for developing accurate assessments of flood damages, nor is funded to do so. The affected states and the Federal Emergency Management Agency (FEMA) conduct preliminary damage assessments to determine if a Presidential disaster declaration is warranted and to estimate the resources necessary for response and recovery. Once sufficient damage has been identified that justifies a declaration and once FEMA has a general idea of how resources should be allocated, federal agencies have little incentive to expend resources updating preliminary assessments. Resources are instead focused on tracking and projecting expenditures. The NWS is not funded to estimate total damages but does so to support other missions. The USACE, which in the past estimated flood damages, is no longer funded to do so. The Review Committee is concerned that decisions involving hundreds of millions of dollars often are being made without systematic assessments of flood damages and without a clear understanding of the nature and extent of those damages.

Agriculture

Agricultural damages from the Flood of 1993 had two primary causes: excessive moisture that prevented planting and reduced yields in upland and floodplain areas and actual flooding that destroyed crops and severely damaged many acres of fertile floodplain cropland. It is difficult to separate the factors that influenced crop production during the 1993 growing season in the 9-state region. They included rain, low temperatures, early frost, and floods. More than 70 percent of the crop disaster assistance payments, however, were made to counties in upland areas -- not in main stem river floodplains.[13]

Agricultural damages directly attributed to actual flooding totaled more than $2.5 billion, with an estimated $1.4 billion in lost corn and soybean sales. Most of these losses were restricted to 1993 as the productive capacity of the land was unchanged. There were, however, damages to field fertility and farm infrastructure of at least $100 million.

Each state suffered different types of losses. For



example, Missouri with 34 percent of its cropland (5.1 million acres) in the floodplain, had crop damages from flooding on 3.1 million acres causing $247 million in lost sales.[14] In Illinois, only 3 percent of the state's corn and soybean acreage (312,000 and 276,000 acres respectively) were lost to flooding with a loss in sales of $153.4 million.[15] Minnesota farmers lost $500 million in crop sales, but most of the damage was caused by wet conditions rather than riverine flooding.[16]

Damage from scour and deposition affected 455,000 acres on the Missouri River floodplain representing 20 percent of the flooded cropland along the Missouri and Mississippi rivers.[17] Drainage ditches were filled with sediments, and other agricultural infrastructure was destroyed. Almost 60,000 acres have sand deposition more than 24 inches thick and reclamation costs to restore fertility to damaged cropland are approximately $190/acre.[18] If cropland restoration requires removal of sand, it will cost approximately $3,200 to remove each acre-foot of sand.[19] It will cost $10.8 million to remove sediment and debris from ditches.[20]

Secondary impacts of agricultural losses to a local economy vary substantially with the dependence of that economy on the agricultural sector. Immediate losses are due to lost sales and unemployment. In the long run, the assessed value of land that sustained long-term damage may be reduced which will affect the property tax base of affected communities.

Another secondary effect was a reduction in crop-support payments after prices adjusted to the reduced

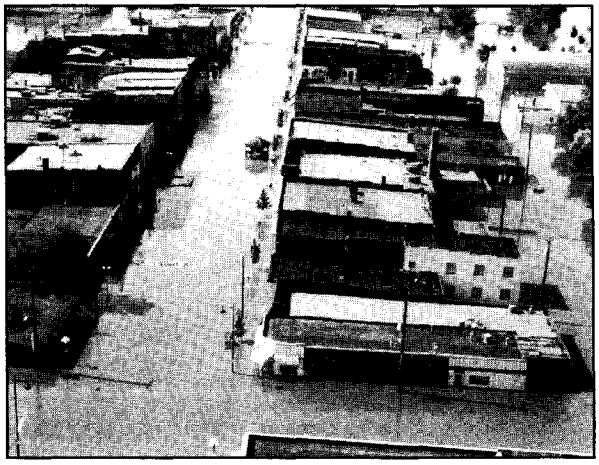
production caused by wet weather in the Midwest and drought in the Southeast in 1993. This loss to farmers was a gain for taxpayers since subsidies represent transfer payments. For corn, these deficiency payments were reduced by more than $2.6 billion.[21] These price effects and subsequent reduction in deficiency payments will be temporary, if the 1994 crop supply returns to past levels.

Conclusion: ***The majority of 1993 agricultural damages in the Midwest were caused by wet soil conditions and inundation in upland areas. Damage to inundated cropland in the floodplain was significant with almost complete crop losses behind failed levees. Areas affected by severe erosion and deposition may suffer long-term loss of productivity.***

Residences and Businesses

Estimates vary on the number of homes flooded and families impacted by the Midwest flood. Surveys made by Red Cross workers immediately after the floods identified more than 55,000 flooded residences.[22] FEMA subsequently verified these damages with Red Cross chapters and developed an updated estimate of 70,545 residences.[23] The *New York Times* estimated that more than 84,000 residences were damaged.[24] As of April 11, 1994, the federal government had received 167,224 registrations for individual assistance and 112,042 applications for the Disaster Housing Program. Among this latter group, 89,734 applications have been approved. The Disaster Housing Program data indicates that more than 100,000 residences were flooded.[25]

The fluctuating numbers illustrate an overlooked characteristic of this flood. While the media focused on flooding of communities along the main stem Mississippi and Missouri rivers and their major tributaries, at least as many families were impacted by flooded basements due to high groundwater, overloaded storm sewer systems, or sewer back-up. Many of the homes with flooded basements were not in the 100-year floodplain or behind levees that overtopped or failed. In Cook County, Illinois, for instance, large numbers of homes on the south and west sides of Chicago had basement flooding due to stormwater and sewer back-up caused by heavy rainfall which overwhelmed the city's combined storm and sanitary sewer system. The county was eventually added to the Illinois disaster declaration even though this type of damage generally does not warrant inclusion. Over half of the 60,448 registrations for individual disaster assistance in Illinois and 20



percent of the registrations for the entire 9-state region were in Cook County.[26]

Businesses sustained significant physical damages particularly in urban areas such as St. Louis County and the Kansas City areas of Missouri. Much of this damage occurred behind levees that failed or were overtopped. The 996 National Flood Insurance Program (NFIP) claims payments made to small businesses[27] and the 4,667 Small Business Administration (SBA) loans for damages to businesses[28] indicate that in excess of 5,000 individual businesses were damaged. No overall damage estimates for businesses are available, but a measure of this damage, SBA loans to businesses, exceeded $334 million for physical damage[29] and economic injury. Add to these loans NFIP flood insurance payments for small businesses and other non-residential buildings that exceeded $94 million,[30] and the total exceeds $431 million. In addition to physical damage to buildings and their contents, lost profits and wages from businesses closed by the flood had local and regional impacts. For example, an American Cyanamid Plant near Hannibal, Missouri, was protected by its own levee and not damaged by floodwaters, but the plant was shut down for nearly three months because its access road was inundated when an agricultural levee failed.

Transportation Systems

Rivers and river valleys historically have been major transportation routes, particularly in the area impacted by the 1993 flood. In the Midwest, transcontinental railroads, interstate highways, and other road systems either follow river valleys or cross them. As a result, physical damages to transportation systems form a significant percentage of total flood damages. In addition to direct damages, indirect costs accrue when transportation routes are inundated by floodwaters, and traffic is halted or detoured.

A major portion of flood damages to public facilities in 1993 involved roads and bridges. These damages ranged from blown culverts and wash-outs on rural roads and city streets to loss of bridges and damages to interstate highways inundated by floodwaters. The repair of flood-damaged roads and bridges generally is

funded through the FEMA Public Assistance Program or the Department of Transportation. Funds expended by those agencies when added to the state/local cost share for public assistance indicates that total physical damages to roads and bridges exceeded $250 million.[31]

Road and bridge flooding caused indirect losses related to increased transportation costs. In extreme cases, detours of 100 miles were required to travel between adjoining communities that had been connected by a bridge. Often bridges were elevated high above the river to allow for navigation or to minimize hydraulic impacts of floods, but bridge approaches built at or near the natural elevation of the floodplain were inundated by floodwaters. Even though the bridge was undamaged and the approach damage was minimal, the economic impacts on the communities served by the bridge could be extreme, particularly for a long duration flood such as occurred in 1993. For example, Keokuk, Iowa, was cut off from market areas in Illinois and Missouri for several weeks when the approaches to bridges over the Mississippi and Des Moines rivers were inundated. This resulted in serious economic impacts on local businesses. Flooding of the approaches to the bridge over the Mississippi River at Quincy, Illinois, for 73 days resulted in an estimated $30 million in lost business to Quincy merchants.[32] In addition, many people who lived in Missouri and could not commute to work in Illinois were temporarily unemployed. Ferries were eventually established to address part of this problem. The full magnitude of

these losses are reflected in over 36,000 claims approved for a total of $92 million in Disaster Unemployment Assistance.[33]

Historically railroads were built in floodplains and river valleys to minimize construction and fuel costs. Main lines continue to parallel both the Missouri and Mississippi rivers. Although generally tracks are elevated on embankments above the elevation of most floods or are located behind levees, they remain subject to major flood events. In 1993 over 800 miles of track were flooded and several main lines were inundated for varying periods of time, but most trains were routed around flooded areas. The Association of American Railroads estimates that railroad damages totalled $182 million, including $131 million in physical damages to tracks, bridges, signals, communication lines, switches, locomotives, rolling stock, and buildings. Additional costs of $51 million resulted from detouring trains around sections of flooded track.[34] Repair costs are generally borne by the railroads themselves although $21 million was distributed to railroads through the Supplemental Appropriation for Local Rail Freight Assistance.[35]

Airports often are located in floodplains because of the flat terrain and close proximity to urban areas. The Federal Aviation Administration (FAA) has identified 33 airports with varying degrees of flood damage. Estimated repair costs exceed $5.4 million. The airports range in size from the Spirit of St. Louis Airport in St. Louis County, Missouri, to airports that are little more than grass landing strips with a few hangars for private aviation. Most of the flooded airports were in Missouri (16) and Iowa (12). The Spirit of St. Louis Airport, an alternate for Lambert-St. Louis Airport, sustained $1.7 million in damages when the Monarch-Chesterfield Levee failed. Other major airports that were flooded include those at Creve Couer and Jefferson City and the Kansas City Downtown Airport. Several smaller airports remain closed and may not reopen.[36]

Navigation

Most of the main stem rivers were closed to barge traffic from July 11 until August 15, 1993, and severe limitations on barge traffic continued through September, October, and November. The Maritime Administration estimated that losses of revenue to the navigation industry were $300 million per month.[37] More than $165 million were lost in Illinois alone. Regional impacts on jobs from barge and port disruptions were also greatest in Illinois.[38]

Public Facilities

The Midwest flood caused extensive damages to water and wastewater treatment plants and other public facilities. Damages to utilities, including water and wastewater treatment facilities and stormsewer systems, exceeded $85 million.[39] Water treatment plants often are located in floodplains to be near well fields or the surface water that supplies the system. In addition, water supply lines must cross floodplains to serve floodplain residents. The EPA has identified 200 municipal water systems impacted to some degree by the flood.[40] The most prominent example is the Des Moines Water Works that serves the City of Des Moines and adjoining communities. The plant was flooded and remained out of operation for 12 days, and water from it was not safe to drink for another seven days. In addition to physical damages of $12 million, significant impacts were felt in the service area.[41] Businesses and government offices closed because of lack of fire protection, and bottled water and portable toilets had to be provided for residents. The economic impact of the shutdown may far exceed the cost of repair of the physical damage.

Wastewater treatment plants tend to be located in floodplains which are generally the lowest point in a community and offer the advantage of gravity flow. Furthermore the effluent from these plants is discharged into major rivers or streams. The impact of flooding ranges from temporary plant shutdown and the discharge of raw sewage into the river during the flood to physical damage that results in extended plant shutdowns and continued discharges of raw sewage or partially treated effluent until such time as the plant can be repaired. A total of 388 wastewater facilities were impacted by the flood.[42]

Damages to public buildings exceeded $27 million. Water control facilities had more than $20 million in damages, and facilities such as parks and other recreation facilities recorded more than $22 million. These estimates are based on FEMA projections of infrastructure spending that include a 10-percent local cost share.[43]

DAMAGES PREVENTED

Management and structural practices prevented damages from being worse than they were. These practices involved nonstructural solutions, upland conservation treatment, and major flood control projects.

Nonstructural Flood Protection

The term "nonstructural measures" is used to describe techniques that "modify susceptibility to flooding (such as regulation, floodplain acquisition, and floodproofing techniques)."[44] A nonstructural approach to flood damage prevention was effective in the town of Prairie Du Chein, Wisconsin where the flood was a 40- to 50-

year event. Prairie du Chein was the site of the first relocation project undertaken by the USACE and carried out between 1978 and 1984. A measure of the project's success was reported by the Red Cross. Used to responding to floods in Prairie Du Chein, Red Cross workers came to town but left within two weeks because no one needed their help.[45] Relocation had freed citizens of anxiety about the risk of flood damage to their homes and businesses. Nonstructural land management applications such as the Minnesota Valley National Wildlife Refuge and the Upper Mississippi River Wildlife and Fish Refuge provided for storage and conveyance of a portion of the 1993 floodwaters within the floodplains of the lower Minnesota and upper Mississippi River valleys. Refuges, parklands, greenways, and agriculture are examples of appropriate floodplain uses that reduce flood damages by minimizing the number of structures at risk.

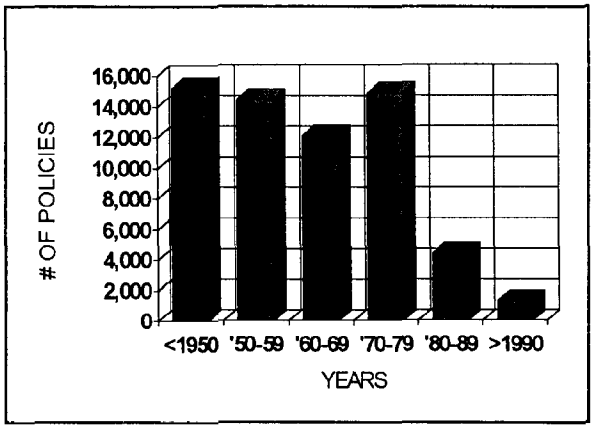
The National Flood Insurance Program. The NFIP has not encouraged floodplain development in the Midwest and, in combination with state and local floodplain managment programs, appears to have discouraged it. The NFIP has discouraged floodplain development by (1) increasing awareness of flooding by identifying and mapping the flood hazard, (2) internalizing the cost of floodplain occupancy, making development in the floodplain more costly (i.e., added cost of protecting buildings from flooding and the added cost of the NFIP flood insurance premium), and (3) requiring additional permitting and engineering studies that developers and individuals may choose to avoid.

The Review Committee met with a number of communities in the Midwest, large and small, that actively discourage development in their floodplains even if permitted by federal or state regulations. This "steering" of development to flood-free locations has deterred new floodplain development in these communities.

Approximately 93 percent of the properties which are located in the 100-year floodplain in the flooded area and are currently insured by the NFIP were constructed before the issuance of a Flood Insurance Rate Map (FIRM) for the community and conversion of the community to the Regular Program of the NFIP,[46] i.e., between December 31, 1974 and the early to mid-1980's. Floodplain management regulations appear to have prevented or reduced damages to new construction (post-FIRM construction). These buildings sustained proportionally fewer losses than older buildings even though the flood elevations exceeded the 100-year design standard in many locations. These new buildings comprise 6.4 percent of the insured floodplain buildings in the declared counties, but account for only 3.2 percent of the losses.[47]

Figure 1.7 indicates a significant reduction in the number of buildings built in the floodplain after 1980. Since insured buildings tend to include newer, more expensive buildings with mortgages subject to the mandatory flood insurance purchase requirement, the percentage and numbers of all buildings built prior to enactment of the NFIP are likely to be even higher.

Figure 1.7 Construction Dates of NFIP Insured Buildings in the Nine Midwest States



Source: Federal Emergency Management Agency, Federal Insurance Administration. Computer Printout, March 28, 1994.

Acquisition and relocation. Acquisition or relocation of floodprone buildings through federal programs or state and local initiatives continues to be an important strategy for reducing potential flood damages. Successful buy-out programs normally are a response to a flood or series of floods. Implemention occurs over a multi-year period as funding becomes available. The Review Committee identified more than 600 buildings in the upper Mississippi River Basin which have been acquired and relocated out of floodprone areas over the past 20 years. Most of these buildings had been damaged previously by floods and would have been severely damaged by the higher waters of the Flood of 1993.

Upland Watershed Treatment

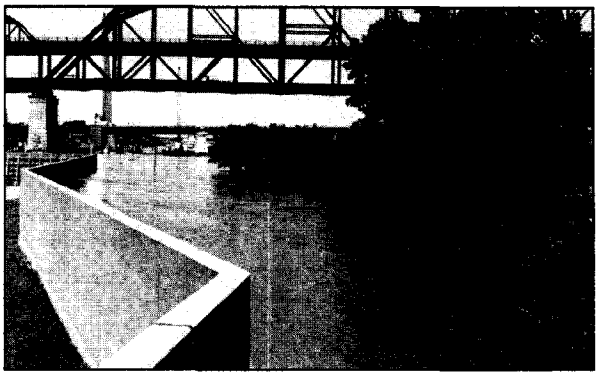
The Flood of 1993 demonstrated the value of installing flood-prevention measures and of improving land-treatment practices on agricultural lands throughout the watershed. In upland watershed areas, the Soil Conservation Service (SCS) small watershed projects prevented damages estimated at $400 million. Crop losses to landowners were lower in areas with upland watershed treatment. An example is the SCS project on the Grindstone-Lost-Muddy Watershed Project that protects approximately 60 percent of Dekalb County and portions of Clinton, Gentry, and Davies counties in Missouri. Flood protection on the 326-sq. mi. watershed includes land treatment, flood prevention, multi-purpose flood control reservoirs, and erosion-grade control structures. The project area recorded two storms exceeding the 1-percent chance of occurrence in July and September 1993. Estimated agricultural benefits accrued were $915,900 for the July storm and $989,700 for the September storm with road and bridge benefits of $66,000 and $70,000. Agricultural disaster payments per acre in Dekalb County were less than half those paid in neighboring counties. Since the storm, local people have donated $3,000 to purchase landrights for construction of remaining flood control reservoirs.

Flood Damage Reduction Projects

The USACE estimates that flood-control facilities in place during the 1993 flood prevented $19.1 billion in damages.[48] Of that total, $11.5 billion in damages were prevented along the Missouri River. Damages prevented by the water control management of flood storage reservoirs amounted to $7.4 billion in the Missouri River Basin; $4.0 billion by the storage of flood water in the six main stem Missouri River reservoirs, and $3.4 billion by the dams and reservoirs on the tributaries. The other $4.1 billion in damages prevented along the Missouri River is attributed to levee projects. USACE and Bureau of Reclamation flood control reservoirs on the main stem and tributaries in the Missouri River Basin reduced peak discharges on the Missouri River by storing over 17 million acre-feet of flood water between June and August.[49] In the St. Louis metropolitan area, a combination of upstream reservoirs, levees, and floodwalls prevented damages of approximately $3 billion. Upstream reservoirs and

levees also prevented damages of about $5.6 billion at Kansas City.

Conclusion: ***Damages from the 1993 flood were reduced significantly through use of nonstructural and structural measures.***



RESPONSE AND RECOVERY COSTS

By the end of the flood, nine state disaster declarations included more than 525 counties. Current estimated federal response and recovery costs include $4.2 billion in direct federal expenditures, $1.3 billion in payments from federal insurance programs, and more than $621 million in federal loans to individuals, businesses, and communities.

A review of the types and amounts of federal response and recovery costs by state illustrate again the differences in types of damages among the nine states.

In the upper basin states of Minnesota, Nebraska, North Dakota, and South Dakota and in Wisconsin and northern Iowa, the losses were primarily to agriculture, much of it in upland areas. Along the main stems of the Mississippi and Missouri rivers and their major tributaries in Missouri, Illinois, and central Iowa, significant losses occurred in agriculture as a result of bottomland flooding, but urban areas also recorded damages.

Federal Expenditures

Federal expenditures represent disaster response and recovery costs borne by the federal government. Among these are disaster assistance payments to individuals and farmers, costs to repair levees and other infrastructure, costs to provide health and social services; and costs associated with hazard mitigation, housing, and community development. A summary of federal expenditures for the Midwest flood is included in Table 1.4.

Crop disaster payments. Disaster payments are made for production and quality losses of most commercially-grown crops when losses are caused by damaging weather and related conditions. Production losses related to prevented planting and low yield are eligible for compensation. The Agricultural Stabilization and Conservation Service of USDA can authorize crop disaster payments without a Presidential Disaster Declaration. Participation in price-support programs does not affect eligibility or payment levels. Producers with crop insurance qualify if losses are greater than 35 percent of expected production; and those without crop insurance qualify if losses are greater than 40 percent. For most crops grown in the 9-state region, payments are calculated by determining the eligible amount of loss and multiplying it by 65 percent. As a general rule of thumb, farmers can expect disaster payments to cover 40 percent of expected cash receipts.[50] For 1993, yields less than 9 bushels an acre of corn or 4 bushels per acre of wheat counted as total losses for calculation of disaster payments. Figure 1.8 shows the location of crop disaster payments in the 9-state region. More than 70 percent ($1.02 billion) went to the prairie pothole

Table 1.4 Summary of Federal Expenditures by State for the Midwest Flood of 1993 in Millions of Dollars.[51]

Program	Total	IL	IA	KS	MN	MO	NE	ND	SD	WI
Crop Loss Payments	1,463.3	49.2	351.1	65.5	442.5	121.2	76.0	99.5	151.1	107.2
Emergency Conservation Program	2.7	0.1	1.5	-	0.1	0.7	0.1	-	0.2	-
Emergency Watershed Program	57.2	9.5	13.8	4.0	1.1	11.9	1.0	0.9	3.5	1.0
Food Stamps and Commodities	10.9	2.1	2.4	-	-	6.4	-	-	-	-
FmHA Loans and Grants	15.8	2.4	7.4	0.2	2.5	1.4	0.1	0.2	0.9	0.8
SCS Supplemental for 1994	150.0	-	-	-	-	-	-	-	-	-
USDA Subtotal	1,699.9	63.3	376.2	69.7	446.2	141.6	77.2	100.6	155.7	109.0
Infrastructure (proj.)	424.4	92.8	99.6	31.2	27.5	94.9	41.8	8.2	9.9	18.5
Human Services (proj.)	449.1	59.7	54.9	56.5	24.4	125.9	3.5	22.7	20.4	18.0
Hazard Mitigation (proj.)	134.9	26.3	27.0	15.2	9.7	30.0	10.0	4.2	4.5	8.0
Administration (proj.)	89.6	18.7	8.3	8.8	1.3	40.7	3.5	2.0	2.1	1.9
FEMA Subtotal	1,098.0	197.5	189.80	111.7	62.90	291.5	58.80	37.10	36.90	46.40
CDBG 1993 Allocations	200.0	35.9	43.1	18.8	13.5	57.2	7.8	11.9	6.0	5.9
HOME 1993 Allocations	50.0	10.8	11.4	3.4	2.7	15.3	1.3	2.6	1.30	1.30
CDBG 1994 Allocations	250.0	48.2	53.2	18.4	13.6	79.6	15.3	7.7	6.8	7.2
HUD Subtotal	500.0	94.9	107.7	40.6	29.8	152.1	24.4	22.2	14.1	14.4
EDA Assistance Programs *	200.0	8.3	48.4	17.9	7.4	51.7	0.6	2.9	1.6	0.7
NOAA Expenses	1.0	0.1	0.1	-	0.5	0.2	-	-	-	0.1
Legal Services Corporation	0.3	-	-	-	-	-	-	-	-	-
Commerce Subtotal	201.3	8.4	48.5	17.9	7.9	51.9	0.6	2.9	1.6	0.8

Table 1.4 Summary of Federal Expenditures by State for the Midwest Flood of 1993 in Millions of Dollars (cont'd).

Program	Total	IL	IA	KS	MN	MO	NE	ND	SD	WI
Flood Control Emergency	218.0	70.0	7.0	11.0	0.3	128.0	1.0	-	-	-
Emergency Operations and Contingencies	31.4	-	-	-	-	-	-	-	-	-
Operation and Maintenance	3.7	0.3	2.7	-	-	0.7	-	-	-	-
USACE Subtotal	253.1	70.3	9.7	11.0	0.3	128.7	1.0	0.0	0.0	0.0
HHS Subtotal	75.0	7.4	22.8	4.2	4.0	19.3	2.3	2.2	2.6	3.9
Impact Aid	70.0	-	-	-	-	-	-	-	-	-
Student Financial Assistance	30.0	1.4	11.1	0.2	0.8	4.5	0.4	0.8	0.5	0.3
Education Subtotal	100.0	1.4	11.1	0.2	0.8	4.5	0.4	0.8	0.5	0.3
Labor Subtotal	64.6	10.0	15.0	10.0	5.0	15.0	3.0	2.0	3.1	1.5
National Community Service Subtotal	4.0	0.4	1.2	0.4	0.7	1.0	-	-	-	0.3
Coast Guard Operation	10.0	-	-	-	-	-	-	-	-	-
Federal Highway Administration	152.1	32.7	16.7	19.8	4.6	66.4	3.0	3.6	2.5	2.8
Local Rail Freight Assistance	21.0	0.6	5.4	3.8	2.7	7.1	-	-	1.4	
DOT Subtotal	146.7	33.3	22.1	23.6	7.3	73.5	3.0	3.6	3.9	2.8
Abatement, Control, and Compliance	24.3	3.4	3.4	1.9	0.8	6.9	1.5	0.9	0.7	0.9
Program and Research Operations	1.0	0.2	-	0.1	-	-	-	-	-	-
Underground Storage Tanks	8.0	1.4	1.2	0.7	1.4	0.7	0.5	0.3	3	1.5
Oil Spill Response	0.7	0.3		0.4						
EPA Subtotal	34.0	5.3	4.6	3.1	2.2	7.6	2.0	1.2	3.7	2.4

Table 1.4 Summary of Federal Expenditures by State for the Midwest Flood of 1993 in Millions of Dollars (cont'd).

Program	Total	IL	IA	KS	MN	MO	NE	ND	SD	WI
FWS Construction	30.0	10.5	0.2	0.7	5.2	2.7	-	0.4	-	4.3
Historic Preservation	5.0	1.0	1.0	0.2	0.3	1.0	0.3	0.2	0.2	0.2
NPS Construction	0.9	-	0.3	0.1	0.1	0.2	0.1	-	-	0.1
USGS Surveys	1.4	0.3	0.6	0.3	0.3	1.2	0.1	0.2	0.3	0.2
BIA Programs	3.9	-	-	-	0.1	-	-	-	0.4	-
DOI Subtotal	41.2	11.8	2.1	1.3	6.0	5.1	0.5	0.8	0.9	4.8
TOTAL	4,254.2	520.8	810.8	294.1	573.5	910.4	173.2	173.4	203.4	186.1

* Includes $18M for Levees
Sources[52]

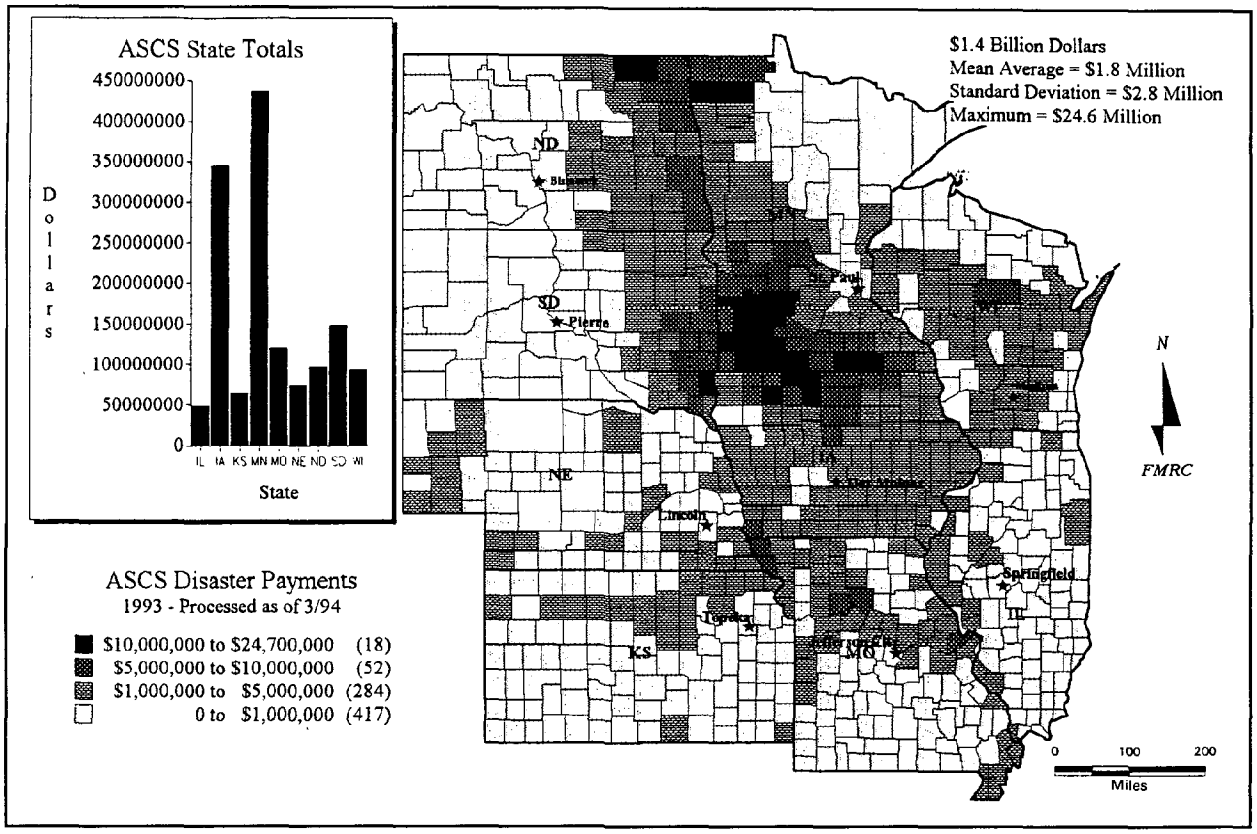
Table 1.5 U.S. Department of Agriculture ASCS Disaster Payments, 1993.

States	Program Crops ($)	Non-Program Crops ($)	Total Payments ($)
Illinois	42,662,617	7,445,761	50,108,378
Iowa	342,849,940	12,910,334	355,760,274
Kansas	42,662,617	4,823,055	65,562,624
Minnesota	414,574,259	30,983,156	445,557,415
Missouri	113,812,607	8,290,327	122,102,934
Nebraska	64,123,698	13,233,694	77,357,392
N. Dakota	67,127,874	34,760,511	101,888,385
S. Dakota	142,318,846	11,299,410	153,618,256
Wisconsin	82,468,812	18,377,402	100,846,214
9-State total	1,330,678,222	142,123,650	1,472,801,872

Source: Agricultural Stabilization and Conservation Service, April 15, 1994.

Note: Program crops that received 1993 disaster payments within the 9-state region include those within the Commodity Program (barley, corn, upland cotton, oats, rice, sorghum, sugar beets, wheat) plus those in special programs (soybeans and tobacco).

Figure 1.8 Crop Disaster Payments, 1993.



Source: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, March 1994.

region of the Dakotas, Minnesota, Wisconsin, and northern Iowa.[53] Cropland in this area of hydric soils and excessive rainfall does not drain well. The majority of payments went to farmers participating in commodity programs (Table 1.5), but damages would have been higher without farmer enrollment because the 6 million acres of land set aside (the 1993 requirement for program participation) would have incurred crop losses if production had been allowed.

Federal Insurance Programs

The federal government operates two insurance programs that provided claims payments to those impacted by the Midwest flood; the National Flood Insurance Program (NFIP) and the Federal Crop Insurance Program. Claims payments by federal insurance programs are distinct from federal expenditures. Table 1.6 summarizes claims payments from these programs by state. Under both programs, individuals pay an annual insurance premium to the government and the government provides insurance coverage. Tables showing insurance payments from the NFIP and the Federal Crop Insurance Corporation (FCIC) follow.

National Flood Insurance Program. Flood insurance coverage on buildings and their contents is available through the NFIP in participating communities. Under

Table 1.6 Summary of Federal Insurance Claims Payments by State for the 1993 Midwest Floods in Millions of Dollars.

Program	Total	IL	IA	KS	MN	MO	NE	ND	SD	WI
Federal Crop Insurance Program Claims Payments	1,017.0	25.4	281.2	40.4	353.9	27.7	49.0	139.3	54.1	46.0
National Flood Insurance Program Claims Payments	297.3	61.4	23.4	10.7	1.7	192.3	4.8	0.3	0.8	2.0
Total Claims Payments	1,314.3	86.8	304.6	51.1	355.6	220.0	53.8	139.6	54.9	48.0

Sources: U.S. Department of Agriculture, Flood Information Center, "USDA Emergency Assistance Paid to Flood States," April 4, 1994; Federal Emergency Management Agency, Federal Insurance Administration, computer print-out, March 16, 1994.

the NFIP insurance premiums for buildings that pre-date the identification of the flood hazard in a particular community are subsidized, but for buildings built after that date, premiums are based on full actuarial rates. All costs of administering the program, including the costs of floodplain mapping and salaries of federal employees are charged to policyholders. The Midwest flood was the third most costly in terms of NFIP payments, exceeded only by Hurricane Hugo and the December 1992 coastal storm that struck New York, New Jersey, Massachusetts, Delaware, and Connecticut. In 1993, over half of the losses and two thirds of the payments were in Missouri. States in the upper basin had lower average payments since buildings were generally subject to shallow flooding along tributaries which flooded basements and some first floors. States in the lower basin had much higher average losses reflecting the deep flooding in the bottoms along the main stems of the Mississippi and Missouri rivers (Table 1.7 and Figure 1.9). High average payments in Missouri also reflect large payments to small businesses and other non-residential buildings, particularly in Chesterfield and elsewhere in St. Louis County. Even in the counties with disaster status, in excess of 80,000 insured properties did not sustain flood losses. Some of these were behind levees that did not overtop or fail, but most were on tributaries that did not flood or where flooding was of less than 100-year frequency.

Federal Crop Insurance Program. Farmers can protect themselves from actual crop losses or prevented planting caused by uncontrollable natural events through purchase of crop insurance from the FCIC. This government corporation within the USDA provides coverage for 51 crops in the event of loss from drought, excess soil moisture, flood, frost, hail, wind, insects, and other natural perils. Historically drought has been the major cause of crop loss (55 percent) while floods represent only two percent of claims. Excess soil moisture, however, represents 16 percent of losses.

Farmers must purchase the insurance early in the crop year. For example, a policy to cover a corn crop planted in 1994 in the Midwest would have to be purchased by April 15. Farmers can choose the level of insurance coverage that they wish to purchase, but they are not able to insure their crop for the full value. Maximum coverage is 75 percent of expected crop yield.[54] To encourage participation, the federal government subsidizes crop insurance premiums up to 30 percent and pays administrative, actuarial, underwriting, and selling expenses.

Table 1.8 shows the participation rate for crop insurance purchases in the 9-state area for 1993 as well as the indemnities paid to policyholders. Participation is lowest in the corn/soybean region and highest where

Table 1.7 NFIP Flood Insurance Losses for the Period From April 1 Through September 30, 1993 by State for the 1993 Midwest Floods.

State	Policies 1/31/94	Loss Count	Total Payments ($)	Average Payment ($)	Losses (%)	Payments (%)
Illinois	36,844	3,624	61,389,123	16,939.60	22	21
Iowa	8,689	1,690	23,378,415	13,833.38	10	8
Kansas	11,065	1,071	10,702,780	9,993.26	7	4
Minnesota	3,472	372	1,712,960	4,604.73	2	>1
Missouri	20,981	8,271	192,296,740	23,249.52	5	65
Nebraska	6,652	503	4,833,133	9,608.61	3	2
North Dakota	3,008	198	285,572	1,442.28	1	>1
South Dakota	1,313	115	745,309	6,480.95	2	>1
Wisconsin	7,096	323	1,999,654	6,190.88	2	>1
Total	99,120	16,167	297,343,686.00	18,392.01		

Source: Federal Emergency Management Agency, Federal Insurance Administration, Computer print-out, March 16, 1994.

wheat is the principal crop. The largest claims were in the prairie pothole region (as were the bulk of the crop disaster payments) rather than in the floodplains. The probability of participation in the crop insurance program is lower for floodplain farmers than for those in the upland because flood damage is, in general, more localized than drought which is the primary hazard in the Midwest.

Loans. Federal agencies have approved $623 million in loans to individuals, businesses, and communities impacted by the Midwest flood. These loans, which must be repaid, are a federal expenditure only to the degree that interest rates are subsidized, borrowers default on loans, and administrative costs are incurred (See Table 1.9). The primary source of the loans is the Small Business Administration (SBA) Disaster Loan Program which provided $597 million in loans to flood-affected homeowners and renters, businesses of all sizes, and non-profit organizations. Interest subsidies, defaults, and administrative costs amount to approximately 30 percent of the loans.[55] Farmers Home Administration (FmHA) is the source of agricultural loans because SBA is prohibited from making loans to farmers.

Federal income tax deductions. Uninsured and otherwise unreimbursed losses resulting from casualties such as a flood are deductible for Federal Income Tax purposes to the extent that they exceed 10 percent of Federal Adjusted Gross Income plus $100. This deduction results in decreased tax revenue to the federal government. The Internal Revenue Service provides tax counseling to disaster victims to assist them in applying for refunds by amending their previous years tax return when a major disaster is declared. The loss of tax revenue has not been quantified for the Midwest flood. Due to the amount of insurance and disaster assistance payments, the income levels of many of the flood victims, and the requirement that the loss exceed 10 percent of adjusted gross income, the loss may not be substantial. The casualty loss deduction, however, does act as an additional mechanism for transferring the costs of flood damage from the private sector to the federal government.

Figure 1.9 National Flood Insurance Claims, 1993.

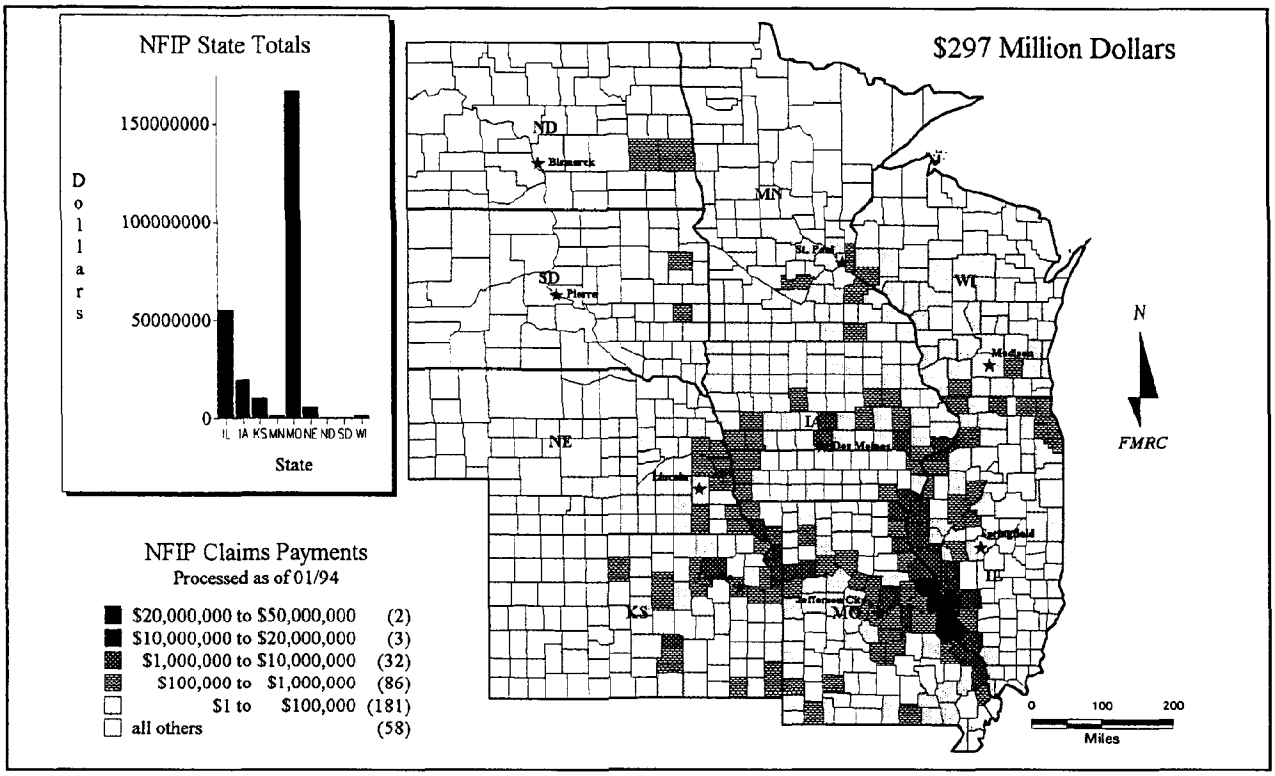


Table 1.8 Federal Crop Insurance Participation and Payments, 1993.

State	Participation (%)	Payments ($ million)
Illinois	44.4	25.4
Iowa	60.2	281.2
Kansas	76.4	40.4
Minnesota	52.4	353.9
Missouri	24.0	27.7
Nebraska	56.1	49.0
N. Dakota	93.4	139.3
S. Dakota	47.0	54.1
Wisconsin	11.3	46.0
Total		1,017.0

Source: U.S. Department of Agriculture, Federal Crop Insurance Corporation, April 15, 1994.

State and Local Costs

The Midwest flood was also costly for state and local governments. Because the FEMA provided assistance at a 90/10 cost share, the state/local share was approximately $42 million for Public Assistance and nearly the same amount for assistance to individuals.[56] States and communities also had unreimbursed expenses associated with response and recovery. State and local costs for the restoration of damaged levees and watersheds exceeded $130 million. These expenditures were part of the USACE 80/20 and the SCS 75/25 required cost shares.

Of greater concern to some communities is the short- and long-term reductions in real estate tax revenues as properties are reassessed to reflect flood damages to buildings and agricultural lands or losses in market value due to the increased awareness of the flood hazard. In those areas, where homes are not being rebuilt and fields are not being restored, these losses will be permanent. Impact aid from the U.S. Department of Education, currently budgeted at $70 million, will replace a part of the lost tax revenues that would have gone to schools.[57] At the state level, losses in tax revenue may result from lost profits and wages. Partial compensation for these losses may come in part from the increased economic activity of the recovery effort and from federal assistance.

Non-Quantifiable Costs

The EPA determined that 59 Superfund sites experienced flooding; however, impacts to the sites were minimal and corrective measures have been completed on sites requiring them.[58] In addition, 73 solid waste treatment,[59] storage, and disposal sites were also flooded,[60] and large propane tanks that were dislodged floated downriver creating the potential for massive explosions. Besides the large propane tanks, the states collected over 18,000 orphaned drums[61] -- each with a potential hazardous or toxic substance -- and a large amount of household hazardous wastes whose disposal was necessitated by the flooding. Daily loads of agricultural chemicals (herbicides and nitrates) transported by the Mississippi River were large relative to previous years; record flooding did not dilute the concentrations of herbicides.[62] Concentrations of two herbicides (atrazine and cyanazine) in some samples from the Mississippi River exceeded health-based limits for drinking water; however, the annual concentration was not expected to exceed those limits for 1993.[63] The cumulative impact of any flood-related releases of hazardous materials, including pesticides, herbicides, and other toxic materials has not been established.

The effects of flooding on groundwater hydrology and groundwater quality have yet to be determined. In response to concerns regarding the safety of private wells, the Administration established a well-water contamination survey in coordination with the nine flood states.[64] The EPA performed floodwater quality sampling around major metropolitan areas on the Missouri River. In some cases, drinking water standards were exceeded, but the majority of the readings posed no health risk.[65] Results from sampling of treated drinking water revealed three locations where Maximum Contaminant Levels were exceeded although results from a single sample do not necessarily indicate a problem.[66] USGS and National Oceanic and Atmospheric Administration (NOAA) have not found significant changes in water chemistry since the 1993 flood.[67]

Impacts of the flooding on the distribution of contaminated river sediments is also unknown. Studies are underway to determine sediment chemistry and characterize sediment deposition patterns in rivers and streams.[68]

Effects of the flood on public and mental health are largely anecdotal. Some communities noted increases in spousal and child abuse and numbers of calls for police response. Mental health effects of community and individual buyout/relocation are poorly understood. Several studies are currently being completed to assess the human response to the 1993 flood and to evaluate the factors that strain the ability of families to function adaptively to the event.[69] Experience with other floods indicates that outbreaks of Equine,Western, and St. Louis encephalitidies can be expected two years after a flooding event (due to the lag time in amplification of disease vectors).[70] The length of time between the flood event and the appearance of disease adds to the problem of attributing costs.

The flood took its toll on historic and cultural resources

Table 1.9 Summary of Amount of Federal Loans by State for the 1993 Midwest Flood in Millions of Dollars.

Program	Total	IL	IA	KS	MN	MO	NE	ND	SD	WI
Small Business Administration Disaster Loans	597.3	134.7	108.5	31.6	27.4	235.3	14.2	16.1	16.7	12.8
Rural Development Administration Loans	9.3	-	6.7	1.2	-	0.7	0.1	-	0.6	-
Farmers Home Administration Emergency Disaster Loans	14.7	2.1	7.3	0.1	2.4	0.9	0.1	0.2	0.9	0.8
Total Amount Approved	621.3	136.8	122.5	32.9	29.8	236.9	14.4	16.3	18.2	13.6

Sources: Kulik, Bernard, Associate Administrator for Disaster Assistance, U. S. Small Business Administration, personal communication, May 3, 1994; U.S. Department of Agriculture, Flood Information Center,"USDA Emergency Assistance Paid to Flood States," April 4, 1994.

in the area. Historic homes in Grafton, Illinois and Ste. Genevieve, Missouri and a church in Portage des Sioux were damaged. A cemetery in Hardin, Missouri was inundated which disinterred over 500 bodies. There were several American Indian tribes affected by the Flood of 1993. The SAC and Fox of the Mississippi in Iowa (Mesquakie) lost 10 homes and the ceremonial area of their Pow-wow grounds.[71] The Kickapoo Tribe in Kansas had damages to their crops, bridges, roads, and water system.[72] Indian lands in the prairie pothole area were saturated by frequent rains. Local lakes flooded homes on the shore and contaminated drinking water wells. Well and lake water continue to be monitored for pesticides, animal wastes, and other pollutants potentially carried by runoff to the upland lakes.[73]

Preliminary field investigations by state and federal forestry staff in Mississippi River navigation pools 25 and 26 revealed that all hackberry and sugarberry and a large percentage of sycamore appeared to be dead or dying at those locations. Similar effects might be expected elsewhere in the Basin's floodplain where flood duration coincided with the entire growing season. Hackberry and sugarberry are important mast-producing trees, and mature sycamore are frequently selected by species of colonial nesting birds.[74] The full effects on forest canopy and subcanopy structure will not be known for years to come.

Conclusion: ***Not all costs of the Flood of 1993 can be quantified in monetary terms, but both quantifiable and non-quantifiable costs were significant in magnitude and importance.***

BENEFICIAL EFFECTS

Flooding is a natural phenomenon of every river. Historically, flood water enriched bottomlands and provided spawning habitats for native fish. The ecological value of maintaining connections between the river and its floodplain and the flood-pulse advantage are among the benefits conveyed by a flood.[75] The 1993 flood connected many midwestern rivers with their floodplains, and for the first time in decades this flood coincided with the natural spawning period of riverine fishes. The benefits of this inundation to fisheries and aquatic resources was evidenced anecdotally in reports of fishermen utilizing newly created scour holes, and

empirically in fisheries samples collected as part of the fall fish sampling for the cooperative interagency (USACE, FWS, and 5 states) upper Mississippi River System Long Term Resource Monitoring Program (LTRMP). Catches of young-of-the-year fish in fall 1993 samples (after the flood) were greater than numbers of such fish collected in all samples for the entire 1992 sampling year (before the flood).[76]

ENDNOTES

1. U.S. Army Corps of Engineers, Missouri River Division, Reservoir Control Center, ***1993-1994 Missouri River Mainstem Reservoirs Annual Operating Plan,*** December 1994.

2. U.S. Army Corps of Engineers, Kansas City District, maps of the Missouri River from Rulo, Nebraska to St. Louis, Missouri 1879-1954.

3. The Fema study area was selected in the early phases of the response and recovery effort and includes 419 contiguous counties in the upper Mississippi and Missouri River basins believed at the time to be most severely impacted by the 1993 flood.

4. The analysis was based on those Census Block Groups (CBGs) whose centroids were in the flood extent and the floodplain as mapped by the SAST team. These CBGs then were compared to CBGs with their centroids in uplands. Although most of the CBGs with centroids within the flood extent and floodplain contain extensive upland areas, the data are an indicator that areas inundated by the Midwest flood differ from upland areas. The data were developed for both CBGs within Metropolitan Statistical Areas (MSA) and those outside of those areas.

5. The Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 128-98, February 11, 1994) requires agencies to conduct activities related to human health and the environment in a manner that does not have the effect of discriminating against low-income and minority populations.

6. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, ***Natural Disaster Survey Report, The Great Flood of 1993,*** (Silver Springs, MD: DOC, February 1994).

7. Parrett, Charles, Nick B. Melcher, and Robert W. James, Jr., ***Flood Discharges in The Upper Mississippi River Basin, 1993,*** U.S. Geological Survey Circular 1120-A, Second printing (with revisions), September 24, 1993.

8. ***Natural Disaster Survey Report, The Great Flood of 1993.***

9. The primary source for information in the Rainfall and River Flow sections was ***Natural Disaster Survey Report, The Great Flood of 1993.***

10. U.S. Army Corps of Engineers, ***Annual Flood Damage Report to Congress for Fiscal Year 1993,*** Prepared by USACE Engineering Division in Cooperation with the National Weather Service Office of Hydrology, (Washington, DC: USACE, April 1994). The NWS supporting report, ***Water Year '93 Flood Damage Report,*** includes several pages of discussions on the problems and limitations of current methods of estimating flood damages.

11. Ayres, B. Drummond, Jr., "What's Left from the Great Flood of '93," ***The New York Times,*** (August 10, 1993).

12. NWS Totals: "Water Year '93 Flood Damage Report," Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, 1994. NY Times Totals: Ayres, B. Drummond, Jr., "What's Left from the Great Flood of '93," New York Times, August 10, 1993. Illinois: Bhowmik, Nani G., editor, ***The 1993 Flood on the Mississippi River in Illinois,*** (Illinois State Water Survey Misc. Publication No. 151. 1993). Iowa: Ostendorf, Jerry, Iowa Department of Public Defense, Emergency Management Division, personal communication, April 1, 1994. Kansas: Region VII Interagency Hazard Mitigation Team, Interagency Hazard Mitigation Team Report for FEMA-DR-1000-KS, 1993. Minnesota: McCright, Kathee, Director, State of Minnesota, Washington Office, letter, April 14, 1994. Missouri: Governors Task Force on Floodplain Management, ***Draft Recommendations and Updates,*** February 1994. North Dakota: North Dakota Governor's Office, personal communication, March 29, 1994. South Dakota: Interagency Hazard Mitigation Team, ***Hazard Mitigation Opportunities for South Dakota, FEMA 999-DR-SD,*** August 1993. Wisconsin: Wisconsin Department of Natural Resources, ***The Floods of 1993, The Wisconsin Experience,*** December 1993.

13. Derived from USDA/ASCS and USDA/FCIC data, April 1994.

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51. National totals may not equal cumulative state totals for some programs because funds have not been fully allocated, obligated, or expended.

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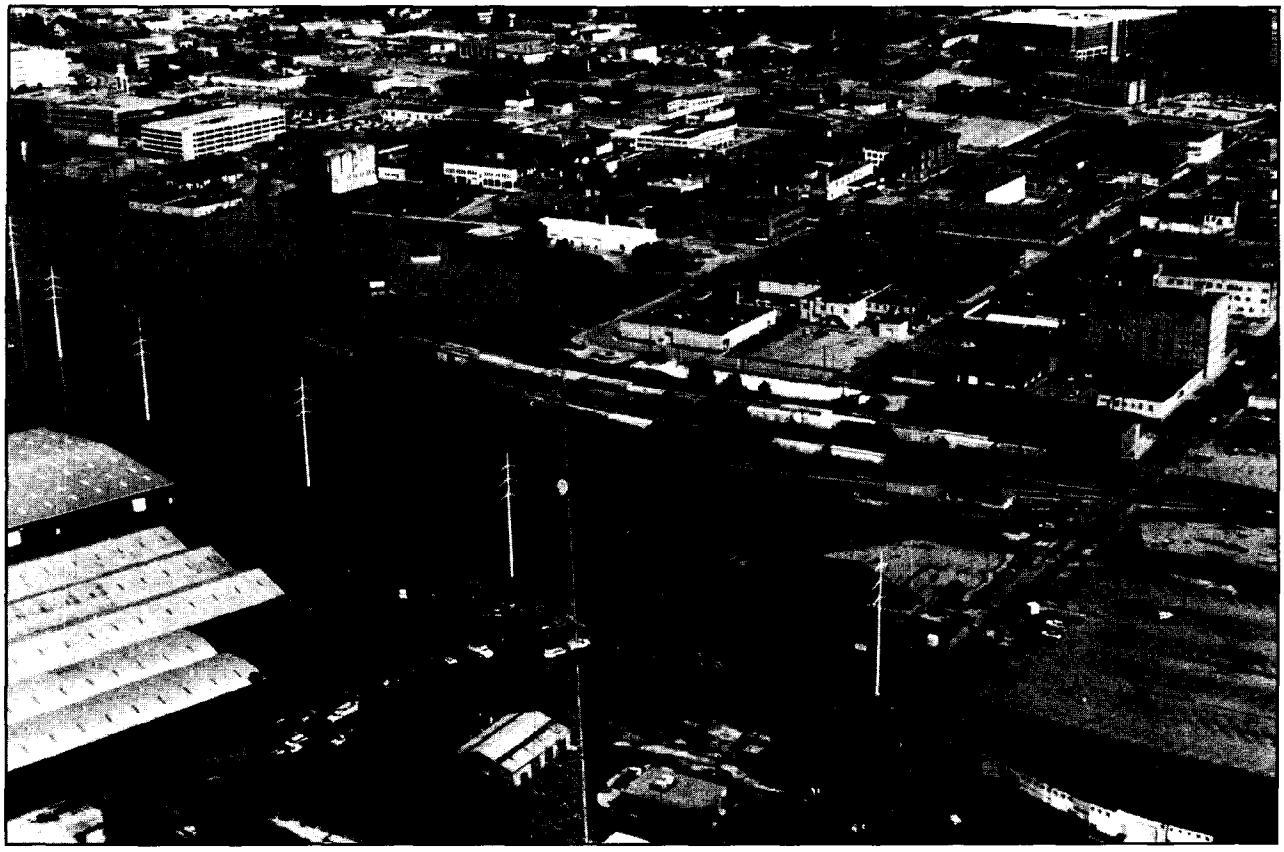


Chapter 2

IMPACTS OF HUMAN INTERVENTION

In the matter of floodplain management, most people agree that some combination of structural and nonstructural methods are probably a better approach than the previous complete reliance on dams and levees.

Luna B. Leopold
Water Resources Update, Issue No. 95: Spring, 1994

HISTORY

The rivers and streams of the Midwest were focal points for early settlement because they provided sources of drinking water and avenues for transportation and trade. Once settlements were established along rivers, the problem of controlling floods to protect human life and investments became readily apparent. At first small mounds of dirt were thrown up to divert water away from towns, and over the course of time, these mounds became levees and floodwalls. Many people living in floodplains behind those levees and floodwalls remain at risk because of decisions made many years ago. The modern challenge is to reduce those risks.

As settlers spread west they altered prairie, forest, meandering streams, and free-flowing river landscapes to provide arable farmland, raw materials for homes and industry, and transportation. Federal policies encouraged extensive private land development which then required construction of reservoirs and levees for flood protection. Human use thus changed midwestern landscapes to the detriment of natural ecological systems. The Flood of 1993 raised questions as to what extent these landscape changes have contributed to flood frequency and duration.

Agricultural Policy and Farm Production

Since the 1930s, when one quarter of the population lived on farms, U.S. farm policy has used a system of price supports (loans, purchases, payments, or a combination of methods) to improve farm income and promote conservation, while assuring a dependable food supply for the United States. The Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA) continued the market orientation of its predecessor, the Food Security Act of 1985. Stated goals of the 1990 Farm Bill (FACTA) were to ease financial stress on farmers, reduce government costs, reduce crop surpluses, maintain export competitiveness, and enhance environmental quality. Among the best known features of the farm policy are the Production Adjustment/Price Support Programs administered by the Agricultural Stabilization and Conservation Service of the U.S. Department of Agriculture (USDA). Appendix C provides an example of how price supports operate.

Agriculture is the leading industry in most counties of the nine states affected by the Flood of 1993 (See Table 2.1). The area's 208 million cropland acres represent 32 percent of the nation's farm acreage, 35

PRODUCTION DIFFERENCES OF FLOODPLAINS VS. OTHER AREAS

Agricultural production in floodplains of the nine midwestern states affected by the flood is focused on commodity crops such as corn and soybeans. Corn yields in well-drained floodplains uniformly average 15 percent higher than the state average in Missouri. Production on portions of the floodplains, however, can be reduced by poor drainage. Upland production yields are variable, depending on soil type and location. The highest upland corn yields are 16 percent higher than the highest floodplain yields; however, high-yield upland areas are presently in full production. Any additional production in upland areas would be in areas with yields averaging 14-26 percent lower than the average well-drained floodplain yield.

percent of total agricultural sales, and almost 60 percent of total national corn, wheat, and soybean acreage.[1] Combined production from Illinois and Iowa alone represent 33 percent of corn and 30 percent of soybean acreage in the United States, but dominant crops and yields vary by state throughout the region. Floodplains comprise approximately 11 percent of total acreage affected by the 1993 flood and 66 percent of this acreage is in agricultural production.[2]

Navigation

There are two types of navigation projects present in the Basin. One, on the upper Mississippi River, is slack water navigation created and controlled by a system of locks and dams. The other, open water navigation, is utilized on the Missouri River and middle Mississippi River.

Upper Mississippi River. The upper Mississippi River navigation system provides a variety of uses: commercial transportation, recreation, environmental resources, water supplies for domestic and industrial use, and energy production. The Water Resource Development Act of 1986 declared the upper Mississippi River system to be a nationally significant ecosystem and a nationally significant commercial navigation system.

Navigation on the Mississippi River was a primary factor in settlement of the valley. The federal government began to support commercial navigation actively in 1824; first with 4-foot deep channels, then 4.5-foot and then 6-foot channels. The navigation channel projects, authorized by Congress in the 1930s for the Mississippi and Illinois Rivers, extended 9-foot draft navigation upstream to Minneapolis/St. Paul and connected the St. Lawrence-Great Lakes with the Mississippi-Ohio-Missouri navigation systems (Figure 2.1).

The upper Mississippi River 9-foot navigation project has converted the Mississippi River (St. Louis to Minneapolis/St. Paul) into a series of pools at low and normal flow (Figure 2.2). Navigation dams, each consisting of a row of gates mounted between piers over a low sill, are used to maintain sufficient water depth for navigation. During periods of high flow, the navigation gates are completely opened to allow passage of the flood flows.

Construction of the 29 lock and dam projects on the Mississippi River north of St. Louis was completed by 1950. These locks are nearing the end of their economic life span and may soon start to require

Table 2.1 Agricultural Characteristics of Flood Affected States

STATE	FARMLAND (million acres)	AVERAGE FARM SIZE (acres)	CASH CROPS RECEIPTS: $million/yr	CASH CROPS RECEIPTS: U.S. Rank	CASH LIVESTOCK RECEIPTS: $million/yr	CASH LIVESTOCK RECEIPTS: U.S. Rank
Illinois	28.5	321	3,913	3	2,262	10
Iowa	31.6	301	3,510	4	5,270	2
Kansas	46.6	680	1,807	11	3,914	6
Minnesota	26.6	312	2,165	6	3,645	7
Missouri	29.2	275	1,517	14	2,173	11
Nebraska	45.3	749	1,975	8	4,848	3
N. Dakota	40.3	1143	1,548	13	760	32
S. Dakota	44.2	1214	813	27	1,910	15
Wisconsin	16.6	221	795	28	4,222	5

Source: 1987 U.S. Department of Commerce, *Census of Agriculture,*

expensive replacement. Locks and Dam 26 near Alton, Illinois, was replaced during the early 1980s at a cost of nearly $1 billion. Below the southernmost lock, Lock 27 at Granite City, Illinois, navigation is maintained through placement of flow regulating structures such as wing dikes and by dredging that channelize, narrow, and deepen the river.

Maintenance of the upper Mississippi River navigation system requires periodic dredging at over 200 sites, removing an average of 9.5 million cubic yards of material annually. Additionally, about 2,400 submergent and 700 emergent wing dikes are maintained to reduce main-channel sedimentation and 420 miles of bankline stabilization are maintained to prevent shoreline erosion.[3]

Illinois River. Two construction projects have supported navigation activities on the Illinois River. The first, the Chicago Sanitary and Ship Canal, completed in 1900, diverted water from Lake Michigan into the Illinois River. The second, a modern lock and dam system, similar to that in operation on the upper Mississippi River, consists of seven separate navigation locks. This system was completed in 1965.

Missouri River. In 1945 Congress authorized a comprehensive navigation plan for the Missouri River system. The result was a 9-foot channel navigation project to channelize and deepen the river from St. Louis upstream to Sioux City, Iowa. Six multi-purpose main stem reservoirs, affecting over 900 river miles, were developed above Gavins Point Dam. One purpose was to provide a regulated release of water for downstream navigation. Downstream of Gavins Point Dam, the river consists largely of a 735-mile navigation channel maintained with wing dikes, channel stabilization and other erosion and sedimentation control devices. Annual water release for navigation is based upon available water supplies. Navigation needs combined with winter releases for water supply and hydropower demands obligate all available water during a normal year. The navigation season on the Missouri River is limited to the ice-free season between April 1 and December 1.

Figure 2.1 Upper Mississippi River System Nine-foot Commercial Navigation Project with Timetable of Development.

Timetable of Navigation Activities

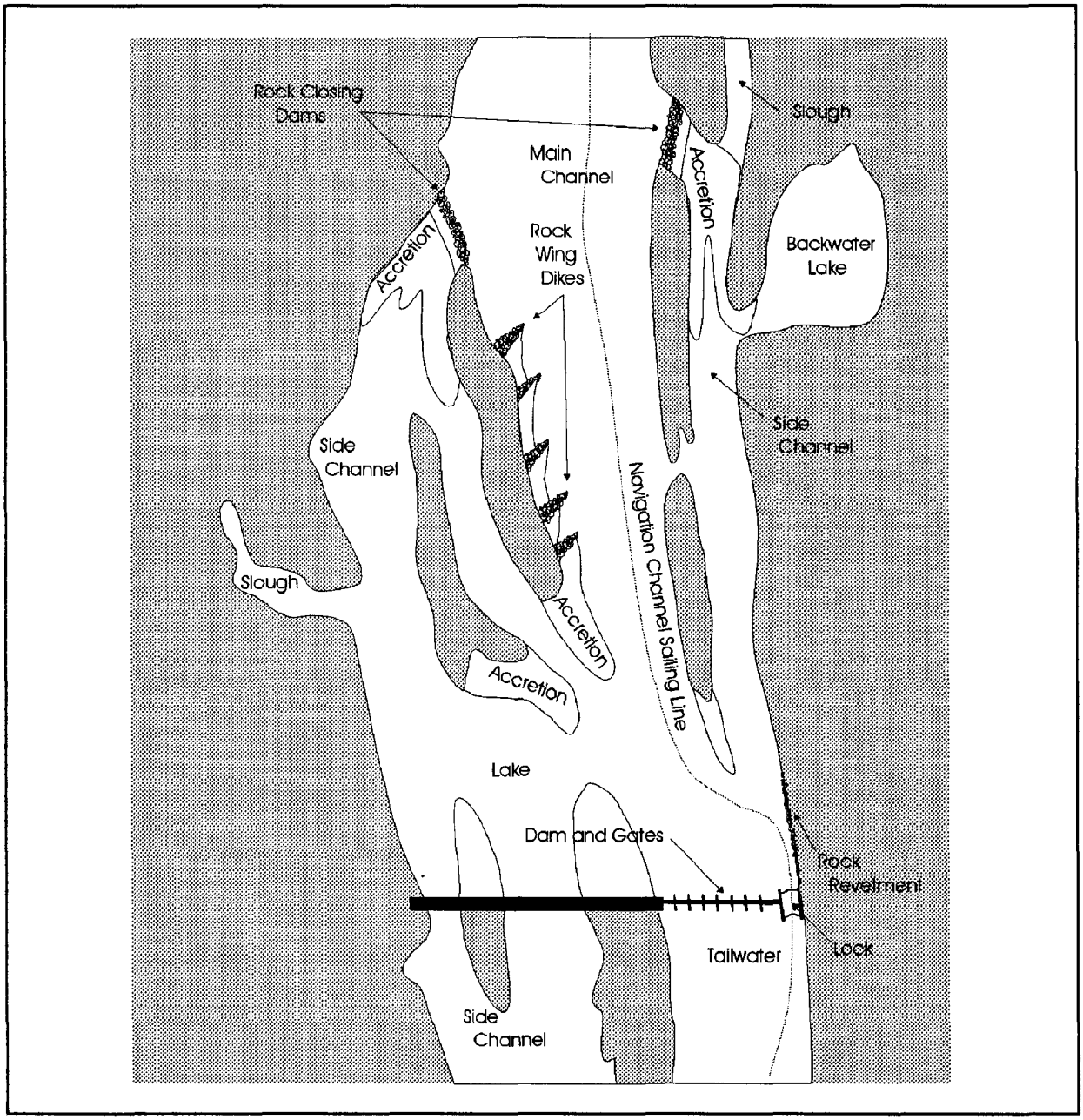
Activity	Year
Mississippi River:	
Congress authorizes removal of snags and local obstructions	1824
Congress authorizes 4.5 ft. channel from St. Louis to St. Paul	1878
Congress authorizes 6 ft. channel	1907
Construction of Lock and Dam 19	1914
Construction of Lock and Dam 1	1917
Congress authorizes 9 ft. deep, 300 ft. wide channe St. Louis to Cairo	1927
Congress authorizes extension of 9 ft. channel to St. Paul through construction of locks and dams	1930
Construction of 29 locks and dams	1930-1950
Construction of Lock and Dam 27	1953
Construction of 1200 ft. chamber at Lock and Dam 19	1957
Illinois River:	
Congress authorizes construction of the Illinois and Michigan Canal	1822
Construction of Chicago Sanitary and Ship Canal and 5 low navigation locks and dams	1900
Construction of present day system of 7 locks and dams	1933-1939

Source: Upper Mississippi River Basin Commission, *Comprehensive Master Plan for the Management of the Upper Mississippi River System.* January 1, 1982.

Flood Damage Reduction

A flood in 1927 affected millions of people throughout the Mississippi River Basin and demonstrated the inadequacy of the pattern of private flood damage reduction measures begun in 1879. It became a milestone event leading to major changes in national floodplain management policy. The 1928 Flood Control Act, which established the lower Mississippi River flood damage reduction system, and the 1936 Flood Control Act were the first codification of the

Figure 2.2 Typical Upper Mississippi River Lock and Dam.



Source: Adapted from Upper Mississippi River Basin Commission, *Comprehensive Master Plan for the Management of the Upper Mississippi River System.* January 1, 1982.

federal interest in the coordinated development and installation of flood damage reduction measures. The primary method used to prevent damages in those early years was floodplain levees. Starting in 1936 the USACE responsibilities were focused on major rivers and development of congressionally approved plans for reservoirs, levees, channelization, and diversions. The methods used were those determined to be most cost effective for preventing flood damages.

The USACE has constructed 76 reservoirs in the upper Mississippi River Basin. These control a drainage area of almost 370,000 square miles and contain a total flood storage volume of 40 million acre-feet of water.[4] Forty-nine are located in the Missouri River Basin where the USACE also operates 22 Bureau of Reclamation reservoirs for flood storage. The majority of the reservoirs are operated to provide benefits on the tributaries where they are located; some are operated to benefit the main stem rivers.

In addition to the reservoirs, the USACE has constructed or improved over 2,200 miles of levees for the protection of communities and agriculture in the upper Mississippi River Basin. Though records on the federal levees are kept by the USACE (Table 2.2), there is no known inventory about the estimated 5800 miles of non-federal levees that are in the upper basin.

Flood damage reduction-related activities of the SCS began nationally in 1944 with passage of PL 78-534 authorizing installation of upland treatment and flood damage reduction works in selected watersheds. The Watershed Protection and Flood Prevention Act of 1954 (PL 83-566, referred to herein as PL-566) expanded the SCS flood damage reduction program to the entire nation. During the past 40 years, in the nine midwestern states affected by the Flood of 1993, the SCS has planned and evaluated 316 watershed projects covering 40,000 sq. mi. (25.5 million acres). Locally sponsored PL-566 projects have resulted in the installation of 2,964 reservoirs that influence the drainage of over 5 million upland acres, and 818 miles of channel work, 75 percent of which is located in North Dakota, Minnesota, and Illinois. The SCS requires 75 percent of the land above a proposed reservoir site to be treated before construction. It is estimated that PL-566 has resulted in soil and water conservation treatments on more than 3 million upland acres.

Although flood damage reduction reservoirs and levees reduce the risk of flooding, they do not eliminate it. Given enough rainfall the flood damage reduction storage capacity of a reservoir can be exceeded and water will overtop the spillway. Local flooding may then occur downstream; its extent will depend upon the

Table 2.2 Levees Constructed or Improved by the USACE in the Upper Mississippi River Basin.

River Reach	Corps District	Federal Maintenance (Miles)	Local Maintenance (Miles)
Upper Mississippi	Saint Paul		17
Upper Mississippi	Rock Island	27	650
Missouri	Omaha/Kansas City	15	1100
Middle Mississippi	Saint Louis		440
	Total Above Cairo, IL	42	2207

Source: USACE Headquarters.

condition of the stream when the overtopping occurs. Throughout the basin, the Flood of 1993 exceeded the design capacity of many levees and the flood storage capacity of some reservoirs, flooding lands and property of persons who may have thought they were not at risk.

Wetland Losses

Wetlands occur in poorly drained soils and in areas where water is found at or near the ground surface. Between 1780 and 1980 an estimated 53 percent of the nation's original 221 million acres of wetlands were drained.[5] In the nine midwestern states affected by the flood 57 percent of the wetlands have been converted to other uses (Figure 2.3). The Swamp Land Acts of 1849, 1850, and 1860 resulted in the transfer of nearly 65 million acres of wetlands in 15 states from federal to state administration for the purpose of expediting their drainage.[6]

United States policy from the mid to the late 1800s has been to cede "overflow and swampy" lands to the states and to convert these lands to productive use.[7] Substantial bottomland timber harvesting began with the arrival of pioneers, and by the 1930s, most wetlands had been converted from natural to agricultural uses and over 84 million acres nationwide had been included in regional enterprises known as drainage districts.

By the 1950s, forested wetlands had been reduced to 66.7 million acres, and by the mid-1970s an additional 6.5 million acres had disappeared.[8] Between the mid-1950s and 1970s an average of 458,000 wetland acres were lost each year in the coterminous United States. Agricultural development was responsible for 87 percent of the loss as wetlands were drained, filled, or otherwise converted to cropland.

IMPACT AND EFFECT

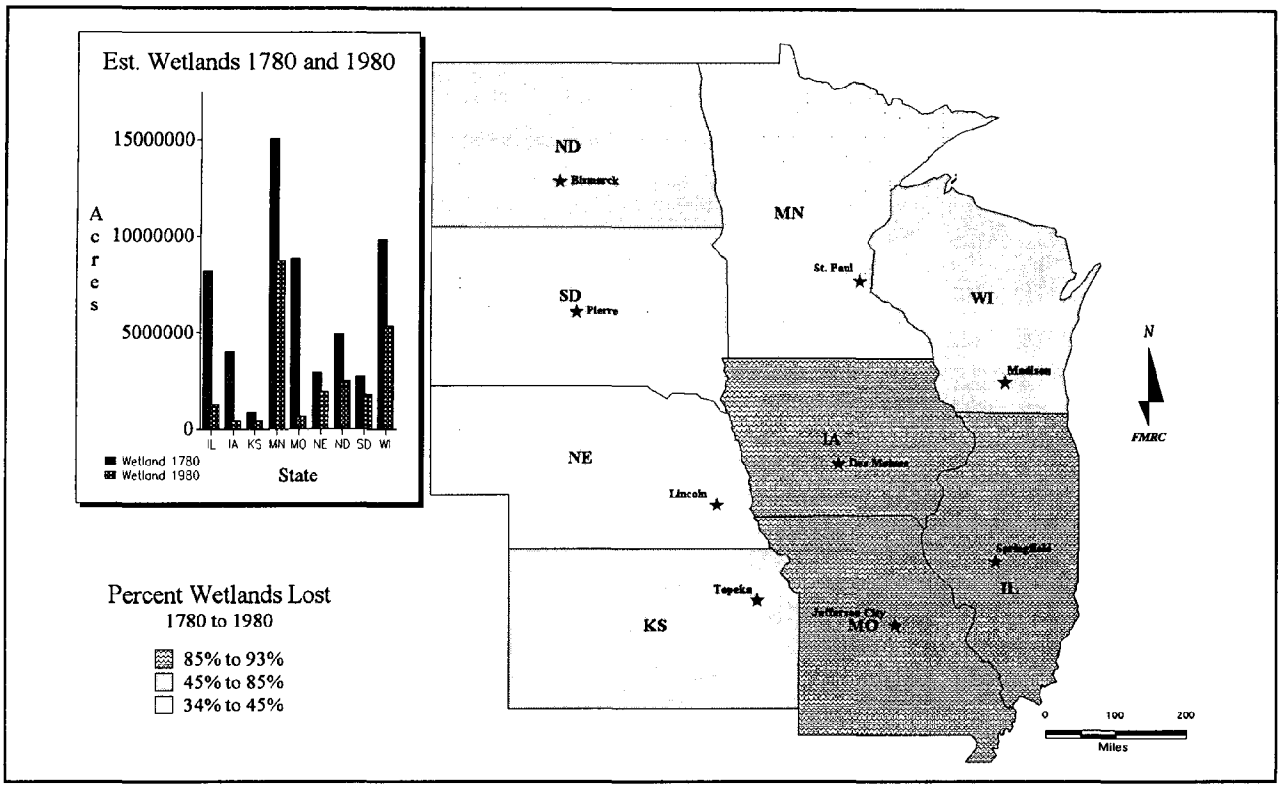
Development in the upper Mississippi River Basin for agriculture and other economic activity, flood damage reduction and navigation has greatly altered the original landscape. The characteristics of flood events and the modification of the basin's natural resources reflect these changes.

Upland Treatment and Runoff

Upstream land use and land treatment affect downstream flow regimes of rivers and floodplains. In considering floods and floodplain management, knowledge of where and how runoff occurs and which land practices can hold the rain where it falls for as long as possible become critical. Proper management can greatly affect the quantity and quality of water and sediment transported by flood waters. Factors influencing the amount and velocity of runoff include the amount and intensity of precipitation, soil type, land slope, available storage and land cover.

Proper management of agricultural lands requires use of protective cover or land conservation practices. In the Midwest cropland erosion can be reduced by using measures such as conservation tillage, terraces, crop rotations, field borders, sediment and debris basins, strip cropping, and permanent vegetation. Such land use practices increase infiltration rates and help hold both water and soil in place. It is estimated that 37

Figure 2.3 Estimated Wetland Losses, 1780 Through 1980

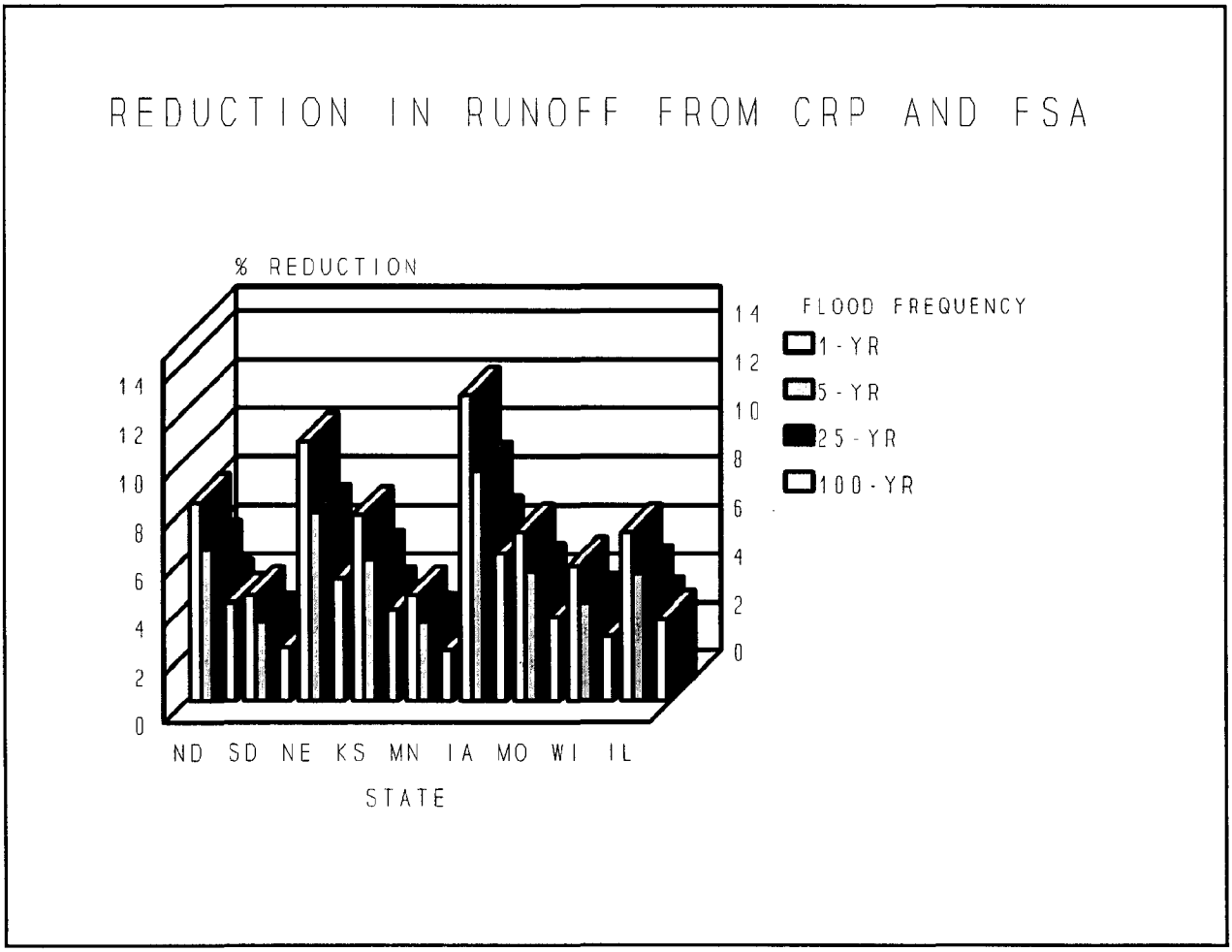


Source: Based on GAO/RCED-92-79FS, Report of November 1991.

percent of the nation's croplands have adequate land treatment installed.[9]

The 1985 Food Security Act (1985 Farm Bill) mandated treatment of all highly erodible land (HEL) with conservation measures needed to reduce erosion. The Conservation Reserve Program (CRP) established by the Act was intended to encourage landowners to retire highly erodible and other environmentally fragile land from crop production for ten years. In the upper Mississippi River Basin, over 200,000 CRP contracts were signed and 19.9 million acres were converted from cropland to grass or tree cover at a ten year cost of $11.3 billion. This has reduced the average erosion rate from 18.6 tons per acre per year to 1.4 tons per acre per year. Assuming normal antecedent soil moisture conditions, CRP lands reduced runoff volumes by approximately 6-12 percent for the 1-year event, 3-8 percent for the 25-year event, and 2-4 percent for the 100-year event.[10] In the case of the 1993 flood, soils were saturated and the quantity and intensity of rainfall so great that runoff reduction attributable to land treatment was minimal (Figure 2.4).

Figure 2.4 Effects of the Food Security Act.



As CRP contracts begin to expire in September 1995, a large portion of enrolled acres are expected to revert to cereal, row-crop, and forage production. Current estimates are that 63 percent of land under contracts will revert to cropland and 23 percent to grazing and pasture land. The remainder are expected to remain in permanent grass and trees and other miscellaneous uses.[11] Conversion of these lands to cropland is expected to increase storm runoff even allowing for installation of proper conservation practices.

Conclusion: ***Upland watershed treatments such as conservation tillage practices and CRP land easements are effective in reducing upland runoff, especially for smaller storm events. For large events like the 1993 flood, upland treatments had little effect.***

Wetlands and Flood Storage

Pre-1850 historical records indicate that even prior to the clearing of wetland areas major floods occurred in the Mississippi River Basin. As part of economic development in the midwest a substantial percentage of agricultural lands were created by drainage of wetlands and hydric soils. Hydric soils, good indicators of past and present wetland locations, total 10.4 percent of Mississippi and Missouri basin soils.[12] The Review Committee heard numerous times that flooding would have been reduced had more wetlands been available for rainfall and runoff storage. An evaluation of the upper Mississippi River Basin's capacity to store rainfall runoff estimates that the soil profile has 10 times more storage capacity than above ground storage in depressional potholes.[13] Because much of the basin was wet in 1993, particularly the areas that received the highest rainfall, the buffering capacity of the basin was depleted and unable to store water from the rains of June and July.[14]

Surface depressions or potholes occur throughout the glacial landscapes of north central Iowa, east central Illinois, Minnesota, eastern South Dakota, and North Dakota. When these depressions fill, surface waters flow from pothole to pothole through an ill-defined drainage network, eventually finding an outlet to a surface stream. This intricate network of depressions slows runoff. A different pattern of runoff occurs in the remainder of the basin. There surface runoff flows through an open network of streams, with only minor areas of surface water storage available. Historically, shallow wetlands and wet prairies which occurred in these areas served a similar, but less effective, function to that of potholes.

Topography has a direct impact on water movement and soil formation. The upper Mississippi River Basin is characterized by two distinct kinds of landscape: open systems which drain externally, and closed systems where drainage is trapped within a common depository. Due to the extended period of rain preceding the 1993 flood, the impacted area became completely saturated and surface depressions filled; therefore, storage available for additional runoff could only be found in the deep depressional areas located in the prairie pothole region of the Dakotas, Minnesota and Iowa.

Hydrologic model studies of four watersheds that are representative of distinctly different upper Mississippi River Basin areas or terrain units were completed in 1994.[15] The modeled watersheds represent only 5 of the 70 terrain types in the basin and therefore information derived from these models has limited applicability to assessing flood flow reductions basin-wide. The following watersheds were selected for hydrologic studies:

- Boone River near Webster City, Iowa -- a Central Iowa and Minnesota Till Prairie with a relatively flat 840 sq. mi. watershed with low relief prairie pothole terrain.

- Whitebreast Creek near Dallas, Iowa -- a Illinois and Iowa Deep Loess and Drift and Iowa and Missouri Heavy Till Plain with a relatively steep 380 sq. mi. watershed with well incised drainage.

- West Fork Cedar River near Finchford, Iowa -- a Eastern Iowa and Minnesota Till Prairie with a flat 850 sq. mi. watershed but having well defined drainage system.

- Redwood River Watershed above Redwood Falls, Minnesota -- a Central Iowa and Minnesota Till Prairie and Loess Uplands and Till Plain with both high relief and low relief pothole areas of a 700 sq. mi. watershed.

For the analysis all model runs used antecedent moisture condition II for the start of modeling conditions. Condition II is defined as the average soil condition prior to the annual flood event. For the 1993 flood antecedent conditions were condition III in most areas. Condition III indicates near saturated soils prior to the storm and gives significantly higher runoff than antecedent II. Because the model analysis used a lower antecedent moisture condition than was actually experienced in the 1993 flood, the peak discharge reductions resulting from the model analysis are greater than would have occurred.

In areas where opportunity exists, wetlands and small detention structures can aid in lowering peaks. However, flood peak discharge reduction is dependent on the topography of the watershed, the percentage of the basin containing deep depressional storage, and the intensity and volume of the rainfall.

In the watersheds modeled the maximum reduction for floodplain wetlands was 6 percent of the peak discharge for the 1-year event and 3 percent of a 25- and 100-year storm event. Wetlands are more effective in upland areas with more deeply incised potholes, such as the Redwood River watershed, where reductions were 23 percent of the 1-year event, 11 percent of the 25-year event, and 10 percent of the 100-year event. In areas of shallow depressions, such as the Boone River watershed, restored wetlands reduced peak discharge by 9 percent of the 1-year event, 7 percent of the 25-year event, and 5 percent of the 100-year event.

With the installation of a combination of land treatment measures and restored wetlands in the watershed, the models indicate runoff reductions of 12 to 18 percent are possible for the 25-year or less event. This indicates these practices could be effective for the smaller storm events.

Wetland restorations in the uplands could function much the same as small upland reservoirs. It was shown more than three decades ago that small flood damage reduction dams are effective in the reach of stream immediately downstream but their effect diminishes rapidly with distance. As far as a series of small headwater dams is concerned, they are essentially ineffective under conditions in which major floods occur on large rivers.[16]

A State of Illinois report concluded that for certain watersheds, peak flow decreases as wetland areas increase. In very small watersheds (less than 100 sq. mi.), peak flowrates decreased by an average of 3.7 percent for each increase in wetland area equivalent to one percent of the area of the watershed. Applicability of this report may be limited only to the study areas. While wetlands may have some impact on peak flow in the smaller watersheds during smaller storms, their effects in larger watersheds during larger events has not been sufficiently documented and needs further study.

Previous watershed evaluations, such as the study of Devils Lake in North Dakota (a closed basin), indicate reductions of peak flowrates up to 41 percent for a 100-year storm. These widely ranging results from the aforementioned studies demonstrate that alternative watershed practices produce varying degrees of success in reducing flood runoff rates depending (in addition to the magnitude and intensity of the rainfall and antecedent moisture conditions) on the percentage of the basin treated and basin topography. Generally, as drainage areas increase, upland treatment measures, wetlands, and small detention structures have less effect in decreasing peak flowrates. In short, land treatment and detention storage (upland wetlands) can play a role in reducing peak runoff in some watersheds but are not a panacea for solving flood problems. Only a combination of upland and floodplain management practices can reduce floodplain damages in the future.

Conclusion: ***Upland wetlands restoration can be effective for smaller floods but diminishes in value as storage capacity is exceeded in larger floods such as the Flood of 1993. Present evaluations of the effect that wetland restoration would have on peak flows for large floods on main rivers and tributaries are inconclusive.***

Flood-storage Reservoirs

The 1993 flood demonstrated that dams and reservoirs, engineered and built to store and regulate floodwater discharge, can reduce flood damages. All federally funded flood storage reservoirs operated as planned during the 1993 flood. At some facilities, such as Tuttle Creek Reservoir (Kansas) and Coralville Reservoir (Iowa), emergency spillway flows occurred when inflow volume exceeded reservoir storage capacity. The storage space allocated in a typical reservoir and the effect of flood storage is depicted in Figure 2.5. During the period of peak flooding (April 1 to August 1, 1993), the USACE reservoirs stored 22.2 million acre-feet of flood water.[17] Approximately 18.7 million acre-feet were stored in the Missouri Basin, half of which was stored in the 6 main stem Missouri River reservoirs. Most of the remainder was stored in tributary reservoirs of the Kansas and Osage rivers. About 3.5 million acre-feet of water was stored in the Mississippi River Basin and an additional 1.1 million acre-feet were stored in 2,964 small PL-566 upland flood damage reduction reservoirs. Flood damage reduction reservoirs effectively controlled excess runoff and reduced damages to downstream floodplains during the 1993 flood event. The combined effect of the storage of flood waters in the federal flood damage-reduction reservoirs in the Missouri River basin reduced the average discharge of the Missouri River near its mouth, during the month of July, by 211,000 cfs. This had the effect of lowering the peak stage of the Mississippi River at St. Louis by 5 feet.

RESERVOIR OPERATIONS

Flood-control reservoirs temporarily store a part of the flood flow for later release so that peak downstream flows will be reduced. Flood-storage capacity is always located above sediment and multi-purpose pool elevations. Flood damage reduction reservoirs have emergency spillways that allow safe passage of flows that exceed storage capacity. All managed flood damage reduction reservoirs are operated pursuant to a water control management plan. In no case will the peak discharge from the dam exceed that which would have occurred without the dam.

Levees

Federally constructed levees, in concert with upstream flood-storage reservoirs, protect many large urban areas from potentially significant damage. For example, without levees or floodwalls, portions of low lying areas in Rock Island and Moline, Illinois, and Kansas City would have been devastated. At St. Louis the Mississippi River crested at 49.6 feet on the USGS gage, almost 20 feet above flood stage, yet that portion of the city protected by the large flood wall escaped inundation.

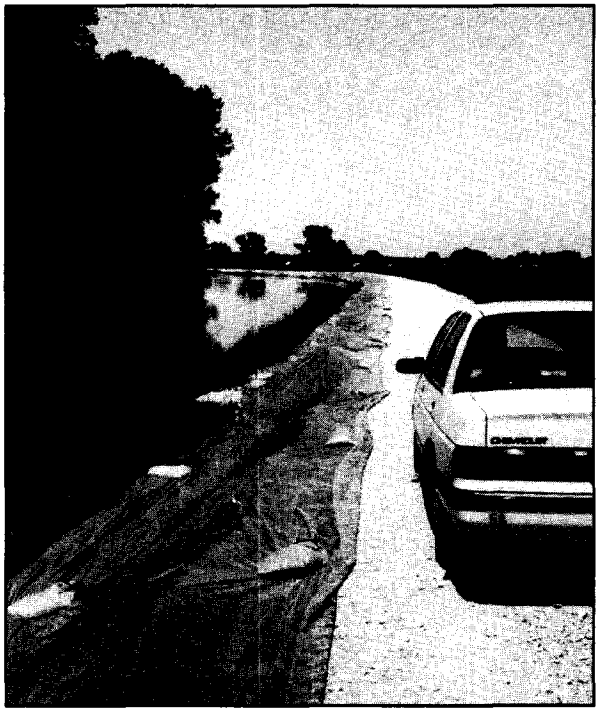
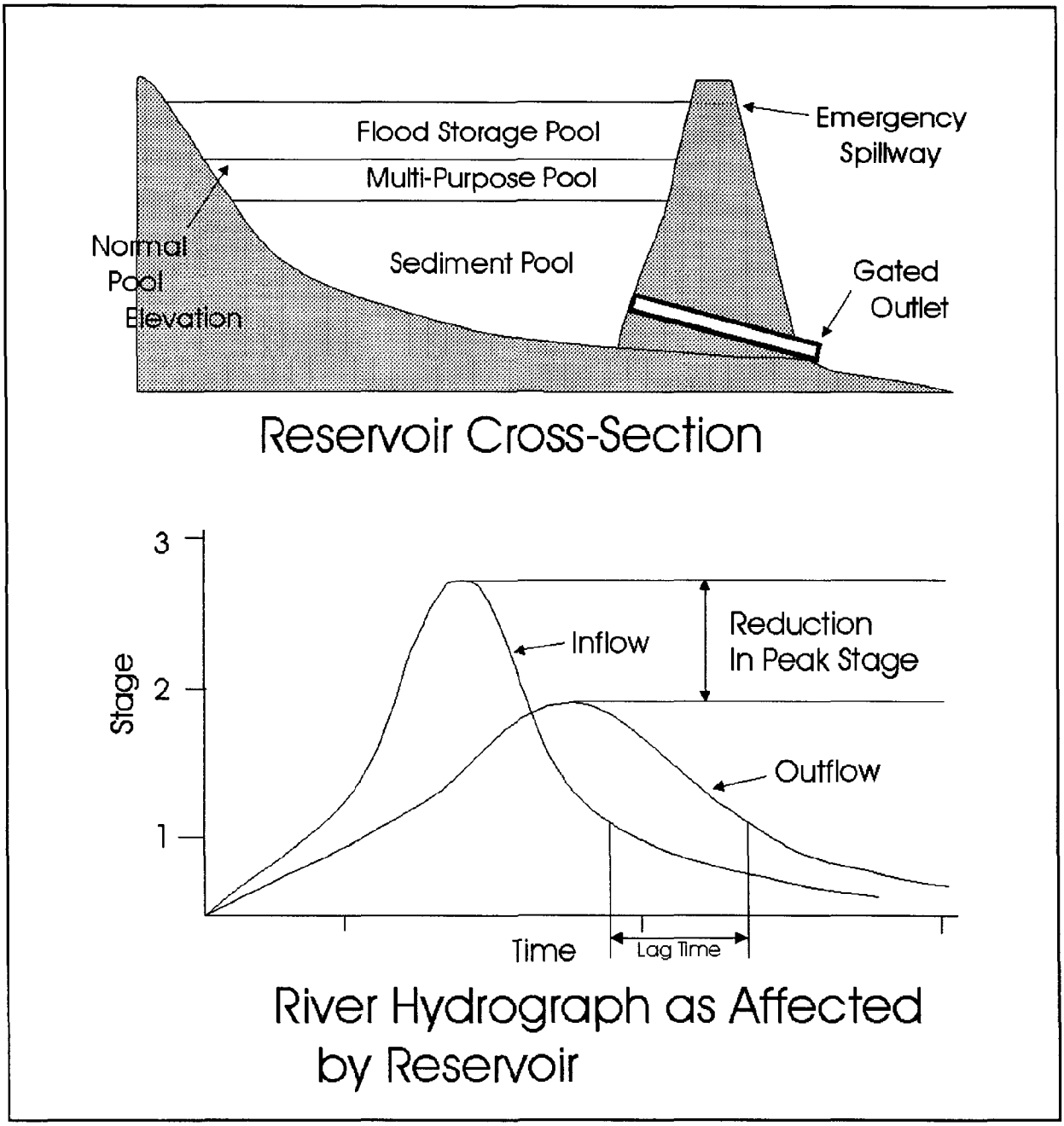


Figure 2.5 Typical Reservoir Cross Section and Hydrograph.



Source: Floodplain Management Review Committee. Adaptation

Much of the speculation about the effect of levees on flood levels during the 1993 flood was based upon inferences drawn from comparisons between recent event data, obtained from systematically-measured river flow (discharge) and river level (stage) records, and similar data for historical floods. Such discussions fail to recognize that significant differences in data quality exist between the modern (after 1930) and the historic record.[18] In addition, many other changes have occurred in the upper Mississippi River Basin which have created differences in flow regimes over time.

To ascertain the actual effect existing levees had on peak 1993 Mississippi and Missouri river flood stages, the UNET model, which analyzes unsteady state river flow conditions,[19] was applied to the river reaches where cross-sectional data were available:

(1) the Mississippi River between Hannibal, Missouri, and Cairo, Illinois,

(2) the Missouri River between Hermann, Missouri, and the mouth at St. Louis, and

(3) the Illinois River between Meredosia, Illinois, and the mouth above St. Louis.

The analysis used flow data from 1993, 1986, and 1973 floods and developed water surface profiles resulting from the same flood flows without levees. The model was calibrated and a range of possible floodplain ground covers was used.[20] The analysis suggested that if all the levees (other than urban levees) were absent, the peak stage at St. Louis in 1993 would have been reduced by 2.5 feet, but still more than 17 feet above flood stage and almost 4 feet higher than the previous known maximum level recorded during the 1973 event. This model scenario assumes the improbable condition of a totally open floodplain covered only with bare soil or short grass cover. If one assumes existing levees would have been constructed to contain all flows, peak stages at St. Louis would have been increased by 2.3 feet.

An independent model commissioned by the *St. Louis Post-Dispatch* showed that the overtopping and breaching of two levees downstream from St. Louis at Columbia and Harrisonville, Illinois, reduced peak stage at St. Louis by 1.6 feet.[21] This analysis used a steady-state model applied to a short stretch of the river and lends support to the UNET findings.

A physical model study conducted at the Waterway Experiment Station (WES) in 1979 by Foster and Allen[22] showed that the removal of the trees between the river bank and levee along the middle Mississippi River between St. Louis and Cape Girardeau would lower the stage at St. Louis about 2.5 feet for the 1973 flood, which corresponds with the mathematical (UNET) model results for the fully open, treeless floodplain assumption.

Farther downstream along the middle Mississippi River, the UNET model predicted that there would have been a sizeable local drop in river levels in the absence of levees under the most conducive flow scenario. At Chester, Illinois, the stage of the Mississippi River during the 1993 flood would have been approximately 11 feet lower if the levees containing the river were removed. But the floodplain would have been under water. The model predicted that there would be no stage reduction if the entire floodplain was covered in dense forest or brush -- a scenario representing a least conducive flow condition. It is expected that a typical floodplain without levees would contain a mix of uses and associated land covers such as sloughs, side channels, forested and non-forested wetlands and agriculture.

Conclusion: ***Levees did not cause the 1993 flood. During large events such as occurred in 1993, levees have minor overall effects on floodstage but may have significant localized effects.***

Erosion and Sedimentation

Upland erosion and the sedimentation in downstream areas are major causes of reduced water quality and habitat destruction in most midwestern rivers and streams. Sedimentation in the backwaters of the upper Mississippi River is the most significant problem in that river. In recent years, Missouri, Minnesota and

Wisconsin have developed watershed management programs to reduce runoff and erosion. Land use planning and land stewardship are key nonstructural factors in reducing runoff and downstream flooding.

Significant floodplain erosion and deposition occurred during the 1993 flood, principally on floodplain agricultural lands along the Missouri River. Preliminary analyses of aerial photography, satellite imagery, and historic Missouri River floodplain maps reveal that more than 90 percent of the areas affected by significant erosion and deposition are associated with breached levees situated in active, high-energy floodplain zones.[23] Review of the history of levee failures in this area shows levees have been breached repeatedly at sites of natural river cutoffs or chutes in the past three decades. Construction of levees across these high energy channels is a risky investment which has required repetitive repair.

In most cases where levees breached, scour holes, locally known as blow holes or blue holes, occurred. These holes, typically 25 to 50 feet deep, are caused by scouring of alluvial soils underlying the levees and farm fields and are caused when the head of water exceeds the height of a levee or its ability to withstand water pressure, overtopping or breaching the levee and releasing river water through the constricted levee breach with velocities similar to that of a dam break flood wave. This sudden release of energy scours tremendous volumes of materials creating both new aquatic and terrestrial habitat. Erosional zones of scour and stripping can extend as far as one mile downstream from the larger breaches (Figure 2.6). Locally constricted floodflows in breaches through railway embankments and in the vicinity of railroad and highway bridges act in a similar manner.

Comparison of the effects of the 1993 floods on the upper Mississippi and Missouri rivers shows that river reaches in broadly similar physiographic regions may respond very differently to floods. The annual discharges of the upper Mississippi River are generally comparable to those of the Missouri River, but sediment yields of the Missouri average more than five times those of the Upper Mississippi. Average slope of the lower Missouri River floodplain (upstream of St. Louis) is about twice that of the middle Mississippi River floodplain (downstream from St. Louis). Levee breaches along the lower Missouri commonly resulted in high-velocity flows across its relatively narrow and relatively steep (high gradient) floodplain, contributing to extensive deep scour and thick sand deposition across agricultural lands located there. In contrast, levee breaches along the middle Mississippi produced less intense erosion and sedimentation; impacts were largely limited to passive inundation of large bottomland tracts.

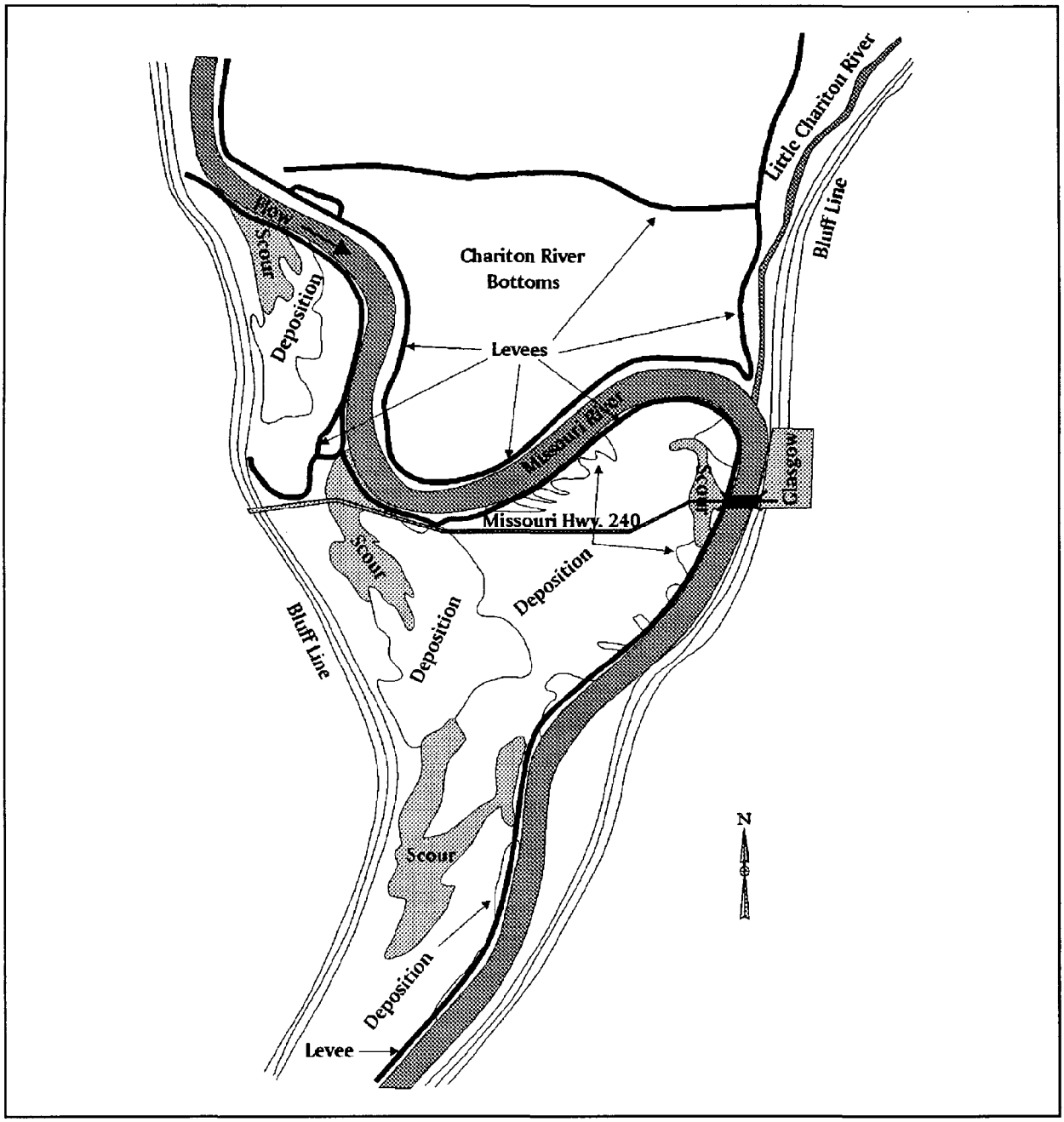
The Pick-Sloan plan authorized by Congress in 1944 called for the creation of a floodway from 3,000 to 5,000 feet wide between levees along the Missouri River from Sioux City, Iowa, to the mouth near St. Louis, Missouri. The purpose of this floodway was to provide sufficient space for flood waters to pass and reduce potential damage to adjacent farmlands. For a number of reasons, this plan was never implemented. The Flood of 1993 demonstrated the need for some form of floodway to provide greater capacity to convey flood flows. Implementation of any future flood damage reduction plan should recognize that in lieu of a standard setback distance, the floodway should coincide with the natural high-energy zone of the river, which commonly is wide in areas of large meanders and narrow in straighter portion of the river.

Conclusion: ***Levee location and height are factors in determining erosion and deposition in the floodplain. There are certain locations where levees should not be constructed. In these cases set-back levees might allow normal river functions. Each situation needs to be evaluated on its own merits.***

Navigation

The Review Committee received numerous suggestions that the flood crest could be lowered significantly by opening navigation dam gates before the arrival of flood waters. Hydraulic investigations by the University of Iowa,[24] and evaluations of the 1993 flood show that navigation dams cause slight, localized increases in

Figure 2.6 Reach of the Missouri River Bottoms Showing "High Energy" Erosion and Deposition Zones.



Source: Floodplain Management Review Committee. Adapted from SAST data, 1994

flood height just upstream of a dam. They do not cause increases in flood elevations for the entire Mississippi River System. In the middle Mississippi (from St. Louis to the confluence with the Ohio River) and on the Missouri River, navigation channels have no locks and dams, and the dikes and revetments which are in place cause little or no restriction to flow.

Conclusion: ***Navigation dams and locks did not cause an increase in the stage heights of the 1993 flood.***

Habitat Loss

Fish and wildlife resources in the upper Mississippi River Basin have been significantly affected by the loss of wetlands and other terrestrial and aquatic habitats due to construction for navigation and flood damage reduction structures.

Upper Mississippi River. The upper Mississippi River was originally a free-flowing, alluvial riverine environment with associated riparian habitats. Construction of navigation control structures (rock dikes) and installation of the slackwater navigation dams have created habitat types substantially different from those found in a free-flowing alluvial river.

Habitat types within the upper Mississippi River slackwater navigation pools are created by coincident physical, water quality, and botanical characteristics. River position, depth, water-surface area, stage and discharge, vegetation, river-bottom types, water quality, and the superimposed structural elements within the river define the various habitats. Three distinct habitat zones occur in the slackwater navigation pools. The upper end of each pool is like the original river although subject to exaggerated water level fluctuations from the upstream dam releases. Marsh development is limited. In the middle portion of the pools, downstream impoundment backs water up and over the islands and old hay meadows, creating large areas of shallow water. This section has the best marsh development, and some deep sloughs and wooded islands can be found. In the lower end, immediately above each dam, wide open water lake-like areas occur (Figure 2.2).

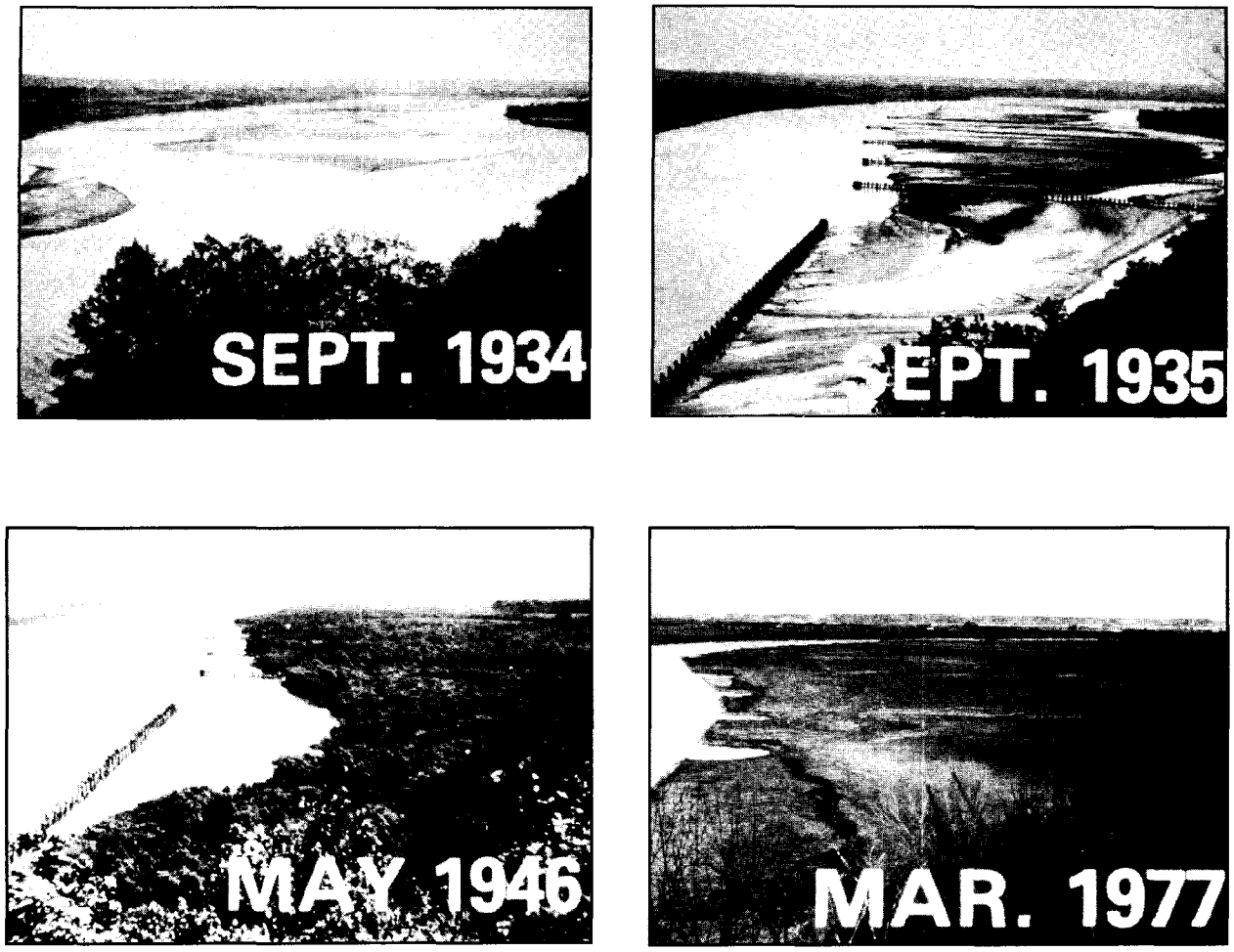
While impoundment of the upper Mississippi River for slackwater navigation created a variety of backwater and side-channel habitats, these dams also slowed river currents, starting the irreversible process of sedimentation. Many backwater habitats are filling with sediments from the erosion of upland agricultural and developed lands. Rock dikes and channel maintenance dredging also contribute to the problem. Mississippi River backwaters still provide critical fish production and nursery habitats, but may be lost to sedimentation and eutrophication within 50 yrs.[25]

Downstream from its confluence with the Missouri River, the upper Mississippi River takes on a very different character, similar to that of the Missouri River (see Missouri River habitat description). Forty-six species of Mississippi River fish, virtually all of which have been affected by flood damage reduction measures and navigation, are listed by basin states as rare, threatened, endangered, or a species of special concern. [26]

Missouri River. Parts of the Missouri River were well known as a braided river with swift, muddy flows. The historic floodplain was a ribbon of islands, chutes, oxbow lakes, backwaters, marshes, grasslands, and forests. Sandbars and wooded islands dotted the channel. Between 1879 and 1954, human actions and natural changes shortened the river by 45.6 miles, reduced river surface area by over 50,000 acres, reduced the number of islands from 161 (24,419 acres) to 18 (419 acres), and converted nearly 67,000 acres of river habitat from public to private ownership, most to agriculture.[27]

Nearly one-third of the Missouri River has been impounded, another one-third channelized, and the hydrologic cycle, including temporal flow volume and sediment transport, has been altered on the remainder. The Missouri River formerly had peak run-off during two periods, March-April and June. Prior to 1954 flushing flows, known as dominant discharge, occurred every 1.5 years. The river was in a state of equilibrium; net sediment entering a reach replaced an equal amount leaving allowing for ample habitat

Figure 2.7 Changes in Channel Morphology Following the Addition of Navigation Dikes, Indian Cave Bend, Missouri River, North of Rulo, Nebraska.

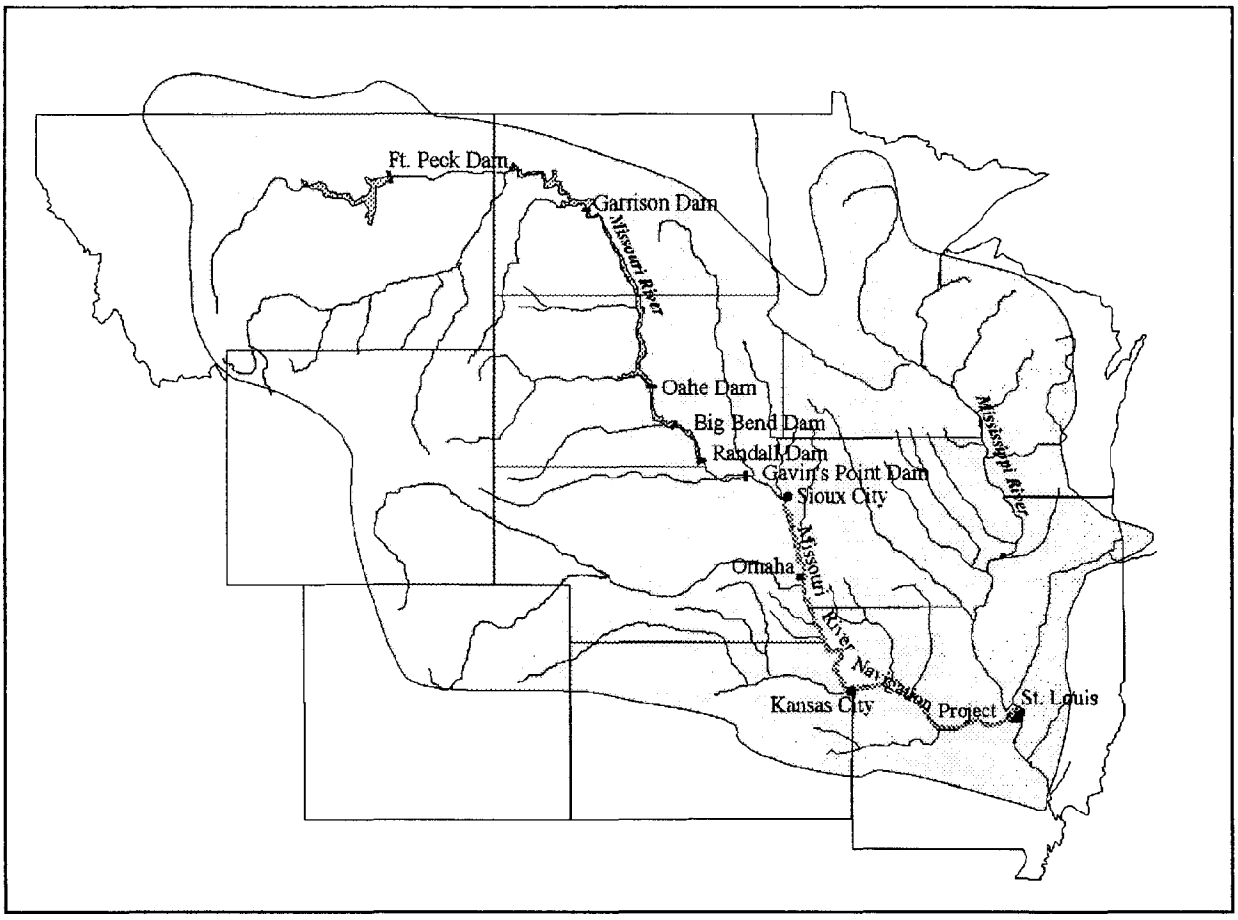


Source: USACE

development, and aquatic nutrition. Loss of sediment load led to channel degradation which contributed to the loss of off-channel habitat and further severed the river from its floodplain. Since the early 1950s the Missouri River has thus been deprived of a floodplain in most reaches. Water temperature, photoperiod, and run-off cues have been altered by reservoir releases for navigation and other purposes.[28]"

Changes in basin and floodplain physiography and channel morphology have reduced commercial fish harvest by more than 80 percent and are implicated in the demise of native species. The Missouri River's natural riparian ecosystem has been nearly eliminated and presently consists of a discontinuous, single row of trees. Missouri River floodplain forest coverage decreased from 76 percent in 1826 to 13 percent in 1972, while cultivated lands increased from 18 percent to 83 percent.

Figure 2.8 Missouri River Reservoirs and Navigation System.



Thirty-four species of Missouri River Basin stream fish are listed by basin states as rare, threatened, endangered, or as species of special concern.[29] The pallid sturgeon, piping plover, least tern, and bald eagle are all native Missouri River species listed as endangered by the U.S. Fish & Wildlife Service (FWS).[30] Population densities of five species of chubs[31] and two species of minnows[32] have been reduced by as much as 95 percent since 1971.[33] Burbot have been nearly extirpated, sauger have been greatly reduced, and blue catfish are rare.

The Master Water Control Manual for the six Missouri River main stem reservoirs is currently under review by the USACE. Decisions made with regard to this manual are important to the future of the Missouri River ecosystem. For example reservoir water releases could be adjusted to simulate natural hydrographs and, in combination with riparian land acquisition, be used to restore many of the river's natural functions including low-level flooding of riparian lands.

Illinois River. Aquatic and terrestrial habitats of the Illinois River Valley have suffered a series of cataclysmic events since 1900: (1) permanent rise in water level from water diverted from Lake Michigan, (2) the draining of more than half of the 400,000 acre floodplain through the construction of levees and pumping stations, (3) an upsurge in untreated urban and industrial pollution during the 1920s, (4) the creation of a 9 ft. channel and its attendant navigation dams in the 1930s, and (5) an acceleration in sedimentation rates following World War II, apparently resulting from an increase in the amount of open row crops grown within the basin.[34] As an example, in 1908, a 200-mile reach of the Illinois River produced 10% of the total U.S. catch of freshwater fish (employing 2,000 commercial fishermen and yielding 24 million lbs. of fish annually). Commercial fish yield totalled about 178 lbs/ac of permanent water, but by the 1950s yield had dropped to 38 lbs/ac and by the 1970's to 4 lbs/ac, totaling 0.32% of the total U.S. freshwater harvest.[35]

Conclusion: ***Alteration of Mississippi, Illinois and Missouri Rivers and floodplains has resulted in significant changes or losses of habitat. The disruption of natural ecosystems has caused the destruction of many native species populations and has caused an increasing number to be listed as threatened or endangered.***

ENDNOTES

1. The statistics in this section are from U.S. Department of Commerce, *1987 Census of Agriculture,* (Washington DC: DOC, 1988). The 1992 census figures are being compiled as this report goes to press. A preliminary look at data from three states in the region indicates that the relative values are consistent with the 1987 figures.

2. U.S. Department of Agriculture, Soil Conservation Service. *Regional Analysis of 11 Major Land Resource Areas, Agriculture Handbook 296,* (Washington DC: SCS, December 1981).

3. Upper Mississippi River Basin Commission, *Comprehensive Master Plan for the Management of the Upper Mississippi River System,* (Minneapolis, MN: UMRBC, January 1, 1982).

4. The USACE and Bureau of Reclamation reservoirs in the Missouri River contain 28 million and 5 million acre feet of flood storage capacity respectively, those in the upper Mississippi River 4,5 million and those in the middle Mississippi River 1.2 million acre feet.

5. U.S. Government Accounting Office, Wetlands Overview, (Washington DC: GAO, November 1991).

6. Reuss, Martin, *Wetlands, Farmlands, and Shifting Federal Policy: A Brief History,* (Washington, DC: U.S. Army Corps of Engineers, February 1994), pages 3-5.

7. Ibid, page 3.

8. Sharitz, R., "Bottomland hardwood wetland restoration in the Mississippi drainage," pages 496-505 in National Research Council, *Restoration of Aquatic Ecosystems.* (Washington, DC: National Academy Press, 1992).

9. U.S. Department of Agriculture, Soil Conservation Service, *Summary Report 1987 National Resources Inventory,* Statistical Bulletin, No. 790, (Washington DC: SCS, 1988).

10. U.S. Department of Agriculture, Soil Conservation Service, *Impacts of Food Security Act (CRP and HEL),* SAST Studies, (Des Moines, IA: SCS, February 1994).

11. U.S. Department of Agriculture, Economic Research Service, *Analysis of the Conservation Reserve Program: Farmers' Plans and Environmental Targeting Issues,* (Washington, DC: ERS, April 1994), page 9.

12. Scientific Assessment and Strategy Team, "Scientific Assessment and Strategy Team Report", Draft, (Sioux Falls, SD: SAST, 1994).

13. Ibid.

14. Ibid.

15. Ibid.

16. Leopold, Luna B., "Flood hydrology and the floodplain", *Water Resources Update, 95*: page 11.

17. U. S. Department of the Interior, U.S. Geological Survey, *Effects of Reservoirs on Flood Discharges.,* Circular 1120-E, (Washington DC: USGS, January 1994).

18. Dyhouse, G.R., *Comparing Flood Stage-Discharge Data--Be Careful!* (Orlando, FL: American Society of Civil Engineers (ASCE) Hydraulics Specialty Conference, August 1985). Belt, C.B., Jr., Science Vol. 189, footnote 9, August 29, 1975

19. The UNET Model is a computer program that solves unsteady state flow equations to describe floodflow conditions. Unsteady state means that the depth of flow changes with both distance along the channel and with time. The model uses a network approach to solving the unsteady state flow relationships. UNET is a 1-dimensional model and assumes that the calculated velocity at a cross-section exists across the entire river. The area behind levees are modeled as storage cells. After calibration using flow data observed in the 1993, 1986, and 1973 flows with pre-flood conditions of levee development in the floodplain, the model analyzed the water surface profiles that would result from those same flood flows assuming levees were absent. Under such a scenario, land use in most areas would be different than presently exists as would ground cover types. Because the hydraulic roughness (resistance to flow) of the floodplain cross-section must be represented in the model, a range of possible ground cover types was used, from bare soil or short grass to dense forest or dense brush. A floodplain absent of levees would likely have a mix of ground cover types ranging between and including these extremes.

20. Ibid.

21. Koenig, Robert L., and Virgil Tipton, "The Flood That Wasn't", *St. Louis Post-Dispatch,* (December 26, 1993), B-1.

22. U.S. Army Corps of Engineers, Waterways Experiment Station, *Effects of Overbank Vegetation on the Mississippi River Stages in the Saint Louis -To Thebes Reach, Vicksburg, MS,* Mississippi Basin Model Report 81-6 (Vicksburg, MS: USACE, June 1979).

23. Scientific Assessment and Strategy Team Report.

24. The University of Iowa, Iowa Institute of Hydraulic Research, *Effects of Navigation-Dam Operating procedures on the Mississippi River Flood Levels,* (Ames, IA: The University of Iowa, August 1969).

25. Fremling, C.R., et al., "Mississippi River fisheries: a case history", pages 309-351 In Dodge, D.P., (ed.) *Proceedings of the International Large River Symposium.* (Ontario, Canada: Can. Spec. Publ. Fish. Aquat. Sci. 106, 1989).

26. Ibid.

27. Funk, J.L., and J.W. Robinson, *Changes in the Channel of the Lower Missouri River and Effects on Fish and Wildlife.* Aquatic Series No. 11, (Jefferson City, MO: Missouri Department of Conservation. November 1974).

28. Ibid.

29. Hesse, L.W., J.C. Schmulbach, J.M. Carr, K.D. Keenlyne, D.G. Unkenholz, J.W. Robinson, and G.E. Mestl. *Missouri River fishery resources in relation to past, present, and future stresses,* pp. 352-371. In: D.P. Dodge (ed.) Proceedings of the International Large River Symposium. Can. Spec. Publ. Fish. Aquat. Sci. 106. (1989).

30. Hesse, L.W., et al., "Missouri River fishery resources in relation to past, present, and future stresses", pages 352-371 in Dodge, D.P., (ed.) *Proceedings of the International Large River Symposium, (Ontario, Canada: Can. Spec. Publ. Fish. Aquat. Sci. 106, 1989).*

31. U. S. Department of the Interior, Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants,* 50 CFR 17.11 & 17.12, (Washington, DC: FWS, 1993).

32. The sturgeon chub, sicklefin chub, flathead chub, silver chub, and speckled chub.

33. The plains minnow and the silvery minnow.

34. Hesse, L.W., "Flora and Fauna of the Missouri River Downstream from Fort Randall Dam to the Mouth as They Relate to the Alteration of the Hydrosystem," Prepared for the Scientific Assessment and Strategy Team (SAST) of the Interagency Floodplain Management Review Committee, (Sioux Falls, SD: SAST 1994), pages 1-68.

35. Sparks, R.E., "The Illinois River-floodplain ecosystem." pages 412-432 in National Research Council, ***Restoration of Aquatic Ecosystems.*** (Washington, DC: National Academy Press, 1992).

Chapter 3

FUTURE FLOOD POTENTIAL

After the 1965 flood, they told us this wouldn't happen again for another 100 years.

Midwestern mayor
July 1993

This quote illustrates the lack of understanding by many individuals concerning flood potential. Many people think of flooding only in relation to a flood of a 100-year magnitude. They overlook the fact that although government regulators have selected the 100-year flood as a reasonable regulatory standard, it is not the only magnitude of flood that can occur. Floods are random, variable events. Through frequency analysis, hydrologists can characterize them as a 50-year flood, 100-year flood, or 500-year flood. The Midwest flood of 1993 varied from less than a 50-year flood at St. Paul, Minnesota, to less than a 100-year flood at Lincoln, Nebraska,[1] to over a 100-year flood at St. Louis, Missouri.[2] No one -- especially those living at risk in floodplains -- should be misled into believing that a 100-year flood occurs only once in a century. What happened in the Midwest in 1993 could happen again at any time!

WHAT IS A 100-YEAR FLOOD EVENT?

The American people have heard quite a bit recently about a 100-year flood. What exactly is it? A 100-year flood has a 1-percent chance of being equaled or exceeded in any given year. It has a 26-percent chance of occurring over the life of a 30-year mortgage, and a 63-percent chance of occurring over the next 100 years. The terminology used to describe the 100-year flood can be confusing. The terms 100-year flood, 100-year recurrence interval flood, 100-year frequency flood, 1-percent flood, 1-percent annual chance flood, and base flood, which all refer to the same event, are often used interchangeably. Confusion can result because the 100-year flood is usually the only type people hear about, even though larger and smaller floods are likely to occur.

As commonly applied, the concepts of a 100-year flood and 100-year floodplain can be misleading. Technically only the outer edge of a 100-year floodplain has a risk of one percent. The risk rises for sites closer to a river, ocean or other water feature, and also at lower elevations, yet most people think of the entire area between the water body and the outer edge of the 100-year floodplain as subject to the same risk.[3] Variation of risk is not usually shown on floodplain maps. There are areas within the mapped 100-year floodplain that may flood more frequently and to greater depths than others.

Uncertainties surround 100-year discharges and elevations, and mapping 100-year floodplain boundaries is at best an imperfect science. Estimates of the 100-year flood discharge (or flowrate) can be based on a range of techniques, and current techniques provide estimates that could be off as much as 5 to 45 percent.[4] Factors such as the size of the watershed, the availability and length of streamgaging records, and the level of detail of mapping for use in determining model

parameters contribute to the uncertainty in a 100-year flood discharge estimate. Flood discharges associated with infrequent events, such as the 500-year flood discharge, are more difficult to predict and have more uncertainty associated with them. Even if a fairly accurate 100-year discharge is determined, it may subsequently change due to land-use changes in the watershed and natural and human changes to the channel and floodplain.

After determining a discharge rate, this figure is entered into a hydraulic model to determine the elevation of the 100-year flood. Hydraulic models, depending upon the level of accuracy of information on topography, friction losses, and hydrology, can produce estimates of 100-year flood elevations within 0.5 to 2 feet.[5]

Once the elevation of the 100-year flood has been determined, the extent of the floodplain can be mapped. Topographic maps vary in precision and level of detail.

The accuracy of the floodplain boundary line is influenced most strongly by the quality of the 100-year flood discharge estimate. The next most significant factor is the quality of the topographic mapping. Research suggests that the probable nationwide standard error for base (100-year) flood elevation mapping is 23 percent of the base (100-year) flood depth. This value, translated into an average depth, amounts to about 3 feet.[6] Thus, the floodplain boundary line shown on a map is not absolute and structures located within several feet (vertically) of the 100-year floodplain are still at risk. In flat areas, structures located within several hundred feet (horizontally) of the 100-year floodplain also may be at risk.

MARBLES AND FLOODS

At one of the public meetings attended by the Review Committee, a young Missouri farmer provided a correct explanation of the possibility of experiencing a 100-year flood. He described a bag full of 100 marbles with 99 clear marbles and one black marble. Every time you pull one of those marbles out, and it's black, you've got a 100-year flood. After each draw, you put all 100 marbles back in the bag and shake it up. It's possible that you could pull the black one out two or even three times in a row. To represent the uncertainty of estimating a 100-year flood, it's also possible that the bag could hold two or three black marbles.

STANDARD PROJECT FLOOD

Another magnitude of flood that can occur is one that results from the standard project flood (SPF) discharge. This event is not assigned a frequency or recurrence interval, although it is often used by hydrologic engineers to approximate the 0.2 percent annual chance (500-year) flood. The SPF discharge in a river represents the flow that can be expected from the most severe combination of meteorologic and hydrologic conditions reasonably characteristic of the geographic region involved. SPF discharges exclude extremely rare combinations. The SPF procedure is used in lieu of the discharge-frequency approach because of the unreliability inherent in estimating large magnitude infrequent events from short record, or even regional, discharge-frequency analyses.

The SPF discharge is currently used for design of engineered structures which, if compromised, could result in catastrophic flooding. The SPF discharge is generally used to determine the level of protection for urban population centers where there is great threat of loss of life and of damage to critical infrastructure.

RESIDUAL RISK BEHIND LEVEES

Risk exists in all areas within a floodplain -- both areas protected by channel modifications, dams, or levees and areas outside the 100-year floodplain. Levees built to provide a 100-year level of protection modify the natural overflow boundary of the 100-year floodplain and the boundaries for lesser floods. Individuals and businesses remaining in what was once the 100-year floodplain, are not required to carry flood insurance even though the chance of a flood greater than the 100-year flood occurring in the next 30 years is about 1 in 4. Uncertainties also surround a levee's level of protection. Engineers may account for discharge and elevation uncertainties in the design of a levee by the use of freeboard -- the difference between the top of the levee and the design flood height. Even though areas protected by levees are considered safe, the potential for catastrophic loss still exists. If floodwaters overtop a levee, flooding in the protected area could reach depths equaling or exceeding the levee's height. Higher levees reduce risk but could increase potential damage.

CLIMATE CHANGE

Climate change could increase flood risk. Although considerable uncertainty exists, climate change could bring about more-frequent and/or more intense floods. Given that development in and near floodplains is expected to last a considerable period of time and that the nation's ability to predict the magnitude and frequency of future events is still limited, it may be prudent to consider the potential effects of climate change when decisions are made (or revised) about the type and amount of development allowed in vulnerable areas. In the absence of sufficient data, flexible and cautious policies are preferred.

U.S. Congress, Office of Technology Assessment
Preparing for an Uncertain Climate----Volume I

FUTURE FLOODS

Not every state and local government regulates stormwater runoff, and the volume of runoff and flood peaks may increase in the future because of urbanization. The streets, parking lots, gutters, drains, and storm sewers accompanying urbanization convey rainfall rapidly to stream channels. Natural channels are often straightened, deepened or lined, transmitting flood waves downstream more quickly. Stormwaters can therefore accumulate downstream more quickly than in natural river systems and produce higher, sharper flood peaks. Unless steps are taken to mitigate the impacts of urbanization, flood volumes and peaks will continue to increase.

Current flood records are limited by their length. As flood records for more years become available, current estimates of flood discharge, volume, stage, and duration will change.

In the 1993 flood, out of more than 500 USGS gaging stations in the area of flooding streams,[7] 45 exceeded the 100-year discharge,[8] but at least 450 did not. Many people think that the entire upper Mississippi River Basin experienced a 500-year flood, when estimates indicate that only the reach of the Mississippi River from Keithsburg, Illinois, to above St. Louis and the reach of the Missouri River from Rulo, Nebraska, to above Hermann, Missouri, endured such a flood.[9] Since 1900, St. Louis has experienced large floods in 1903, 1909, 1927, 1973, and 1993. The communities in the Midwest that experienced a 10- to 50-year flood in 1993, may experience a 100- to 500-year flood in the near future. There is no question that flooding is inevitable. The open questions are when? where? and how much?

Conclusion: ***Floods equal to and greater than the flood of 1993 will continue to occur across the nation. It is difficult to predict precisely when and on what rivers these large events will happen.***

ENDNOTES

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2. Bhowmik, Nani G., et al., *The 1993 Flood on the Mississippi River in Illinois*, Miscellaneous Publication 151, (Champaign, IL: Illinois State Water Survey, 1994).

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4. Burkham, D.E., "Accuracy of flood mapping," *Journal of Research, U.S. Geological Survey,* 6(4): 515-527 (July-August 1978).

5. U.S. Army Corps of Engineers, Hydrologic Engineering Center, *Accuracy of Computed Water Surface Profiles,* (Davis, CA: USACE, December 1986).

6. "Accuracy of flood mapping," page 526.

7. Kirby, William H., Hydrologist, Office of Surface Water, USGS, Reston, VA, personal communication, June 13, 1994.

8. *Flood Discharges in the Upper Mississippi River Basin,* page 1.

9. U.S. Army Corps of Engineers, Missouri River Division, *1993-94 Annual Operating Plan, Missouri River Main Stem Reservoirs,* (Omaha, NE: December 1993).

Part II

A BLUEPRINT FOR THE FUTURE

Chapter 4

A VISION FOR THE FLOODPLAIN

The Congress... declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

Section 101, National Environmental Policy Act of 1969

... it is the sense of Congress that flood control on navigable waters or their tributaries is a proper activity of the Federal Government in cooperation with the States, their political subdivisions, and localities thereof; that investigations and improvements of rivers and other waterways, including watersheds thereof, for flood control purposes are in the interest of the general welfare; that the Federal Government should improve or participate in the improvement of navigable waters or their tributaries, including watersheds thereof, for flood control purposes if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected.

Section 1, Flood Control Act of 1936

The United States, as it moves into the 21st century, is at a crossroads in the use of its floodplains. The nation may choose to use these flood-prone lands for the primary purpose of economic development, or it may take action to better balance their economic and environmental outputs. Floodplain resources can be shared by human occupants and natural systems. Over the last century, in the upper Mississippi River Basin, while human activities have produced significant economic and social benefits, some of these activities have placed both humans and nature at risk.

Flood control works have allowed cities to grow in the face of periodic high waters. Until the middle of this century, the nation did little to control the clearing of lands upland of the floodplains. Subsequent increases in runoff generated the need for additional flood damage reduction activities. Levees, built by both the federal government and private landowners, helped agriculture flourish in the fertile bottomland environment; however, the overtopping of these levees by floodwater created major economic losses. Reservoirs, like levees, reduce the flood threat to many downstream communities, but the reduction in flood flows simultaneously creates incentives for many people to settle riverbanks and become subject to the impacts of the next major flood. The promise of post-flood support from government and private agencies may encourage people to continue occupying land at frequent risk of flooding.

In recognition of this continuing vulnerability to flooding, watershed-focused programs are now emerging, and the United States has begun to move in a new direction. Concern for the environment and sustainable development as well as recognition of the severe limits on federal spending and of funding opportunities lost in flood recovery speak clearly to the need for reexamining the nation's flood damage reduction strategy.

This reexamination must acknowledge that the current state of floodplains reflects in part a succession of political decisions made at the national level. Much of the flood-control effort of the last half-century in combination with other infrastructure development had major land-development implications. Many people moved to or remained in the floodplain with the understanding that the federal government was providing them flood protection. Others saw upstream activity, over which they had no control, increasing their hazard. As the nation seeks a new approach for floodplain management, it must not lose sight of the realities of the past.

Recognition in the early 1960s of the natural functions and resources of the floodplain -- habitat, scenic beauty, water filtration, storm buffer, groundwater recharge, and floodwater storage -- caused the nation to reconsider its policy of supporting wholesale conversion of natural areas to other uses. Persistent flood losses during a half century of flood-control programs raise serious questions concerning the long-term efficiency of such programs. A movement to reduce flood damages through nonstructural means, limiting unwise development of the floodplain and evacuating those at most risk, gradually has become a viable alternative to the construction of dams, levees, and floodwalls.

DEFINING THE VISION

The National Commission on the Environment, a non-profit group, proposes a concept of sustainable development to accomplish economic progress by protecting and restoring the quality of the natural environment, improving the quality of life for individuals, and broadening the prospects for future generations.[1] Effective floodplain management embodies these very concepts by seeking to balance competing uses in a way that maximizes the net benefits to society.

What then should be the national vision for use of the floodplains? To assist in developing this vision, the Floodplain Management Review Committee reviewed the literature on early and recent goals of the nation's floodplain management. Committee members consulted with interest groups at national, regional, and local levels and discussed possible goals with citizens affected by the flood of 1993. The governors of the 9 flood-affected states in the Midwest provided their vision of future floodplain activity. The Review Committee looked to the *National Assessment* and the accompanying *Action Agenda* prepared by the Federal Interagency Floodplain Management Task Force for definition.[2] Based on this input, the Review Committee proposes strategic and operational goals for the nation's future use of its floodplains and management of that use:

Strategic Goals

Reduce the vulnerability of the nation to the dangers and damages that result from floods.

Reduce the vulnerability to urban areas, industry and agriculture, when such reduction is justified and reasonable; avoid new development when reduction is not appropriate. As appropriate, move those currently at risk from the floodplain. Strive to eliminate threats to life, property, and the environment, and to the mental health and well being of floodplain occupants. Ensure the viability of critical infrastructure and the regional economy.

Preserve and enhance the natural resources and functions of floodplains.

Treat the floodplain as part of a physical and biological system that includes the floodplain within the larger context of its watershed. Seek to identify and enhance the cultural, historic, and aesthetic values of floodplains. Where appropriate, restore and enhance bottomland and related upland habitat and flood storage. Use existing government and private programs to acquire, over time, environmental interest in these lands from willing sellers. Ensure the consideration of social and environmental factors in all actions relating to the floodplain.

Operational Goals

Streamline the floodplain management process.

Implement consistent, equitable, flexible, cost-shared, and efficient floodplain management by improving the National Flood Insurance Program, federal-state-tribal-local-individual relationships, and the conduct of mitigation and disaster planning and execution. Ensure federal-state-tribal-local-individual collaboration and accountability in a bottom-up, shared planning and decisionmaking process. Reduce the cost to the nation of flood damages. Share the risk among all levels of government and among flood-affected individuals.

Capitalize on technology to provide information required to manage the floodplain.

Provide timely and accurate information to assist in identifying hazards, determining impacts of proposed actions, and developing a temporal and spatial basis for long-term action strategies. Leverage the strength of geographic information systems.

FLOODPLAIN OF THE FUTURE

If this vision was implemented, how would the floodplain of the future appear and how would it be managed? Human activity in the floodplain would continue (Figure 4.1) but with a clear recognition that any such activity would be subject to the residual risk of flooding and assumption of the costs of this risk by those sponsoring the activity. Determining future activities would depend on historical settlement, on a balancing of the economic, social, and environmental impacts of an activity together with a recognition of its place in the hydrologic and hydraulic regime of the river basin and what physical impacts its existence has on other segments of that basin.

Urban centers whose existence depends on a river for commerce or whose locational advantage is tied historically to a floodplain would be protected from the ravages of devastating floods by means of levees, floodwalls, upstream reservoirs, or floodwater storage in managed upland and floodplain natural areas. Sections of communities with frequently flooded businesses or homes would become river-focused parks and recreation areas as former occupants relocated to safer areas on higher ground.

In areas outside of these highly protected communities, where land elevation provided natural protection from floods, state and local officials would control new construction by requiring it to be at elevations well out of harm's way. Those who were at risk in low-lying areas would be relocated, over time, to other areas. Higher land in these alluvial areas would continue to produce rich harvests. Outside of the urban areas, industry would protect its own facilities against major floods. Critical infrastructure, such as water and wastewater treatment plants, power plants, and major highways and bridges would be either elevated out of the flood's reach or protected against its ravages. Much of this infrastructure, as well as the homes, businesses, and agricultural activities located behind

lower levees, would be insured against flooding through full participation in commercial or federally supported insurance programs.

At the upstream end of many levees, federally built water-control structures would permit river waters to keep sloughs wet throughout the year maintaining and restoring aquatic habitat with resultant benefits for fisheries, waterfowl, and other wildlife. Levees would be modified to provide for controlled overtopping in the event of major high waters, eliminating the catastrophic failures that have occurred in the past.

Some bottomland owners behind modified levees would choose to convert from row crops to alternative crops or silviculture or to return their lands to a natural state under federal or state easements. Owners would base their decisions on private and government analyses that found their land too wet for farming or in a location where levee protection was impossible to maintain.

Upland of the floodplain, federal-state-tribal-local programs to improve the treatment of lands, control new runoff, and restore wetlands, would reduce the flows during frequent floods and shave the peaks off larger events.

Both commercial and recreational vessels would continue to ply the river's waters, operating in a navigation system that would enhance riverine ecosystems through water-level adjustments and control. Modifications in river-control structures would continue to increase fisheries and wildlife habitat.

Floodplain activity would be guided by broad-based plans of federal-state-tribal-local governments working together as partners in a streamlined floodplain management effort. Operation of the waterway and the levee systems, with their attendant environmental components, would be focused in a single agency that would collaborate with other interested agencies. Levees along main stem rivers and principal tributaries would be maintained on a cost-shared basis by federal and state governments and local levee boards. Decisions concerning activities in and near the water would be assessed using computer models to indicate the effects of such actions on other regions of the river basin. Forecasts of river conditions would reflect the availability of basin-wide data and the rapid processing of these data. Use of high technology remote sensing platforms and data-filled geographic information systems would provide highly accurate information on which to base key decisions for both planning and crisis management.

A New Approach

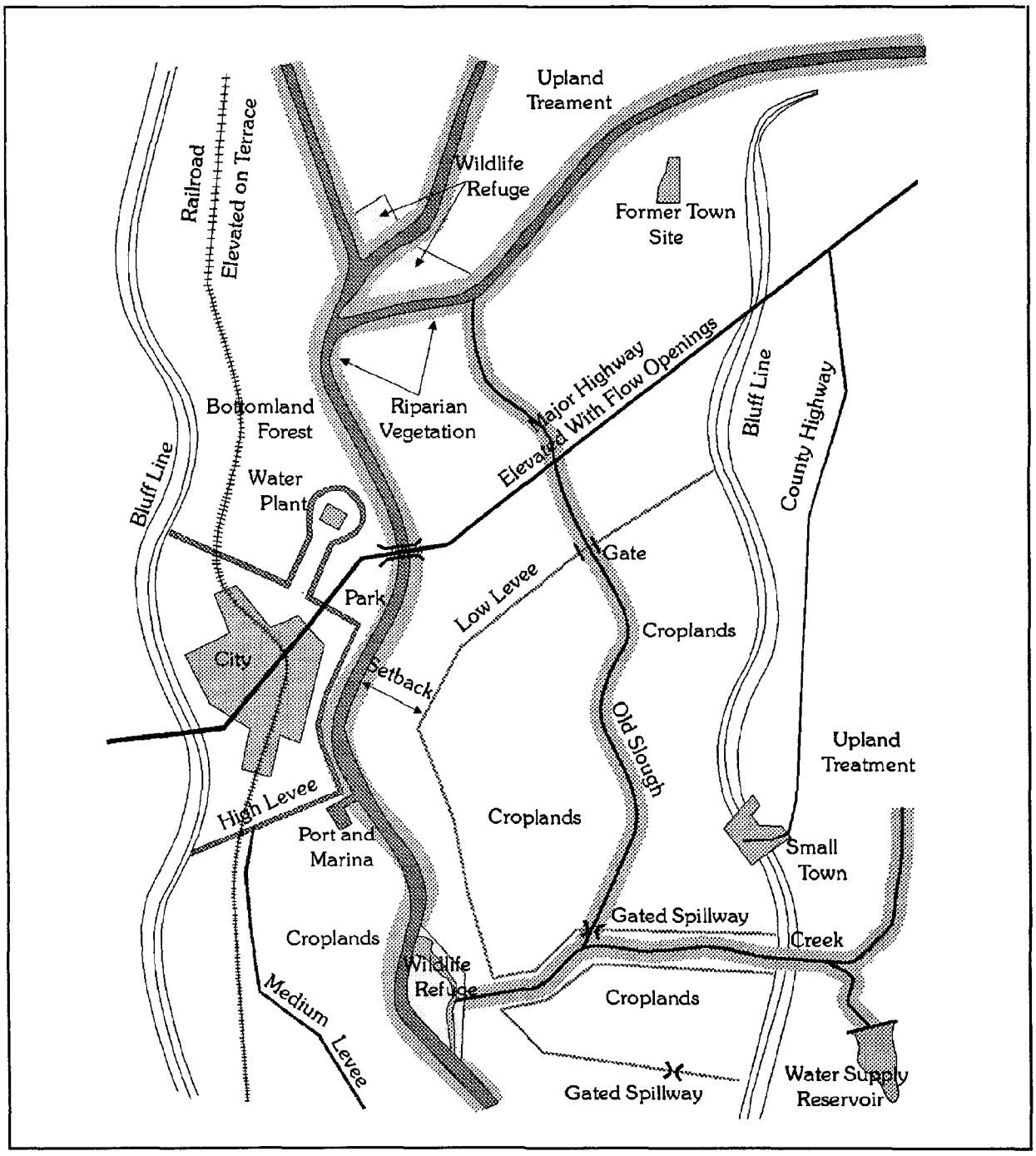
Through most of the past two centuries, the nation's approach to floodplain management has focused on reducing flood impacts through structural means. Floodplain management has been flood control. In the 19th century and the first half of this century, the debate was whether or not a levees-only policy should be pursued. Only in the last 30 years has the nation moved to increase the use of nonstructural approaches.

To achieve the goals of floodplain management, the nation must adopt a new approach--one that takes full advantage of all methods available to reduce vulnerabilities to damages and, in parallel, to protect and enhance the natural resources and functions of the floodplain. Translated into actions this approach, espoused in the draft 1994 Unified National Program, would achieve floodplain management through:

- Avoiding the risks of the floodplain;
- Minimizing the impacts of those risks when they cannot be avoided;
- Mitigating the impacts of damages when they occur; and
- Accomplishing the above in a manner that concurrently protects and enhances the natural environment.

The citizens of the nation bear a responsibility to exercise good judgment in their use of the floodplain and to share in the costs of their judgments. Under this approach, state and local governments serve as the principal managers of the land. The federal government provides support for state and local floodplain management, establishes broad national goals, and, by its own actions, sets an example. Federal actions will continue given the interstate nature of water and the related impact of all riverine activity on these waters, the ever-present potential for

Figure 4.1 A Typical Reach of a 21st Century Floodplain.



catastrophic floods, and the federal government's longstanding commitment to flood-control activities as being in the interest of the general welfare.

Reducing the Vulnerability of the Nation to Flood Damages

Individuals and their investments in the floodplain will always be at risk. Though it is impossible to remove the risk completely and remain in the floodplain, it is possible to reduce the degree of risk.

One solution is to evacuate floodplains and move people and their public and private investments out of harm's way. This is not always a viable or desirable solution. Techniques that either modify the susceptibility to flood damage and disruption or modify the extent of the flooding may be more reasonable for cases in which evacuation is not feasible. The new vision seeks to reduce the vulnerability of those floodplain residents and activities whose continuing presence in the floodplain makes economic, social, and environmental sense.

The lessons of the flood of 1993 are clear. The United States should not continue to tolerate the loss of life and the damage to cities, rural communities, and farms caused by major flooding, nor should the nation carry the burden of massive federal flood disaster relief costs that current policies generate each time a major flood occurs. Even with a large infusion of federal funds, private donations, and volunteer assistance, the 9-state area still has not returned to normal. Individuals, communities, and the agricultural sector will experience the long-term effects of the flood for years. Many of these damages could be avoided through vulnerability reduction measures.

This chapter addresses the vulnerability reduction goals that the Review Committee seeks to achieve with the new vision. Subsequent chapters will address, given the experiences of 1993, the strategies for achieving these goals.

Defining the Risk

Against what magnitude of flooding should damage reduction programs be focused? The answer depends on the social, environmental, and economic assets of the flood-prone area. This will be reflected by the use being made of the land, as well as the amount of human activity and critical infrastructure located in the area.

Risk of damage or loss from flooding is greatest where human life and property are concentrated in highly populated areas on the floodplain. For many years following the passage of the Flood Control Act of 1936, the federal government focused its efforts on protecting communities at risk from the largest flood they could expect to encounter. Over time, with limited federal monies available for flood damage reduction purposes, selection of this high level of protection diminished as decisions on level of protection came to be driven more by benefit-cost analyses. Communities with little at economic risk received less protection that those with more. Today many cities and towns are able to see major floods move by with minimal effect. Others could not survive a lesser event without experiencing major trauma. Had the 1993 flood been centered slightly to the north, several urban centers would have been inundated. Given the social and economic consequences of such flooding in affected communities, floodplain management activities need to focus on reducing the vulnerability of population concentrations to the most significant flood event expected to occur. Reducing the vulnerability of communities, where appropriate, to the discharge associated with the standard project flood (SPF) provides a greater reduction in residual risk than is provided by using the 1 percent annual chance (100-year) flood discharge. The SPF serves as a practicable expression of the discharge to be considered in evaluating alternatives to reduce the vulnerability of activities associated with communities where large population and high-value property are involved. In most cases the SPF approximates the 0.2 percent chance (500-year) discharge.[3]

Recommendation 4.1: *Reduce the vulnerability of population centers to damages from the standard project flood discharge.*

The identification of a target flood does not represent a call for new levees or floodwalls. In fact, given this target discharge, floodplain managers would develop a strategy for evaluating vulnerability reduction considering all of the nonstructural and structural approaches available. Planning for the future may move a community to first seek funding for mitigation activities such as relocation or elevation. Availability of land in the watershed or in the floodplain may result in upstream storage or riverine floodways being considered better approaches. When other approaches have been reviewed, higher or upgraded levees or floodwalls might also be considered. The costs and benefits of each approach would determine whether the vulnerability would be eliminated, reduced, or the status quo maintained.

Critical Infrastructure

The risk of imposing severe hardship on the public or endangering public health and safety arises when infrastructure critical to maintaining the wellbeing of a community, region or nation is damaged. This is especially true in floods of long duration, such as the one that occurred in the Midwest in 1993. For example, when the city of Quincy, Illinois, lost both of its crossings over the Mississippi River, it faced the situation of having no open bridge across the river between Iowa and St. Louis, Missouri, for over two months. People were put out of work, local businesses were isolated from their market areas, and the local economy was disrupted.

Recommendation 4.2: *Reduce the vulnerability of critical infrastructure to damage from the standard project flood discharge.*

Critical infrastructure can be defined as structures, facilities, and installations of the following type and function:

- Those that, if rendered unserviceable, would impose significant hardship on the public, or
- Those that, if flooded, would pose a threat to public health, public safety, and/or the environment.

Critical infrastructure could include, on a situation-dependent basis, municipal drinking water facilities, wastewater treatment plants, interior drainage pumping stations, major highway bridges, major passenger and freight railroads, critical access roads running through or over floodplains, major airports, hospitals and related medical care facilities, electricity generating plants, and facilities that generate, store, or dispose of hazardous, toxic, or radioactive materials. For many of these facilities, such as roads, the element of flood duration must be considered in determining the applicability of the definition. A road out for five hours may not be critical, but one out for three months might be. The only road to a county hospital might be critical under any circumstances.

Where feasible, critical infrastructure should be located outside the floodplain. Critical infrastructure, which must be situated in the floodplain, should be evaluated for protection against the SPF discharge. This issue is not new. Floodplain Management Guidelines for implementing Executive Order (EO) 11988, issued by the Water Resources Council in February 1978, require that critical high-risk activities be protected at a minimum against the 0.2 percent annual chance (500-year) flood. They also provide planners assistance in determining whether infrastructure should be considered critical.[4] In 1982, a National Academy of Science panel concurred and recommended that critical infrastructure be protected against, at a minimum, the 0.2 percent annual chance flood.[5]

Vulnerability of Other Areas

If the goal of floodplain management is to reduce the vulnerability of population centers and critical infrastructure to damages from an SPF discharge, what should it be for areas that do not fall into these categories? While extending an SPF goal to all areas might seem equitable to many, such an action is neither physically, economically, environmentally, nor socially feasible. The strategy for damage reduction and the

target flood against which the strategy is based must be determined on a case-by-case basis using modern planning techniques and methods of analysis. In the long term, much human habitation and related businesses might move to higher ground leaving only agriculture, silviculture, and natural use behind existing levees. Where such an approach is not feasible or desirable and structural solutions appear appropriate, the hard facts of benefit-cost analysis normally will preclude using the SPF discharge as a basis for federally supported increases in protection.

The level of protection provided these areas would be determined considering social and environmental values as well as the economic benefits and costs. Depending on the mix of population, infrastructure, industry, and agriculture, the level of protection will vary.

Sharing the Challenge -- Government, Business, Citizen

Since passage of the Flood Control Act of 1936, the federal government has for the most part, dominated the nation's flood control efforts and as a result the nation's floodplain management activity. Structural programs needed for flood damage reduction were also the principal sources of funds for any efforts to stem the rising tide of flood losses. Many states and local governments have developed and carried out floodplain management efforts that both reduced flood damages and enhanced the natural functions of the floodplain; but in carrying out these programs they were hampered by the diversity of federal programs, regulations, and guidelines that hindered efficient floodplain management. The dominant federal role in funding flood damage reduction and recovery activities limited the incentive for many state and local governments, businesses, and private citizens to share responsibility for making wise decisions concerning floodplain activity. Now is the time to:

- Share responsibility and accountability for accomplishing floodplain management among all levels of government and with the citizens of the nation.

- Organize the federal government and its programs to provide the support and tools necessary to carry out effective floodplain management.

Succeeding chapters detail how the nation should organize for successful floodplain management and then, by improving the efficiency and effectiveness of programs already in existence, reduce the vulnerability of the nation to flood damages in the years ahead.

ENDNOTES

1. National Commission on the Environment, ***Choosing a Sustainable Future***, (Washington, DC: World Wildlife Fund,1992)

2. Federal Interagency Floodplain Management Task Force. ***Floodplain Management in the United States: An Assessment Report***, (Washington, DC: FIFMTF, 1992); and, White, Gilbert, et al., ***Action Agenda for Managing the Nation's Floodplains***, Special Publication 25, National Hazards Research and Application Information Center, (Boulder, CO: NHRAIC, March 1992).

3. The Economics Advisory Group strongly disagrees with the establishment of the standard project flood discharge as any form of a reference point, believing that the level of protection provided should be determined only by appropriate project evaluation. The Review Committee believes that there are sound engineering reasons to establish a target for vulnerability reduction and an understanding of the problems associated with passing the target flood discharge. Determination of the level of protection should result from appropriate benefit-cost analysis.

4. U.S. Water Resources Council, "Floodplain Management Guidelines for Implementing E.O. 11988," Federal Register, February 10, 1978 (44 FR 6030).

5.National Research Council, Committee on a Levee Policy for the National Flood Insurance Program, ***A Levee Policy for the National Flood Insurance Program***, (Washington, DC: National Academy Press, 1982)

Chapter 5

ORGANIZING FLOODPLAIN MANAGEMENT FOR SUCCESS

...it is hereby declared to be the policy of the Congress to encourage the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal Government, States, localities...

Section 2, Water Resources Planning Act of July 21, 1965

The current system for managing floodplains and protecting the nation from impacts of unwise use is piecemeal. It is dispersed among a variety of agencies at federal, state, and local levels. The Unified National Program was intended to correct this...that program has not succeeded...the Unified National Program is neither unified nor national. In several respects if falls short of achieving the goals set out for it by the Congress and previous administrations.

Gilbert White, et al.
Action Agenda for Managing the Nation's Floodplains
March 1992

The test of how well floodplain management activities are being carried out is in what happens at the level of individual farms, households, and local communities.[1] The 1993 Midwest flooding illustrates where local, state, and national efforts succeeded and failed. Progress has been short of what is desirable or possible or of what was anticipated when current policies and activities were initiated.[2]

The collective floodplain management efforts of federal, state, tribal and local governments, individuals, and the private sector must be improved. Together they can use the regionally and nationally significant assets of watersheds and associated floodplains to reduce risk, achieve economic efficiency, and enhance natural resources and functions. The current floodplain management infrastructure has the capability and the responsibility to influence floodplain development and recovery from floods. At issue is the appropriate distribution of responsibilities across and creation of accountability for governments and individuals.

DEFINE FEDERAL-STATE-TRIBAL-LOCAL RELATIONSHIPS AND RESPONSIBILITIES

The strengths of the federal government -- nationwide experience; ability to examine issues from a national, inter-state and systems perspective; and multi-disciplinary technical expertise -- should guide strategic decisions regarding its obligations and duties. Since the Water Resources Council ceased operations in 1981, however, activities of the federal government have offered little leadership or guidance in resolving interstate water-resource issues.

Management of the nation's water resources is provided by several federal agencies. Yet water resource issues are inextricably linked and accomplishment of agency mandates requires coordination and collaboration among agencies. The National Flood Insurance Act of 1968 required reports to Congress analyzing the implementation of current programs and recommending actions needed to achieve a unified program of planning and action at all levels of government to reduce flood losses and losses of floodplain natural values.[3] Despite these *Unified National Program for Floodplain Management* reports, the United States, in practice, has no unified national program for floodplain management.[4] This stems in part from ambiguity in national goals.[5] If limited resources of money and people are to be utilized effectively, the vision articulated in this Report needs to be accepted and adopted by the populace and assimilated into all levels of government.

A major component of floodplain management is land-use control, which is the sole responsibility of state, tribal, and local entities. The local process for land use and construction decisions (i.e., what, where and how to build) is supplemented in some states by state floodplain permit programs. The federal responsibility rests with providing leadership, technical information, data, and advice to assist the states in their pursuit of sound floodplain management. The federal government is also a partner with states, tribes, and communities in funding floodplain management activities. Where the federal government is contributing funds to protect local communities, however, there is a compelling interest that the funds do not spur increased development in vulnerable locations and that local jurisdictions assume greater responsibility in their land use planning to not increase potential losses. The federal government should not undertake actions that lower the incentive for those in the floodplain to avoid risk because they know the federal government will provide compensation for damages resulting from the risk (see Chapter 14). The federal role should be to coordinate interstate water flows while promoting and assuring interstate commerce, national economic development including a viable agriculture industry, and national environmental quality including the enhancement of the quality of the human environment. Congress established the federal interest in flood damage reduction.[6] This interest complements the fundamental state, tribal, and local interests in flood damage reduction.

Action 5.1: *Enact a national Floodplain Management Act to define governmental responsibilities, strengthen federal-state coordination and assure accountability.*

The Administration should propose enactment of a Floodplain Management Act to declare a national policy and goals for floodplain management. These should reflect the vision articulated in Chapter 4 and move the nation toward implementation of a new floodplain management vision that:

- Reduces vulnerability to flooding by avoiding of flood risk through watershed planning, land treatment, floodplain management planning, buyout of structures in the floodplain, and mitigation;

- Reduces vulnerability to flooding by modifying flood risk or protecting against floods by minimizing risk to existing population centers (such as cities), protecting existing critical infrastructure, and protecting the nation from flood-related releases of hazardous materials; and

- Recognizes that floods will continue to occur but that the residual risk in floodplains can be reduced

by insuring against flood loss and rebuilding properly when flood losses occur.

The purpose of the Act should be to provide incentives including funding for state and local entities to develop and implement floodplain management plans and increase their accountability for actions in the floodplain. This should be achieved by assigning primary responsibility for floodplain management to states and providing federal guidance and technical and financial assistance to them for development and implementation of floodplain management programs meeting minimum federal standards. The Act should authorize funds to supplement state efforts to build and institute effective floodplain management programs. Participation in on-going, non-disaster flood damage reduction and mitigation activities could be withheld from those states that do not conduct floodplain management planning. To support local planning and emphasize state leadership, the Act should require that federal activities affecting floodplains be consistent to the maximum extent practicable with federally approved state programs. The fundamental components of the proposed Floodplain Management Act are found in Appendix D.

...there needs to be a fundamental change in the federal flood protection role. This new role must be to facilitate and to assist state and local government in the implementation of these multi-objective programs.

Doug Plasencia, P.E.
Chair, Association of State Floodplain Managers
Testimony before Congress, October 27, 1993

IMPROVE FEDERAL COORDINATION, EFFICIENCY AND FEDERAL-STATE-TRIBAL PLANNING

The 1965 federal Water Resource Planning Act established the U.S. Water Resources Council (WRC).[7] However, the WRC ceased operations in the early 1980s when funding was discontinued. Lost with the WRC funding was its ability to provide interagency coordination, technology transfer, and data and information services. Deficiencies inherent in the original WRC which established a command-and-control, top-down approach to achieve consistency in federal water resources activities should not be repeated.[8] Nevertheless, the WRC provided an avenue to bring together federal agencies to address water resources issues, in general, and floodplain management, in particular. The Midwest Flood of 1993 illustrates the need to move toward the unified national program of floodplain management that the nation has sought since, at least, 1968.

Some federal agencies and states, numerous organizations and individuals noted to the Review Committee the continued need to revive the WRC or some WRC-type of organization to provide a coordination function. Many examples demonstrate why a WRC, composed of department and agency heads, is needed to provide policy-level coordination of cross-cutting issues of floodplain management and other water resource issues:

• Federal agencies continue to fail to comply with the spirit and letter of Executive Order 11988, Floodplain Management, by locating or funding non-floodplain dependent activities in floodplains putting federal investments at considerable risk (this issue is further discussed below);

• The shortcomings of and opportunities for increasing the effectiveness of floodplain management identified by the Federal Interagency Floodplain Management Task Force in 1992 in its *Floodplain Management in the United States: An Assessment Report* have not been acted upon. No entity exists to act upon those recommendations.

• The Unified National Program is neither unified nor national -- it does not adequately integrate either the numerous program aims that have been set forth or the efforts of those charged with implementing them. There is no central direction for the Unified National Program.[9]

A minimal staff would facilitate operations of the Council and would prepare, based on input from federal agencies and states, items for discussion or action by the Council.

Action 5.2: *Revitalize the Water Resources Council.*

Immediate revitalization of the WRC would launch and promote cooperation among federal agencies and the states-tribes. The WRC would, among other things, serve to align federal floodplain management goals with other broad national goals; provide a single point of focus to assist coordination and resolution of interstate water resource management issues; serve as an innovative planning and technology center, including intergovernmental data gathering and dissemination activities; and facilitate resolution of federal agency issues. The Secretary of the Interior, as designated chairman of the WRC, should request that the Administrator of EPA and the Director of FEMA become full-time participants on the Council. Other full-time members, as established by the 1965 federal Water Resources Planning Act, are the Secretaries of Army; Agriculture; Commerce; Housing and Urban Development (HUD); and, Health and Human Services and the Chair of the Federal Energy Regulatory Commission. The Secretary of the Interior, as Chair of the WRC, should restaff the Council. A small staff and budget to support pursuit of the Council's mandate is suggested. Appendix I provides additional details about this proposal.

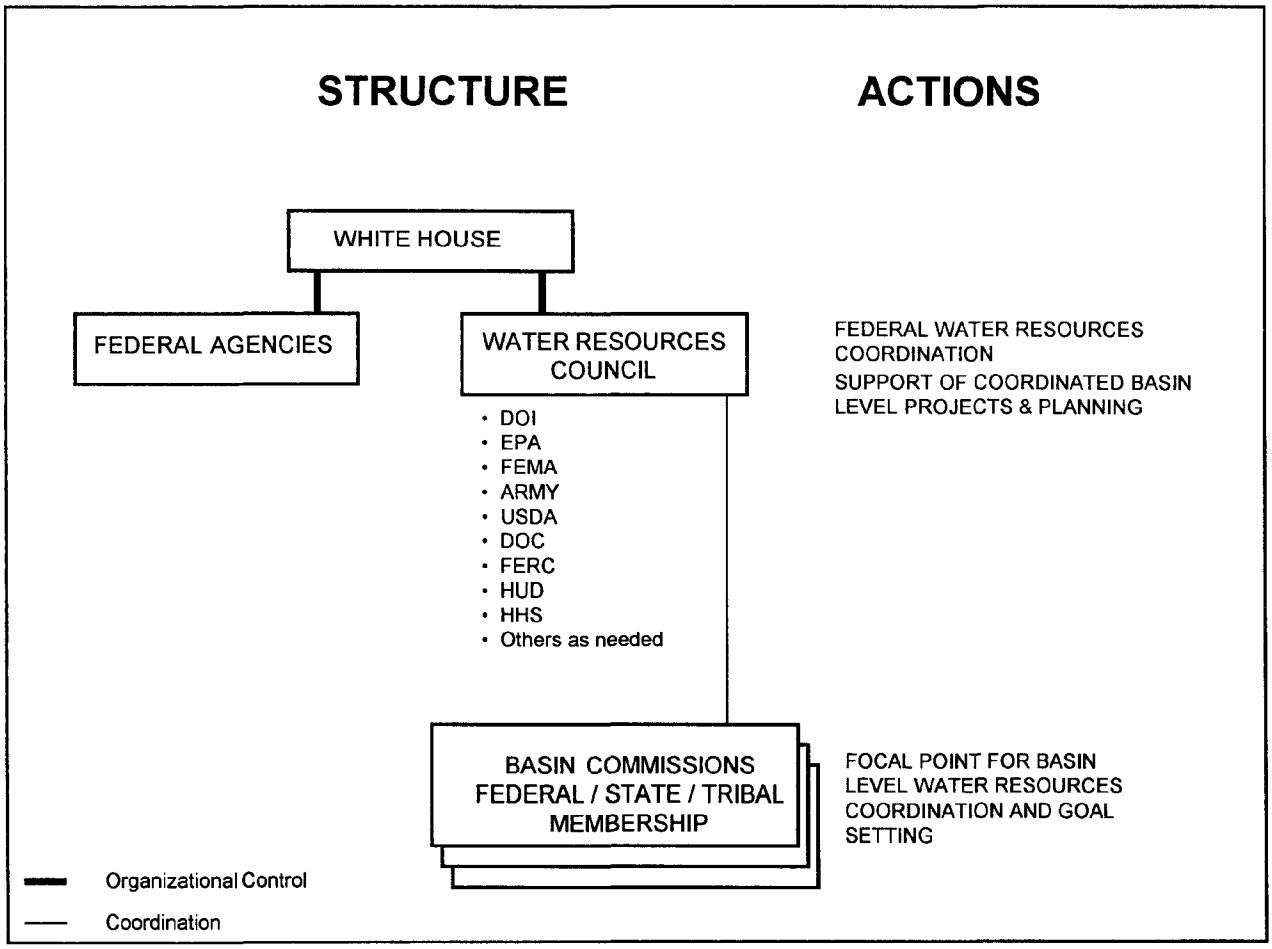
The 1965 federal Water Resource Planning Act also authorized creation of federal-state-tribe basin commissions and authorized financial assistance to states-tribes for water planning.[10] The individual basin commissions produced comprehensive, coordinated plans for water and related land resources that were advisory to federal, state, tribal and local authorities. The basin commissions established pursuant to the Act were abolished, along with federal funding, in 1981.[11] While several interstate organizations evolved to fill, in part, the gap left by the demise of the basin commissions, federal participation is limited to non-voting membership. A mechanism is needed to facilitate enhanced federal presence among and continuing participation with these groups.[12] Basin commissions provide a means of preserving and enhancing the state and local attention to floodplain management as well as broader water and natural resource issues, while providing a mechanism to involve or enroll appropriate federal agencies in state and local floodplain management activities. Because watersheds and associated ecosystems do not coincide with, nor do water resources and environmental protection problems respect, political boundaries, a vehicle is needed to integrate federal-multi-jurisdictional examination of issues and solutions. This basis for formation of basin commissions remains valid.

Action 5.3: *Reestablish basin commissions in a revised form reflecting current needs.*

The President should reestablish basin commissions to provide a forum for coordinated federal and state planning. Basin commissions are not needed everywhere. Basin commissions would be formed in consultation with the governors of states for those areas where the governors determined that interstate or federal-state coordination of several activities was needed or appropriate. The states, in consultation with

the WRC, would define the geographical extent of each proposed basin commission. Each basin commission would serve as the principal agency for the coordination of federal, state-tribe, interstate, local, and non-governmental plans for their designated areas and would undertake other activities pursuant to Title II of the Water Resources Planning Act of 1965. Their focus should be results oriented and their process collaborative. Their charters should look beyond traditional water and flood management challenges to allow the commissions to address regional issues of biodiversity conservation, water quality, sustainable development, and other environmental goals. Each basin commission would be co-chaired by a state and federal representative and would operate with a limited staff of four to five professionals. While many federal agencies would participate on the commissions, that voice could be limited to increase state significance and responsibility in addressing land-use planning issues. The basin commissions would use federal and state agencies, working within existing programs and structures to realize commission responsibilities. Actual staffing requirements, therefore, would be small. Public participation and comment should be vital aspects of their functions. The above changes are proposed to address criticisms of the original basin

Figure 5.1 Proposed Institutional Framework for Water Resources Council, River Basin Commissions, and Federal Agencies.



commissions. Funding of the commissions would be shared by federal and state governments. It is anticipated that no increase in costs to states will occur for those states currently participating in river basin associations; however, the federal government would have to contribute some funding.[13] Appendix I describes in greater detail the Review Committee's concept of revived basin commissions.

FEDERAL ACTIONS IN THE FLOODPLAIN -- SETTING AN EXAMPLE

In 1977 with issuance of Executive Order (EO) 11988, Floodplain Management, President Carter raised federal agency attention to issues of floodplain use.[14] With time, however, it has become apparent that some federal agencies either are unaware of or misunderstand the requirements of the EO and either build or support building in floodplains. Under the EO, federal agencies must

- Demonstrate that no practicable alternative site exists outside of the floodplain, and
- If no alternative exists, take steps to minimize direct and indirect impacts of the proposed action and to restore and preserve the floodplain.

Review Committee visits to the Midwest and discussions with the FEMA, USACE, and state floodplain managers revealed several examples of apparent non-compliance by federal agencies with the EO. While the responsible agencies no doubt believe they have complied with the EO, these developments point out some of the deficiencies with the EO. Among the most notable examples were a low-income housing project funded by HUD and a federally funded state prison within floodplains, and a proposed construction of a federal weather station behind an uncertified levee. The Association of State Floodplain Managers report that such federal activities occur nationwide. This type of activity lessens the capacity of the federal government to demonstrate leadership in floodplain management.

The EO also requires that federal agencies with responsibility for federal real property and facilities in the floodplain comply with the National Environmental Policy Act (NEPA) requirements and the construction standards of the NFIP. This task of evaluating cumulative, direct, and indirect impacts and risks associated with individual projects within a floodplain requires scientific and technical expertise beyond the capacity of a single reviewer, and often requires consultation with FEMA or USACE.

The EO applies to all federal agency activities including the acquisition, management, and disposition of lands and facilities. It covers federally undertaken, financed, or assisted construction and improvements and federal activities and programs affecting land use. These include but are not limited to water and related land resources planning, regulating, and licensing activities. One objective of the EO is to ensure that all federal agencies avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy of floodplains.

Federal activities that induce development weaken the effectiveness of existing local or state floodplain management regulations and place pressure on local governments to relax their regulations. Conversely an active federal program to undertake activities outside the floodplain sets an example and encourages the establishment and implementation of state and local programs. A number of states and communities have enacted floodplain management regulations, some of which are more stringent than those issued by FEMA.[15] The EO does not explicitly recognize the existence of local or state floodplain regulations or the effect federal actions may have on them. Neither are federal agencies required to consult with state floodplain managers concerning floodplain activities. Federal leadership in floodplain management requires an adjustment in the way that federal activities are undertaken in the floodplain.

The EO does not explicitly recognize that certain federal actions or activities in the floodplain are critical to the health and welfare of floodplain inhabitants. The extended closure of transportation systems, pipelines, dispersal of hazardous materials, and power outages

caused by the 1993 flood demonstrated the vulnerability of floodplain infrastructure. The destruction or disruption of critical infrastructure can have a widespread impact on a community or region. The current definition of critical actions contained in the EO Guidelines, "those for which even a slight chance of flooding would be too great," suggests that critical actions not be undertaken in any area subject to flooding of greater than a 500-year frequency. The guidelines, which fail to recognize that flood events differ in frequency, duration, and type, must be made more flexible.[16]

Federal and federally sponsored facilities, including critical infrastructure, remain at risk. To reduce the possibility of major losses, the vulnerability of these existing buildings and infrastructure should be assessed. Federal agencies that provide funds for improvements to previous investments in the floodplain fall under the EO requirements and accordingly should take measures to reduce the risk of flood loss and minimize the impact of floods on human safety, health, and welfare. There is an opportunity to mitigate the impacts of federal activities completed prior to the creation of the NFIP and the EO that may have resulted in flow constrictions that increased flood risk.[17] Continuing improvements to federal facilities in the floodplain, such as the Defense Mapping Agency's facility in St. Louis that was severely flooded and damaged in the 1993 flood, also require consideration of the EO. Federal programs that are delegated to or assumed by states may fall outside the EO. Examples of the latter are state revolving funds authorized by the EPA and Rural Development Administration or situations where the use of federal funds is at the discretion of state or local governments. These federal funds may directly or indirectly affect development in floodplains in ways that are inconsistent with the intent of the EO.

The federal government also leases some of its property in floodplains for seasonal recreational cottage use. Some leasees are using the cottages on a full-time basis. In St. Charles County, Missouri, 13 percent of the repetitive NFIP claims are from properties on land leased from the federal government.[18] These leases appear to contradict the EO mandate that the government "take action to reduce the risk of flood loss to minimize the impact of floods on human safety, health, and welfare"; however, Section 1134 of the Water Resources Development Act of 1986 directed the Secretary of the Army to extend the leases until such time as they are terminated by the leaseholder or their assigns.

Action 5.4: *Issue a new Executive Order to reaffirm the federal government's commitment to floodplain management with an expanded scope.*

A new EO, built upon EO 11988, will reaffirm the federal commitment to floodplain management by addressing the full scope of federal activities, particularly critical infrastructure, acknowledging uncertainties of scientific information, stating the economic policy implications of floodplain development, and requiring an interagency consultative process. The EO would provide a means to clearly articulate and thereby institutionalize the new vision of floodplain management. It would emphasize avoidance of federal activities in the floodplain. Requiring federal agencies to evaluate all structures during maintenance and repair activities to determine the feasibility of mitigating flow constrictions or undertaking other mitigating measures will reduce the risk of flooding and minimize the impacts of floods. Requiring federal activities to comply with state and local regulations when more stringent than national standards will affirm the state's role as floodplain manager. The revision will also require each agency to prepare new implementing guidelines for activities potentially occurring in or affecting floodplains, increasing agency awareness of the issue, and allowing agencies to address issues unique to their programs. It would also require that federal spending does not increase development in sites vulnerable to flood damages. The FEMA will provide oversight of EO compliance as described in Appendix G.

Action 5.5: *OMB should direct all federal agencies to conduct an assessment of the vulnerability of flooding using a scientific sample of federal facilities and those state and local facilities constructed wholly or in part with federal aid.*

This vulnerability assessment should identify and quantify the total federal investment subject to flood damage. The target flood for protecting critical infrastructure (i.e., SPF or 500-year) should be considered in the assessment. The assessment also should contain recommendations on mitigation measures to protect federal facilities currently at risk. The results of this study would be used to make decisions regarding the need, if any, to take mitigative measures.

Action 5.6: *Seek revision of Section 1134 of the Water Resources Development Act of 1986 to provide for phase-out of federal leases in the floodplain.*

The Administration should seek revision of Section 1134 which requires continuation of leases of federal lands. Then the Administration should phase out leases along the Mississippi River to reduce the risk of flood loss and minimize the impact of floods on human safety. The USACE should enforce provisions of the leases prohibiting year-round occupancy. In the interim community floodplain management ordinances should apply.[19]

The EPA's regulations for the Resource Conservation and Recovery Act (RCRA) on permitting hazardous materials treatment, storage, or disposal facilities have locational standards; but these standards appear inconsistent with the EO guidelines for critical actions.[20] The EPA, in draft regulations (1978), proposed design standards for facilities located in the 500-year floodplain. Public comment on the draft reflected difficulties with identifying the 500-year floodplain and a concern that EPA was holding these facilities to a higher standard than that required by EO 11988. The final regulations addressing flood design require that no wash out of hazardous materials occurs. Therefore they apply only to those facilities located in areas with a 1 percent annual chance of flooding.[21] The EPA requires that permitted facilities have contingency plans addressing notification and response for any unplanned sudden or non-sudden release. The regulations do not specifically require that the plans address flooding events, even for facilities in areas with 1 percent annual chance of flooding where an obvious cause of releases could be flooding.[22] Furthermore, there exists no feedback mechanism regarding plan effectiveness in the event of a hazardous material release.

Recommendation 5.1: *Revise the RCRA locational standards and contingency planning regulations for consideration of flood hazards in areas impacted by the Standard Project Flood.*

Revision of the site regulations to recognize that releases of hazardous materials are critical actions for which "even a slight chance of flooding is too great" would provide a greater level of environmental protection and public health and safety and would be consistent with implementing guidelines for EO 11988.[23] Revision of the EO would automatically trigger this action. Specifically requiring contingency plans to reflect the special activities and coordination required in the event of flooding would also decrease the risk of hazardous material releases and enhance governmental response. An additional requirement for review of contingency plans after hazardous material releases would provide the means to enhance pre-disaster planning.

STATES LEAD THE WAY

The state should be the entity best able to coordinate the overall watershed and floodplain management activities occurring within its borders. Communities deal with local problems and solutions. Active involvement by the states is necessary to develop flood-reduction projects consistent with multiple floodplain and watershed management goals as well as other state natural resource and economic goals. States need to be more involved in setting floodplain management priorities, adjudicating intrastate issues regarding priorities and determining impacts of floodplain management projects, and in brokering federal

assistance. Currently, the extent of state involvement in locally sponsored flood-reduction projects is highly variable, ranging from requiring approval of the governor at the end of project planning to multiple agency collaborative commitment throughout project planning. In many areas state-level leadership and coordination is vital: floodfighting, repair activities, buyouts, hazard mitigation, and permitting of levees and other structures that impact beyond the local area. State involvement in levee programs should be increased. The Association of State Floodplain Managers notes that only 16 of the contiguous states regulate levees -- five of which are Midwest states.

State floodplain management programs vary within the region and the nation. Several of the states in the upper Midwest are pioneers in floodplain management and have programs that pre-date the NFIP. These states have adopted floodplain management laws and minimum floodplain management regulations implemented with state funds. They provide technical assistance to communities and undertake other activities that are critical to achieving the vision articulated in this report. Other states in the region have minimal state floodplain management programs. In these states floodplain management is often incidental to other resource and emergency management. Appendix F summarizes state floodplain management activities.

Prior to the 1993 flood, states took little cognizance of the fact that many levees had been dropped from the USACE emergency levee repair program. States need to be more involved in coordinating floodfight to ensure that these efforts do not harm other parties, that they are focused to ensure greatest public benefit, and that they have no long-term adverse effect on floodplain management. Several midwestern communities noted that because they did not belong to a levee district offering some level of protection, they were not involved in levee maintenance or floodfight decisions. State involvement could raise community issues to the attention of federal officials. State involvement in coordinating levee repairs needs to be enhanced. Some states did not assume an active role, so the USACE and USDA levee repair programs had to work directly with local entities. An example of more appropriate state involvement is the PL-566 watershed program wherein each governor makes recommendations and sets priorities for proposed local watershed projects.

Increasing state involvement will require greater state technical capabilities in floodplain management. Few incentives exist, however, for the state to build this expertise. The federal government currently provides technical assistance directly to local entities and/or states through the USACE Floodplain Management Services and Planning Assistance to States programs, the SCS PL-566 Program, and the Tennessee Valley Authority (TVA) programs. Provision of technical assistance directly to individuals and local communities does not build and, in fact, detracts from state capabilities. The FEMA Community Assistance Program provides technical assistance to local entities through the states. The TVA, in a self review to increase customer service, determined that provision of assistance directly to individuals was not the most efficient use of federal resources and decided to focus its assistance on states.[24]

Recommendation 5.2: *Increase the state role in all floodplain management activities including, but not limited to, floodfighting, recovery, hazard mitigation, buyout, floodplain regulation, levee permitting, zoning, enforcement, and planning.*

A shift towards a state role from what is now primarily a federal-local relationship is necessary to set priorities, adjudicate intrastate issues regarding priorities and impacts of floodplain management projects, and broker federal assistance. This could be accomplished for all federally assisted or funded floodfight, repair and recovery, flood damage reduction, and other floodplain activities by requiring:

- State sponsorship or co-sponsorship in conjunction with local sponsorship or
- Prior state approval.

The non-federal cost share could be provided by either or both the state or local entity or both.

Recommendation 5.3: ***Restructure and refine the scope of federal technical services programs and increase funding for the USACE in the areas of Floodplain Management Services and Planning Assistance to the States programs and increase funding for states through the FEMA Community Assistance Program.***

By altering the focus of technical and planning assistance for floodplain management from individual and local assistance to state assistance for coordinated dispersal to local areas, federal programs can create an incentive for states to build these types of expertise. Federal information transfer and training for the states for subsequent transmittal to local governments are far more efficient uses of federal expertise and limited federal funds because the same information reaches more people and provides a public service. In its most recent testimony to Congress, the Association of State Floodplain Managers indicated that floodplain management funding and planning assistance for states are not sufficient to provide dissemination of critical data necessary to support sound decisions at the local and state level. This viewpoint was echoed by state officials in the Midwest. The federal government receives far more requests for assistance from local governments and individuals than can be accommodated given current funding constraints. The inability to provide assistance in some situations can lead to inappropriate floodplain development decisions and, therefore, increased long-term costs. Additional funding would allow federal agencies to provide and analyze pertinent data necessary for state and local governments to make sound floodplain management decisions.

INCREASE THE STATE-LOCAL STAKE IN FLOODPLAIN MANAGEMENT

Ultimate responsibility for floodplain management rests with individuals and local government through local land use planning decisions. The federal government must ensure that it provides incentives for, and no disincentives to, community-based floodplain management. Cost-sharing is essential to maintain the state and local stake in all floodplain management activities and should be retained.

In the series of recent disasters impacting large populations (i.e., Hurricane Andrew, the Midwest flooding, and the Northridge earthquake), non-federal cost-share requirements were decreased to respond to state and local financial constraints. Disaster-specific changes in federal/non-federal cost-share percentages for FEMA disaster assistance programs may have an adverse effect on floodplain management. The federal-state cost-share originally 75/25 was adjusted for all three disasters to a 90/10 basis. These cost-share changes have two potentially significant consequences. First they set up an expectation of similar treatment in subsequent disasters and increase political pressure to provide a lower non-federal share. This perpetuates the dominant federal role in recovery and increases federal costs. Second they may defeat the fundamental purpose behind cost-sharing which is to increase the amount of local involvement, responsibility, and accountability. By lessening the non-federal investment, state and local governments have less at stake and, therefore, may have a lower incentive to develop and adopt sound floodplain management policies and practices.[25] Community consequences for choosing not to participate in the NFIP are limited because FEMA disaster assistance pays for damages to all public (i.e., community) facilities and infrastructure other than buildings regardless of whether a community is participating in the NFIP. In non-participating communities individual citizens suffer the consequences of non-participation by losing eligibility for flood insurance and individual/family assistance related to the repair of buildings, while the community itself suffers lesser consequences. Few, if any, incentives exist for communities to seek private insurance for damages to community facilities; rather, most communities rely solely on FEMA to provide reparation. This is inconsistent with the philosophy that federal disaster assistance should be provided in situations where communities and states, due to the magnitude of damages, will exhaust their resources and not have the capability to recover on their own.

PRIVATE INSURANCE HELPS CITY COVER ITS LOSSES

In July 1993 the Des Moines Water Works was inundated and put out of commission for two weeks. The damage totalled $12 million, $9.9 million of which will be covered by private insurance previously obtained by the water works. This resulted in minimizing federal public assistance costs to $2.1 million. Although the insurance carrier would not renew their insurance, the water works was able to acquire new insurance for the water treatment plant. The new private insurance premium of $1,720 per year purchased $10 million of flood insurance. Subsequent to the flood of 1993, the levees surrounding the plant have been raised six feet and concrete flood gates have been constructed to close the gap made by the roadway into the plant.

Recommendation 5.4: ***Hold FEMA's existing disaster assistance cost-sharing requirements to no more than 75/25; seek to make other agencies disaster programs' cost-share requirements consistent at 75/25.***

By retaining 75/25 as the basic FEMA disaster assistance cost-share for mitigation and disaster, non-federal investments will serve as an incentive for non-federal interests to pursue means to protect those investments through more effective floodplain management. Cost-sharing requirements by other federal programs for floodfighting and repair should be consistent. Circumstances may occur where changes in the cost-share ratio are justified; further evaluation of how to define those circumstances is warranted.

Action 5.7: ***For communities not participating in the NFIP, limit public assistance grants.***

Create additional incentives for communities to participate in the NFIP by limiting public assistance given to non-NFIP communities to rescue and emergency operations only. Participation in the NFIP will help assure that new infrastructure complies with basic floodplain management requirements and does not adversely impact other development.

Action 5.8: ***Encourage communities to obtain private affordable insurance for infrastructure as a prerequisite to receiving public assistance.***

Require a community desiring public assistance to demonstrate that it had done all it could to secure affordable private insurance for public facilities. This would help to increase community responsibility and accountability and would reduce the federal taxpayer burden associated with risky behavior in floodplains.

FUNDING FOR PUBLIC FACILITIES

Concerns have been expressed that the current FEMA public assistance program may provide disincentives for communities to take actions to protect public infrastructure from flood damages or to relocate those facilities out of the floodplain. Public Assistance funds the repair of damaged public facilities under a 75/25 cost share formula (although a 90/10 cost share was used for the Midwest flood). A local cost share of less than the cost of relocating the facility out of the floodplain or protecting the facility from flood damages, creates a disincentive for the community to mitigate. A further concern is that communities may not budget adequate funds for the maintenance and upgrading of infrastructure and other public facilities. When a flood disaster occurs and the facilities are damaged, a portion of the damage may be due to deferred maintenance or to the community's failure to upgrade or properly size the infrastructure. Although FEMA can reduce the amount of the grant to account for deferred maintenance, it is often difficult to make this distinction and the community receives a windfall in the form of a new or repaired facility.

A further problem is that storm and sanitary sewer systems were inadequate to handle the high groundwater and rainfall that occurred in many areas of the Midwest in 1993. This resulted in flooding and sewer back-up into the basements of thousands of homes and businesses. The public assistance program currently will provide funds to repair sewer systems to their pre-flood conditions but not to upgrade those systems so that they are adequately sized to handle similar storm events with minimal damages.

The Review Committee considered a recommendation that all public assistance to communities for the repair or upgrading of infrastructure or other public facilities be in the form of loans rather than grants to remove these disincentives, but loans may not be practicable for a community devastated by a major disaster.

FEMA can provide limited funds through the public assistance program for cost effective mitigation measures that will reduce future damages to a facility. In addition a community can decide not to repair, restore, reconstruct, or replace a facility at its existing location and obtain up to 90 percent of the federal share of repair costs to expand alternate facilities, build a new facility, or fund hazard mitigation measures. However, the community must pay any additional costs to relocate or upgrade the facility. If it can not afford to do so, the facility is then repaired to its pre-flood condition at its current location and remains vulnerable to further flood damage. Some funds may also be available through FEMA Section 404 Hazard Mitigation Grant Program to upgrade these systems. However, these funds are often fully allocated for other purposes and are not available for public facilities.

States and communities should undertake efforts to identify vulnerable facilities in the floodplain. This inventory would help target priorities for pre-disaster mitigation and would be necessary to determine insurance needs.

Action 5.9: *Provide loans for the upgrade of infrastructure and other public facilities.*

A loan program would encourage and enable communities to undertake actions during recovery to reduce future damages to public facilities by relocating or protecting those facilities rather than repairing the facility at its current location. In addition such a program would assist communities to upgrade undersized storm sewer systems or other flood control facilities. Because upgrades are capital improvements that have long term benefits for the community, loans are more appropriate than grants. The loan program can be established to allow flexible terms based on the communities' ability to pay (e.g., zero or low interest rates and long repayment periods). The Administration should seek Congressional action to establish such a program.

PROVIDE A BALANCED FOCUS IN THE PLANNING PROCESS

Federal actions taken to develop water resources reflect the objectives set over several decades by the Congress. Various Administrations have defined federal water resources objectives.[26] The two most significant publications on federal water resources development are *Principles and Standards for Planning Water and Related Land Resources* commonly referred to as *Principles and Standards* or *P&S*, published in 1973, and *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* commonly referred to as *Principles and Guidelines* or *P&G* published in 1983. The *P&S* was a rule applied to water and land programs, projects, and activities carried out by the federal government and non-federal entities with federal financial or technical assistance. The rule guided formulation and evaluation of projects to enhance national economic development (NED) and the quality of the environment. When the *P&S* was superseded by *P&G* in 1983, rules became guidelines. The *P&G* contain a single objective for planning of water resources projects: "contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements." Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. Under *P&G*, alternative plans can reduce net NED benefits to further address other federal, state, local, and international concerns not fully addressed by the NED plan. A plan recommending federal action is to be that with "the greatest net economic benefit consistent with protecting the nation's environment" (the NED plan), unless the Secretary of a department or head of an independent agency grants an exception to this rule. Exceptions require overriding reasons for recommending another plan, based on other federal, state, local, and international concerns. Since 1983, exceptions to the NED plan have been limited.

Calculations of NED are meant to include all environmental and social benefits and costs for which monetary values can be obtained. The monetary focus on NED, however, does not give adequate consideration to unquantifiable environmental and social values. Because of their non-market nature, environmental quality, ecosystem health, the existence of endangered species, and other social effects are not as easily quantified in monetary values.[27] This limits formulation and acceptance of projects capable of striking a better balance between flood damage reduction or other water resources development and the environment.

Action 5.10: *Establish as the new, co-equal objectives for planning water resources projects under Principles and Guidelines:*

- ***To enhance national economic development by increasing the value of the Nation's output of goods and services and improving national economic efficiency, and***
- ***To enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of natural and cultural resources and ecological systems.***

The current national economic development objective of the *P&G* should be revised immediately through the issuance of an executive order. This will provide a balanced focus for guiding decision making.

Update *Principles and Guidelines*

The *P&G* is now more than ten years old, and several areas are in need of thorough review. Critics of the *P&G* see a bias toward structural solutions to flooding problems and a failure to evaluate nonstructural alternatives in the same way as structural alternatives, such as levees. One of the differences in the evaluation is that for structural alternatives the reduction in flood

damages is included as a measure of the benefits of a project, while for some nonstructural alternatives, such as evacuation of structures from the floodplain, reduced damages must be separated into internalized and externalized damages. Then, only the externalized damages prevented (those borne by other than the floodplain residents) are claimed as benefits for the nonstructural evacuation alternative. There is an economic rationale for doing this, but the concern still exists that it results in a bias against nonstructural projects. In addition, many social benefits of removing people at risk from the floodplain and environmental benefits of a natural floodplain are not included adequately within the evaluation. Although the *P&G* does not exclude these considerations, application deficiencies exist because of the non-market nature of the impacts. Because of these application deficiencies, research is recommended in Chapter 11 to allow greater consideration of difficult to quantify inputs for which no market system exists and to improve techniques for measuring social or environmental outputs that result from alternative actions.

A system-of-accounts analysis can provide critical information on market and non-quantifiable, non-market impacts necessary to provide the basis for trade-offs. Such analysis can support a sound formulation-of-alternatives process that includes the efficient allocation of scarce resources. It includes quantified impacts where available as well as qualitative impacts and displays beneficial and adverse effects of each alternative considered on the following accounts: national economic development; regional economic development; other social effects; and environmental quality of various project alternatives. The *P&G* does not require the system-of-accounts; however, some agencies strongly encourage this comparison of impacts to these four areas within agency rules. The system of accounts or something similar is needed to help ensure balanced planning.

The *P&G* requires the responsible federal agency to contact the governor or designated agency for each affected state before initiating a study. It requires the federal planning agency to provide the state agency or agencies responsible for or concerned with water planning with opportunities to participate in defining the problems and opportunities in scoping the study and in review and consultation. A truly collaborative approach, however, is not required or encouraged. The *P&G* also states that interested and affected agencies, groups, and individuals should be provided opportunities to participate throughout the planning process and that a coordinated public participation program should be established with willing agencies and groups. This falls short of establishing partnerships and collaborating within an ecosystem context on major watershed efforts. Benefits of collaborative approaches include improved efficiency and cooperation (both within and across agencies) and improved service to the public. The approach also serves to crystalize public opinion regarding problems and builds consensus for solutions. Criteria should be established to indicate where collaborative approaches are appropriate and recommend a mechanism for implementation to include single or separate agency funding of participation in the collaborative efforts. For cost-shared feasibility studies, a determination should be made as to whether it is reasonable to require participation in collaborative funding by the non-federal cost-sharing sponsor.

The *P&G* provides an overriding philosophy and process for formulating alternative plans and weighing the impacts of each alternative to select a recommended plan for meeting the study needs. The requirements of the NEPA are included as part of the *P&G* process. This process can be applied to all federal agency evaluations of alternatives to most efficiently allocate scarce resources to meet the needs of the nation.

SHIFTING THE PROJECT ANALYSIS PARADIGM

Utilizing benefit-cost analysis under the existing system, net monetary benefits must exceed zero. Under the proposed approach, the sum of net monetary benefits and society's value of net nonmonetary benefits must be greater than zero.

Currently the only federal agencies required to use *P&G* are the USACE, the SCS, the TVA, and the Bureau of Reclamation. To increase efficient resource allocations, *P&G* should be extended. It should apply to the planning and evaluation of the effects of water and land programs, projects, and activities carried out by the federal government and by the states or other entities with federal financial or technical assistance.

Action 5.11: ***Establish an interdisciplinary, interagency review of the P&G by affected agency representatives to address:***

- ***Structural versus nonstructural project bias;***
- ***Inclusion of system of accounts or a similar mechanism for displaying impacts;***
- ***Inclusion of collaborative planning in an ecosystems context for major studies; and***
- ***Expansion of the application of the revised P&G to water and land programs, projects, and activities to include:***
  - ***All federally constructed watershed and water and land programs;***
  - ***National parks and recreation areas;***
  - ***Wild, scenic, recreational rivers and wilderness areas;***
  - ***Wetland and estuary projects and coastal zones; and***
  - ***National refuges.***

An interdisciplinary, interagency committee of individuals from potentially affected federal agencies should be established to focus on the new broadened objectives, and to make specific recommendations for revisions to the current *P&G*, based on the four areas identified above and any others as appropriate. Revisions must be consistent with the intent of EO 12893, Principles for Federal Infrastructure Investments, and EO 12898, Environmental Justice, both issued in 1994. This committee should be convened as soon as possible with a goal of making all necessary revisions by December 1994. To ensure that coordination of planning principles occurs at the state, tribal, and local level and that a balanced approach is taken, any revisions to *P&G* should be published and provided for public review and comment prior to finalizing.

COLLABORATIVE EFFORTS

Ecosystem, watershed, and large-scale river studies lend themselves to collaborative approaches by virtue of their scope. Only by working in partnerships with other federal agencies, state agencies, tribes, local governments, and private organizations can individual agencies look beyond their defined missions. A collaborative approach in an ecosystem context is needed for major watershed and floodplain management planning to move agencies away from single-agency problem solving. A more comprehensive evaluation of problems and solutions is likely if a collaborative approach includes governmental parties at all levels as well as public and private stakeholders. Such collaborative partnerships also constitute a means of leveraging limited funds to implement projects with multiple benefits. Collaborative efforts require more than consultation, coordination, and seeking public input; they require a commitment to working collectively to solve complex, interrelated concerns.

The ongoing USACE 18-month Floodplain Management Assessment study provides an opportunity to include other agencies as partners in a collaborative atmosphere. The study is being coordinated with

federal agencies, many of which would prefer to participate as a partner in the Assessment. By redirecting the current planning process, the Assessment can become a partnership of federal agencies in a collaborative effort to assess the floodplain management objectives of the basin. Funding for this collaborative planning effort may necessitate a supplemental appropriation. If necessary, funds would be dispersed at the discretion of USACE, the lead agency, after consultation with collaborating agencies. If the supplemental request is not approved, USACE should provide the opportunity for other agency collaboration at the expense of each individual agency. Active involvement by multi-agency participants in all aspects of the USACE Floodplain Management Assessment would ensure a holistic review of the area's floodplain management issues. A collaborative approach would identify a broader set of alternative solutions that address problems or multiple state and local objectives. It would build greater trust in and support for findings and recommendations of the Assessment.

In keeping with the trend toward ecosystem- or watershed-based planning federal agencies are expected to work as partners or to collaborate. Currently funding constraints limit the ability or most federal agencies to participate without reprogramming their funds. The USACE districts are particularly limited by the project-specific nature of their funding. Feasibility studies are cost-shared with the non-federal sponsor on a 50-50 basis, and partner interests are more likely to be limited to the study area than to the entire watershed. Additional funding is needed for all federal agencies for the purpose of collaborative planning. While it will cost more initially, collaborative planning is an investment in the future that will reduce future project-specific planning expenditures.

Recommendation 5.5: *The Administration should seek increased funding for federal agencies to support collaborative planning participation with other federal agencies.*

For major ecosystem or watershed planning studies, the lead federal agency should budget for adequate funding to reimburse other key federal agencies for their collaborative participation. Studies that are not watershed in scope or that have not been adequately funded to support a multi-agency collaborative effort may require that individual agencies budget their own participation monies.

Programmatic NEPA Documents

The Review Committee heard comments that requiring independent NEPA documents on similar but individual projects can be an inefficient and time-consuming approach to decision making. Efficiencies can be realized by analyzing all the anticipated actions as a group and applying NEPA on a programmatic basis before proceeding on individual projects requiring site-specific NEPA compliance. Application of multi-agency programmatic environmental impact analyses performed at the watershed scale allows agencies to focus on issues that are geographically related or have timing, impact, or other subject matter similarities. In addition the programmatic NEPA process provides a formal public involvement mechanism to address strategic decisions. Subsequent impact analyses would only focus on project-specific purposes and needs and those issues in need of decisions.[28] Where subsequent plans are consistent with the programmatic analysis, further analysis would be focused, costs reduced, and planning made more efficient.

The Council on Environmental Quality (CEQ) needs to actively pursue use of programmatic NEPA documents and issue a directive to agencies to also increase their emphasis on this approach.

Recommendation 5.6: *Promote the use of programmatic NEPA documents in the planning process.*

A workshop should be sponsored on strategic and programmatic application of NEPA by the CEQ so that success stories in this area can be shared. This will build knowledge about the applicability of these approaches, their utility, and the means of undertaking broad program-level analyses. The CEQ should explore other means to pursue strategic and programmatic analysis of problems.

Federal Agency NEPA Participation

Currently lead agencies designate those agencies that should cooperate in the NEPA process. Where agencies have not been designated by the lead agency but specifically request participation due to a vested interest, these agencies should be allowed to cooperate in the process. No mechanism exists to require the lead agency to include these other requesting agencies in the process. The CEQ should revise the regulations implementing NEPA to require the lead agency to designate those federal agencies formally requesting cooperating agency status, where appropriate. This would further the goal of establishing collaborative planning among pertinent federal agencies.

REEVALUATING WATER RESOURCES PROJECTS

Many of the nation's water resources projects were constructed a number of years ago. The Review Committee heard concerns that: (1) these projects will eventually need major maintenance expenditures, (2) conditions have changed that make them less effective (such as headwaters development that increases runoff and flood stages causing protection downstream to be lessened), and (3) consideration is not adequately given to changing societal goals with regard to potential modifications to the projects themselves or modifications in the operation of them.

Recommendation 5.7: ***OMB should issue a directive that requires periodic reevaluation of federal water resources projects to include potential operation and maintenance modifications.***

Projects for which construction was completed 40 or more years ago should be reevaluated to consider potential project modifications and insure project integrity. Other projects less than 40 years old should be reevaluated when known major problems exist, where conditions have changed that impact the effectiveness of the project, or where changing societal goals demand that modifications be considered. Specific procedures tied to the new *P&G* should be established and a directive issued by OMB. Legislation should be provided in a Water Resources Development Act or other act to give water resources construction agencies the blanket authority to address these issues, where appropriate, without the need for project-specific study authorizations by Congress.

FUNDING CONSIDERATIONS FOR PROJECTS THAT INCLUDE FUTURE DEVELOPMENT

Some flood damage reduction projects, in their effort to reduce damages for existing floodplain structures, also provide protection for undeveloped land areas that have a high potential for future development. In these cases, future development savings resulting from the project are estimated and included in the benefit-cost ratio. A separate accounting of existing and future benefits is required by *P&G* to provide decisions makers with the information necessary to make informed decisions. The total benefit-cost ratio, however, is reported in the feasibility report and usually used for budgetary considerations in establishing funding priorities.

Recommendation 5.8: ***OMB should use only the benefit-cost ratio for damage reductions to existing development in establishing Administration funding priorities unless a standard project flood level of protection is provided.***

The Office of Management and Budget should give more detailed consideration to the type of project benefits being claimed for each individual project recommendation. Future development benefits should not be used as the basis for increasing the funding priority of flood damage reduction projects unless a standard project flood level of protection is provided.

ENDNOTES

1. White, Gilbert, et al., *Action Agenda for Managing the Nation's Floodplains*. Special Publication 25. (Boulder, CO: National Hazard Research and Application Information Center, March 1992).

2. Ibid, page 4-5.

3. National Flood Insurance Act, PL 90-488 (Section 1302(c)) 1968. The "Unified National Program for Floodplain Management" report has been submitted to Congress in 1979 and 1986 and is planned for submittal in 1994.

4. *Action Agenda for Managing the Nation's Floodplains*, page 8.

5. *Ibid*, page 4.

6. Concern was expressed to the Committee regarding the magnitude of the federal interest.

7. Water Resources Planning Act of 1965, 79 Stat. 244, 42 USC 1962, 1965.

8. Ibid.

9. *Action Agenda for Managing the Nation's Floodplains*, page 9.

10. Water Resources Planning Act of 1965,

11. Executive Order 12319 -- River Basin Commissions, September 9, 1981.

12. National Fish and Wildlife Foundation, Mississippi River Initiative Part II: After the Flood, (Washington, DC: National Fish and Wildlife Foundation March 1994).

13. Historically revenues of the Upper Mississippi River Basin Commission were shared between the federal government and the participating states. Generally the federal share ranged from 50 to 75 percent of each years revenues; an even larger federal proportion occurred when the WRC funded preparation of a Master Plan in 1980; Stoerker, Holly, Executive Director, Upper Mississippi River Basin Association, personal communication May 5, 1994.

14. For example, see Federal Interagency Floodplain Management Task Force, *Floodplain Management in the United States: An Assessment Report*, FIA-18. (Washington, DC: Federal Insurance Administration,June 1992).

15. Association of State Floodplain Managers, Inc., *Floodplain Management 1992: State and Local Programs.* (Madison, WI:ASFPM, 1992).

16. U.S. Water Resource Council, "Floodplain management guidelines for implementing EO 11988", 43 *Federal Register* 6030 (Part II, Step 1, Section 1(c)). February 10, 1978.

17. *Several examples were provided by Kucera, Ron, Director, Intergovernmental Cooperation, Department of Natural Resources,* MO, personal communication March 3, 1994. Bachant, Joe, Department of Conservation, MO, personal communication March 3, 1994.

18. Zensinger, Larry, Coordinator, Midwest Acquisition Relocation Program, Federal Emergency Management Agency (based on analysis performed by Miriam Anderson, St. Charles County Planning Department), personal communication April 28, 1994.

19. The U.S. Department of Justice indicated to the Review Committee that state and local floodplain management requirements can apply to structures on lands leased from the federal government.

20. "Floodplain management guidelines for implementing EO 11988."

21. 40 CFR 264.18. Wright, Felicia, EPA Office of Solid Waste, personal communication April 26, 1994.

22. Ibid.

23. Floodplain management guidelines for implementing EO 11988.

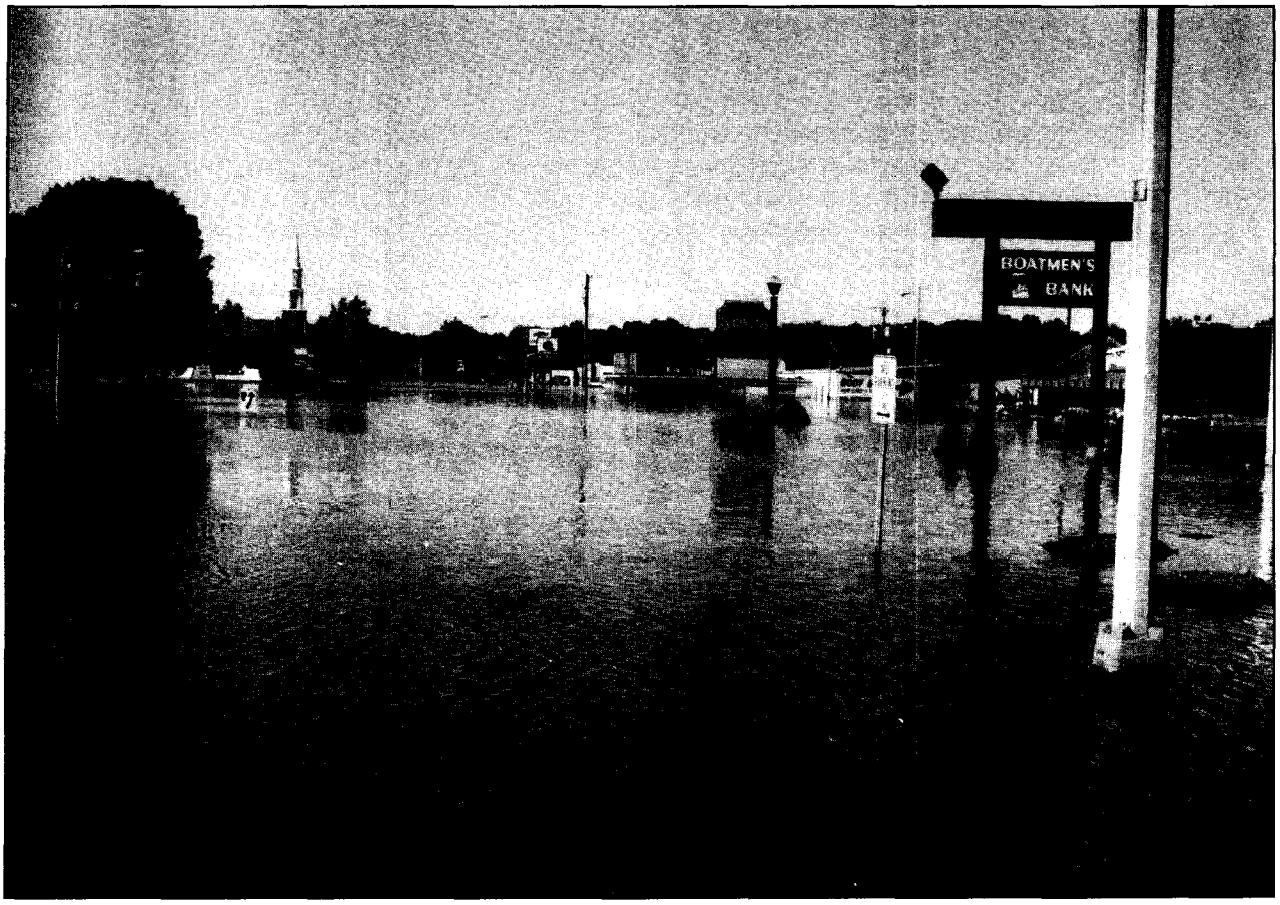
24. Miller, Barbara A. Manager, Flood Risk Reduction, Tennessee Valley Authority, personal communication February 22, 1994.

25. The Economics Advisory Group pointed out to the Review Committee that optimal cost-share payments should reflect the relative net benefits gained by federal, state, local, and individual interests. If such a cost-share program could be implemented, project costs would be allocated in proportion to the benefits that were accrued by each party.

26. Some objectives are defined in laws such as PL 74-738, PL 89-80, the Water Resources Planning Act of 1965; the Flood Control Act of 1936; and the Water Resources Development acts. Some are defined in Congressional Reports, such as the 1958 the report to the Inter-Agency Committee on Water Resource "Proposed Practices for Economic Analysis of River Basin Projects;" and the 1962 "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for use and Development of Water and Related Land Resources," commonly referred to as "Senate Document Number 97".

27. The Economics Advisory Group pointed out that there methods exist for quantifying and monetizing environmental benefits and costs, but these methods frequently cannot be used because of the lack of an accurate characterization of the biological effects of environmental changes.

28. Council on Environmental Quality, ***Regulations for implementing the procedural provisions of the national environmental policy act,*** 40 CFR Part 1502.20, (Washington, D.C.: CEQ,1986).


BOATMEN'S
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Chapter 6

AVOIDING VULNERABILITY THROUGH PLANNING

Throughout human history it has been the way of nature to visit us on occasions with disaster, without apparent cause, without explanation, often without mercy, always reminding us that we need to live our lives with a little more humility and always understanding that we are not in full control...We know we cannot contain the fury of a river.

President Clinton
Remarks on signing flood relief legislation at a tribute to flood heros in St. Louis, Missouri, August 12, 1993

The goals of floodplain management are to reduce the nation's vulnerability to floods while concurrently integrating preservation and enhancement of the natural resources and functions of the floodplain. The basic tenet of reducing vulnerability is to avoid risks as much as possible in the planning stage. Moving people out of harm's way or limiting development in the floodplain lessens risks from flood damages. Planning on the watershed level can balance competing and compatible uses of the floodplain to meet social, environmental, economic, and other community goals.

For planning to be effective, it needs to be coupled with an educational program for local people involved with planning activities as well as landowners. Once communities and individuals understand the residual risk inherent in floodplain use, and once they understand how natural and hydraulic systems operate, they can make more informed decisions that balance multiple objectives.

With planning and education as the cornerstones of floodplain management, the nation can further reduce risks through watershed management, programs such as the NFIP, and acquisition of floodprone lands. By pursuing planning efforts in a collaborative and coordinated fashion, the nation can reduce its vulnerability to flooding substantially.

MANAGING FLOODPLAINS AS WATERSHED COMPONENTS

What happens in the larger watershed affects what happens in the floodplain. The upper Mississippi River Basin consists of watersheds of varying size. Each watershed is a physically discrete hydrologic unit in which water is channelled from upland areas to lower areas and eventually into main stem rivers. The flood stage, frequency, and duration normally are influenced by the degree to which rainfall is captured and released in the uplands. As discussed in Chapter 2, wetland restoration and maintenance and upland treatment can be effective for smaller floods with lesser impacts on larger floods. The correlation between upland rainfall

capture and release and downstream flood stage, though complex and incompletely understood, indicates that well-managed watersheds reduce downstream flood stages with concomitant reductions in flood damages and increases in water quality and ecosystem benefits.

A number of Midwest communities flooded in 1993 reported to the Review Committee that they perceived an increase in flood stages and frequencies over the past few decades. Some attribute this to structural flood control (levees), and others to changed land use practices in upland areas of the watershed. Among the changes they mentioned were agricultural development and paving of residential and industrial areas -- both of which reduce storage capacity and increase runoff. People rarely consider the downstream cumulative effects of individual activities, in large part because watersheds typically encompass a number of political jurisdictions with differing economic interests.

Watersheds have long been recognized as the optimal management unit for water resources planning. As early as the 1970s, the USACE was performing analyses of water quality and supply using watersheds as the basic planning unit.[1] The USDA for decades has recognized benefits of watershed planning under its PL 566 program and through the Forest Service.[2] More recently within the Department of the Interior, the National Park Service and the Fish and Wildlife Service have instituted watershed management programs, and the Environmental Protection Agency has begun using watersheds as the most practical unit to resolve problems that traditional programs have been unable to address adequately.[3]

Federal watershed programs and policies suffer from a lack of coordination and a failure to develop achievable multiple objectives. Many of these programs focus exclusively on water quality or habitat improvements derived from watershed management but disregard flood damage reduction benefits. Federal watershed programs primarily operate in rural areas, neglecting non-agricultural urban and suburban land uses. Program eligibility requirements and incentives also differ among agencies. The regional structure of most federal agencies, tied to state boundaries, complicates the ability to focus on watersheds.

Any pending legislation dealing with watershed planning and management should consider achieving multiple objectives, including flood damage reduction as an element of watershed management and incentives based upon demonstrated flood reduction. Legislation should also consider opportunities to trade for flood control, such as payments from floodplain farmers to induce upland farmers to install land-management practices that reduce flood peak and frequency. Currently, pending legislation (S. 2093, formally S. 1114; President Clinton's Clean Water Initiative; and H.R. 3948)[4] considers the achievement of multiple objectives for watersheds, although flood control management activities and incentives are not explicitly stated.

The best parts of federal programs must be merged to encompass a holistic and synergistic approach to watershed management. Opportunities for change include current congressional action on the Clean Water Act and reauthorization of the Farm Bill due in 1995. To capitalize on potentially forthcoming legislative authority, the federal government must build upon ongoing watershed programs, focusing on the most effective means of achieving multiple objectives, and targeting conservation programs to complement watershed management goals.

Action 6.1: *The Administration should establish an interagency task force, jointly chaired by the USDA and EPA, to formulate a coordinated, comprehensive approach to multiple objective watershed management.*

Many federal agencies undertake watershed programs to achieve goals consistent with their primary mission. Such goals may be inconsistent with local, regional, or basin-level ecosystem needs. Currently, success is measured by achieving agency goals irrespective of other attainable benefits. For example, the Forest Service watershed program seeks to improve stream habitat through reduced siltation and temperature reduction. Success is measured by increases in fish population. Flood damage reduction and water quality -- goals that could be accomplished with small incremental expenditures of expertise and money -- are not factors in determining program success.

The recommended task force would provide an overview of federal watershed management programs to ascertain their effectiveness and identify areas for improvements. The task force will necessarily include the USACE and the DOI due to their missions and jurisdiction in water resources activities. Task force members could identify areas in which interagency missions coincide and are achievable through watershed management on a collaborative level. The task force should also follow up on the demonstration project discussed in Chapter 11 under the section on hydrologic and hydraulic benefits of natural floodplain functions.

Enhancing Stream and Riparian Areas

Stream and riparian restoration vital to watershed management holds, for a relatively small investment, promise of improved water quality, wildlife habitat, and reduced runoff. Federal efforts designed to restore non-urban stream and riparian areas include those of the Bureau of Land Management, the National Park Service, the Soil Conservation Service, and the Forest Service. Nonprofit groups and private and local interests have also focused on similar activities. Unfortunately many stream and riparian sites located within urban and suburban areas are degraded, undervalued, and ignored by federal programs. Properly restored urban streams provide the same benefits as restored rural streams, often becoming centerpieces for urban revitalization. Recognizing the need for stream and riparian restoration, Congress recently introduced legislation to establish a national urban watershed restoration program.[5] On the national level, current stream and riparian restoration is largely uncoordinated; federal expertise is decentralized and underutilized; and valuable information on costs, techniques, and effects is unavailable.

Action 6.2: *The DOI, USDA, and EPA should coordinate and support federal riverine and riparian area restoration.*

Because of the importance of stream and riparian restoration to water resource management, the Administration should establish a stream and riparian restoration program with the DOI, USDA, and EPA cooperating to provide technical assistance for state, tribal, local, and private restoration.

Enhancing Agricultural Conservation Programs

The Food Security Act of 1985, and the Food, Agriculture, Conservation, and Trade Act of 1990, the last comprehensive congressional actions on agricultural policy, contained strong conservation measures to reduce soil loss and improve water quality by creating incentives and disincentives, primarily through cross-compliance with other agricultural programs. Two programs were of particular importance: the Conservation Reserve Program (CRP), introduced in 1985, provided payments to farm operators who agreed to protect temporarily highly erodible lands, and the Wetland Reserve Program (WRP), established in 1990, acquires conservation easements on agricultural lands from voluntary sellers and restores wetland conditions. About 36.4 million acres currently enrolled in the CRP will begin to come out of the program in 1995. Even with application of conservation practices, conversion of these acres to cropland will increase runoff.

The emergency supplemental appropriation for the Midwest floods established an Emergency Wetlands Reserve Program (EWRP) applicable to farmland damaged by flooding in the nine affected Midwest states. The Review Committee suggests that the authority for the EWRP be continued in some form to provide an alternative means of recovery for farmers. Other programs within the Agricultural Resource Conservation Program of the USDA also are used to protect wetlands from development and degradation.

The USDA found many acres that met program criteria, but funding constraints precluded enrolling all of the eligible land. Conservation programs need to target limited funds to acquire critical lands that offer the greatest benefits per federal dollar. Present selection criteria, which consider natural characteristics on a site-by-site basis, do not recognize flood control benefits as an objective. Other benefits of the programs are well documented.[6] A systems approach to watershed management would consider a wider range of environmental objectives within enrollment criteria.

Action 6.3: ***The Administration's legislative proposals for the 1995 Farm Bill should support continuation and expansion of conservation and voluntary acquisition programs focused on critical lands within watersheds. The proposal should support technical and financial assistance for implementation of watershed management, riparian enhancement, wetland restoration, and upland treatment measures.***

STREAMLINING DISASTER PLANNING

A floodplain management plan that attains the national goals described in Chapter 4 is dependent on the ability to tie together pre-disaster, response, recovery, and mitigation programs with long-term floodplain planning efforts. Many federal agencies have programs designed to help disaster-stricken areas. Such programs can be improved by streamlining the system so that pre-disaster and post-disaster efforts are natural extensions of each other. Comprehensive pre-disaster planning and mitigation efforts will reduce risks and damages during the emergency, and recovery efforts will be consistent with long-term floodplain management goals. Improvements in federal coordination made before the 1993 flood led communities to report that things worked "better than expected."

Pre-Disaster Planning

Pre-disaster planning needs to coordinate individual, business, community, state, tribal, and federal personnel and activities to minimize health and safety impacts and environmental risks. Such planning will help ensure adequate response. Awareness of flood threat, the first step in pre-disaster planning, relies on individuals who understand their risk and plan for disasters. Individual responsibility in knowing what to do, such as closing household gas lines, and when and where to evacuate in the event of a flood or other emergency is essential. The Review Committee heard from communities where owners did not remove mobile home trailers on wheels and farm equipment from low-lying areas. Some individuals refused to evacuate voluntarily when access was open and later required evacuation by air or boat, endangering both themselves and their rescuers. For better participation by individuals in pre-disaster planning, federal agencies must undertake education and outreach.

Pre-disaster planning is also a corporate responsibility. Operators of facilities generating, storing, or disposing of hazardous materials -- including farmers who use herbicides, pesticides, and fertilizers -- need plans for removing such materials should the facility lack the capability of assuring that no materials will be released. Local emergency managers need to be aware of locations of hazardous materials within their jurisdiction; local hospitals, fire companies, and others potentially involved with response need to be knowledgeable about threats posed by hazardous materials, their treatment, containment, and removal in the event of an unplanned release. Several emergency managers working in the Midwest flood reported the need for more pre-disaster information about facilities where hazardous wastes are generated, stored, and disposed. Siting issues should go hand in hand with pre-disaster planning.

Planners also need to consider how to safeguard valuable assets, such as cultural and historical properties. Communities should identify these properties prior to a disaster and coordinate with emergency managers, local government officials, federal agencies, and others following an event.

Pre-disaster planning requires action, involvement, and cooperation among not only floodplain residents, tribes, businesses, and industries but also across local, state, and federal government agencies. Application of advanced geographic information systems technology will increase efficiency and facilitate coordination.

Recommendation 6.1: *Enhance pre-disaster planning and training.*

The FEMA, in coordination with the EPA, USACE, USDA, DOT, and other federal agencies involved with aspects of emergency response, should increase state, tribal, local, public, and corporate awareness of risk. Those involved should practice implementation of pre-disaster plans. The EPA should work with the FEMA and states to emphasize local pre-disaster planning, including notification and coordination procedures for responding to releases of hazardous materials. Pre-disaster plans for spilled hazardous materials must identify suitable containment areas and develop a coordinated response of the emergency network. All agencies should encourage the use of geographic information systems to link data sources.

FLOODPLAIN PLANNING AND THE NATIONAL FLOOD INSURANCE PROGRAM

The National Flood Insurance Program (NFIP) is a primary component of the nation's floodplain management strategy. The Congress created the NFIP in 1968 in response to mounting flood losses and escalating costs to the general taxpayer for disaster relief. Federal flood insurance is available only in communities that adopt and enforce floodplain management regulations that meet minimum NFIP requirements.

Building on NFIP Floodplain Management Requirements

The NFIP provides a framework for protecting new construction from flood damages through its floodplain management requirements that communities adopt and enforce as a condition of program participation. New and substantially improved residential buildings must be elevated to or above the elevation of the 100-year flood and non-residential buildings must be elevated or floodproofed at least to that elevation. Flood insurance premiums support floodplain mapping. In riverine floodplains, encroachments in the floodway are prohibited if they will result in any increase in flood stages. This limits development in areas of the floodplain adjacent to the river channel.

Flood insurance rates reinforce NFIP floodplain management requirements. Rates on new buildings are actuarial (based on the risk of flooding). When a structure is built in compliance with a community ordinance, the flood insurance premium is generally affordable. When a building violates a community ordinance, the flood insurance premium can increase to thousands of dollars a year or the building can be denied insurance at the request of the community.

In the Midwest, the NFIP tends to discourage floodplain development through the increased costs in meeting floodplain management requirements and the cost of an annual flood insurance premium, although this may not be the case elsewhere in the nation. Individuals and developers appear to choose locations out of the floodplain to avoid these costs. Developers have the added incentive of wanting to avoid marketing floodprone property. Many communities visited by the Review Committee actively discourage floodplain development.

The NFIP, however, has its limitations. NFIP requirements are minimum standards applied throughout

the nation in areas subject to very different flooding conditions. Requirements that are reasonable and prudent in some parts of the nation are not reasonable in others. As a result minimum standards tend to be just that. An example of a requirement that might be reasonable to apply in some areas of the country but not in others, is access to subdivisions and other new development at or near the elevation of the 100-year flood. While access to buildings may not be a critical issue in areas of the country subject to shallow or short-duration flooding, it is critical in the bottomlands of the Mississippi and Missouri rivers. A home elevated to above the flood elevation is of little use to a family if the house cannot be occupied for weeks at a time because it is cut off by floodwaters. Provision of emergency services to these areas also can be a burden on a community. These issues are best addressed at the state or community level, not through a minimum federal regulation. Several states in the Midwest have more restrictive state floodplain management regulations that address a number of these issues.

NFIP requirements dictate how the structures are to be built to minimize property damage but not whether the location is appropriate given the flood risk and the overall objectives of the community. Because land use planning is traditionally a responsibility of state and local governments, the NFIP does not require that communities undertake these decisionmaking processes that are a necessary part of an effective floodplain management program. Decisions such as subdivision approval and providing capital improvements for roads and sewer, water, and other utilities are critical to the location of development. Such decisions largely determine the uses of the floodplain. Land-use controls, including techniques such as density controls, cluster development, performance zoning, dedication of floodplain lands, and maintenance of greenways and buffers, can result in development that avoids or minimizes impacts on the floodplain but ensures property owners and developers an adequate return on their investment.

The NFIP Community Rating System (CRS) provides discounts on flood insurance premiums in those communities that have floodplain management programs above and beyond NFIP minimum requirements. The CRS recognizes those communities that have developed floodplain management plans and in some instances encourages communities to undertake new floodplain management initiatives. These premium discounts, however, are not sufficient to encourage widespread participation in the Midwest. New initiatives are needed to encourage local floodplain management planning.

Addressing Issues Raised by States and Communities

One state expressed a concern to the Review Committee that NFIP requirements were not being enforced by some communities. Although most communities visited by the Review Committee had little new floodplain development since joining the NFIP, without a review of permit files, it is difficult to determine how well these communities were implementing floodplain management requirements that applied to buildings substantially damaged by the Midwest flood. FEMA regional staff have conducted systematic visits to NFIP communities impacted by the flood to monitor enforcement of local floodplain management ordinances. Preliminary results from these visits indicate that many communities are not enforcing their ordinances adequately, often because they do not understand the program requirements or the long-term benefits of reducing flood damages. This finding indicates the continuing need for federal or state agencies to provide technical assistance to communities and to monitor their compliance. The enactment and funding of the Floodplain Management Act called for in Action 5.1 of this report will enable states to provide significantly increased levels of technical assistance to communities. This assistance will improve implementation by communities of floodplain management programs and compliance with NFIP requirements.

States and communities have suggested that the FEMA amend its minimum floodplain management criteria to provide freeboard and a more restrictive floodway requirement. They also advocate discontinuing the practice of issuing Letters of Map Revision that remove from the floodplain those properties elevated on fill. Other issues of concern include access above the 100-year flood elevation to all subdivisions and other development in areas subject to deep flooding and

appropriate requirements for agricultural buildings. The FEMA should review these issues in the context of its minimum criteria for floodplain management with consideration given to hydraulics and environmental effects.

Action 6.4: *Promote the NFIP Community Rating System as a means of encouraging communities to develop floodplain management and hazard mitigation plans and incorporate floodplain management concerns into their ongoing community planning and decisionmaking.*

Many of the more restrictive floodplain management requirements suggested by states and communities currently are credited by the NFIP Community Rating System (CRS). The CRS provides discounts on flood insurance premiums in those communities that implement floodplain management programs exceeding the NFIP minimum.

The CRS should provide additional credits to encourage comprehensive planning at the community level to incorporate floodplain management into day-to-day decisions on capital improvements and land development.

Action 6.5: *Provide funding for the development of state and community floodplain management and hazard mitigation plans.*

The development and implementation of state and community floodplain management and hazard mitigation plans can reduce significantly federal expenditures for future disasters. Funding should be provided to encourage these planning initiatives. One source of this funding could be a mitigation fund established using NFIP premiums (such as that provided for in S. 1405 and H.R. 3191 both entitled the National Flood Insurance Reform Act of 1994). An additional source of funding could be a portion of the monies appropriated for the FEMA Disaster Fund or other appropriated funds.

Recommendation 6.2: *The FEMA should review its policy of issuing revisions to flood insurance maps which remove property from the floodplain based on fill.*

Under current NFIP policy, if floodplain areas are filled to above the 100-year flood elevation, the property can be removed from the floodplain by revising the flood insurance map for the community. Within these areas, floodplain management measures and the mandatory flood insurance purchase requirement do not apply. This policy may encourage the filling of floodplains by developers to avoid community floodplain management requirements and to assist in marketing floodprone properties. It also may result in individuals making decisions to purchase a property without full knowledge of the residual risk of flooding, the advisability of obtaining flood insurance coverage, or access problems during floods. FEMA's review of this policy should include consideration of all program and engineering issues.

Identifying Those at Risk

State and local officials are concerned that some sparsely populated rural counties with occupied floodplains have not been mapped by FEMA. The agency did not map these areas because their low populations and minimal development did not warrant the expenditure or because base mapping was not available when the initial identification of floodprone communities was made in the mid-1970s. Funding constraints have limited the agency's subsequent ability to map these communities given the priority for communities with more concentrated development. Without floodplain maps federal sanctions do not encourage community participation. In the nine Midwest states, 209 counties have not been mapped, including 108 that were declared as disaster areas due to the 1993 floods.

Action 6.6: *Map all communities with flood hazard areas that are developed or could be developed.*

The FEMA should review floodprone communities that have never been mapped, and map those communities with flood hazard areas that are developed or have potential for development. NFIP communities then would have the information necessary to enforce floodplain management regulations and to ensure that individuals at risk purchase flood insurance. Mapping the floodplain will provide an incentive for non-participating communities to join the program because federal assistance for acquisition and construction of buildings is not available in designated flood hazard areas unless a community is participating in the NFIP.

Improving Accuracy and Timeliness in NFIP Mapping

The nation must have an adequate floodplain mapping program to achieve its floodplain management goals. At the core of any floodplain management program is knowledge of the risk-floodplain boundary and flood elevations.

The flood risk information on the NFIP Flood Insurance Rate Map (FIRM) forms the technical basis for administering federal flood insurance and is utilized nationwide. Since creation of the NFIP 25 years ago, it has identified approximately 22,000 communities as floodprone. Nearly 21,000 of these have been mapped, and over 18,300 are participating in the NFIP.[7]

States and communities indicated to the Review Committee that for some areas, NFIP maps are out of date, inaccurate, take too long to get revised, or may not exist. Others encountered difficulty in obtaining copies of the maps. The program for maintaining and distributing maps is funded entirely by flood insurance policyholders through a $25 surcharge on each policy. The annual mapping budget is $35 million.[8] This surcharge covers administrative costs as well. This funding allows the FEMA to initiate about 250 studies per year and to respond to requests to update maps based on local or state data.[9] A small portion of the budget goes to the digital conversion of the maps. About $4 million annually covers the printing and distribution of the maps.[10]

The FEMA is striving to automate the mapping process as much as possible under current funding constraints. Beginning in FY 1995, all engineering studies contracted by the FEMA will be submitted in digital format. A tool for automated review of engineering models has been developed. The mapping program recognizes the benefits derived from using digital technology but has not implemented it through to the final phase of the map production process. Because a large inventory of old, traditionally mapped FIRMs do not meet national map accuracy standards, the addition of horizontal control to the FIRM has become part of the digital conversion process. The current level of production is slightly over 2,000 digital map panels per year.[11] With current funding and procedures, it would take 40 years to complete the digital conversion of 80,000 map panels nationwide. The FEMA is drafting a plan for flood studies maintenance that would inventory and prioritize nationwide floodplain mapping needs every five years.

Action 6.7: *To improve and accelerate delivery of NFIP map products, the Administration should propose supplementing those funds obtained for floodplain mapping from NFIP policyholders with appropriated funds.*

Current NFIP funding derived from the $25 federal policy charge is not adequate for maintaining and updating floodplain management maps. Raising this surcharge may undermine efforts to market flood insurance and would not be equitable since policyholders are only one user of these maps. Since the maps are critical for floodplain and emergency management, Congress should supplement policyholder dollars with appropriated funds. Flood insurance claims payments for the 1993 Midwest flood totaled $297 million,[12] a small percentage of the federal payments for this disaster. The federal government has an interest in maintaining and updating the NFIP's $1 billion investment in floodplain mapping to ensure that all levels of government and individuals have the information necessary to manage their floodplains and reduce future damages.[13]

USERS AND USES OF NFIP MAPS

WHO	WHY
Communities participating in the NFIP	Enforce floodplain management ordinances
State and local floodplain managers	Enforce regulations and land use decisionmaking
State and local emergency managers	Response and recovery planning
Federal agencies	Compliance with EO 11988
Federal Insurance Administration	Establish insurance rates
Insurance companies and agents	Rate flood insurance policies
Lenders	Comply with mandatory purchase requirement
Designers of floodplain development	Determine design requirements
Disaster response agencies	Coordinate disaster response and recovery
Real estate brokers and agents	Disclosure of the flood risk

Action 6.8: *Utilize technology to improve floodplain mapping.*

The FEMA should investigate alternative methods of expediting the conversion of FIRMs to digital format. Digital conversion will result in a long-term cost savings because of reduced ongoing map maintenance requirements. The digital format will enable the efficient accommodation of large as well as small changes and will result in more accurate maps. Digital floodplain boundary information combined with land parcel records from a community or street address range data, such as are available from the U.S. Bureau of the Census TIGER files, will facilitate applications under floodplain and emergency management. The simplest and most common use is to look up the flood risk data for a specific address. Some areas in which the FEMA would realize savings and increase efficiency are in processing certain revisions, verifying insurance ratings, analyzing repetitive loss data, assuring local compliance, and marketing. Digital FIRMs will also facilitate the completion of a national inventory of floodprone structures, which is recommended in Action 11.2 of this report.

INCREASING EDUCATION AND OUTREACH EFFORTS

If individuals and communities are going to participate in pre-disaster, response, recovery, and mitigation efforts, then awareness of natural hazards should be the first step in pre-disaster planning. This is especially true for flood hazards since individuals have to make decisions that affect their vulnerability. To increase

awareness, the federal government should pursue education and outreach activities.

Because the general populace may not have a complete understanding of natural physical processes, such as the hydrologic cycle and river hydraulics, and of geomorphology, they poorly grasp their vulnerability to flooding and the economic, environmental, and social benefits of alternative strategies to avoid or reduce risk. Unawareness of flood vulnerability results in the inappropriate development of floodprone areas. Another result is that only a portion of the public responds appropriately to flood warnings, and this lack of response can have grave results.[14]

Floodplain information is not distributed widely beyond floodplain regulators, federal and state agencies, and the insurance and lending industries. Many individuals may not even be aware that flood and other hazard information exists for their community. Success stories of local efforts in the area of zoning, pre-disaster planning, biotechnical engineering, and collaborative programs should be distributed and shared with all levels of government in an effort to achieve widespread application of successful floodplain management strategies and tools.

Recommendation 6.3: *Federal agencies involved in floodplain management should include information regarding floodplain management and past and probable future flood heights and extents in their education and public affairs initiatives.*

Floodplain information should be available to the general public in formats that the average person can understand and use. All agencies involved in floodplain management should continue efforts to inform and educate the public about the nature of flood hazards, the natural resources and functions of floodplains, and the various strategies and tools available for comprehensive floodplain management.[15] Agencies should adhere to guidance given in EO 11988 (or in a revised EO on floodplain management) regarding the conspicuous delineation of past and probable flood heights on property used by the general public.

Recommendation 6.4: *State floodplain management officials should encourage local school districts to include natural hazard education in their curricula.*

Education regarding the existence of natural hazards, such as floods, should be introduced into the elementary and secondary education curricula to provide an early awareness and understanding of how and why floods occur. Information should include what to do in the event of a natural hazard emergency. If educated from an early age, adults will be better able to participate in pre-disaster, response, recovery, and mitigation efforts.

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Chapter 7

FOCUSING ON ENVIRONMENTAL ENHANCEMENT

Even before the Great Flood of '93, we had started to realize that some of the areas within our levees should have never been cleared for farming. The events of the last year have driven this point home. Many farmers with marginal and submarginal land are tired of fighting the river and want to find a way to get out from under their financial burdens.

Letter from Union County Board of Commissioners
to U.S. Senator Paul Simon (D-IL), April 1994.

During the 1993 flood, environmental easement and land acquisition programs became tools in assisting recovery and in removing people from long-term flood vulnerability. In addition to meeting the needs of disaster relief victims, these programs can be effective in achieving the nation's environmental goals. Environmental enhancement and mitigation programs essential to ecosystem management are often part of federal development projects. In the past, though, such programs have been delayed, underfunded, or not funded at all. Had they been implemented before the 1993 flood, these programs would have restored natural lands and provided a measure of flood protection through reduced runoff and increased floodwater storage. Environmental mitigation programs also have tended to be site-specific rather than focusing on broader ecosystem goals. This chapter recommends ways to use federal environmental programs in ecosystem management to meet the needs of human development and the environment.

ESTABLISHING A LEAD AGENCY FOR LAND ACQUISITIONS

Following a disaster like the 1993 flood, landowners can benefit from a number of federal assistance programs, such as fee title or land easement acquisitions. During the early post-flood response period, land acquisition did not emerge as a viable risk-reduction option for a number of reasons: limited funds, lack of a participatory mechanism for mixing funds from different agencies, and lack of a focal point within the government for such action. Part of the problem is that no single federal agency has authority to coordinate existing land buyout or easement programs for environmentally related acquisitions, such as the USDA Wetland Reserve Program, Emergency Wetland Reserve Program, and FS forest acquisition program; the USACE Missouri River Mitigation Project; and the FWS National Wildlife Refuge acquisition program.

Federal acquisition and easement programs share capabilities to restore habitats for native fish and

FEDERAL AGENCIES COMPETING FOR THE SAME LAND

Stan Hinnah's farm on the Missouri River near Glasgow, Missouri, was devastated by the 1993 flood. His farm lies in one of the river's high energy zones on the site of an old channel bed. When Mr. Hinnah's levee broke, a surge of water scoured out unconsolidated sands from the old channel and deposited them across the remainder of his fields. Mr. Hinnah owns other lands in the nearby uplands and would like to sell his Missouri River bottomland and get on with his farm operations at another location "out of harm's way," as he put it. When Review Committee members spoke with him, he was frustrated because even though several federal and state acquisition programs were available, none were clearly defined, and none were able to get funding approved and released to complete the sale. Mr. Hinnah was confused by the number of governmental units involved in buyouts, and he was hesitant to make a deal with any one of them and miss a better deal.

wildlife species of special federal interest. Such programs can address the needs of landowners who may wish to discontinue row cropping or who may simply wish to sell fee title interest altogether. One way to overcome problems associated with these programs is to involve non-governmental organizations (NGOs) that can contribute financially to the federal buyout process and act as a catalyst between landowners and government agencies.

During visits with government agencies and landowners, the Review Committee found an interest in establishing one federal agency as the lead for environmental land acquisitions.

Action 7.1: *The Administration should establish a lead agency for coordinating acquisition of title and easements to lands acquired for environmental purposes.*

Several federal agencies have land acquisition authority, but lack of coordination between them creates confusion and provides opportunities for landowners to shop around, promoting potential bidding wars between interested agencies. Taken together, government land acquisition-easement programs provide an opportunity to address both landowner and ecosystem needs. Several programs already exist to address these needs, but coordination among the primary agencies -- DOI, USDA, and USACE -- would improve efficiency. Because the mission of the FWS within the DOI "...is to conserve, protect and enhance the Nation's fish, wildlife and habitat for the continuing benefit of the American people...", the Review Committee suggests that the DOI coordinate federal acquisitions of environmental lands. This role does not imply ultimate exclusive ownership or management by the DOI but provides for leadership in identifying the capabilities and interests of other federal agencies, states, tribes, and local resource managers, as well as individual landowners.

The recommended cooperative land acquisition-easement program would develop Memoranda of Agreement (MOA) between the DOI, USDA, USACE and other agencies. Federal land acquisition agencies would establish rules for acquisitions and easements based on program authority. Transfer of acquisition funds to the DOI would be made, as appropriate, under Cooperative Agreements (CAs). When such CAs have

PRIVATE INVOLVEMENT IN PUBLIC BUYOUTS

NGOs, such as the Iowa Natural Heritage Foundation and the Conservation Fund, played significant roles in acquisition of the Louisa No. 8 Levee District on the Iowa River near its confluence with the Mississippi River. Louisa No. 8 had a history of repair from past floods, and, although it was eligible for repair under the USACE PL 84-99 program, affected landowners expressed an interest in alternatives to continued farming. Administrative and authority limits in the land acquisition programs of federal Disaster Field Office participants prevented federal agencies from pooling funds to initiate land acquisition. By utilizing their funds, the Iowa Natural Heritage Foundation and the Conservation Fund were able to step in and purchase the land, holding it until federal funds were released to finish the buyout. This allowed landowners to get on with their lives.

been completed, agencies would provide oversight and would assist the DOI with landowner contacts to assure that all federal mandates are met. The DOI would not be involved in non-environmental land acquisitions, such as the purchase of construction sites or FEMA structure-buyouts that offer no special potential for environmental enhancement.

The nation needs a coordinated program to maximize federal use of funding for programs such as the FWS refuge acquisition program, the USACE Missouri River Mitigation Project and the USDA Wetland Reserve Program. Coordinated leadership would help ensure that federal environmental land acquisition programs focus on ecosystem management to meet the needs of interjurisdictional, native, and threatened and endangered species. It would help guard against acquisitions or easements involving disconnected or disaggregated lands that are checkerboard in appearance and difficult to manage.

Federal land acquisitions would be coordinated with existing state and local programs to avoid conflicts, as well as complement and further their environmental activities. In addition, the DOI would not necessarily maintain fee title and operation and maintenance responsibility for acquired lands. When appropriate, a cooperating agency or state would assume ownership and operation-maintenance responsibility, although the DOI would maintain those lands critical to federally listed threatened and endangered species.

PROTECTING THE TAX BASE OF LOCAL GOVERNMENTS

During discussions with individuals and local governments regarding federal land acquisitions, the Review Committee learned that lost tax revenues from acquired lands are an issue. For acquisitions involving the DOI, Congress designed the Refuge Revenue Sharing Act (RRSA) to reduce the financial hardship of lost tax revenues by providing government payments in lieu of taxes. Inadequate funding of the RRSA program, however, has limited the attractiveness of federal land acquisition in various areas of the country.

Recommendation 7.1: ***The Administration should support increased funding for the Refuge Revenue Sharing Act.***

Increased funding of the RRSA, in conjunction with review and revision of implementing regulations, would assist in equitable distribution of funds among different regions of the country and would address the concerns of local governments regarding tax base impacts that negatively affect schools and infrastructure.

ALLOWING AGENCIES PROCEDURAL FLEXIBILITY IN DISASTERS

In examining the federal flood response, the Review Committee learned of difficulties encountered by agencies in their efforts to enhance natural resources while considering landowner needs. Uncertainty among landowners about the ability of federal agencies to execute timely real estate actions limited their interest in full or partial land sale or easement acquisition. Statutory features of easement-acquisition authorities for federal agencies prevent spending without first completing full procedural cycles. In a disaster response situation, procedural flexibility would be advantageous for federal agencies and economically distressed landowners.

Action 7.2: ***The Administration should develop emergency implementation procedures to organize federal agencies for environmental land acquisitions.***

The waiver of certain procedural components of land acquisition programs that require extended intra- and interagency review and comment would improve response to economic hardships during immediate post-disaster periods. The Administration should direct the DOI, in cooperation with other federal land acquisition agencies, to develop an interagency, programmatic environmental land acquisition plan that could be implemented during emergency situations.

All agencies with jurisdiction or special expertise in land acquisition should participate in the DOI interagency plan. Agencies will have program-specific interests in a planning area, but, within the context of a programmatic document, they can integrate their interests to articulate the range of federal, tribal, state, and local options. Following disasters, the federal government could use available funds to immediately acquire lands with preidentified environmental values and hazard plans. This approach, similar to one used by the FWS for acquiring available parcels within pre-identified Waterfowl Production Areas, would involve a larger group of agencies.

Recovery Operations

The 1993 flood caused major infrastructure damage throughout the upper Mississippi River Basin. An August 1993 interagency letter of cooperation[1] signaled the Administration's awareness that disaster response must provide innovative actions using various federal programs, such as the USDA Emergency Wetland Reserve Program, Section 1135 of the Water Resources Development Act (WRDA) of 1986, and public-private partnerships. The acquisition of the Louisa No. 8 Drainage District exemplifies this partnership. Although the lack of experience and institutionalization of buyouts limited actions similar to the Louisa No. 8 buyout, this situation could be improved if the ad hoc relationship established by the aforementioned letter were formalized.

Action 7.3: ***The DOI should formalize environmental considerations in multi-agency disaster recovery land restoration activity through a coordinated Memorandum of Agreement.***

The Administration should direct the DOI to use the Louisa No. 8 project as an example to develop a MOA

between agencies for post-disaster recovery. Formalization of working relationships would expedite recovery efforts by providing coordination points and a central clearinghouse for information on buyout options, sources of funds, and a list of potential cooperators.

Emergency Funding

PL 84-99 provides the USACE with flexibility to quickly reprogram funds from agency accounts to fund Presidentially declared flood disaster response efforts. This enables the USACE to use appropriated funds to address emergencies and disaster response in a timely manner.

Action 7.4: *Seek legislative authority for flexibility in use of programmed funds in emergency situations.*

The Congress should provide legislative authority and flexibility, similar to that provided the USACE by PL 84-99, to other agencies and programs. Such flexibility would expedite landowner relief and enhance the federal ability to capitalize on environmental enhancement opportunities. Funds used could be reimbursed, if necessary, from supplemental appropriations, when they became available and, as appropriate, by reprogramming funds from other sources within the agency. As an example, following the 1993 flood, the FWS was unable to access several million dollars of appropriated Land & Water Conservation (LAWCON) funds. If the FWS had been able to access those funds, which were earmarked for other uses, the agency could have offered landowners an immediate alternative to realigning and repairing levees. The opportunity to restore wildlife habitats was missed. The LAWCON account could have been reimbursed subsequently either by special appropriation or transfer from other accounts.

ACQUIRING AND RESTORING LAND ON PROBLEM RIVER REACHES

Federal agencies are focusing on ecosystem management in recognition of the functional relationships between living resources and physical features of the landscape. This is evidenced by the March 1994 concept document *Ecosystem Approach to Fish and Wildlife Conservation* circulated by the FWS; the April 1993 *Ecosystem Management Principles and Applications* document prepared by the FS for the Eastside Forest Ecosystem Health Assessment, and the *Reinventing Environmental Management* document prepared by the National Performance Review (NPR) in September 1993. These documents call for interagency coordination and a resultant collaborative approach to managing the health of whole ecosystems, such as the upper Mississippi River Basin.

Ecosystem management is in its infancy, and federal agencies have just begun ecosystem planning and related programs. Explicit funding for ecosystem management remains minimal and plan development incomplete. In the absence of plans and funding, the DOI, as the recommended lead agency for environmental land acquisitions and easements, should focus federal acquisitions and easements on problem river reaches with known habitat values and threatened and endangered species.

Action 7.5: *The DOI should focus land acquisition efforts on river reaches and areas with significant habitat values or resource impacts.*

The Administration should provide funding for and the DOI should develop and implement cooperative ecosystem management plans with the states and other agencies. The NBS currently operates a major GIS system for the upper Mississippi River main stem and is in the process of developing GIS capability for the Missouri River main stem. The Congress should appropriate funds to expand these facilities to survey the natural resources of the entire upper Mississippi River Basin. The NBS should work in collaboration with the states, NGOs, and other agencies to identify critical habitats, significantly impacted ecosystems, and opportunities for ecosystem management. Participating

states and agencies should evaluate site-specific, collaborative management plans developed as part of their own operations for use in ecosystem management.

The Accompanying Report on the DOI by the NPR[2] identified several factors that prevent the agency from making long-term decisions that provide for wise ecosystem planning and management. In response, the NPR indicated that the DOI should be able to acquire lands using a comprehensive approach and that it should have a set amount of discretionary funds so that the Secretaries of the Interior and Agriculture can take advantage of unforeseen opportunities or urgent acquisition developments. The NPR Action for this issue stated: "the Secretaries of the Interior and Agriculture and the Director of OMB should modify the process for determining land acquisition priorities and modify current procedures." The Review Committee endorses this action as a key component in providing better focus for such acquisitions.

USING O&M FUNDS TO MANAGE ECOSYSTEMS

Construction of various federal navigation and flood control projects have impacted federal trust resources in many rivers of the upper Mississippi River Basin.[3] Operation and maintenance of some of these projects continue to impact fish and wildlife resources and, in some cases, may accelerate those losses. In the 1970s and 1980s, concerns related to these impacts on the upper Mississippi River resulted in formation of cooperative interagency management efforts, such as the Great River Study,[4] Upper Mississippi River Master Plan,[5] and Upper Mississippi River Environmental Management Program.[6] These programs, which address both development and natural resource needs, have resolved many interagency conflicts and problems.

Across the upper Mississippi River Basin, though, federal agencies need to develop and implement ecosystem management plans. Especially on the Missouri River, such plans would help ensure protection of fragile ecosystems and address the needs of plant and animal species that are of interjurisdictional federal interest. Presently a funding mechanism to develop and implement ecosystem management plans does not exist.

As a matter of practice, agencies responsible for operating and maintaining major development projects should procure funding for representation and participation of other federal agencies in their major study and implementation efforts. The USACE-FWS Memorandum of Agreement for fund transfers related to Fish and Wildlife Coordination Act compliance makes such participation possible during the planning process, but no authority exists to transfer funds for support of post-construction ecosystem planning. Similarly no funding mechanisms exist for state or local participation in either the planning or post-construction phases of federal water resources development.

Action 7.6: *Require agencies to co-fund ecosystem management using Operation and Maintenance funds.*

Ecosystem management planning would document natural resource needs and identify actions that federal agencies can take to offset development impacts and enhance ecosystem sustainability. Funding for development and implementation of ecosystem management plans should be an annual standard component of each federal agency's operation/maintenance/construction budgets along with annual funding for development projects, which often impact the ecosystem. Funds should provide for participation of outside agencies and the states. Once costs of minimizing environmental impacts become a standard part of project costs, they can be reflected more closely in federal benefit-cost ratios.

EXPANDING FEDERAL, STATE, AND NGO COST-SHARING

Many levee and drainage districts contain remnant natural features, such as oxbow lakes and sloughs, that were hydraulically disconnected from the main stem river either by natural processes or by levee construction. Structural modifications to these levees would allow periodic, controlled flows between the river and former oxbows or channels. By providing these connections, off-channel habitat could be available during spawning periods. Such areas could contribute to the river fishery and increase seasonal wetland values.

During the PL 84-99 review process, resource agencies and landowners sought to use levee modifications to reconnect some oxbows and sloughs to the river, but they were unable to do so because Congress authorized PL 84-99 only for emergency structural repair and not for modification to serviceable projects. New construction for other purposes was simply not possible. On the other hand, the USACE environmental enhancement authority provided by Section 1135 of the 1986 WRDA includes new construction as an option. Additionally, Section 906 of the 1986 WRDA provides general authority to undertake mitigation measures for projects, whether completed, underway or unstarted, including acquisition of any needed related lands. Section 906 provides for mitigation cost-sharing consistent with other project purposes. The review Committee found that potential activities authorized by Section 906 have not been pursued.

It was brought to the Review Committee's attention that current reporting and approval processes require multi-level review of Section 1135 projects within USACE. This may discourage pursuit of small scope projects. It is anticipated that many small projects could be pursued at lower administrative costs with abbreviated report requirements and decentralized approval authority. In discussions of the Section 1135 option with several landowners and drainage district representatives, the USACE found that many did not accept it because of the cost-share burden added under PL 84-99. The USACE could not overcome the cost-sharing problem because other federal agencies, such as the FWS, are not able to participate as cost-share sponsors.

Action 7.7: *Enact legislation allowing cost-share participation and eligibility requirements under Sections 906 and 1135 of the 1986 WRDA to include federal, state, and non-governmental contributions as well as work in-kind.*

By expanding the array of possible cost-share sponsors and by providing for cost-sharing consistency in Section 906, more enhancement opportunities can be leveraged by cooperating federal, state, and non-governmental organizations. Permitting work in-kind to qualify as local sponsor cost-share contributions would expand the availability of Section 1135 for environmental restoration activities.

MOVING MITIGATION AT THE SAME RATE AS DEVELOPMENT

Development projects often require agreement to purchase mitigation lands before project construction plans receive approval. Although authority exists for mitigation measures and acquisition of mitigation lands and although agency policy encourages concurrent mitigation, funding of mitigation land acquisition has not proceeded on the same schedule as construction funding. In some cases this lack of funding has led to unmet mitigation over periods of years.

Action 7.8: *Allocate funds for mitigation lands in concert with and at the same pace as project construction.*

The Administration through OMB must assure an

equitable funding stream where mitigation is required as part of authorized projects.

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Chapter 8

MINIMIZING THE VULNERABILITY OF EXISTING DEVELOPMENT

Floods are an act of God; flood damages result from acts of men.

House Document 465, 89th Congress, 2d Session
A Unified National Program for Managing Flood Losses, August 1966

Development will continue to occur in the nation's floodplains. Two fundamental strategies -- protection or removal -- can minimize the vulnerability to floods in these lowlands. Each strategy is appropriate in different circumstances. The nation should discourage new development in floodplains. For areas with existing concentrated development, such as cities where removal is impracticable, combine structural and nonstructural measures to protect existing development.

In the past structural measures were the primary approach to flood damage reduction. Throughout history, well-designed and well-sited structural measures have demonstrated their effectiveness in protecting property and saving lives. The traditional structural strategies to modify flooding have relied on the following tools: dams and reservoirs; urban stormwater management systems; dikes, levees, and floodwalls; channel alternations; and diversions, spillways, and floodways.

Each of these measures carry environmental and social impacts that may limit their future applicability. While they work well, they also create problems. Structural approaches, particularly those taken prior to implementation of federal environmental protection statutes, have caused or contributed to environmental degradation. The 1993 flood demonstrated not only the strengths of structural approaches but also their weaknesses, particularly those of levees.

Another approach to minimizing vulnerability, not widely used in the past, is the removal of vulnerable populations from the floodplain. Because of the severity and duration of the 1993 flood, the general public has taken a new interest in this strategy. Building on its experience with the NFIP, the FEMA capitalized on this interest in removals. The Administration responded by targeting federal recovery that support buyouts and relocation of floodplain populations. The fundamental value of buyouts over structural approaches is that they completely eliminate flood risk for affected individuals and, at the same time, may have environmental and hydrologic benefits. Relocation associated with buyouts can, however, involve social, environmental, or hydrological impacts. For federal relocations, compliance with the NEPA would identify and help to avoid such impacts. Careful planning by state and local agencies should also identify these issues.

ADOPTING A SYSTEMS APPROACH

The first step in minimizing flood vulnerability is to approach the problem from a systems perspective. Determining the array of potential solutions requires an understanding of the source of the vulnerability and the current risk that flooding poses. Is the risk one of debris-laden flows from highly erodible canyons? Is it increased runoff? Is it changed river hydrology? Is it flash floods or slowly rising waters? The best solution

to a localized flooding problem may be watershed management rather than channelization. The flooding river cannot be analyzed separately from its watershed and ecosystems. The initial focus ought not be exclusively on structural flood damage-reduction projects. The situation calls for a system-wide approach that accounts for basin hydrology, hydraulics, and ecosystem concerns. Such an approach will identify the nature of the flooding problem and help in the selection of the most appropriate combination of flood damage reduction measures. A systems approach allows planners to address flood vulnerability and identify the best means for minimizing flood impacts, when they do occur. The systems approach brings to the forefront the ecosystem effects of flood damage-reduction projects, and it allows for avoiding, minimizing, and compensating for adverse effects and capitalizing on environmental opportunities.

The next step in changing the historic approach to flood damage reduction is to equally consider structural and nonstructural approaches. Objective consideration of the various flood damage reduction options looks at their short- and long-term engineering and their environmental, social, and economic feasibility. Such a consideration is vital to achieving a new pattern of flood vulnerability reduction. The revisions proposed by the Review Committee for the *Principles and Guidelines* would facilitate this type of consideration. If structural alternatives provide the only means to address a local flooding problem, they need to be considered within the context of the larger systems of the river and its watershed. The direct and incremental impact of each structure on river hydrology, hydraulics, and ecology needs evaluation and balancing. By understanding the system and designing and constructing in response to that system, more efficient opportunities to reduce the vulnerability of flood impacts can be found.

Existing and future flood damage reduction strategies must consider the impact on upland and riparian areas of the ecosystem. The design, operation, and repair of flood damage reduction systems can lessen these impacts and may, in some circumstances, enhance the environment. Chapter 7 focused on flood damage reduction measures that also protect and improve wildlife habitat.

Recommendation 8.1: ***Federal agencies should capitalize on opportunities, within existing authorities and resources, to enhance the environment when reviewing operations or undertaking repairs or improvements to existing flood damage reduction programs.***

IMPROVING STRUCTURAL MEASURES

Levees will continue to serve as a means of minimizing flood vulnerability. Of the approximately 8,000 miles of levees in the upper Mississippi River Basin, roughly half were constructed by the federal government or meet federal standards and thus receive support from the federal government in post-disaster situations. Some new levees may be built to protect critical infrastructure, but the remainder of these structural flood damage reduction facilities with their numerous strengths may also have room for improvement.

Constructing and Repairing Levees

Five different federal agencies are engaged in the repair of federal and non-federal levees damaged by the 1993 flood. These agencies are involved in funding, design, construction, or a combination of the three. The water resources design and construction agencies, the USACE and SCS, have been joined in the levee repair and construction business by the FEMA, EDA, and HUD, through their public assistance and grant programs. Normally only the USACE and SCS construct levees as part of projects authorized by Congress, although in recent years, SCS levee construction has significantly declined.

These agencies have not used the same engineering standards or methods of economic analysis in carrying out their programs. Some of the differences rest with

the purposes of the programs and the varying nature of the levees. Nevertheless these differences cause confusion among those dealing with the multiple programs. The nation cannot afford to have this duplication of effort in the federal system. The costs to the nation of this multi-agency approach, measured in dollars or social and environmental impacts, remain large.

Action 8.1: *Establish the USACE as the principal federal levee construction agency.*

This action is not a call for new levee construction, but a recognition that when repairs or construction have been authorized, the USACE would be the principal agency for the work on major rivers and tributaries. The USACE, with its long history of levee building and repair has the in-house expertise to serve as the federal government's principal representative pertaining to major levee construction and repair. The SCS has the history and expertise for assistance pertaining to small agricultural levees in small watersheds and assistance to individual landowners. To coordinate their different responsibilities and engineering and evaluation guidelines, the USACE and the SCS should review and modify, as appropriate, the existing 1986 Memorandum of Agreement (MOA). When complete this MOA should be provided to all states and appropriate levee districts. Other government agencies wishing to pursue levee construction must arrange planning, design, and construction through the USACE which will follow the revised *P&G* procedures. For small agricultural projects, the USACE would coordinate the action with the SCS.

While multiple federal agencies currently participate in levee construction and repair, this report recommends in Action 8.1 that USACE be established as the principal federal levee construction agency. If this recommendation is implemented, cost-sharing inconsistencies between different federal agencies currently involved in levee construction would be resolved. If the recommendation is not implemented, cost-sharing inconsistencies exist that should be rectified to eliminate shopping by non-federal sponsors for the best federal deal. Regardless of the decision made on levees, inconsistencies between federal agencies for similar types of activities also exist for other federal water resources projects. One example is under the SCS PL 83-566 program, in which non-federal sponsors provide the lands necessary for project construction, but 100 percent of the cost for flood damage reduction is provided by the federal government. Non-federal sponsors of flood damage reduction projects constructed by the USACE are required to pay a minimum of 25 percent share of the total project cost and a maximum of 50 percent. A minimum cash contribution of 5 percent of the total project cost is required as a part of this cost-share. In addition, the USACE requires a 50 percent cost-sharing for feasibility studies while the SCS feasibility studies are at 100 percent federal cost. The SCS multi-purpose projects involve non-federal cost-sharing but SCS allows credit for in-kind services in meeting that requirement. The USACE allows credit for in-kind services only for meeting a portion of study cost-sharing requirements. The SCS multi-purpose projects involve non-federal cost-sharing but SCS allows credit for in-kind services in meeting that requirement. The USACE allows credit for in-kind services only for meeting study cost-sharing requirements.

Another example is in relation to the levee rehabilitation program. The SCS Emergency Watershed Protection Program requires a non-federal cost-share of 25 percent of the cost of the project which excludes inspections and design. Under the USACE PL 84-99 program, there is no cost-sharing for federally built levees, however, the non-federal cost-share for qualified non-federally constructed levees is 20 percent of the cost of the project to include inspections and design. The FEMA and the EDA also are players in levee repair with non-federal shares of 25 percent for the FEMA repairs (although this was modified to 10 percent for the 1993 flood) and 20 to 25 percent for the EDA repairs. Other examples of inconsistencies also exist but are not elaborated on in this document.

Recommendation 8.2: *The Administration should propose legislation that establishes consistent cost-sharing across agencies for non-federal participation in like activities.*

Affected federal agencies should coordinate with each other to identify all differences in cost-sharing and in-

kind services and provide documentation of inconsistencies to the Administration. For those flood damage reduction activities where multiple federal agencies will still be participating, consistent cost-sharing is recommended. In addition, consistent approaches should be taken regarding non-federal credit for in-kind services in meeting the cost-sharing requirement.

Performing Emergency Repairs

The federal review of levees impacted by the Midwest Flood of 1993 provided valuable lessons in applying the USACE emergency flood-control repair program under PL 84-99. Approximately 1,600 levees (1,400 of them non-federal) were damaged to the point of requiring some form of rehabilitation or repair.[1] Less than 500 of these levees are under the USACE program, and of these, only 229 were federally constructed. Many levees which had been under the USACE program in the past were not under it at the time of the flood for various reasons, such as failure to operate and maintain the levee properly, individual decisions not to participate, lack of a public sponsor, or inability to meet required engineering criteria. In the past benefit-cost analyses have not included consideration of previous levee failures and the potential for future failures.

Given the seriousness of this situation and the fact that less than 15 percent of the non-federal levees that were damaged qualified for repair consideration under the USACE program, the Administration and Congress provided supplemental funding for levee repair. Even with the waiver of the USACE requirements, the Administration and Congress stipulated that levee districts or sponsors would have to meet the following requirements to receive federal funding: agree to join the USACE program; and, within two years, provide public sponsorship, ensure levee maintenance, and meet engineering, environmental and other eligibility requirements of the program.

This USACE program should continue in the future. The Review Committee reviewed the eligibility requirements of the program and found them to be reasonable. Even though the 1993 flood was not a typical flood, this is no reason to deviate from the established and sound principles of the levee program. Waivers of these requirements may send the wrong message to levee sponsors. It is in the interest of the nation to provide incentives to ensure the integrity of public levees. This can best be accomplished by the participation of levee sponsors in the USACE program. It must be clear that the federal government provide repair assistance in the future only to levees enrolled in the program and that the risks associated with non-participation are simply too great to take.

Action 8.2: *The Administration should reaffirm its support for the USACE criteria under the PL 84-99 levee repair program and send a clear message that future exceptions will not be made.*

In addition to the specific requirements of the USACE program, the USACE should ensure that levees are properly located and aligned to reduce the probability of repetitive losses and do not adversely impact river hydraulics and other properties. Benefit-cost analyses should be expanded to include consideration of environmental and social benefits and costs in addition to the traditionally quantifiable benefits and costs. Where levees have a history of failures and realignment is not feasible, the benefit-cost analysis should consider the greater risk of failure, adjusting operation and maintenance cost estimates appropriately. Where the site is unsuitable, no federal support should be provided.

Design Considerations to Lessen Levee Overtopping Impacts

During the 1993 flood, many levees were overtopped and catastrophic damages occurred from scour and sand deposition. There are various methods for lessening these types of impacts such as use of spillways, control structures, and levee superiority (choosing where a levee should overtop first).

Recommendation 8.3: ***The USACE should investigate procedures to minimize impacts associated with levee overtoppings.***

Differing methods to lessen levee overtopping impacts should be investigated. A report should be prepared by USACE that details preferred engineering techniques to improve current levee structures, where appropriate.

Coordinating Economic Evaluation Criteria

Both the SCS and USACE have requirements for economic feasibility with regard to potential levee repairs. Differences exist in the detail of analysis, period of analysis, and interest rate used for each of these programs.

Recommendation 8.4: ***The USACE should coordinate with the SCS to decide on appropriate criteria for evaluating the economics of levee repairs.***

The Review Committee recommends that one agency, the USACE, be the principal federal levee repair and construction agency. Past differences in the evaluations by the two agencies suggest that coordination of methods could lead to an improved procedure.

Floodfighting on Levees

Threatened communities and owners of agricultural levees conducted heroic levee floodfighting during the Flood of 1993. They took action, however, without knowledge or consideration of the effects that keeping the water off their portion of the floodplain would have on the river level in proximity to that location. The act of raising a levee during rising flood conditions has the effect of increasing the river level in the immediate area and possibly upstream and downstream as well. The magnitude of the increase could be minor or significant, depending on hydraulic factors pertinent to the affected levee and river reach. If the water level raise is significant, it could cause greater damage than otherwise would have occurred to nearby lands, especially if levee raising results in the failure of a neighboring levee.

Action 8.3: ***Federal and state officials should restrict support of floodfighting to those levees that have been approved for floodfighting by the USACE.***

The USACE would determine by advance planning, with the benefit of river hydraulic modeling analysis, those levees that can and those that cannot be floodfought without significant adverse impacts on other properties in the floodplain. This action would not prevent floodfights which are consistent with state and local floodplain management regulations under the National Flood Insurance Program (NFIP).

Floodfight Controls

In 1978, during federal construction of an agricultural levee on the Missouri River downstream of Brunswick, Missouri, the USACE, FEMA, the City of Brunswick, and the levee sponsor agreed to limit the height of the levee being constructed to a 25 year protection level and that the levee district would not increase the levee height during a flood event. This agreement was to prevent the levee from raising upstream flood elevations more than one foot, especially at Brunswick. During the 1993 flood, the USACE provided technical assistance to the Brunswick Dalton Drainage District in its efforts to fill in low spots in the levee -- locations where the levee elevations were below the authorized project levels. Therefore, in accordance with the agreement, the levee sponsor did not raise any sections of the levee above the design grade. In late July, the levee overtopped.

Urban Stormwater Management

The use of detention basins as a type of structural flood damage reduction measure has greatly increased over the last 20 years. Many local ordinances now require "zero-increment" runoff for new development, which means that on-site detention must be provided. State and federal government involvement in runoff management is typically limited to managing stormwater runoff from roads and highways. The *Floodplain Management in the United States* report indicates that federal and state governments have increased attention to this problem due to an awareness that a large percentage of flood insurance claims come from areas not identified as floodplains.

Flooding can be increased significantly by the runoff from land that has been stripped of vegetation or covered with buildings, pavements, and other impervious materials. Historically the approach to such runoff has been to confine and transport that water as quickly as possible. As urbanization spread, this approach contributed significantly to increased magnitude and frequency of downstream flooding and the construction of flood damage reduction structures. Reduced groundwater supplies and degraded water quality are frequent byproducts of this approach. New efforts to handle runoff from frequent storms (e.g., 2- to 10-year events) include on-site detention or retention though a variety of measures and management of total runoff within a watershed to ensure that discharges from watershed sub-units reach the main channel at different times and, therefore, reduce peak flows in downstream areas. Most on-site detention measures typically provide little protection from large, infrequent events such as those that caused the Midwest flood because their capacity is exceeded.

While the main objective of on-site detention is to prevent excessive runoff from developed areas, a secondary benefit is that on-site detention measures can be designed to trap pollutants and, therefore, improve water quality. Throughout the country there is considerable interest in using natural wetlands or creating wetlands to help manage stormwater runoff.

EXPANDING NONSTRUCTURAL MEASURES

Hazard mitigation includes those actions taken by individuals and communities to reduce damages from such hazards as earthquakes, tornados, and floods. Examples of actions commonly taken after a flood are buyouts, elevation or floodproofing of damaged buildings, structural flood protection, flood-warning systems, and flood hazard awareness programs. There are ways to reduce the vulnerability of floodplain structures through design for all flood loads, selection of flood-resistant materials, and use of flood-resistant construction practices.

The Administration established buyouts of flood-damaged properties as the first priority for mitigation funds available for the Midwest flood. As of April 25, 1994, the federal government had approved applications from 61 communities for acquisition or relocation of 4,181 buildings. Other applications are pending, and as many as 6,000 buildings will be acquired or relocated.[2]

This initiative represents a turning point in flood recovery policy, since it is the first time that buyouts have been attempted on such a large scale.

Buyouts are an appropriate federal response for the Midwest flood and for floods like it. Many of the buyout neighborhoods have been damaged repetitively by flooding. Subject to deep and long duration flooding, they were isolated by floodwaters for extended periods of time. In addition a significant percentage contain older, lower value housing, much of it of poor quality and in need of rehabilitation. Under the right circumstances, the buyouts will not only reduce flood damages and protect people and property but also achieve other objectives such as improving the quality of affordable housing, increasing recreational opportunities and wildlife values, and general betterment of the community.

A TEAM EFFORT

The Home Life Restoration Committee, a local citizen's group in Hannibal, Missouri, and the Missouri Housing Development Office joined forces to assist four families whose homes had been severely damaged in the flood of 1993 to move into new housing outside the floodplain. Bridge loans of up to $5,000, bearing interest of 1%, were provided to each family through a program of the Housing Development Office. The Committee members, in conjunction with another charitable group, the Natural Resources Community Action Coalition, solicited a total of $50,000 in donations from local business and industry. This joint state/local effort enabled four homes outside the floodplain to be acquired and rehabilitated. The state loans will be forgiven if these families remain in their new homes for five years.

Buyouts and Other Hazard Mitigation Actions Following a Flood

Prior to the current buyout initiative, the primary federal response to mitigating damages to flooded structures was the substantial damage requirement implemented by communities participating in the NFIP. Buildings damaged so that the cost of repair is equal to or greater than 50 percent of the market value prior to the flood must meet program requirements for new construction, such as elevating above the 100-year flood elevation. Substantially damaged structures also become subject to actuarial rates under the NFIP.

While enforcing a substantial damage requirement is critical to achieving long-term objectives of reducing flood damages, financial assistance will be required to assist property owners who cannot afford to elevate or relocate their buildings or obtain replacement housing. The buyout initiative, in part, meets this need.

Individuals and communities impacted by the Midwest flood appear to be far more receptive to buyouts than after past floods. Often in the past, people regarded a flood as a one-time event. Any interest in acquisition or relocation waned with time as memories of the flood faded. But with the Midwest flood, the duration of the flooding and the multiple flood crests and floodfights created stress for floodplain occupants and communities. By the end of the summer, floodplain occupants just wanted out.

Implementation of buyouts has not been without problems. Federal agencies had to overcome significant obstacles to make the initiative work. This resulted in confusion and uncertainty among states, communities, and individuals. Since no federal or state agency had ever attempted buyouts on this scale, agencies had to invent policies and procedures and establish relationships between programs. They had to create mechanisms to coordinate programs and provide technical assistance to small communities with limited resources and expertise. They also had to develop expedited procedures for compliance with the NEPA, historic preservation, and other federal mandates.

A common theme throughout the Review Committee's meetings with states, communities, organizations, and interest groups has been the need for common policies and procedures among federal agencies participating in buyouts and other mitigation activities. The current initiative with multiple programs, applications, and eligibility requirements is overwhelming to communities, even with the improvements made to date. A corollary need is for sufficient flexibility in these programs to respond to a variety of flooding conditions or other circumstances, including responding to other types of disasters.

Expedited decisions on buyouts would reduce the uncertainty of property owners and avoid needless

PRINCIPAL SOURCES OF FUNDING FOR BUYOUTS

The following federal programs provide funding for buyouts following a disaster such as the Midwest Flood of 1993:

Department of Housing and Urban Development Community Development Block Grants (CDBG). The 1993 Supplemental Appropriation included $200 million for the CDBG program to assist in acquisition and relocation and in meeting other housing needs. The 1994 Earthquake Supplemental included an additional $250 million for a total of $450 million.

Federal Emergency Management Agency Section 404 Hazard Mitigation Grants. The Hazard Mitigation and Relocation Assistance Act of 1993, signed into law on December 7, 1993, revised the formula for determining the amount of the Section 404 Hazard Mitigation Grant in the Stafford Act and changed the cost share to 75/25. Under the revised formula the FEMA estimates that $134.9 million will be available through the Hazard Mitigation Grant Program funds for the Midwest flood.

Economic Development Administration (EDA) Grants. The 1993 Supplemental Appropriation included $200 million for EDA for grants to states and communities to preserve or create jobs or upgrade infrastructure. The funds can be used to assist in the relocation of businesses or for the infrastructure needed to support those businesses.

National Flood Insurance Program Section 1362 Flood Damaged Property Purchase Program. Several million dollars are available from the appropriation for the NFIP Section 1362 program for acquisition of insured properties. These funds are paid from the National Flood Insurance Fund, using premium dollars.

Other Programs. Funds were available from other programs such as the FEMA Public Assistance Program to assist in various aspects of buyouts and relocation. SBA loans are available to help individual property owners not eligible for CDBG monies.

expenditures for repairs to houses that are subsequently purchased. This duplication cannot be entirely avoided. It takes time to properly conduct a buyout, particularly for relocation of buildings or neighborhoods. Situations will continue to occur where making minimal repairs to a structure will be more cost-effective than providing rental assistance through the FEMA Disaster Housing Program.

While the Review Committee applauds the work of federal and state agencies in adapting existing programs to make buyouts work, these gains need to be consolidated to position the government for future buyouts and other hazard mitigation initiatives. A critical issue is how to transfer the buyout experience and other mitigation actions of the 1993 flood to other floods. The Midwest flood, a unique event covering a 9-state area and impacting over a thousand communities, required large supplemental appropriations. For more typical floods without supplemental appropriations, funding for mitigation must come from the FEMA Section 404 Hazard Mitigation Grant Program, the NFIP Section 1362 program, and other existing programs.

Recommendation 8.5: *Maintain flexibility in hazard mitigation programs to promote cost-effective and appropriate mitigation techniques.*

Buyouts are the optimal solution for many neighborhoods impacted by the Midwest flood. Circumstances arise, however, where other mitigation techniques may be the most cost-effective method for reducing flood damages with the least impacts on the community and the environment. In areas of shallow, short-duration flooding, elevation of structures on site may be the preferred alternative. Where high groundwater or sewer backups flood basements in or out of identified flood hazard areas, the optimal mitigation action could be drainage improvements, upgrading sewer systems, or installing backwater valves. Future mitigation initiatives must be flexible enough to respond appropriately to these differences.

Action 8.4: *Establish a task force to develop common procedures for federal buyouts and mitigation programs.*

A federal interagency task force should coordinate pre- and post-disaster buyouts and other hazard mitigation actions. This task force should include representatives of agencies that could be involved in a buyout program as well as agencies with responsibilities for consultation and oversight on compliance with laws and executive orders. The task force should build on the Midwest flood experience to accomplish the following objectives:

- Develop common policies and procedures among agencies for buyouts and provide for increased flexibility in programs to respond to the unique circumstances of a disaster;
- Address compliance with the NEPA, applicable executive orders, historic preservation requirements, and other federal mandates during multi-agency buyouts;
- Design delivery systems to expedite buyout decisions to be responsive to disaster victims and minimize duplication of assistance in instances where properties are to be bought out;
- Identify statutory and regulatory barriers to buyouts and other mitigation actions and propose changes where appropriate; and,
- Make recommendations on how supplemental appropriations would be channelled through a single program such as the FEMA Section 404 Hazard Mitigation Grant Program rather than being provided through multiple agencies and programs.

Coordination issues that arise during future disasters should be resolved through the Interagency Hazard Mitigation Task Force.

Recommendation 8.6: *Encourage establishment of state-chaired task forces to coordinate buyouts and other hazard mitigation activities.*

One of the success stories of the Midwest flood is the creation and operation of state task forces to coordinate buyouts and other mitigation actions. These task forces include participation by representatives of state agencies and of field offices of various federal agencies. In some cases communities have had to make only one application to the task force, which then determined the funding sources and amounts available to the community. These task forces have proved to be important forums for resolving differences between agencies and for coordinating buyout programs. They have provided the additional benefit of involving agencies that previously had not conducted floodplain management. Operating at the state level, they could effectively coordinate future buyout programs and package FEMA Section 404 funds with other available state and federal funds.

Action 8.5: *Provide states the option of receiving FEMA Section 404 Hazard Mitigation Grants as a block grant.*

A number of states have indicated an interest in coordinating buyouts and other mitigation actions after

disasters. They feel that they could be more responsive to communities and could expedite decisions if they received FEMA Section 404 Hazard Mitigation Grants in the form of a block grant. Under the current program, states already are given considerable latitude in establishing priorities and allocating Section 404 Hazard Mitigation Grant Program monies. A block grant also may provide greater flexibility to use these funds in conjunction with other federal, state, and local funds. The Review Committee suggests that block grants be an offered as an option for those states that have adopted approved floodplain management or hazard mitigation plans. Block grants are consistent with the Review Committee's call for an expanded state role in floodplain management and hazard mitigation.

The block grants should be subject to the current cost share and to general federal requirements including the establishment of overall priorities for hazard mitigation actions. Issues such as compliance with the NEPA, the Endangered Species Act, Historical Preservation, EO 11988 and other Federal mandates require resolution. For the CDBG program, the HUD is authorized to delegate these responsibilities to states and communities, but the FEMA is not.

Action 8.6: *Provide funds in major disasters where supplemental appropriations are made for buyouts and hazard mitigation, through FEMA's Section 404 Hazard Mitigation Grant Program.*

The federal government is providing funds for buyouts and other hazard mitigation activities for the Midwest flood through several agencies and programs. For major disasters that require supplemental appropriations, a better approach would be to make supplemental appropriations to the Section 404 Hazard Mitigation Grant Program. The FEMA should issue mission assignments to other agencies with expertise in community development and in providing technical support to states and communities in developing buyout programs. Providing funds to a single agency would invoke a single set of policies and procedures.

Action 8.7: *Establish a programmatic buyout and hazard mitigation program with funding authorities independent of disaster declarations.*

The current buyout program is funded primarily through supplemental appropriations made only after extraordinary floods and other disasters. Most flood events impact on much smaller geographic areas and may or may not result in a Presidential disaster declaration. Programs need to be in place to accomplish buyouts and other appropriate mitigation for such floods on an on-going basis.

Money currently available for mitigation activities includes funds from existing programs -- such as the FEMA Section 404 Hazard Mitigation Grant Program, the NFIP Section 1362 program, SBA loans to individuals, and any monies remaining available from funds allocated to states and communities through CDBG and EDA. Recent changes to the Section 404 Hazard Mitigation Grant Program to increase available funding will help.

Mitigation insurance coverage through the NFIP and cost-shared mitigation grants for states and communities for on-going hazard mitigation planning and actions also should be components of such a program. Such funding measures are included in pending legislation.

In addition to this NFIP mitigation fund, the FEMA should have authority to allocate a percentage of its annual Disaster Assistance Fund appropriation to states for community hazard mitigation plans and actions.

Recommendation 8.7: *Encourage use of CDBG, EDA, and other funding to acquire and relocate or take other mitigation actions where consistent with program objectives.*

The Midwest Flood of 1993 demonstrates a commonality of objectives between mitigation actions to protect neighborhoods and businesses from flooding and

ON-GOING ACQUISITION AND RELOCATION PROGRAMS

A number of communities in the nine states affected by the Midwest flood have undertaken systematic programs to acquire or relocate buildings in their floodplains. Two examples are Beatrice, Nebraska and Austin, Minnesota.

Beatrice, Nebraska. Over a multi-year period, the City of Beatrice, Nebraska, obtained annual Community Development Block Grants (CDBG) totaling about $3 million to purchase owner occupied floodplain properties from willing sellers. The city usually purchased these properties when they became vacant which minimized acquisition costs. Between 85 and 90 properties were acquired. More recently the city has acquired an additional 20 to 25 properties using their own funds. The lands acquired have been converted to parks.

Austin, Minnesota. After a 1978 flood, the city of Austin, Minnesota, consulted with the USACE over construction of a flood damage reduction project but decided that the best alternative was to clear out the floodplain. At that time the city obtained $1.4 million in CDBG money and acquired 44 homes, 16 of which were relocated. In 1983 the city initiated an NFIP Section 1362 project to acquire flood-damaged buildings covered by flood insurance. The city made offers on 11 homes and eventually acquired 6 of them. Others dropped out because they had spent their insurance/disaster assistance and could not afford to move. The city is currently putting together an application for another relocation project for another 40-50 homes that were damaged by the 1993 flood.

the missions of federal housing and development programs intended to provide safe and sanitary affordable housing and to create and preserve jobs. For example, many of the neighborhoods most severely impacted by the Midwest flood are low-income neighborhoods with substandard housing. Often these neighborhoods further deteriorate as a result of floods or the threat of floods. Similarly, efforts to create or preserve jobs are made more difficult in communities where business expansion is prevented or results in the relocation of these businesses to other communities or regions. Agencies administering these programs should continue to be active participants in floodplain management and to seek out opportunities for reducing flood losses.

Reducing Risks to Insured Buildings Substantially or Repetitively Damaged

NFIP minimum criteria require that substantially improved buildings, including those substantially damaged, meet most requirements for new construction including the requirement that residential structures be elevated to or above the elevation of the 100-year flood. The substantial damage requirement is an integral part of the NFIP strategy to reduce future damages to existing floodprone development. The substantial damage requirement has been difficult to enforce because property owners often do not have the funds necessary to meet it or to obtain replacement housing.

PENDING LEGISLATION ON FLOOD INSURANCE

Legislative initiatives are pending in the Congress that would provide for increased financial assistance for mitigating flood damages. The National Flood Insurance Reform Act (S 1405) has passed the Senate as Title VI of S 3474, the Community Development, Credit Enhancement, and Regulatory Improvement Act of 1994. The bill provides for mitigation insurance that would pay for the additional costs of elevating, floodproofing, demolishing or relocating substantially damaged or repetitively damaged buildings (two damages in 5 years averaging 25 percent of the value of the property) as a standard benefit to the policy holder. A mitigation program funded by $20 million from the National Flood Insurance Fund would be established at a 75/25 match for state and community mitigation projects to reduce damages to other insured buildings. A portion of these funds would be available for state and community mitigation planning.

The House of Representatives has passed HR 3191, also called the National Flood Insurance Reform Act of 1994, which provides for a study of mitigation insurance and establishes a mitigation fund of more than $30 million per year for state and community mitigation projects and planning. HR 3191 would provide grants from the Mitigation Fund, through an application process, to be available to individuals for floodproofing, demolishing or relocating substantially damaged or repetitively damaged buildings. These projects and activities would be funded through a surcharge on flood insurance policies. Neither bill addresses mitigation for uninsured buildings.

For the Midwest flood and for several other recent catastrophic disasters, the FEMA has allowed communities to use replacement cost instead of market value for calculating substantial damage except where state regulations are more restrictive. The use of replacement cost usually means that far fewer structures will be substantially damaged. This change has been a source of controversy in the Midwest. Because the agency did not communicate the change to communities early enough, some communities, after making determinations based on market value, had to recalculate based on replacement cost to placate affected property owners. Because fewer buildings are considered substantially damaged using replacement cost, some states and communities believed that the change was inconsistent with sound floodplain management as it resulted in fewer buildings being elevated, demolished, or relocated. Persuasive arguments can be made for using either market value or replacement cost to define substantial damage. The FEMA needs to decide on a definition and be consistent.

A related issue is that of repetitively damaged structures, i.e., those damaged on two or more occasions since 1978. These buildings currently account for 35.9 percent of all NFIP losses and 44.2 percent of all payments.[3] Unless these buildings are substantially damaged by one flood, no regulatory requirements apply and flood insurance continues to be available at highly subsidized rates. Significant numbers of these repetitive loss buildings, including

buildings that have had as many as eight losses, can be found in areas in Missouri and Illinois.

St. Charles County, Missouri, alone has 1,055 of these repetitively damaged buildings which have sustained a total of 3,625 losses.[4] Other communities in the surrounding counties of Missouri and Illinois also have large numbers of these buildings in areas with chronic flooding problems. Because repetitive loss buildings were substantially damaged by the Midwest flood, rigorous implementation of the requirement should reduce the numbers of these buildings.

Action 8.8: *The FEMA should continue to enforce substantial damage requirements, but decide on a definition of substantial damage and stick to that definition.*

The NFIP substantial damage requirement is crucial to reducing flood damages to structures built prior to the adoption of floodplain management regulations in participating communities. The FEMA should decide on a definition of substantial damage/substantial improvement and consistently apply that definition in disaster and non-disaster situations. This will eliminate confusion and improve the overall level of compliance with NFIP regulations.

Action 8.9: *The Administration should support insurance coverage for mitigation actions necessary to comply with local floodplain management regulations.*

Critical to continued enforcement of the substantial damage requirement is providing NFIP flood insurance coverage for the costs of elevating, floodproofing, or relocating substantially damaged buildings. Currently flood insurance pays only for the repair of physical damage to the building. Mitigation insurance would provide coverage that pays the costs of bringing insured buildings that are substantially damaged by floods into compliance with community floodplain management regulations either by elevating, floodproofing, demolishing, or relocating the building. The coverage would be funded by flood insurance premiums and be part of the claims adjustment process. Mitigation insurance has a number of advantages:

- It supports consistent enforcement of the substantial damage regulatory requirements;
- It more fully indemnifies policyholders from flood-related losses;
- It is funded by flood insurance premiums and not by appropriated funds;
- It would reduce over time the subsidy for these pre-FIRM buildings; and,
- The flood insurance claims adjustment procedure is an efficient way to deliver assistance.

The National Flood Insurance Reform Act of 1993 (S 1405 which has passed the Senate) authorizes the NFIP to provide mitigation insurance. Similar legislation that has passed the House of Representatives (HR 3191) provides for a study of mitigation insurance.

Action 8.10: *Develop a program to reduce losses to repetitively damaged insured properties through insurance surcharges, increased deductibles, mitigation insurance, and/or mitigation actions.*

Repetitive loss buildings account for a disproportionate percentage of NFIP losses and represent a significant liability for the program. The FEMA should develop a comprehensive strategy to address these losses, including flood insurance premium surcharges and increased deductibles. Such a strategy should reflect more accurately the increased risk to these buildings and provide an incentive for protecting the buildings from flooding. Mitigation insurance should cover the cost of mitigation for the most vulnerable structures. Buyouts and other mitigation initiatives should place a high priority on these buildings. When such structures are substantially damaged, the FEMA should enforce this requirement rigorously.

The flood insurance program should include cost-shared funding for on-going pro-active planning and mitigation independent of disasters. This element should include provision for a mitigation fund financed out of NFIP premiums (such as that provided for in S. 1405 and H.R. 3191 both entitled the National Flood Insurance

Table 8.1 NFIP-insured Buildings with Repetitive Losses, Midwest States, 1978-1993.

State	Buildings with Repetitive Losses	Number of Losses for Such Buildings
Missouri	3,268	10,038
Illinois	1,351	3,774
Iowa	287	565
Nebraska	247	608
Minnesota	201	627
Kansas	175	441
North Dakota	142	713
Wisconsin	66	177
South Dakota	16	35
TOTAL	5,723	16,978

Source: Federal Emergency Management Agency, Federal Insurance Administration, computer printout, Washington, DC, February 7, 1994.

Reform Act of 1994) for state and community mitigation projects and planning. Since the source of these funds is NFIP premiums, projects financed by the mitigation fund should mitigate damages to insured buildings. Any assistance to uninsured buildings should be incidental and necessary to the success of the project.

ENDNOTES

1. Some estimate the total at approximately 2,200 levees which would mean approximately 2,000 non-federal levees.

2. Federal Emergency Management Agency, "Acquisition/Relocation Program. Project Approval Summary," (Washington, DC; FEMA, April 25, 1994).

3. Federal Emergency Management Agency, Federal Insurance Administration, Washington, D.C., computer print-outs, July 21, 1993 and unknown date.

4. Federal Emergency Management Agency, Federal Insurance Administration, Washington, DC, computer print-out, February 7, 1994.

Chapter 9

MITIGATING FLOOD IMPACTS THROUGH RECOVERY AND INSURANCE

Keep in mind, we can't hold harmless everybody from every loss...there are programs to help businesses, farms, communities, and individuals who are out of work and who have no means of support.

President Clinton
Interview with Larry King, July 20,1993

Despite efforts on the part of the government and affected individuals to reduce vulnerability, flood disasters will continue to occur. The eventuality of flooding carries with it the necessity to have a coherent and coordinated disaster response and recovery strategy and effective insurance programs. The National Flood Insurance Program indemnifies individual property owners for their losses without requiring costly disaster assistance expenditures. The Federal Crop Insurance Corporation provides partial coverage for crop losses caused by natural perils. The challenge to the federal government is to develop a cooperative framework under which federal, state, and local entities can marshal their forces to address emergency response and recovery issues. At the federal level, the Review Committee is calling for a streamlining of disaster-related activities to avoid duplication of effort or working at cross purposes. In addition, the Review Committee seeks to encourage those who voluntarily choose to live in a floodplain to purchase NFIP coverage so that they can bear, to the degree possible, the costs associated with the risks. Ultimately, flood insurance will reduce disaster payments by internalizing the costs of living in the floodplain and by creating an incentive to move out of harm's way.

REORGANIZING DISASTER RECOVERY

The key to mitigating damages during recovery, especially after a disaster such as the Flood of 1993, is in organizing the recovery effort to establish leadership at the federal level and to involve fully all appropriate federal, state, and local government agencies.

Integrating Flood Response and Recovery under a Single Federal Agency

Congress established the FEMA in 1979 to consolidate emergency management programs that previously were scattered among multiple agencies. Over the last several years, the federal government has assigned other agencies the leadership responsibility for the recovery portion of disaster response following larger disasters in an attempt to provide a more responsive system.[1] These agencies, however, do not have the collective experience in disaster recovery offered by the FEMA, nor do they have an expansive knowledge of federal floodplain management goals or existing recovery and hazard mitigation programs including multiple hazards. The nation needs a single agency to coordinate federal flood response and recovery because the two are integrally linked. A single agency also can develop and maintain a core knowledge of the full suite of federal

programs available to help recovery. By decoupling flood response from flood recovery, the nation is losing opportunities for hazard mitigation and floodplain management. Response activities that occur without regard to potential recovery alternatives may foreclose opportunities to lessen future damages. This may leave people and property at risk and potentially increase future disaster support. The federal government must strike a balance between being responsive and adding to the inherent confusion resulting from any disaster.

Recommendation 9.1: *Integrate federal flood response and recovery under the FEMA.*

The Review Committee suggests that the FEMA be the federal agency coordinating response and recovery to help achieve floodplain management goals. Development of a federal response and recovery plan would incorporate national floodplain management goals and reflect state floodplain management responsibilities by identifying federal and state agency roles and responsibilities and establishing consistent rules and priorities, thus streamlining both response and recovery by the federal government.

Linking Response and Recovery with Floodplain Management

In 1980 the Office of Management and Budget established a FEMA-led Interagency Hazard Mitigation Task Force through a memorandum of agreement (MOA) to coordinate federal post-disaster recovery and to identify means to mitigate hazards.[2] Thirteen federal agencies agreed to participate in the task force and on interagency hazard mitigation teams activated for each flood disaster.[3] The USACE, SCS, and NWS have participated regularly on these teams as have state agencies. The FEMA encouraged states to lead these teams and, in the process, to build expertise transferable to disasters not needing federal disaster assistance. Participation by other federal agencies has been limited (see Table 9.1) by lack of staff and travel funds, a perception that the teams are tangential to an agency's mission, and the lack of high level support.

Most federal agencies participated on hazard mitigation teams for the Midwest flooding. Although activation of a 13-agency team is not necessary for each Presidentially declared disaster, regional coordination is desirable to review and determine each agency's involvement in such disasters.

While the Federal Interagency Floodplain Management Task Force and the Interagency Hazard Mitigation Task Force provide for interagency exchange of information, neither has successfully created the interagency dynamic and commonality of purpose needed for floodplain management activities.[4] Separation of the two task forces perpetuates a distinction between hazard mitigation and floodplain management when, in fact, the former is a key component of the latter. Neither has provided a link between emergency response and recovery, hazard mitigation including multiple hazards, and floodplain management at large. While both provide some information transfer, they do not coordinate federal funding to focus on priority problems, nor do they provide research oversight, planning advice, or issue resolution.

Between emergencies, federal agencies need to improve their coordination. In the aftermath of an emergency, the priority issues of that emergency soon fade into an agency's daily activities with little resolution. In 1986, the USACE and the SCS signed a Memorandum of Agreement to establish engineering standards for levees and levee repair responsibilities. But when the 1993 flood occurred, the two agencies had not yet set levee standards and did not fully delineate their separate responsibilities until months into the flood recovery, creating additional confusion.[5]

Recommendation 9.2: *Enhance the linkage among response, recovery, and floodplain management.*

Coordinating the Interagency Hazard Mitigation Task Force, the Interagency Floodplain Management Task Force, and other groups involved with emergency response will help link disaster response into a seamless set of functions. In the intervals between disasters, the increased support and interest by all federal agencies

Table 9.1 Interagency Hazard Mitigation Teams, 1992-1993.

Teams and Member Agencies	National Disasters	1993 Midwest Flood June 1992-July 1993
Interagency Teams	14	6
Member Agencies by Service on Teams		
Federal Emergency Management Agency	14	6
U.S. Army Corps of Engineers (DOD)	12	6
Soil Conservation Service (USDA)	11	6
National Weather Service (DOC)	10	6
U.S. Geological Survey (DOI)	5	2
Housing and Urban Development	5	5
Small Business Administration	4	2
Environmental Protection Agency	3	3
Department of Energy	2	0
Forest Service (USDA)	2	1
Economic Development Commission (DOC)	1	2
Department of Transportation	1	3
Public Health Service (HHS)	1	1
Bureau of Reclamation (DOI)	1	NA*
U.S. Fish and Wildlife Service (DOI)	1	3
Bureau of Indian Affairs (DOI)	1	1
National Ocean Service (DOC)	1	NA
National Park Service (DOI)	0	1

*NA = Not Applicable
Source: FEMA, Interagency Hazard Mitigation Team reports for disasters between June 1992 and the 1993 Midwest flood, (Washington, DC: FEMA, 1992-1994).

would facilitate all facets of floodplain management, including disaster planning, recovery, and hazard mitigation.

Action 9.1: *Hold an interagency strategic planning meeting for those Presidentially declared disasters that require a multi-agency recovery effort.*

Coincident with deliberations regarding each proposal for a Presidential disaster declaration, the FEMA should hold an interagency strategic planning meeting to review and determine the necessary or desired involvement of each agency. At such a meeting, the FEMA could brief each agency on the situation and figure out its involvement. More efficient interagency coordination, early enlistment of agencies, and clear direction regarding agency involvement should result.

Recommendation 9.3: *Continue to seek federal-state co-leadership of an interagency hazard mitigation team.*

State co-leadership of hazard mitigation teams formed in response to a Presidentially declared disaster recognizes the responsibility of the states for floodplain management. In addition the experience gained by state participants increases opportunities for hazard mitigation in state or locally declared disasters and should decrease federal expenditures for hazard mitigation in the future.

REBUILDING MORE EFFICIENTLY

As part of flood response and recovery, the federal government should offer individuals and communities that choose to relocate or rebuild opportunities to integrate energy efficient technologies, such as solar devices and more efficient lighting, into the design and construction of new structures. For example, the town of Valmeyer, Illinois, received assistance from the Department of Energy to integrate more energy efficient standards into building designs. Relocations, in particular, offer a unique opportunity to start from scratch in planning and constructing to assure that sustainable development becomes an integral part of the entire community. Each community would choose the characteristics it values such as an agricultural base, the historic or rural nature of the town, affordable housing, energy and/or water efficiency, diversity of species, or natural resources. Communities would incorporate these into planning and construction. Individuals also would use energy efficient technologies to conserve limited natural resources with resultant cost savings. Rebuilding also offers an opportunity for reducing potential damages from hazards other than floods and for increasing awareness of these hazards. As part of response and recovery, a team of federal experts would work through state agencies to provide communities and individuals technical assistance and information on the use of more innovative technologies.

MITIGATING LOSSES THROUGH FLOOD INSURANCE

The National Flood Insurance Program was created by Congress in 1968 in response to mounting flood losses and escalating costs to the general taxpayer for disaster relief in the belief that flood insurance is preferable to disaster assistance. To encourage participation in the NFIP by communities and purchase of flood insurance by individuals, the federal government subsidizes the premiums for buildings constructed prior to the issuance of a FEMA Flood Insurance Rate Map (FIRM). This subsidy also recognizes that many floodplain buildings were built or purchased without knowledge of the flood risk. New construction (post-FIRM) is charged an actuarial premium that reflects the property's risk of flooding. Currently 59 percent of NFIP policyholders pay a full actuarial rate and 41 percent are subsidized.[6]

If the NFIP is to be successful in indemnifying property owners from flood losses and reducing federal expenditures for disaster assistance, a high percentage of property owners must purchase and maintain flood insurance coverage. The program depends on the mandatory flood insurance purchase requirement contained in the Flood Disaster Protection Act of 1973 and voluntary purchase by other property owners at risk. The 1973 Act requires the purchase of flood insurance by property owners who receive federal grants or loans or loans from a federally supervised, regulated, or insured lender for the acquisition, construction, or improvement of structures located in identified special flood hazard areas (the 100-year floodplain). In the 9-state region affected by the 1993 flood, only about 20 percent of structures in the floodplain carried flood insurance, a rate well below optimal levels.

FLOOD INSURANCE VS. DISASTER PAYMENTS

The federal government should encourage the purchase of flood insurance because it internalizes the risk of locating investments in the floodplain, and it more adequately indemnifies property owners from flood losses. The Midwest flood confirms the Congressional findings in the Flood Disaster Protection Act of 1973, which states:

... 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 provisions of costly disaster relief benefits; and it is in the public interest for persons already living in floodprone areas to have both an opportunity to purchase flood insurance and access to more adequate limits of coverage, so that they will be indemnified for their losses in the event of future flood disasters.

NFIP Market Penetration

The NFIP has not achieved the public participation needed to reach its objectives. This situation is evidenced by the assistance provided to individuals and businesses during the Midwest flood. Although policyholders filed 16,167 flood insurance claims,[7] the FEMA approved 89,734 applications for the Disaster Housing Program and 38,423 applications for Individual and Family Grants. The SBA approved 20,285 loans for individuals and businesses.[8] Many of these applications or loan approvals were for persons outside of identified flood hazard areas or from renters who do not normally purchase flood insurance. Others, including many of those who obtained SBA loans, should have had flood insurance either because it was required or because they were at risk. Some of those who obtained SBA loans may have had flood insurance, but their coverage may not have been sufficient to cover their losses.

Estimates of those covered by flood insurance nationwide range from 20 to 30 percent of the insurable buildings in identified flood hazard areas. Initial estimates in the Midwest flood area ranged from below 10 percent up to 20 percent. None of the estimates are authoritative, since no nationwide inventory of floodprone structures exists. The Review Committee obtained reliable structure counts for a number of Midwest communities. Sources of these data included inventories conducted by state and federal agencies, data from community geographic information systems, data submitted by communities participating in the NFIP Community Rating System, and counts obtained by Review Committee members on visits to Midwest communities. Market penetration in these communities ranges from less than 5 percent to more than 50 percent. Based on this information, the Review Committee believes that market penetration in small rural communities is probably less than 10 percent. For most medium to large communities, market penetration appears to be in the 20 to 30 percent range. For a few large communities with middle-income floodplain populations and a high degree of flood hazard awareness among community officials, lenders, and property owners, market penetration can exceed 30 percent and, in one instance, 50 percent.

FLOOD INSURANCE COVERAGE IN THE MIDWEST

Although the nation lacks the structure inventories necessary for a reliable estimate of NFIP market penetration, the Review Committee obtained inventories for individual communities and groups of communities in the Midwest. These data indicate that market penetration is highly variable, depending on the size of the community, the history of flooding, the economic status of floodplain occupants, and the awareness of flood hazards among community officials, lenders, and individual property owners.

State or Community	Buildings Zone A	Policies Zone A	Market Penetration Zone A
Austin, Minnesota	316	174	55.1%
Lincoln, Nebraska (1-4 family)	2,076	475	22.8%
17 Midwest NFIP CRS Communities	14,876	4,467	30.0%
North Dakota (1-4 family)	13,907	3,933	28.3%
23 Minnesota Communities	1,095	157	14.3%

Source: Building counts provided by states, communities, the USACE, and the FEMA; NFIP policy data are from the NFIP Community Information System.

Increasing Flood Insurance Purchase

Lender compliance to the requirement for mandatory flood insurance has been receiving a considerable amount of attention during hearings on pending legislation. The concern is that lenders do not require purchase of flood insurance at closing, nor do they ensure that property owners maintain flood insurance coverage for the life of a loan. Despite differences of opinion over how well lenders comply with the mandatory purchase requirement, most people agree on the need for improvement and for increased compliance to increase NFIP market penetration.

However, the current dependence on the mandatory purchase requirement to drive high levels of market penetration may be unrealistic. According to the 1989 American Housing Survey, 42.4 percent of owner-occupied housing in the nation is owned free and clear of mortgages.[9] An additional percentage of those that are mortgaged were financed by sellers, other individuals, lenders not covered by the mandatory purchase requirement, or they were financed prior to implementation of the requirement. For the nation as a whole, it appears that over half of owner-occupied

properties are not subject to the mandatory purchase requirement.

Reasons other than lender noncompliance contribute to low levels of NFIP market penetration in the Midwest flood area. The most striking characteristic about the floodplain sections of communities visited by the Review Committee is that they appear to be predominantly low-income areas, whose populations have higher than usual percentages of renters, elderly, public assistance recipients, and property owners without mortgages. Housing ownership and sales in small rural communities differ from those in urban or suburban communities. Sales in small rural communities occur less frequently, often as cash sales or as sales financed through land contracts, loans from lenders who are not federally insured or regulated, or loans from family members. These small communities are precisely the areas where the mandatory purchase requirement would be applied least often and where voluntary purchase of flood insurance is least likely.

In the view of the Review Committee, other explanations for low market penetration in the upper Midwest include the false sense of security due to levees, particularly agricultural levees along the main stems of the Mississippi and Missouri rivers, the reluctance of insurance agents to market flood insurance in communities with few potential buyers, and a low level of awareness of the risk to those on the fringes of the floodplain.

Recommendation 9.4: *States should actively encourage flood insurance purchase by their citizens.*

States must play an active role in improving market penetration for flood insurance by working with communities and lenders and by assisting in education efforts. Fiscal assistance to states for floodplain management under a Floodplain Management Act should take into account a state's willingness to undertake this effort.

Action 9.2: *Increase NFIP market penetration through improved lender compliance with the mandatory purchase requirement.*

The Review Committee supports current attempts in pending legislation (S 1405 and HR 3191 both entitled, The National Flood Insurance Reform Act of 1994) to improve the level of lender compliance. This should include establishment of penalties for lenders who do not require the purchase or maintenance of flood insurance coverage.

Action 9.3: *Provide for the escrow of flood insurance premiums or payment plans to help make flood insurance affordable.*

The escrow of flood insurance premiums in those instances where the lender escrows property taxes and hazard insurance would ensure that coverage is maintained over the life of a mortgage. Additionally, those who may not be able to afford a one-time annual payment of a flood insurance premium would be more likely to purchase and maintain flood insurance coverage, if it were possible to spread the cost of the premium through the escrow of flood insurance premiums. The NFIP should provide payment plans for those who do not have mortgages and voluntarily purchase flood insurance.

Action 9.4: *Develop improved marketing techniques.*

Although improved lender compliance is critical to achieving increased market penetration, it will not by itself drive insurance purchase to the levels necessary to achieve program objectives. The program requires additional measures to increase voluntary purchase of flood insurance by those property owners not subject to the mandatory purchase requirement.

Counteracting Negative Incentives for Insurance Purchase

A perception persists that disaster assistance compensates homeowners as fully as flood insurance coverage. This may or may not be true depending on the value of the property affected and the income of the owner. A particular concern expressed by communities and others after the Midwest flood is that disaster victims, particularly those with lower incomes, who obtain disaster assistance from the Individual and Family Grant Program, the Disaster Housing Program, the Red Cross, and other programs may end up as well off as those who purchase flood insurance and receive payment for claims. Generous disaster assistance creates negative incentives for the purchase of flood insurance. The government and the insurance industry must ensure that the public is fully aware of the advantages of flood insurance and the limitations of disaster assistance. They must work to ensure that disaster benefit payments do not approach or exceed flood insurance benefits. Floodplain occupants must be aware that disaster assistance is only available during a Presidentially declared disaster while flood insurance claims are paid any time a general condition of flooding occurs.

Action 9.5: *Reduce the amount of post-disaster support to those who could have bought flood insurance but did not, to that level needed to provide for immediate health, safety, and welfare; provide a safety net for low-income flood victims.*

The FEMA should seek authority to limit the amount of disaster assistance to individuals in the 100-year floodplain who have not purchased flood insurance and investigate approaches that could be used to provide a safety net for those not able to afford flood insurance premiums.

Insuring Those Behind Levees

The Midwest flood brought to the forefront issues regarding the residual risk behind levees, the catastrophic damages that can occur, and the false sense of security that develops among floodplain occupants. Most of the levees that were overtopped or failed were agricultural levees not credited as providing 100-year flood protection, but some credited 100-year levees were overtopped or failed, such as a local levee at Chesterfield, Missouri, and a federal levee at Elwood, Kansas. The mandatory NFIP purchase requirement and floodplain management regulations do not apply behind credited 100-year levees. New structures were not protected from flood damage, and many buildings were not insured. Flooding threatened other credited levees that protect urban areas, and they too could have overtopped or failed had floodwaters been higher.

Currently if a levee meets minimum criteria established by the FEMA, that levee is credited as providing flood protection, and the application of floodplain management requirements and the purchase of flood insurance are not mandatory. The FEMA criteria require that the levee be at or above the elevation of the 100-year flood plus three feet of freeboard and meet certain structural requirements. Levees built by the USACE or other federal agencies are certified by the sponsoring agency.

The Review Committee is concerned that the minimum level of protection recognized by NFIP levee criteria and the level of protection that could result from current USACE procedures for selecting the design level for a federally constructed levee are not sufficient, given the residual risk to new and existing buildings behind levees. The residual risk to a building constructed behind a levee designed to provide protection from a 100-year flood is substantially greater than the risk to a building elevated to or above the 100-year flood elevation. This difference in residual risk, produced by the catastrophic damage that would occur if the levee is overtopped or fails, warrants a reevaluation of current federal policies toward levees and levee construction. Residual risk further warrants designating areas behind levees as flood hazard areas subject to the mandatory flood insurance purchase requirement.

PAYING CLAIMS BEHIND THE MONARCH-CHESTERFIELD LEVEE

The Monarch-Chesterfield Levee at Chesterfield, Missouri, is an example of a levee that induced floodplain development and of the residual risks that result from depending on a levee for flood protection. The Monarch Levee was an agricultural levee with an extensive emergency repair history that was upgraded during the 1980s to meet early NFIP standards. Subsequent to the completion of the levee and its being credited by the NFIP as providing 100-year protection, an industrial area developed behind the levee. In 1993 when it became apparent that the levee might overtop or fail, many property owners were able to purchase flood insurance and later to receive claims payments. Other property owners did not have flood insurance or did not meet the 5-day waiting period for coverage. The Review Committee identified at least 67 flood insurance claims payments behind the Monarch Levee that totaled $13.2 million. This represents nearly 5 percent of the total flood insurance payments for the 9-state region. The flooding of this industrial area had severe impacts to the area not only from insured and uninsured damages but also from the temporary or permanent loss of jobs.

SOURCE: FEMA Federal Insurance Administration, claims data for 1993, geocoding by the Floodplain Management Review Committee.

Action 9.6: *Require actuarial-based flood insurance behind all levees that provide protection less than the standard project flood.*

The FEMA should designate as AL zones those areas behind levees designed to meet current minimum NFIP criteria but which do not provide protection from the Standard Project Flood (SPF) discharge. The AL zone would include those areas landward of the levee that are below the 100-year flood elevation. The mandatory flood insurance purchase requirement would apply within this AL zone, and new buildings would pay flood insurance premiums based on actuarial rates. The FEMA could establish floodplain management requirements for these areas, although elevation or floodproofing to or above the 100-year flood elevation should not be mandatory. This recommendation is similar to one in the 1982 National Academy of Science's National Research Council report, *A Levee Policy for the National Flood Insurance Program.*

A mandatory flood insurance purchase requirement behind such levees would provide a number of benefits to the public and to property owners:

- Property owners would be insured against the real possibility that a levee will be overtopped or will fail,
- Federal expenditures for disaster assistance would decline,
- Property owners would be more fully aware of the residual risk in building or locating behind a levee, and
- Communities would have an incentive to seek higher levels of protection.

Existing Flood Insurance Rate Maps should be revised where appropriate to reflect AL zones. The FEMA should obtain a legal opinion on whether this designation could be made based on residual risk of catastrophic loss, or if it would require legislation.

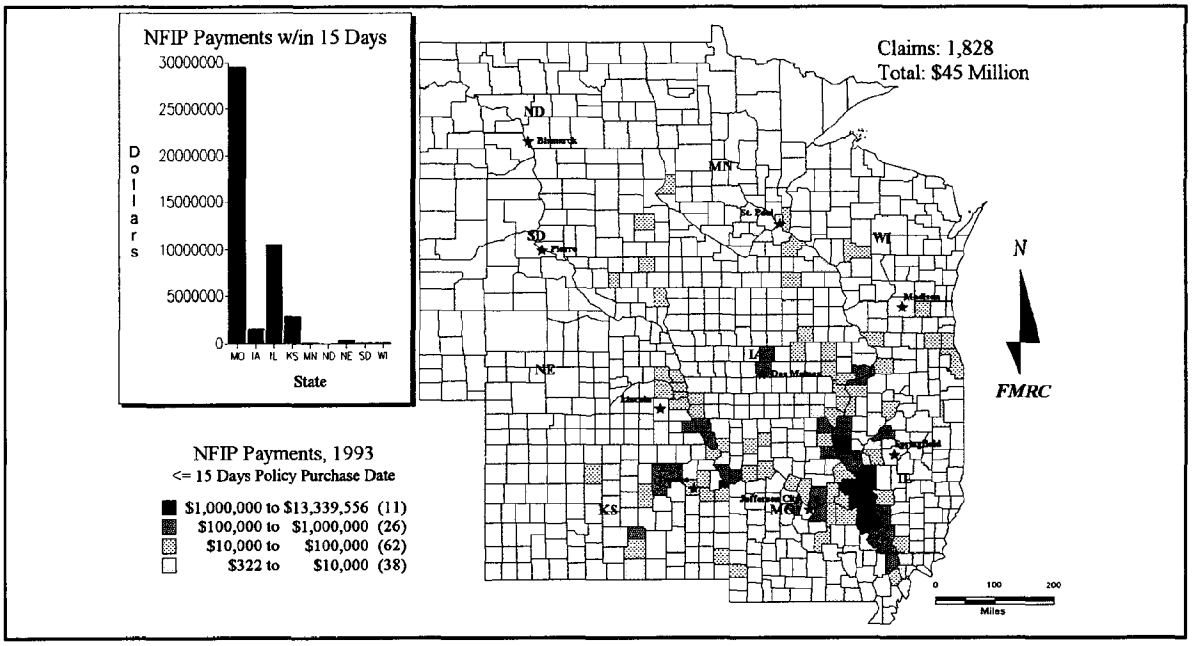
Increasing the Waiting Period for Flood Insurance

The NFIP requires a 5-day waiting period between the time of purchase of a flood insurance policy and when coverage becomes effective. At the closing on the sale of a property, flood insurance can be purchased withcoverage effective immediately. The intent of the waiting period is to ensure that property owners cannot wait and purchase flood insurance only when floodwaters threaten their building.

The Midwest flood demonstrates that a 5-day waiting period before flood insurance becomes effective is insufficient for main stem flooding. In the Midwest flood, 13,310 losses resulted in claims payments totaling $297 million. Over a third of these claims were for losses that occurred within 60 days of the purchase of the initial flood insurance policy for the property. If a 15-day waiting period had been in effect for the Midwest flood, 1,828 fewer claims would have qualified, and claims payments would have been $45 million less (Figure 9.1). If the waiting period had been 30 days, 3,390 fewer claims would have qualified, and claims payments would have been $82 million less. If the waiting period had been 60 days, 4,588 fewer claims would have qualified, and claims payments would have been $105 million less.[10]

Most of these losses were for properties in downstream areas behind levees in Illinois and Missouri. Owners of these properties purchased flood insurance after watching upstream levees overtop and fail. In at least one instance, a community undertook a gallant floodfight not in expectation of protecting a school but rather to keep it from flooding until the 5-day waiting period had expired. The 5-day waiting period creates an incentive to purchase flood insurance coverage onwatching upstream levees overtop and fail. In at least one instance, a community undertook a gallant floodfight not in expectation of protecting a school but rather to keep it from flooding until the 5-day waiting period had expired. The 5-day waiting period creates an incentive to purchase flood insurance coverage on

Figure 9.1 NFIP Payments for 1993 Losses that Occured Within 15 Days of the Purchase of the Policy.



main stems only when flooding is imminent. It is also inequitable for those policyholders who have bought and maintained coverage for a period of years. If the practice became widespread, it could threaten the fiscal soundness of the National Flood Insurance Fund. One consequence of this flood is that some policyholders in the lower basin may drop their coverage in expectation of having time to purchase coverage based on flood forecasts.

Action 9.7: ***Increase the 5-day waiting period for flood insurance coverage to at least 15 days.***

The 5-day waiting period for flood insurance coverage is too short for main stem riverine flooding and should be increased to at least 15 days. At the closing on the sale of a property, coverage should continue to become effective immediately. A 15-day waiting period would introduce sufficient uncertainty to ensure that property owners did not purchase flood insurance only when flooding was imminent. Data from the Midwest flood alone would warrant a 30-day waiting period. FEMA should balance the benefits of a 30-day waiting period against possible impacts on the marketing of flood insurance in other parts of the nation.

IMPROVING THE FEDERAL CROP INSURANCE PROGRAM

Multiple Peril Crop Insurance has been available to farmers for more than 50 years. There have been substantial changes in the program, however, during the intervening years. The Federal Crop Insurance Act of 1980 (PL 96-365) was the last major overhaul of the way insurance is offered to farmers. The purpose of the legislation was to create an insurance program that was almost actuarially sound and had limited government financing and to completely replace ad hoc disaster payments.[11] In the 1970s the existing policy for agricultural crop disaster assistance was expensive and encouraged production in high-risk areas.[12] However, the results of the 1980 reform were disappointing. The program suffered from poor actuarial performance and limited participation, and failed to eliminate federal crop disaster assistance. In fact, disaster payments exceeded $6.9 billion from 1980 to 1989.[13] The current insurance program subsidizes the transfer of risk from farmers to the government rather than being an efficient risk-sharing mechanism.[14]

The Administration has proposed to reform the Federal Crop Insurance Program as a result of these long standing problems and as a direct response to problems experienced by farmers in 1993 who had crop insurance and were flooded. The Administration's Federal Crop Insurance Reform Act was submitted to Congress in March 1994 by the Secretary of Agriculture. The Act contains several features that promise to improve the crop insurance program as a risk-sharing mechanism. It also proposes to repeal standing disaster assistance authority and require that crop insurance coverage be linked to obtaining farm program benefits and FmHA loans.

Data on participation in the current program by floodplain farmers are not available. Discussions with floodplain residents indicate that few farmers choose to participate in the crop insurance program because they consider the 75 percent maximum coverage too low, flooding is relatively rare, and disaster assistance is available that almost equals the insurance indemnity. Drought is the primary natural peril for which farmers make claims, and floodplain farmers are less at risk for the effects of drought than upland farmers. On average, floods represent only 2 percent of the FCIC insurance payments.[15]

Action 9.8: ***The Administration should continue to support reform of Federal Crop Insurance that limits crop disaster assistance payments, increases participation, and makes the program more actuarially sound.***

The Review Committee supports the current initiatives by the Administration to pass the Federal Crop Insurance Reform Act of 1994. It is proposed that FCIC modify its process to make crop insurance actuarially sound. Insurance participation will be increased if coverage is a prerequisite for participation in other USDA programs and will bring more floodplain farmers into the program. The Act also attempts to reduce the demand for ad hoc disaster assistance.

ENDNOTES

1. In 1992 after Hurricane Andrew, President Bush tasked the Secretary of Transportation with recovery and in response to the 1993 flooding disasters, the Secretary of Agriculture was tasked.

2. Director of the Office of Management and Budget; memorandum to heads of agencies on non-structural floodplain measures and flood disaster recovery, July 10, 1980.

3. Memorandum of Agreement on Interagency Hazard Mitigation. Signed by 13 federal agencies, December 16, 1980.

4. The Federal Interagency Floodplain Management Task Force was established in 1975 within the US Water Resources Council. In 1982, OMB assigned its responsibilities to FEMA, which assumed the role of chair. See Federal Interagency Floodplain Management Task Force, *A Unified National Agenda for Floodplain Management* (draft), FEMA Document 248, (Washington, DC: FEMA, April 1994).

5. Memorandum of Agreement between the USDA Soil Conservation Service, and the U.S. Department of the Army, May 20, 1986.

6. Krimm, Richard W., Associate Director, Federal Emergency Management Agency, memorandum, May 9, 1994.

7. Federal Emergency Management Agency, Federal Insurance Administration, computer print-out SRR1387C, March 16, 1994.

8. "Status of Individual Assistance Activities for Major Disasters in the Midwest," Federal Emergency Management Agency, (Washington, DC: FEMA, April 14, 1994).

9. U.S. Department of Commerce and U.S. Department of Housing and Urban Development, *"American Housing Survey Data Chart,"* (Washington, DC: DOC and HUD, 1989).

10. Developed by the committee from computer data provided by the FEMA Federal Insurance Administration, May 1994.

11. Miranda, Mario J., "Area-yield crop insurance reconsidered," *American Journal of Agricultural Economics*, 72:233-242 (May 1991),

12. Miranda, Mario J., and Joseph W. Glauber, "Providing crop disaster assistance through a modified deficiency payment program," *American Journal of Agricultural Economics*, 72:1233-1243 (November 1991),

13. U.S. General Accounting Office, *Disaster Assistance: Crop Insurance Can Provide Assistance More Effectively Than Other Programs*, Report to the Chairman, Committee on Agriculture, U.S. House of Representatives, GAO/RCED-89-211, (Washington, DC: GAO, September 1989).

14. Nelson, Carl H., and Edna T. Loehman, "Further toward a theory of agricultural insurance," *American Journal of Agricultural Economics*, 69:523-531 (August 1987),

15. U.S. Department of Agriculture, Federal Crop Insurance Corporation, "1994 Guide to Crop Insurance Protection: Risk Management for the 90's," Management Support Branch Report (Washington, DC: USDA, 1994).

Part III

A FRAMEWORK PLAN FOR THE UPPER MISSISSIPPI RIVER BASIN

Chapter 10

A NEW APPROACH FOR THE UPPER MISSISSIPPI RIVER BASIN

...we need a comprehensive strategy to substitute for what has been the piece-by-piece building of our levee system in the Upper Mississippi. The River is a single system. Actions in one place to keep water out mean that pressure elsewhere along the system increases, often with adverse effects on other communities...

Richard Gephardt
House Majority Leader
October, 1993

Earlier chapters of this report have suggested a new approach for floodplain management, including collaborative planning by all stakeholders, i.e., local, tribal, state, and federal governments, businesses, and the people who occupy floodplains either through choice or happenstance. The Review Committee has addressed floodplain management issues from both a national perspective and as they apply to the flood-affected nine-state area. This chapter, in response to the Committee's charge, considers the current state of the upper Mississippi River Basin, considers improvements to the present situation, and suggests ways to apply the new approach to those improvements.

DEALING WITH THE RIVER SYSTEM AS A WHOLE

The upper Mississippi River Basin is affected by a complex of independently managed federal programs for navigation and flood damage reduction, water quality improvement, natural resources protection and enhancement, and agricultural production. To coordinate and sustain water resources development consistent with national floodplain management goals, these programs need to be integrated using existing or modified institutional arrangements among federal, state, tribal, and local agencies. The federal sector, however, must first set an example by coordinating programs across its agencies.

Currently no single entity has federal or federal-state oversight responsibility for the range of activities within the upper Mississippi River basin, or for ensuring that funding and performance among programs are commensurate with national goals. The Review Committee found no single hydraulic or hydrologic model, and no system-wide flood reduction strategy or ecosystem management strategy within the basin. Linkage exists among system components, but separate federal agencies deal with component problems independently. With the demise of the river basin planning institution embodied in the Water Resources Planning Act of 1965 (PL 89-80), the coordinated basin-scale approach lost prominence in American water resources planning in favor of more generic and site-

specific solutions.[1] This state of affairs exists despite the tenets of the *P&G* and the NEPA that call for direct, indirect, and cumulative impact analyses and integration of regional federal actions. The situation is exemplified by the number of separate activities currently underway in the basin, such as the Missouri River Master Manual Review and Update Study, the Upper Mississippi River-Illinois Waterway Navigation Study, the Upper Mississippi River Basin Floodplain Management Assessment, the Missouri River Mitigation Project, the Upper Mississippi River Environmental Management Program, and many USACE studies directed at improving or building individual levee projects in the basin.

REDUCING THE VULNERABILITY OF THOSE IN THE FLOODPLAIN

Three situations made evident by the 1993 flood point to the need for reducing the vulnerability of those in the floodplain of the upper Mississippi River Basin. First is the hazard of being in the floodplain. The 1993 flood was a major natural event but floods of even greater magnitude or of larger areal extent could occur at any time. USGS staff reported to the Review Committee that only 30 percent of the streamgaging stations in the flood-affected area recorded discharges having greater than a 10-year recurrence interval and less than one in ten recorded flowrates greater than that of the 100-year flood. Another factor to consider is the presence of the New Madrid Fault, which has potential to create seismic damage to structures over an area encompassing many of the 1993 flood-affected states. This points to the need for multi-hazard planning in known hazard zones. Second, the federal government is being asked to restore much of the pre-flood structural system on an individual project basis without knowledge of system-wide benefits or costs. Structures, lives, and livelihoods will remain vulnerable to damage even with complete restoration of levees and despite buyouts and relocations, . Third, the flood-related, landscape-shaping processes witnessed in the 1993 flood will recur, and these processes will help define compatible uses of the floodplain. Some areas will remain more inherently risky to occupy or develop than other areas.

Current Approaches To Flood Damage Reduction

Development of flood damage reduction strategies in the upper Mississippi River Basin contrasts sharply with that in the lower basin. From the mouth of the Ohio River downstream almost to the Gulf of Mexico, the nation has an integrated system of federally planned, designed, constructed, and maintained facilities. The system includes main stem and tributary levees, floodway bypasses, interior drainage pumping stations and flood storage dams. In the upper Mississippi River Basin, most flood damage reduction facilities were not constructed in accordance with any system plan but were developed on a project-by-project basis by a host of individuals, drainage and levee districts, and the federal government.

Major tributary and main stem flood storage reservoirs in the Missouri River Basin were developed by the USACE and the Bureau of Reclamation as part of the Pick-Sloan Plan (Chapter 2). However, the systematic approach for building main stem levees offered by the Pick-Sloan Plan was never fully implemented. Many levees were constructed by local owners without consideration of the Plan's provision to set levees sufficiently back from the riverbank to retain the floodplain's capacity to convey floods. The result is a collection of federal and non-federal facilities of greatly varying structural integrity, providing widely varying levels of protection for similar land uses, and placed, in some cases, upon the floodplain without full regard to their impacts on the river upstream, across or downstream. Some levees were sited without adequate consideration of physiographic features, the forces the river itself imposes upon them during flood, or their riparian environment. For most of the past 60 years, construction of structural measures was the primary method chosen for flood damage reduction. Under the new approach, nonstructural measures, consideration of

basin-wide hydrologic and river hydraulic processes, and ecosystem functions would weigh heavily in project planning and design. Structural flood damage reduction projects have been built throughout the upper Mississippi River Basin. These projects should be reviewed and in-depth consideration given to modifications that will achieve floodplain management goals.

Levees

By some counts, over 8,000 miles of levees of various description exist in the upper Mississippi River Basin (Chapter 2). They represent a mix of age, ownership, size, purpose, and quality. Most levees, other than those connected with the navigation system, have their origins in efforts by communities, individuals, and groups to protect their land from flooding. They date back, in many cases, to early settlement. Since passage of the 1936 Flood Control Act, many levees have been upgraded or replaced by federal construction and are maintained by local owners or sponsors. Others, built and maintained by local owners, are eligible for post-flood emergency repair under the USACE PL 84-99 program. Eligibility for inclusion in the USACE program requires that a levee be a primary one that provides an adequate level of protection, that it be sponsored by a public entity, that the sponsor maintain the levee to a standard established by USACE, and that the cost of any levee repair be shared: 20 percent by the local sponsor and 80 percent by federal government. Local sponsors also provide all lands, easements, and rights-of-way needed for repairs. Levees not in the USACE program tend to be smaller, single-owner structures or those publicly sponsored levees whose sponsors did not desire to maintain them to USACE standards.

These levees, constructed by different agencies and individuals at various times and under various programs, have very few common characteristics. Their physical composition varies by reach of the river. Some are on the riverbank while others are setback appropriately to permit flood flow conveyance. Many of those built in areas subject to swift currents during floods or over formerly active river channels are destined to fail again and again. Most non-federal levees were built without any substantive understanding about impacts on river hydraulics and the riparian environment. Many of the federal levees were built prior to the availability of river hydraulic models and geologic maps that could provide such needed information. In some cases flows have increased for the same meteorological conditions because of upstream development. Determination of the level of protection provided by a levee is an important piece of information frequently difficult to obtain.

Natural Resources

From the ecosystem perspective, current flood-reduction strategies have direct effects on the floodplain resources and functions at locations where they were implemented, and indirect effects elsewhere in the system (Chapter 2). The lower Mississippi River currently is receiving hydrologic restoration through installation of water control structures in selected interior areas. The upper Mississippi River is receiving ecosystem restoration attention through the Environmental Management Program. The Missouri River, however, remains one of the most highly impacted and least attended floodplain ecosystems. The watersheds of these floodplains receive varied attention through federal programs.

The assemblage of levees described in the preceding section may be considered a metaphor for natural resource management on these rivers. System-wide, coordinated, and integrated management of the Mississippi River ecosystem is not currently a defined objective of any agency, nor is such an approach a part of agency operational plans at the regional or local levels.[2] The Review Committee has found this to be the case with the Missouri River as well. Although several federal agencies have complementary goals and the NEPA establishes a common environmental goal for all federal agencies, no single agency serves as the necessary focal point for ecosystem protection needs in ongoing water management decisions.[3] Separate government programs address land use, nonpoint source pollution, major point sources of pollution, wetlands, and a host of other environmental concerns. Failure to integrate such programs makes it difficult for land and water managers to achieve their goals.[4]

System Integration

It is now recognized that the combination of existing levees requires a systematic hydrologic and hydraulic analysis to determine flood-damage reduction efficiency. Federal agencies must become partners in conducting a systemic analysis of basin hydrology, hydraulics, and overall ecosystem condition. Future decisions regarding federal, state, and local investments will require assessment of the following:

- Impacts that levees may create as physical factors having hydraulic and ecological consequence,
- Effects of river regulation as a hydraulic and hydrologic factor having ecological and flood consequences,
- Effects of watershed condition as a hydrologic factor having ecologic and flood consequences, and
- Impacts of physical and hydrologic characteristics on economic productivity and of government policies as incentives or disincentives on decisions to develop the floodplain.

Detailed analysis of system hydrology and hydraulics will result in the means to evaluate levees for a variety of factors, such as current protection level, flood insurance rate mapping, habitat restoration, flood storage and/or conveyance, and design modification to achieve any combination of objectives. At the same time, an ecological inventory and analysis of species-habitat relationships will provide a sound basis for cooperative decisions regarding river regulation, land acquisition, watershed planning, flood damage reduction, and mitigation activities. The assessment of economic productivity and effects of government policies will determine tradeoffs inherent in watershed planning choices. Many operational and administrative efficiencies should be realized subsequent to completion of system-wide analyses.

Administrative Integration

To organize ongoing activities, the Review Committee sees the need for two levels of activity:

- A strategic level that will result in development of comprehensive plans for water and related land resource development. This strategy is embodied in the authorities of the basin commissions established under Title II of PL 89-80;
- An operational level such as that of the Mississippi River Commission, but with an expanded focus to include stewardship of the ecosystem that supports current and desired levels of development.

At the strategic level, utilization of a regional institutional framework for comprehensive planning was exemplified by the Upper Mississippi River Basin Commission (UMRBC). The UMRBC prepared a Comprehensive Master Plan for the Management of the upper Mississippi River system in response to Section 101 of the Inland Waterways Authorization Act of 1978 (PL 95-502). Termination of the UMRBC and five other basin commissions by EO 12319 in 1981 complicated implementation of the master plan, which represented a successfully integrated federal-state-local planning effort with substantial public input. PL 99-88 and PL 99-662 ultimately authorized implementation of portions of the master plan, one element of which is the Environmental Management Program. This requires federal and state agency input to the USACE through the Upper Mississippi River Basin Association (UMRBA). The UMRBA evolved from the basin commission framework and continues through state commitment to the collaborative planning process. The UMRBA is basically a policy research and coordination forum for the upper Mississippi River basin states. Because the UMRBA is a state initiative, the federal government has no voice in planning activities.

Action 10.1: *Establish upper Mississippi and Missouri basin commissions with a charge to coordinate development and maintenance of comprehensive water resources management plans to include, among other purposes, ecosystem management, flood damage reduction, and navigation.*

Reestablishment of the basin commissions will help decisionmakers reach fully coordinated floodplain

management decisions within the larger context of basin-level water resources planning and goals. Through minimal staffing with qualified leadership, the basin commission format, authority, and funding mechanisms provided by PL 89-80 will stimulate non-federal attention to timely completion, update, and implementation of multiple-use plans (Figure 10.1). The Review Committee considers basin commissions to be a necessary link between federal and state agencies and a coordination forum for implementing national policy. The basin commission structure is described in detail in Appendix I.

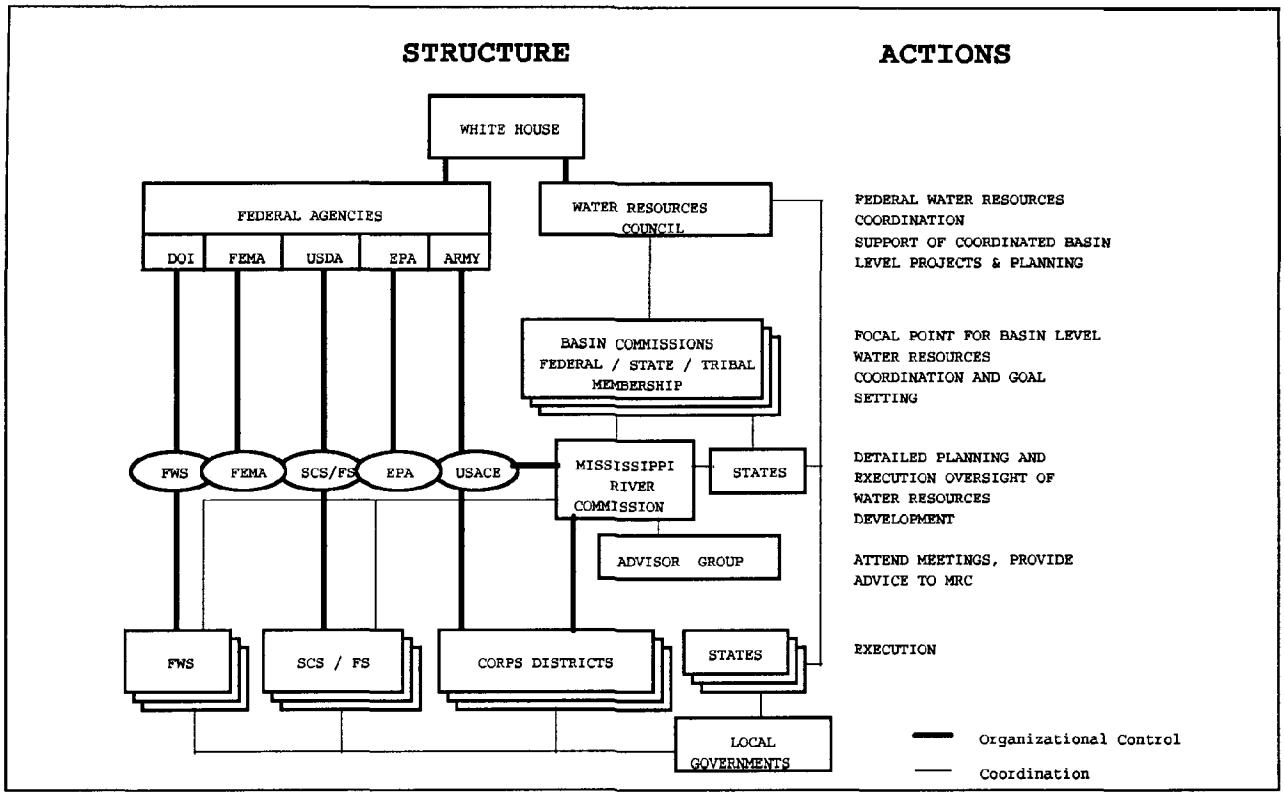
At the operational level, an institutional framework is currently in place to effect operational modifications of flood damage reduction and navigation facilities throughout the basin. The foundation of this framework is the technical capability on water resources found within the USACE. Beyond this technical capability, Congress provided for detailed project planning and implementation oversight on the Mississippi River by establishing the Mississippi River Commission (MRC) in 1879. The MRC Act authorized the Commission to extend its activities "between the Head of Passes near its mouth to its (Mississippi River) headwaters." Until the late 1920s the MRC was based in Saint Louis, Missouri, and was active in mapping the entire river. In 1928 the current Mississippi River and Tributaries (MR&T) project was authorized for the lower Mississippi River basin as a result of the devastating 1927 flood. Since then the MRC, which relocated to Vicksburg, Mississippi, has focused on the MR&T project, though it did continue to build levees in the upper Mississippi River basin as far north as Rock Island, Illinois, until the early 1950s. For more than 60 years the MRC has focused attention on the MR&T project, but its authority still extends to the Mississippi River headwaters. The MRC reports program performance directly to the USACE Chief of Engineers and the White House. No similar framework or technical foundation is in place within one agency or between agencies responsible for natural resource protection or management within the upper Mississippi River basin. Of major importance, no direct connection exists between natural resource management and management of the river and floodplain for other uses.

Action 10.2: ***The Administration should expand the mission of the Mississippi River Commission to include the upper Mississippi and Missouri rivers. Further, to recognize ecosystem management as a co-equal federal interest with flood damage reduction and navigation, the Administration should request legislative change to expand commission membership to include the DOI.***

The Review Committee heard from a number of groups who expressed a desire for establishment of a coordinating body. Conversely many groups have expressed concern over this recommendation. Both pro and con positions are based on perceptions of the MRC and past actions under MRC oversight, primarily the MR&T project. To many the MRC has been synonymous with big levees, uniform main stem river protection, and loss of habitat. The MR&T project began its 70-year development with a structural focus on navigation and a uniform level of flood protection on the main stem Mississippi River. In furtherance of national goals, the MR&T project supported development of agriculture. Environmental resources and natural floodplain functions were foregone. Over the last 20 years, in response to a shift in national goals toward environmental quality, the MRC has been adjusting the MR&T project to provide habitat restoration and environmental enhancement.

The expanded commission will provide for detailed planning and execution oversight of water resources development projects, and it will assure appropriate fiscal attention to programs necessary for achievement of national floodplain management goals. The USACE Chief of Engineers and the Secretary of the Interior will receive annual commission reports on the performance of navigation, flood damage reduction, and ecosystem management projects. Because of the direct relationship between basin hydrology, river hydraulics, and floodplain ecosystem function, expanded membership of the commission will ensure coordination between multiple-use interests. The principal utility of the MRC

Figure 10.1 Proposed Institutional Framework.



model is accountability. It is anticipated that multiple program integration and performance will be assured by assigning responsibility to a single entity which answers directly to the public and the Administration. DOI membership is provided to ensure that its programs for ecosystem stewardship are fully integrated with other activities under MRC oversight. Because of the interrelationship of missions and responsibilities involving water resources, transportation, and emergency preparedness, the MRC advisor group membership must also include the DOT, FEMA, USDA, and EPA. Current and expanded river commission function and structure are suggested in Appendix I.

COORDINATION OF LEVEE ACTIVITY

At the same time that the Administration is considering long-term floodplain management objectives, the federal government has appropriated funds for the repair of many levees damaged by the 1993 flood. The actions proposed subsequently in this chapter and elsewhere in the report are not directed at stopping ongoing authorized activities but are presented to provide necessary integration among federal programs. Federal and state oversight over non-federally constructed levees is diffuse. Several states regulate construction in floodplains, but many do not. The situation is further exacerbated by the potential for future flow increases that could occur if development continues upstream and by the uncertainty about changes that may occur in long term weather patterns. Without a systematic approach, a variety of levee problems will continue.

Action 10.3: *Assign responsibility for development of an Upper Mississippi River and Tributaries (UMR&T) system plan and for a major maintenance and major rehabilitation program for federally-related levees to an expanded Mississippi River Commission, operating under the USACE.*

The objective of developing the UMR&T system plan is to determine how best to integrate existing facilities in the upper Mississippi River Basin into an efficiently functioning flood damage reduction system that is compatible with floodplain ecosystem function. A component of the plan would incorporate all eligible levees in the upper Mississippi River basin into a program to ensure their long-term functional integrity for flood damage reduction and to improve ecosystem function. The functional integrity objective would be accomplished through a federal-state-local cost-shared program of systematic major maintenance and major rehabilitation. Routine maintenance and repair would continue to be a state-local responsibility. The ecosystem function restoration objective would be met by such measures as installation of water control structures in the levees to allow connection of the river with floodplain wetlands and former channels during non-flood periods. These facilities would also be used to control flooding of areas behind levees when overtopping is imminent to avoid a levee breach and the consequence of catastrophic flooding. Involvement in the program by levee sponsors would be voluntary.

Development of such a plan will require a survey to evaluate and identify all levees on the main stems of the Mississippi, Missouri, and Illinois rivers, for program eligibility and/or design criteria. The survey will include tie-back or flank levees on tributaries and those tributary levees currently in the USACE PL 84-99 program. During this survey, information can be gathered to form a foundation for systematic analysis of each levee under the objectives of systemic floodplain management and flood damage reduction.

The USACE is currently engaged in completing repairs to hundreds of levees under its PL 84-99 program. In addition the Congress has charged the USACE with completion of a Floodplain Management Assessment of the upper Mississippi River Basin by the spring of 1995.[5] This ongoing activity could, with congressional approval, be redirected in scope to take advantage of information gathered during the post-flood recovery and reconstruction process.

Action 10.4: *Seek approval from the Congress to redirect the USACE Floodplain Management Assessment of the upper Mississippi River Basin to development of an UMR&T systems plan. Place this assessment under the Mississippi River Commission, operating under the USACE.*

The refocused study would assess the condition of presently existing levees and would develop a general plan for basin flood damage reduction, including structural and nonstructural measures. Development of a flood damage reduction strategy should be collaborative and conducted using the revised *P&G* and the NEPA process to ensure full participation of affected and interested parties in floodplain management. The systemic approach will necessarily involve consideration of the upper Mississippi River Basin and the basin of its principal tributary, the Missouri River, as individual and aggregate watersheds with both unique and common human uses and ecosystem functions. Representatives of the USDA, FEMA, DOI, and EPA should participate on the study team because of their agency missions in watershed management, floodplain regulation, natural resources stewardship, and water quality protection.

Action 10.5: *Following completion of the survey, seek authorization from the Congress to establish the UMR&T project.*

Authorization of the UMR&T project is needed to assign responsibility to the USACE to develop and execute the federal program of major maintenance and major rehabilitation (MM&MR) of those levees found to be eligible for inclusion. The UMR&T project would be identified as a separate line item in the USACE budget and would be funded by annual appropriation.[6] Under the MM&MR program, the

USACE would be responsible for major maintenance and major rehabilitation of levees that are determined by the USACE to be eligible for the federal program. Major maintenance includes such activities as levee surveys and setbacks; repair of levee slides, culverts, and floodwalls; slope paving; and major erosion protection. The FY 94 MRC budget for repair of 1,600 miles of main stem levees in the MR&T project is $4.9 million. Although by comparison the total length of levees in the UMR&T project would be greater, they are smaller in size and the river depths and velocities are lower. Thus the annual cost of major maintenance for the proposed UMR&T project is expected to be the same order of magnitude as for the MR&T project. The cost of major rehabilitation is one of either pay now or pay later; money not spent in a systematic way to rehabilitate aging levee drainage pumping facilities, culverts, gate structures and like facilities will be spent making emergency repairs during and after floods. The federal cost of repairing levees in the upper Mississippi River Basin that were damaged during the 1993 flood is expected to amount to $300 million.

To be eligible for inclusion in the MM&MR program, levees would have to be of such construction as to meet the USACE engineering standards for structural integrity and for proper siting, and they would have to be in good standing in the current USACE PL 84-99 program (or be working toward that end under the 1993 flood-recovery effort). Local levee sponsors would include the states as co-sponsors, and would have to be part of a community enrolled in the NFIP, agree to obtain structure and crop insurance (in the amended program), limit floodfighting, and participate in environmental enhancement activities. For details of the MM&MR program, see Appendix H.

Role of the States

Levees not currently eligible for emergency repair under the PL 84-99 program, and thus not eligible for the UMR&T project, should be regulated by the states when changes are made for either repair, rehabilitation, realignment, or improvement. Future inclusion of a levee in the PL 84-99 program would require, in addition to meeting current USACE eligibility criteria, acknowledgment by the state that the levee is publicly sponsored, does not cause adverse river hydraulic conditions elsewhere, and provides an appropriate level of protection. A levee that subsequently becomes eligible for the PL 84-99 program would require congressional authorization to become eligible for inclusion in the UMR&T project. Levee sponsors and owners who choose not to participate in the PL 84-99 program and those ineligible for participation will not receive federal assistance for repair of damaged levees. This may not preclude assistance under the USDA Emergency Watershed Program.

As discussed elsewhere in this report, not all states in the upper Mississippi River Basin have a permit program whereby either proposed or existing levees are reviewed for compliance with state-established standards for design, construction, maintenance, and repair. Few if any control either the decision about where levees are placed relative to the river channel or whether a particular levee should be protected from overtopping (floodfought) during a flood, although such actions can have hydraulic and environmental consequence elsewhere. The Review Committee found that some states have little or no involvement in the processes associated with federal levee programs since federal agencies generally deal directly with levee districts. Given these circumstances and the number of levees damaged in the flood of 1993, it is clear that there is need for greater involvement of the states in the design, construction, maintenance, and repair of levees.

Recommendation 10.1: *Where they do not already do so, states should assume responsibility for regulating levee-related activities such as levee location, alignment, design, construction, upgrade, maintenance, repair, and floodfighting.*

This is not a call for levee construction but for state oversight of levees to assure their structural integrity and that actions in one location along the river do not create adverse impacts elsewhere.

Using current technology the states have the capability to assure that existing levees are properly located and aligned to avoid or minimize hydraulic impacts and to

avoid high energy, damage-prone locations on rivers. Using a levee permit program, states could also assure that the embankment and foundation conditions meet engineering and environmental standards, that the level of protection afforded is commensurate with land use, that maintenance and repair are performed to assure structural integrity, and that floodfighting is limited to areas deemed critical by the state.

ECOSYSTEM NEEDS

Although federal and state agencies recently have articulated general policies regarding pursuit of ecosystem management, they need a coordinated, multi-agency, ecosystem-based plan upon which to base water resource and floodplain management decisions. Pursuit of watershed planning requires a single hydrologic/ hydraulic model. It also requires development of a natural resource baseline against which agencies can develop and implement appropriate maintenance or restoration plans within their areas of jurisdiction or expertise.

Ecosystem planning strives to protect or restore the function, structure, and species composition of an ecosystem, recognizing that all components are interrelated. The Review Committee recognizes that agriculture is the dominant land use in the upper Mississippi River Basin. Ecosystem planning, therefore, will necessarily include agriculture and forestry as vital contributing elements to ecosystem function and values. The FWS recognizes that the initial step to ecosystem planning is the identification of natural resource needs.[7] Information on the distribution, abundance, and ecological relationships of species and a comprehensive inventory and classification of ecosystems are fundamental nationwide needs.[8] Such information is largely incomplete for the upper Mississippi River Basin[9], and the Review Committee found that funding and support for the effort have been lacking. Ecosystem information is critical for setting resource objectives, examining alternatives within multiple-use planning, and implementing solutions. Additional uses of this information include scientifically sound input to ongoing flood damage reduction, navigation, private lands, water quality, and watershed programs of other agencies.

Action 10.6: *DOI should complete an ecological needs investigation of the upper Mississippi River Basin and provide a report to the Administration within 30 months.*

The ecological needs investigation would be collaborative between government agencies and private groups. It would incorporate information from the NBS, under the Long Term Resource Monitoring Program, the USACE, the USDA National Resource Inventory, and the Review Committee's Scientific Assessment and Strategy Team. An interim report will be necessary to assist activities described subsequently for Action 10.9. This interim report should be completed prior to August, 1995. The final report would provide the necessary focal point from which government agencies could develop coordinated management strategies that reflect true resource needs, measure response to those strategies, and refine further research needs.

Ecosystem components have value for national trust resources such as migratory birds, wetlands, and interjurisdictional fisheries. It is anticipated that the investigation will identify missing components and contribute to understanding the mechanisms that move organisms toward endangered species candidacy. It also will assist avoidance of development conflicts resulting from endangered species listing.

Action 10.7: *Provide an early report in the USACE Upper Mississippi River - Illinois Waterway Navigation Study of environmental enhancement opportunities in the upper Mississippi River.*

COMMERCIAL NAVIGATION AND RECREATIONAL USE OF THE UPPER MISSISSIPPI RIVER

The upper Mississippi River 9-foot depth navigation project provides a wide range of recreational uses (from hunting, fishing, boating, and swimming, to sightseeing). Such recreational use supported over $1.2 billion in national economic benefits in 1990(1990 price levels) and over 18,000 jobs. Boating (33.2%), fishing (28.8%), and sightseeing (15.8%) were the most popular activities. Visits included 62.7% to developed areas, 26.3% to marina slips, 7.0% to sightseeing areas, and 4.0% to permitted docks. Management of the project for commercial navigation produces some impacts on the river's natural and recreational resources, including conflicts between recreational and commercial use of the locks.

Using information generated during the DOI ecological needs investigation, the USACE should develop a report detailing the relationship of its ongoing operation and maintenance activities as well as those of new navigation construction alternatives to ecological needs identified by the DOI. Because the Review Committee recognizes the value of identifying and acting on environmental enhancement opportunities as soon as possible, it is imperative that the USACE establish this report as a milestone in the overall schedule for the Navigation Study. The milestone will be based on the DOI investigation. The Review Committee recognizes that the DOI investigation will be collaborative with the USACE and that establishment of the milestone will not affect the overall schedule for the Navigation Study.

A potential opportunity to enhance upper Mississippi River resources exists through alteration of dam-regulation operations (at-dam vs. mid-pool hinge control points) on some headwater pools at the USACE navigation dams.[10] With little or no impact to navigation, habitat benefits may be gained by alternately drying and inundating areas adjacent to the main channel between a navigation pool midpoint and the dam.

Action 10.8: *Provide a report on the ecological effects of relocating navigation pool control points under the USACE Navigation Study.*

A complete evaluation of navigation dam operations should be conducted under the ongoing USACE Navigation Study to determine if moving navigation pool control points from mid-pool to the dam is feasible and would produce significant benefits. Currently a similar interagency investigation is underway for Lock and Dam 25 on the upper Mississippi River. The Review Committee endorses this effort and would support expansion of the investigation, as necessary, to other facilities. If feasible from the standpoints of navigation and the acquisition of needed lands, and if benefits are significant, modification of water control plans should be implemented.

The Environmental Management Program (EMP) on the upper Mississippi River includes a major habitat rehabilitation component. Land acquisition, however, has not been utilized in alternative development, as a

point of Administration policy. This has hampered habitat rehabilitation efforts along the Illinois and middle Mississippi rivers, where few federal lands occur, even though these are the reaches in most need of rehabilitation.

Recommendation 10.2: ***The USACE should consider land acquisition as an alternative during planning and design of habitat rehabilitation and enhancement projects under the Upper Mississippi River Environmental Management Program.***

This change would improve the effectiveness of the program, and could help to meet both environmental and flood flow attenuation needs. The Review Committee supports the efforts of state and federal EMP partner agencies in their pursuit of additional appropriations to support EMP land acquisition.

The upper Mississippi River Basin should be used as a demonstration ecosystem study area under the current National Performance Review's (NPR) "Reinventing Environmental Management" action item (Env 02 Develop Cross-Agency Ecosystem Planning and Management).[11] The study should be undertaken by the FWS to take advantage of other ongoing initiatives in the Missouri and Mississippi river basins, as well as the information obtained through Action 10.6.

Action 10.9: ***The Administration Interagency Ecosystem Management Task Force should select an Ecosystem Management Demonstration Project within the upper Mississippi River Basin, and establish a cross-agency ecosystem management team under DOI to develop plans and budgets for the project.***

Cross-agency partnerships have already been forged on the upper Mississippi and Missouri rivers through a variety of coordination mechanisms. Given the existence of these coordination groups, attainment of the NPR goal of August 1995 for completion of initial ecosystem management plans is possible. Expanding existing partnerships to develop measurable objectives for protection of existing resources and restoration of missing system components will require selection of one federal agency to serve in a lead capacity. While agency priority and budget adjustments will be necessary, this action is seen largely as a focused coordination effort and is not intended to represent a significant impact to the federal budget. Over time this coordination should result in elimination of duplicative efforts and their costs. DOI representation on the MRC will assure integration of the Demonstration Project with other MRC activities.

ENDNOTES

1. Executive Order 12319 -- River Basin Commissions, September 9, 1981, 46 FR 45591, 3 CFR, 1981. p. 175; and, PL 89-80, 22 July 1965, (1965 Water Resources Planning Act - 79 Stat. 244, 42 USC 1962); Platt, Rutherford H., "Geographers and Water Resource Policy" in *Water Resources Administration in the United States: Policy, Practice and Emerging Issues*. (East Lansing, MI: American Water Resources Association/Michigan State University Press, 1993).

2. Upper Mississippi River Conservation Committee, *Facing The Threat: An Ecosystem Management Strategy for the Upper Mississippi River*, (Rock Island, IL: UMRCC, 1993).

3. Section 101(a) of the NEPA of 1969, as amended. (PL 91-190, 42 USC 4321-4347, January 1, 1970, as amended by PL 94-52, July 3, 1975 and PL 94-83, August 9, 1975); Long's Peak Working Group on National Water Policy, *America's Waters: A New Era of Sustainability*, (Boulder, CO: Natural Resources Law Center, December 1992).

4. Council on Environmental Quality, "Linking ecosystems and biodiversity," in *Environmental Quality: Twenty-first Annual Report of the Council on Environmental Quality*, (Washington, DC: CEQ, 1990).

5. 1994 Energy and Water Development Appropriations Act, U.S. Congress, HR 2445 and House Resolution (Docket 2423, November 3, 1993).

6. Some federal government reviewers of the draft report expressed concern for increasing USACE responsibility without providing commensurate budget increases.

7. U.S. Department of the Interior, Fish and Wildlife Service, "An Ecosystem Approach to Fish and Wildlife Conservation," (Washington, DC: FWS, 1994).

8. Ibid.

9. *Facing the Threat.*

10. Sparks, R.E., "Can We Change the Future by Predicting It?" *Acquatic Ecology Technical Report 93/19,* (Havana, IL: Illinois Natural History Survey, 1993).

11. National Performance Review. *Creating a Government That Works Better and Costs Less, Reinventing Environmental Management, Accompanying Report of the National Performance Review,* (Washington, DC: Government Printing Office, September 1993).

Part IV

INTO THE 21st CENTURY

Chapter 11

USING SCIENCE AND TECHNOLOGY TO GATHER AND DISSEMINATE CRITICAL WATER RESOURCES INFORMATION

Policy decisions are being made in a data vacuum. Yet we are now in an era when the ability to collect and use field data has been greatly augmented by satellite and computer based technologies. There is an immediate need to provide a comprehensive inventory of damaged buildings, damaged infrastructure, impacted lands, and natural areas for conservation and restoration.

Association of State Floodplain Managers
Testimony before Congress, October 27, 1993

Science and technology can be utilized to improve the gathering and dissemination of information critical to water resources management. Floodplain managers need easy access to information about natural and manmade physical features, cultural resources, living resources, climatology and hydrology of the basins in which they operate. In some flood-related areas, however, the social and physical sciences have knowledge gaps that require research.

Recommendations to improve basic knowledge and provide technical services required for floodplain management were made in 1966 in House Document 465, *A Unified National Program for Managing Flood Losses*.[1] At that time, some of the recommendations were unrealistic. In 1994, however, advances in science and technology now make many of them possible.

A COMMON DATABASE

Vice President Gore's National Performance Review (NPR) contains recommendations regarding the use of information technology to create a government that works better and costs less. The NPR advocates creation of a national spatial data infrastructure that would establish standards for data collection and cataloging and create a clearinghouse for finding, accessing, and sharing spatial data, in addition to addressing related issues.

As indicated in the NPR report, "Data collection is duplicated at the federal, state, local, and private levels for different purposes. Moreover different entities are often unaware that much needed data have already been acquired by another party. Even when specific spatial data are known to exist, non-standardized collection procedures and lack of easy access often restrict their use."[2]

The most difficult task for the Review Committee was compiling useful data regarding the upper Mississippi River Basin. Basic information such as the amount of damages from the 1993 floods and the amount of expenditures related to disaster response and recovery

were not readily available, nor easily obtainable. Data assembled from a variety of sources were difficult to use because they were neither spatially referenced nor were they in compatible formats or structures. Precise answers to many questions were difficult, if not impossible, to obtain. For example: How many structures are in 100-year floodplains along the Mississippi and Missouri rivers? How many structures were affected by the flood? Where were levees located and what level of protection did they provide? How many people applied for assistance in a given county or community? Where is critical infrastructure located with respect to the floodplains? What is the expected flood crest, given a certain flow in the river? During a floodfight, the availability of such information is key to decisionmaking. Other data, such as the boundaries of the 100-year floodplain, were not in digital format and had to be digitized. Neither the public nor the nonprofit sectors uniformly apply Federal Information Processing Standards (FIPS) in collecting pre-disaster, response, or recovery data.

The SAST gathered information and geographically referenced data regarding the physical and environmental characteristics of the basin. The team collected several hundred gigabytes of information with the help of states, local communities, and federal agencies. The nation needs to continue maintaining and sharing the results of this effort with all entities having an interest in the upper Mississippi River Basin and to develop this database as a prototype for other future regional efforts. The USGS would be an appropriate lead agency to achieve this.

Action 11.1: *The USGS should establish a federal clearinghouse for data gathered during preparation of the Review Committee report.*

To manage floodplains, mitigate flood damages, and respond to and recover from a disaster, analysts and decisionmakers require easy access to basic data to audit disaster expenditures, identify loss concentrations, and formulate new preparedness and mitigation strategies. The USGS in coordination with the Federal Geographic Data Committee, should take the lead in establishing a federal clearinghouse consistent with that outlined in the NPR for accessing and updating data acquired and developed for the flood-affected 9-state region in the Midwest. The SAST effort demonstrates the benefits of leveraging science and technology. The nation should share its findings with states, communities, and all interests in the upper Mississippi River Basin. Consideration should be given to the establishment of a multiagency committee to assist present and future users of the data.

BUILDING ON THE DATABASE

Advances in science and technology enable improvements to be made in data acquisition, hydrologic and hydraulic analysis, flood forecasting, and mapping.

National Inventory of Structures

The Review Committee was unable to obtain definitive numbers on how many structures were impacted in the Midwest Flood of 1993. Estimates ranged from 55,000 to 100,000 structures. It was also difficult to estimate the level of NFIP market penetration without time and labor-intensive studies. These are two tasks that could easily be accomplished if a national inventory of structures existed. Nationwide there is no authoritative estimate of the number of structures exposed to floods and other natural hazards. As a result floodplain and emergency management decisions are often made based on inadequate information. This results in inappropriate allocation of resources.

Action 11.2 *FEMA should investigate the costs and feasibility of completing a national inventory of floodprone structures.*

A national inventory of floodprone structures should be performed by FEMA through the states and tribes to determine the number, location, building type, and

functional uses of structures in floodplains. Technology certainly makes such an inventory feasible. These data and the risk analysis that would become possible for the first time could allow the nation to focus mitigation and pre-disaster planning at specific areas of high risk. At the same time, funding for these activities could be targeted and adjusted in relation to the degree of exposure to the relative risk. In the event of a disaster, an immediate assessment of response needs would be available in summary format. This information would also enable targeting specific addresses to inform residents of the flood risk and the availability of insurance. Other potential users of such a database are communities, lenders, planners, citizen groups, and underwriters. This database would serve as a cornerstone in the national spatial data infrastructure recommended in the NPR.

Hydrologic, Hydraulic, and Hydrometeorologic Analysis

The Review Committee originally wanted to answer some questions about flow characteristics for the entire reach of the Mississippi River from Cairo to St. Paul and for the Missouri River from its mouth to Gavins Point. A model to accomplish this task, however, does not exist. Five USACE districts are involved in managing these river reaches, and the models used by each differ. Additionally, the availability of topographic data is limited to only certain river reaches.

Current one-dimensional models are unable to satisfactorily model the complex condition of flow in large rivers where water moves into large storage areas in the overbank floodplain and where land cover varies both in the cross section and along the length of the river. The most widely used model for flood elevation determination is HEC-2, a steady-state, one-dimensional, rigid-boundary model that cannot simulate levee breaches or take storage effects into account. UNET, a one-dimensional unsteady-flow model used by the Review Committee to model a portion of the basin, has the capability to assess impacts of levee breaches and associated storage effects. A system-wide, unsteady-flow model of the main stem rivers in the upper Mississippi River Basin would help evaluate the impacts of proposed structures and floodfighting, and could be used for coordinated ecosystem modeling, and for floodplain management decisions. Further, advanced hydrologic and hydraulic models can be combined with meteorologic observations and forecasts to provide information to enable better floodplain and water resources management.

Action 11.3: *The USACE, NWS, and USGS, with other collaborators, should continue development of basin-wide hydrologic, hydraulic, and hydrometeorologic models for the upper Mississippi River system.*

Federal, state, tribal, and local agencies should develop coordinated estimates of floodflow frequency curves, flood elevation profiles, and floodplain maps. Overall improvement in the modelling of complex river systems will lead to advances in hydrologic prediction capabilities for both real-time forecasts of flood events and for water-resources planning. Floodplain managers should consider one- and two-dimensional models for modeling complex areas.

Flood Risk Assessment

Models used for determining flood heights require current estimates of flood discharges. Maintaining up-to-date estimates of discharge-frequency curves requires that they be reviewed as the period of hydrologic record increases and whenever new peak flowrates are recorded. By doing so, the representative sample of the parent population of hydrologic event data is enlarged and the estimate of the frequency of occurrence associated with a given discharge is improved. The 1993 flood established new peak discharges on many tributaries and on major reaches of the main stem rivers. Discharge-frequency curves should be reevaluated to reflect the new data.

In addition, the adequacy of the existing streamgaging network for defining regional flood risk should be evaluated and the network enhanced if necessary. Enhancements could include reactivation of discontinued streamflow gages or establishment of new gages at critical locations where flood risk is not reliably defined.

Recommendation 11.1: ***Federal water agencies, in collaboration with state, tribal, and local entities, should review and update, as necessary, discharge-frequency relationships for streamflow gages in the upper Mississippi River Basin to reflect the 1993 flood data. The adequacy of the existing streamgaging network should also be reviewed.***

In 1979 the USACE estimated flood discharges for the upper Mississippi River corresponding to the 5-, 10-, 50-, 100-, and 500-year frequency floods. Water surface profiles for the Mississippi River developed from these discharge frequency curves form the basis for FEMA's flood insurance rate maps for the areas along the Mississippi River. This is an example of the use of discharge-frequency curves and indicates the importance of keeping them representative of present conditions.

Federal Standards for Determining Flood Risk

Currently the method of computing the relationship between annual flood peak discharge and frequency of occurrence is standardized among federal agencies.[3] Though this method was reviewed less than ten years ago, the magnitude of the 1993 flood and its possible effects on discharge-frequency curves for stations in the upper Mississippi River Basin provide the opportunity to ascertain the adequacy of the recommended method to reflect the probability distribution of annual peak discharges.

Action 11.4: ***The Hydrology Subcommittee of the Federal Interagency Advisory Committee on Water Data should review the current standards for computing discharge-frequency relationships in light of observations from the 1993 flood and other recent large floods in the upper Mississippi River Basin.***

Frequency curves are generally developed using the current federal standard distribution function (log-Pearson Type III) for annual peak discharges. This methodology should be reviewed. The bases for concluding which method produces the most representative relationships should include, in addition to probability theory itself, the end uses of the curves such as selecting the heights of flood protection facilities, evaluating the degree of risk of a site or a structure, determining regulatory floodplain limits, and establishing flood insurance rates.

Flood Forecasting

State and local authorities need river stage and discharge information for emergency situations, for local flood relief efforts, and for floodplain management. During the Midwest flood, conflicting estimates of flood crests created difficulties for local emergency response efforts. Especially important for floodwarning and forecasting are the presence of streamflow gages at locations critical for providing flood alert for downstream populations centers, and capabilities for remote sensing of gages, data transmission, and communications with other agencies. The NWS, USGS, and USACE should collaborate on a study of the effectiveness of the existing flood monitoring and information distribution system.

Recommendation 11.2: ***Federal agencies, coordinated by NWS and USGS, should collaborate on an assessment of the effectiveness of the streamgaging network and flood forecasting during the 1993 Midwest floods.***

This assessment should include an evaluation of the ability of the present streamgaging network to monitor the Mississippi River system and provide the public with timely and reliable flood warnings. The assessment should identify gaps, inconsistencies and areas of duplication in the present system and make recommendations on improvements. NOAA's *Natural Disaster Survey Report*[4] identifies the need for improvements to real-time hydrologic forecasting and

provides 106 findings and recommendations resulting from an interagency evaluation of the 1993 Midwest flood.

Mapping

Critical to the development of any computer model used to estimate flood elevations is detailed topographic information. Engineers can use topographic information in a digital format more efficiently in computer models. Topographic information of the appropriate resolution or accuracy does not exist in a digital format for many locations in the flood-affected 9-state region of the Midwest, or in the nation, at a scale useful for floodplain management or for use in engineering models. Floodplain managers generally prefer contour intervals of two feet or less. Technologies are beginning to emerge that will produce accurate, high resolution digital elevation models at reasonable costs. Such models soon will be generall generally available.

Action 11.5: ***The Administration should support the USGS in development and acquisition of detailed digital topographic data and other land characteristics for use in floodplain management and other water resources management activities. Existing DOD technologies should be leveraged to assist in the acquisition of these data.***

Floodplain managers use detailed topographic data and other land characteristics in floodplain areas for many applications, such as floodplain boundary delineation, habitat and land cover/land-use mapping, and restoration projects.

MAPPING TECHNOLOGY TRANSFER INITIATIVES

NASA has developed a scanning laser device (LIDAR) that operates from a commercial aircraft and collects fine resolution, digital terrain data used in hydraulic models. The Houston Advanced Research Center, in coordination with NASA, developed an aircraft mounted prototype suitable for a wide range of commercial applications. Concurrent with the LIDAR data, the prototype acquires high resolution color video imagery that can be digitally draped over the terrain data to visualize land use. NASA will conduct a system demonstration for an area downstream of Gavins Point Dam in June 1994.

The DOD Advanced Research Projects Agency (ARPA), working in conjunction with the USACE Topographic Engineering Center, is sponsoring the use of IFSARE (InterFerometric Synthetic Aperture Radar for Elevation), a radar technology employing a Lear Jet data-collection platform. Fine resolution digital terrain elevations, as well as synthetic aperture radar (SAR) imagery will be generated by this system. The Environmental Research Institute of Michigan and the Jet Propulsion Laboratory are principal contributors to this program. Data have been acquired in the vicinity of Iowa City, Iowa, to provide sample data for applying this technology to the development of hydraulic models.

NASA, the USGS, and the USACE have agreed to participate in a test of these technologies along a reach of the Missouri River in the vicinity of Glasgow, Missouri.

ANALYSIS AND RESEARCH NEEDS

The Review Committee investigated some of the benefits and costs of floodplain occupancy, agriculture uses, and associated floodplain management measures. This investigation considered national productivity, the impacts on natural functions, and the equitable distribution of benefits, costs, incentives, and disincentives. Federal programs provide for transfer of funds that support several types of private floodplain activities; for example, navigation, agriculture, flood control, and transportation. The National Science Foundation should consider funding research to examine fully the flood-related impacts on these areas.

Although the Review Committee devoted a good deal of its time to floodplain hazards associated with levees, other flood hazards warrant study. These include alluvial stream channels and storm drainage overflow and backup. The National Science Foundation and interested federal agencies should establish a cooperative, jointly funded program to develop methods for mapping, regulating and identifying natural functions in these areas. SAST data would form the basis for further investigation.

Studies on the epidemiological factors and mental health impacts of floods are few in number. Research regarding the social impacts of floods needs federal support. Other items warranting further investigation are the funding of disaster relief and support of floodplain agriculture. With regard to the NFIP, the reasons for limited flood insurance market penetration should be studied.

Many questions posed by the Review Committee remain unanswered, because of time or resource constraints or a lack of information. Even where available, information often led to new questions and new areas to be explored. Listed below are several topics that merit additional study.

Quantifying and Assessing Environmental Impacts

Environmental quality and species diversity remain as social services not sold in conventional markets. Evaluation methods that do not depend on market prices are needed to estimate the benefits of such services. The non-market value to be estimated is the amount of income an affected person would be willing to give up for an environmental service. Where environmental outputs can be identified and effects can be monetized, these monetized environmental effects should be included in benefit-cost analyses.

Significant research exists on non-market evaluation techniques. Most of this research estimates recreation benefits rather than benefits of passive services such as ecosystem health. Economists use two primary approaches to estimate the value of non-market goods: an indirect approach and a direct one.[5] Indirect approaches, such as the travel cost method or hedonic analyses, are based on the premise that the value people place on services is revealed by the choices they make in consuming them. These techniques depend on the observation of human behavior in a particular circumstance and cannot be used for hypothetical situations such as wetland restoration.

The direct approach uses survey techniques to directly elicit a person's value or willingness to pay. The most widely used approach is the contingent valuation method, where respondents are presented with information about the proposed environmental service (either an improvement or degradation) and asked what the change would be worth to them. The direct approach can also be used to evaluate existence values (the satisfaction an individual receives from simply knowing an environmental amenity exists or will continue to exist, even though the individual will never use it) and non-existing or hypothetical situations that indirect methods cannot handle. The reliability of estimates from surveys in these situations is often questionable. Experience with the contingent valuation method indicates it can be successful in estimating values associated with recreation outputs for which the potential user is familiar, for which the product can be clearly defined, and for which a plausible market can be defined. Applications become less successful when the respondent lacks familiarity with the product or when the amount, quality, or other attributes of the product cannot be clearly defined. This is especially true in

trying to measure changes in the quality of environmental amenities or other management actions.

Action 11.6: *The Administration should direct that scientific research be conducted to identify state-of-the-art techniques or applications for estimating and assessing environmental and social impacts.*

Research should identify practical methods and improved techniques to allow greater consideration of impacts, both positive and negative, for which no market system exists. Such research would assist in evaluating the economic value of an environmental output or the willingness to pay to avoid an impact. Research is needed to improve techniques for measuring social or environmental outputs and for establishing criteria to assess the significance of such outputs from a regional and national perspective.[6] Many federal agencies, universities, and private consulting firms are focusing on research in these areas. An organization such as the National Research Council of the National Science Foundation could foster this type of research, with federal oversight provided by the Office of Environmental Policy. The Administration should require that research and case studies be completed and recommendations made concerning appropriate state-of-the-art techniques within three years of initiation.

Geomorphology

Satellite imagery and data analyses provide evidence that some levee failures along the Missouri River coincided with historic river channels (See Figure 2.6). Evidence indicates that levees were largely responsible for raising flood water to levels that generated the high energies necessary to overpower and blow the levees, creating the scour holes and generating the sands that damaged the very farmlands the levees were designed to protect. In many areas riparian forests had minimal flood erosion or deposition damage. These areas commonly coincided with levees that did not fail, indicating some protection was given to levees by riverward forested areas. Evidence also indicates that levees placed in high energy zones would not hold, even if it were possible to excavate all the sand from the old channel and place the levees on a clay core. This suggests that levees should not be reconstructed in such high energy erosion zones, but should be set back to allow high energy zones to remain within a designated, functioning floodway. A mix of compatible land uses, such as dry-year farming, open space, recreation, fish and wildlife habitat, could occur within high energy floodways. Any such use, however, should not be eligible for future emergency federal disaster assistance. A study is needed immediately to better define, document, and map such high energy zones, at least along the Missouri River.

Recommendation 11.3: *The USACE and USGS should investigate and better define relationships between high energy erosion zones, other zones in floodprone areas, and levee failure.*

Hydrologic and Hydraulic Benefits of Natural Floodplain Functions

The federal government established the Minnesota Valley National Wildlife Refuge in the lower Minnesota River valley near the Minneapolis/St. Paul metropolitan area, in part, to maintain the floodplain as part of a naturally functioning ecosystem and floodwater storage/conveyance mechanism. Although the government did not establish the upper Mississippi River National Wildlife and Fish Refuge as a mechanism for flood damage reduction and control, it may have played a significant role in reducing local flood damages in the upper Mississippi River valley. Nonstructural flood damage reduction and control capabilities of floodplain land uses such as green spaces and wildlife refuges have not received adequate evaluation.[7]

Environmental groups have identified upland wetland water-storage capabilities lost to drainage over the past century as contributing factors in the heights of the 1993 floods in the upper Mississippi River Basin.[8] At the same time, agricultural interests have indicated that drainage tiles (underground drains) installed to dry out wetlands and wet soils provided a positive benefit in

reducing flood heights by voiding the soils of water and creating a capacity in the soils for water storage. Once rains exceed a threshold level, however, and soil surfaces are sealed, the ability of rainwater to infiltrate soil is lost and the water runs off.[9] Drainage tiles may have contributed to flood heights rather than lessening them.

Floodplain and upland areas functioning as temporary storage areas can have impacts on flood peaks. The quantification of these impacts has not been well documented. Use of natural storage areas (wetlands) for temporary storage of floodwater to decrease downstream flood heights has not been utilized in modern flood control policy. The mathematical models exist to analyze these impacts, although additional field data may be necessary. The Administration should request completion of these investigations as soon as possible. The functions of wetlands and their drainage for agricultural purposes need better evaluation.

The current USACE project in Marshall, Minnesota, offers the opportunity to further explore the effectiveness of upland treatment in flood damage reduction. Consideration should be given to the use of the watershed component of this project as a demonstration of the capabilities of upland treatment in reducing flood damages. A joint USACE-USDA evaluation of the results would add to the information available on this subject.

Action 11.7: ***The USACE and USDA, in collaboration with the DOI, should evaluate the effect of natural upland storage and floodplain storage in such areas as wetlands and forested wetlands on main stem flooding.***

Biotechnical Engineering

State, local, and private engineers and planners rely heavily on federal design manuals. Currently these manuals do not address biotechnical engineering -- channel or bank modification techniques that use vegetation in innovative ways in contrast to traditional bank sloping and riprap protection. Traditional approaches typically focus on maximizing flood conveyance only. Biotechnical engineering techniques can be employed in engineering designs and contribute to the natural functions of floodplains. These practices have not been incorporated into federal government standards. Federal agencies responsible for establishing guidelines should test and incorporate these methods into their design manuals.

Recommendation 11.4: ***Federal agencies should conduct research on biotechnical engineering techniques and162 incorporate them into design manuals.***

Disaster Relief Funding

Natural disasters in the United States are costly events in terms of both human lives lost and property damaged. Since FY 1989, over $27.6 billion have been spent on federal disaster assistance programs.[10] The Review Committee heard concerns expressed about the current system of funding disaster relief through emergency supplemental appropriations and the subsequent effects on the federal deficit.

Recommendation 11.5: ***OMB should review the current system of funding disaster relief; consideration should be given to encouraging the National Science Foundation to support such a review.***

Floodplain Agriculture

The role of the federal farm programs in influencing sound floodplain management continues to receive great attention. Other federal policies, however, also affect land-use decisions. Data currently exist to support research on the effects of federal incentives and disincentives on agricultural production in the floodplain.

Recommendation 11.6: ***USDA should evaluate the impact of federal farm programs on agricultural land use decisions in and out of the floodplain.***

Flood Insurance Market Penetration

The Review Committee was not able to obtain definitive information on NFIP market penetration or on who buys flood insurance and who does not and why. Much of the information that is currently available is based on inadequate information, personal observation, or speculation. This knowledge is critical to developing strategies to increase compliance with the mandatory purchase requirements and to increase voluntary purchase of flood insurance.

Recommendation 11.7: ***FEMA should conduct research on the issue of NFIP market penetration to determine who buys flood insurance and who does not and why.***

Other Research and Analysis Needs

The Review Committee's investigation revealed several other areas in which research is needed, as described in the following recommendation.

Recommendation 11.8: ***The National Science Foundation should consider funding research on the following subjects:***

- ***Full accounting of all public and private benefits and costs of floodplain occupancy and associated floodplain management measures, including both monetary and non-monetary methods of accounting,***
- ***Mapping and regulating areas with movable stream channels and storm drainage overflow and backup,***
- ***Special impacts of floods, including epidemiological and mental health factors, and***
- ***The feasibility and effectiveness of the use of meteorologic data and geomorphic and botanical evidence in conjunction with hydrologic and hydraulic models to estimate flood frequency.***

ENDNOTES

1. 89th Congress, 2nd Session, House Document 465, ***A Unified National Program for Managing Flood Losses,*** (Washington, DC: U.S. Government Printing Office, August 10, 1966).

2. National Performance Review, ***Department of the Interior: Accompanying Report of the National Performance Review,*** (Washington, DC: U.S. Government Printing Office, September 1993).

3. Hydrology Subcommittee, Interagency Advisory Committee on Water Data, ***Guidelines for Determining Flood Flow Frequency, Bulletin #17B,*** (Reston, VA: USGS, March 1982).

4. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Natural Disaster Survey Report: The Great Flood of 1993, (Silver Spring, MD: DOC, NWS, February 1994).

5. Smith, V. Kerry, "Nonmarket Valuation of Environmental Resources: An Interpretive Appraisal," ***Land Economics,*** 69(1): 1-26 (February 1993); Ribando, Marc O., and Daniel Hellerstein, ***Estimating Water Quality Benefits: Theoretical and Methodological Issues,*** Technical Bulletin 1808, (Washington, DC: USDA Economic Research Service, September 1992).

6. The interagency Economics Advisory Group pointed out that although methods exist for quantifying and monetizing environmental benefits in terms of both direct and indirect uses, these methods have not been applied to all areas for which monetized values are desired. Any application, however, requires a clear definition of the ecological effects that result from alternative actions. This is usually obtainable for impacts of national significance. It becomes difficult for lesser effects and smaller projects where the biological increments of change are small. Without a clear definition, survey responses about the value of hypothetical environmental changes will be unreliable.

7. Leopold, L., "Flood Hydrology and the Floodplain," pages 11-14 in ***Universities Council on Water Resources Update,*** (Carbondale, IL: UCOWR, Spring 1994).

8. Hey, D., "Prairie Potholes," pages 505-509 in National Research Council, Commission on Geosciences, Environment, and Resources, Water, Science and Technology Board, Committee on Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy, ***Restoration of Aquatic Ecosystems,*** (Washington, DC: National Academy Press, 1992).

9. Satterlund, D.R., and P.W. Adams, ***Wildland Watershed Management,*** (New York, NY: John Wiley & Sons, Inc., 1992).

10. Leuthy, Cameron, Office of Management and Budget, Budget Review and Concepts Division, Washington, DC, personal communication, April 13, 1994.

Chapter 12

A FLOODPLAIN ACTION PLAN

Any great disaster or problem usually produces a by-product called "opportunity". This is no less true today as we review the Great Flood of 1993 and our policies for managing floodplains.

Jim Edgar
Governor of Illinois, June 1994

The Review Committee advocates a new approach to managing the floodplains and related watersheds of the nation. This approach involves a shared challenge. The situation that exists on floodplains today is the result of past federal policy decisions that were successful in achieving past national goals. Over recent decades as social preferences shifted, national goals changed. In evaluating ongoing and future floodplain management, the nation must recognize not only that these shifts and changes have occurred but that no action taken today should reduce the opportunity for future adjustments in national goals and purposes. The Review Committee presents a vision for floodplain management that meets these goals.

Achieving this vision of floodplain management will require cooperative action by the Congress, the Executive branch, and the states. The vision and supporting action plan formulated by the Review Committee are interrelated and interactive. Partial success is possible with piecemeal application, but attaining the vision requires complete implementation by all parties in a timely fashion.

The theme developed by the Review Committee is that government at all levels and individuals must share the responsibility of appropriately managing land and water resources to reduce the nation's vulnerability to flood disasters. Coordination of environmental, social, and economic planning is essential to maximize efficiency, equitably share burdens, and distribute responsibility.

The Review Committee calls upon Congress to act on a legislative agenda designed to maximize the efficiency and effectiveness of existing programs, respond to identified gaps with new programs, and provide funding to enable existing programs to function as designed. Major legislative actions requested include:

- Enactment of a Floodplain Management Act to coordinate federal-state actions, and
- Amendments to the NFIP to reduce moral hazard problems and to decrease federal disaster expenditures.

The Review Committee recognizes that these requests require analysis and deliberation by the Congress. Although action is desirable sooner rather than later on these actions, which are indispensable components of the new direction in floodplain management, delay in enactment will not prevent commencement of the policy shift proposed by the Review Committee.

The Review Committee also asks the Executive branch of the government to make changes. The Executive Office of the President can have an immediate impact on floodplain management by promptly implementing the following changes:

- Revitalizing the Water Resources Council to coordinate and direct federal plans for water management;
- Reestablishing basin commissions;
- Reissuing an expanded EO 11988; and
- Establishing new objectives for *Principles and Guidelines*.

Concurrent with these actions by the President, the Review Committee asks federal agencies involved with water resource and floodplain issues to convene interagency task forces to coordinate activities presently conducted independently. In addition suggested changes in federal regulations will further the goals of floodplain management programs.

The need for reform in floodplain management is great and the number of proposed actions considerable. Timing, an essential element, is critical. The first step is to get moving and begin the needed changes.

ACTION OUTLINE

CONGRESSIONAL ACTIONS

Legislative Actions

Floodplain Vision/Resource Planning:

- Enact a national Floodplain Management Act (Action 5.1);
- Continue and expand conservation and voluntary land acquisition programs in the Farm Bill focusing on critical lands (Action 6.3); and
- Support insurance coverage for mitigation actions necessary to comply with local floodplain management regulations (Action 8.9).

Operations:

- Revise Section 1134 of the Water Resource Development Act of 1986 to provide for phase-out of federal leases in the floodplain (Action 5.6);
- For communities not in the NFIP, limit public assistance grants (Action 5.7);
- Provide authority for loans for the upgrade of infrastructure and other public facilities (Action 5.9);
- Enact legislation allowing cost-share participation and eligibility requirements under Sections 1135 and 906 of the WRDA of 1986 to include federal, state, and non-governmental contributions (Action 7.7);
- Provide states the option of receiving FEMA Section 404 Hazard Mitigation Grants as a block grant (Action 8.5);
- Provide funds in major disasters where supplemental appropriations are made for buyouts and hazard mitigation, through FEMA's Section 404 Hazard Mitigation Grant Program (Action 8.6);
- Provide authority to reduce the amount of post-disaster support to those who could have bought flood insurance but did not, to that level needed to provide for immediate health, safety, and welfare; provide a safety net for low-income flood victims (Action 9.5);
- Continue to support reform of Federal Crop Insurance that limits crop disaster assistance payments, increases participation, and makes the program more actuarially sound (Action 9.8); and
- Establish the UMR&T project (Action 10.5).

Floodplain Management Funding:

- Provide authority for flexibility in use of programmed funds in emergency situations (Action 7.4).

Planning, Coordination, and Hazard Mitigation:

- Establish a programmatic buyout and hazard mitigation program with funding authorities independent of disaster declarations (Action 8.7);
- Increase the NFIP market penetration through improved lender compliance with the mandatory purchase requirement (Action 9.2); and
- Provide for the escrow of flood insurance premiums or payment plans to help make flood insurance affordable (Action 9.3).

EXECUTIVE BRANCH ACTIONS

Administrative Actions

Leadership, Policy, Planning and Coordination:

- Revitalize the Water Resources Council (Action 5.2);
- Reestablish the basin commissions in a revised form reflecting current needs (Action 5.3);
- Issue a new Executive Order to reaffirm the federal government's commitment to floodplain management with an expanded scope (Action 5.4);
- Direct all federal agencies to conduct an assessment of the vulnerability of flooding using a scientific sample of federal facilities and those state and local facilities constructed wholly or in part with federal aid (Action 5.5);
- Establish new co-equal objectives for planning water resources projects under the *Principles and Guidelines* document to enhance national economic development and enhance the quality of the environment (Action 5.10);
- Establish a lead agency for coordinating acquisition of title and easements to lands acquired for environmental purposes (Action 7.1);
- Allocate funds for mitigation lands in concert with and at same pace as project construction (Action 7.8);
- Establish the USACE as the principal federal levee construction agency (Action 8.1);
- Establish upper Mississippi and Missouri basin commissions (Action 10.1);
- Expand the mission of the Mississippi River Commission to include the upper Mississippi and Missouri Rivers. Expand Commission membership to include the DOI (Action 10.2);
- Assign responsibility for development of an upper Mississippi River and tributary system plan for a major maintenance and major rehabilitation program for federally-related levees to an expanded Mississippi River Commission, operating under the USACE (Action 10.3); and
- Seek approval from the Congress to redirect the USACE Floodplain Management Assessment of the upper Mississippi River Basin to development of the UMR&T system plan. Place this assessment under the

expanded Mississippi River Commission (Action 10.4).

Operations

- Propose supplementing, with appropriated funds, funds obtained for floodplain mapping from NFIP policyholders (Action 6.7);
- Develop emergency implementation procedures to organize federal agencies for environmental land acquisitions (Action 7.2);
- Require agencies to co-fund ecosystem management using Operation and Maintenance funds (Action 7.6);
- Support the USGS in development and acquisition of detailed digital topographic data and other land characteristics for use in floodplain management and other water resources management activities (Action 11.5); and
- Direct that scientific research be conducted to identify state-of-the-art techniques or applications for estimating and assessing environmental and social impacts (Action 11.6).

Disaster Relief/Recovery:

- Provide funding for the development of state and community floodplain management and hazard mitigation plans (Action 6.5);
- Reaffirm support for the USACE criteria under the PL 84-99 levee repair program and send a clear message that future exceptions will not be made (Action 8.2); and
- Hold an interagency strategic planning meeting for those Presidentially declared disasters that require a multi-agency recovery effort (Action 9.1).

Interagency Activities

Policy, Planning, and Coordination:

- Establish interdisciplinary interagency review of the *P&G* document by affected agency representatives with regard to the potential structural vs. nonstructural project bias, inclusion of a system of accounts, inclusion of collaborative planning, and expansion of *P&G* application to water and related land programs, projects, and activities (Action 5.11);
- Establish an interagency task force, jointly chaired by the USDA and EPA, to formulate a coordinated, comprehensive approach to multiple objective watershed management (Action 6.1);
- Coordinate and support federal riverine and riparian area restoration (Action 6.2);
- Formalize environmental considerations in multi-agency restoration activity through a coordinated Memorandum of Agreement (Action 7.3);
- Restrict support of floodfighting to those levees that have been approved for floodfighting by the USACE (Action 8.3);
- Establish a task force to develop common procedures for federal buyouts and mitigation programs (Action 8.4);
- Select an ecosystem management demonstration project within the upper Mississippi River Basin and establish a cross-agency ecosystem management team under the DOI to develop plans and budgets for the project (Action 10.9);
- Continue development of basin-wide hydrologic, hydraulic, and

hydrometerologic models for the upper Mississippi River system (Action 11.3);
- Review the current standards for computing discharge-frequency relationships in light of observations from the 1993 flood and other recent large floods in the upper Mississippi River Basin (Action 11.4); and
- Evaluate the effect of natural upstream storage and floodplain storage in such areas as wetlands and forested wetlands on main stem flooding (Action 11.7).

Individual Agencies

Federal Emergency Management Agency:

- Encourage communities to obtain affordable private insurance for infrastructure as a prerequisite to receiving public assistance (Action 5.8);
- Promote the NFIP Community Rating System as a means of encouraging communities to develop floodplain management and hazard-mitigation plans and incorporate floodplain management concerns into their ongoing community planning and decisionmaking (Action 6.4);
- Map all communities with flood hazard areas that are developed or could be developed (Action 6.6);
- Utilize technology to improve floodplain mapping (Action 6.8);
- Continue to enforce substantial damage requirements, but decide on a definition of substantial damage and stick to that definition (Action 8.8);
- Develop a program to reduce losses to repetitively damaged insured properties through insurance surcharges, increased deductibles, mitigation insurance, and/or mitigation actions (Action 8.10);
- Develop improved marketing techniques for NFIP (Action 9.4);
- Require actuarially based flood insurance behind all levees that provide protection less than the standard project flood (Action 9.6);
- Increase the 5-day waiting period for flood insurance coverage to at least 15 days (Action 9.7); and
- Investigate the costs and feasibility of completing a national inventory of floodprone structures (Action 11.2).

U. S. Army Corps of Engineers:

- Provide an early report in the Upper Mississippi-Illinois Waterway Navigation Study of environmental enhancement opportunities in the upper Mississippi River (Action 10.7); and
- Provide a report on the ecological effects of relocating navigation pool control points under the Navigation Rehabilitation Study (Action 10.8)

U. S. Department of the Interior:

- Focus land acquisition efforts on river reaches and areas with significant habitat values or resource impacts (Action 7.5); and
- Complete an ecological needs investigation of the upper Mississippi River Basin and provide a report to the Administration within 30 months (Action 10.6).

U. S. Geological Survey (DOI):

- Establish a federal clearinghouse for data gathered during preparation of the Review Committee report (Action 11.1).

Chapter 13

COST ANALYSIS

Some of the recommended actions may result in increased costs to the federal government as well as to states, non-federal sponsors, and individual floodplain occupants. Many of the costs will be incurred over the next few years but will ultimately result in savings to the same parties for many years in the future. Many also reflect the cost of normal business or operations. Costs have been estimated for certain significant actions such as the enactment of a national Floodplain Management Act (Action 5.1), revitalizing the Water Resources Council (Action 5.2), and reestablishing basin commissions (Action 5.3). The cost details for Action 5.1 are found in Appendix D and for Actions 5.2 and 5.3 in Appendix I. The Review Committee did not have the time or resources to develop specific costs for all of the proposed actions. The details of specific action implementation should be analyzed and the costs estimated by those who will administer these actions.

Table 13.1 attempts to identify where additional costs to the federal government are likely and where potential savings, to whomsoever they may accrue, may occur. This additional cost commitment may take the form of a shift in priorities for human resources or a cost of normal Washington level attention and coordination. These items are annotated with the abbreviations "SIP" for shift in priorities and "CNB" for cost of normal business. For some actions, however, increased federal government costs are required and are identified in the table by the abbreviation "IC" for increased cost.

Potential savings for each recommended action are handled similar to the cost column and abbreviations for the areas of savings are as follows: environmental enhancements (EE); improved customer assistance (ICA); increased efficiencies (IE); reduced claims payments (RCP); reduced disaster assistance (RDA); reduced environmental impact (REI); and reduced flood damages (RDA).

Table 13.1 Fiscal Impact of Actions Recommended by the Review Committee

ACTIONS	ADDITIONAL COSTS TO FEDERAL GOVERNMENT	POTENTIAL SAVINGS
Action 5.1: Enact a national Floodplain Management Act to define governmental responsibilities, strengthen federal-state coordination and assure accountability.	IC	ICA, IE, RDA, REI, RFD
Action 5.2: Revitalize the Water Resources Council.	IC	ICA, IE, REI
Action 5.3: Reestablish Basin Commissions in a revised form reflecting current needs.	CNB, IC, SIP	ICA, IE, REI
Action 5.4: Issue a new Executive Order to reaffirm the federal government's commitment to floodplain management with an expanded scope.	CNB, SIP	RDA, REI, RFD
Action 5.5: OMB should direct all federal agencies to conduct an assessment of the vulnerability of flooding using a scientific sample of federal facilities and those state and local facilities constructed wholly or in part with federal aid.	CNB, SIP	RFD
Action 5.6: Seek revision of Section 1134 of the Water Resources Development Act of 1986 to provide for phase-out of federal leases in the floodplain.	CNB	RDA, REI, RFD
Action 5.7: For communities not participating in the NFIP, limit public assistance grants.	CNB	RDA
Action 5.8: Encourage communities to obtain affordable private insurance for infrastructure as a prerequisite to receiving public assistance.	CBE	RDA
Action 5.9: Provide loans for the upgrade of infrastructure and other public facilities.	CBE	RDA

Table 13.1 Fiscal Impact of Actions Recommended by the Review Committee (continued)

ACTIONS	ADDITIONAL COSTS TO FEDERAL GOVERNMENT	POTENTIAL SAVINGS
Action 5.10: Establish as the new, co-equal objectives for planning water resources projects under Principles and Guidelines: (1) To enhance national economic development by increasing the value of the Nation's output of goods and services and improving national economic efficiency, and (2) To enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of natural and cultural resources and ecological systems.	CNB, SIP	EE, ICA, REI
Action 5.11: Establish interdisciplinary, interagency review of the P&G by affected agency representatives to address: (1) Structural versus non-structural project bias; (2) Inclusion of system of accounts or a similar mechanism for displaying impacts; (3) Inclusion of collaborative planning in an ecosystems context for major studies; and (4) Expansion of the application of the revised P&G to water and land programs, projects, and activities to include: (a) All federally constructed watershed and water and land programs; (b) National parks and recreation areas; (c) Wild, scenic, recreational rivers and wilderness areas; (d) Wetland and estuary projects and coastal zones; and (e) National refuges.	CNB, SIP	EE, ICA, IE, REI
Action 6.1: The Administration should establish an interagency task force, jointly chaired by the USDA and EPA, to formulate a coordinated, comprehensive approach to multiple objective watershed management.	CNB	ICA, IE

Table 13.1 Fiscal Impact of Actions Recommended by the Review Committee (continued)

ACTIONS	ADDITIONAL COSTS TO FEDERAL GOVERNMENT	POTENTIAL SAVINGS
Action 6.2: The DOI, USDA, and EPA should coordinate and support federal urban and suburban stream and riparian area restoration.	CNB	EE
Action 6.3: The Administration's legislative proposals for the 1995 Farm Bill should support continuation and expansion of conservation and voluntary acquisition programs focused on critical lands within watersheds.	IC	EE, REI, RFD
Action 6.5: Provide funding for the development of state and community floodplain management and hazard mitigation plans.	IC	ICA, IE, REI, RDA, RFD
Action 6.6: Map all communities with flood hazard areas that are developed or could be developed.	IC	ICA, IE, RDA, REI, RFD
Action 6.7: To improve and accelerate delivery of NFIP map products, the Administration should propose supplementing those funds obtained for floodplain mapping from NFIP policyholders with appropriated funds.	IC	ICA, IE, RDA, REI, RFD
Action 6.8: Utilize technology to improve floodplain mapping.	IC	ICA, IE, RDA, REI, RFD
Action 7.1: The Administration should establish a lead agency coordinating acquisition of title and easements to lands acquired for environmental purposes.	CNB	EE, ICA, IE, RCP, RDA, REI, RFD
Action 7.2: The Administration should develop emergency implementation procedures to organize federal agencies for environmental land acquisitions.	CNB	IE
Action 7.3: The DOI should formalize environmental considerations in multi-agency disaster recovery land restoration activity through a coordinated Memorandum of Agreement.	CNB	EE, IE, REI

Table 13.1 Fiscal Impact of Actions Recommended by the Review Committee (continued)

ACTIONS	ADDITIONAL COSTS TO FEDERAL GOVERNMENT	POTENTIAL SAVINGS
Action 7.4: Seek legislative authority for flexibility in use of programmed funds in emergency situations.	CNB	EE, ICA, REI
Action 7.5: The DOI should focus land acquisition efforts on river reaches and areas with significant habitat values or resource impacts.	CNB	EE, REI
Action 7.7: Enact legislation allowing cost-share participation and eligibility requirements under Sections 906 and 1135 of the 1986 WRDA to include federal, state, and non-governmental contributions as well as work in-kind.	CNB, SIP	EE, ICA, REI
Action 8.2: The Administration should reaffirm its support for the USACE criteria under the PL 84-99 levee repair program and send a clear message that future exceptions will not be made.	CNB	IE, RDA
Action 8.3: Federal and state officials should restrict support of floodfighting to those levees that have been approved for floodfighting by the USACE.	CNB	IE
Action 8.4: Establish a task force to develop common procedures for federal buyouts and mitigation programs.	CNB, SIP	ICA, IE
Action 8.5: Provide states the option of receiving Section 404 Hazard Mitigation Grants as a block grant.	CNB	ICA, IE
Action 8.6: Provide funds in major disasters where supplemental appropriations are made for buyouts and hazard mitigation, through FEMA's Section 404 Hazard Mitigation Grant Program.	CNB	ICA, IE
Action 8.7: Establish a programmatic buyout and hazard mitigation program with funding authorities independent of disaster declarations.	CNB, SIP	IE, RCP, RDA, REI
Action 8.8: The FEMA should continue to enforce substantial damage requirements, but decide on a definition of substantial damage and stick to that definition.	CNB	RCP, RDA

Table 13.1 Fiscal Impact of Actions Recommended by the Review Committee (continued)

ACTIONS	ADDITIONAL COSTS TO FEDERAL GOVERNMENT	POTENTIAL SAVINGS
Action 8.9: The Administration should support insurance coverage for mitigation actions necessary to comply with local floodplain management regulations.	CNB	IE, RCP,RDA, RFD
Action 8.10: Develop a program to reduce losses to repetitively damaged insured properties through insurance surcharges, increased deductibles, mitigation insurance, and/or mitigation actions.	CNB, SIP	RCP, RDA, REI
Action 9.3: Provide for the escrow of flood insurance premiums or payment plans to help make flood insurance affordable.	CNB	ICA, IE, RDA
Action 9.4: Develop improved marketing techniques.	CNB	ICA, RDA
Action 9.5: Reduce the amount of post-disaster support to those who could have bought flood insurance but did not to that level needed to provide for immediate health, safety, and welfare; provide a safety net for low-income flood victims.	CNB	IE, RDA
Action 9.6: Require actuarial-based flood insurance behind all levees that provide protection less than the standard project flood.	IC	ICA, RDA
Action 9.7: Increase the 5-day waiting period for flood insurance coverage to at least 15 days.	CNB	IE, RCP
Action 9.8: Administration should continue to support reform of Federal Crop Insurance that limits crop disaster assistance payments, increases participation, and makes the program more actuarially sound.	IC	ICA, IE
Action 10.1: Establish upper Mississippi and Missouri basin commissions with a charge to coordinate development and maintenance of comprehensive water resources management plans to include, among other purposes, ecosystem management, flood damage reduction, and navigation.	IC	ICA, IE, REI

Table 13.1 Fiscal Impact of Actions Recommended by the Review Committee (continued)

ACTIONS	ADDITIONAL COSTS TO FEDERAL GOVERNMENT	POTENTIAL SAVINGS
Action 10.2: The Administration should expand the mission of the Mississippi River Commission to include the upper Mississippi and Missouri rivers. Further, to recognize ecosystem management as a co-equal federal interest with flood damage reduction and navigation, the Administration should request legislative change to expand commission membership to include the DOI.	IC, SIP	ICA, IE, REI
Action 10.3: Assign responsibility for development of an Upper Mississippi River and Tributaries (UMR&T) system plan and for a major maintenance and major rehabilitation program for federally-related levees to an expanded Mississippi River Commission, operating under the USACE.	IC, SIP	EE, ICA, IE, RDA, REI, RFD
Action 10.4: Seek approval from the Congress to redirect the USACE Floodplain Management Assessment of the upper Mississippi River Basin to development of an UMR&T systems plan. Place this assessment under the Mississippi River Commission, operating under the USACE.	CNB, SIP	ICA, IE
Action 10.5: Following completion of the survey, seek authorization from the Congress to establish the UMR&T project.	CNB	ICA, IE, RDA, REI, RFD
Action 10.6: DOI should complete an ecological needs investigation of the upper Mississippi River Basin and provide a report to the Administration within 30 months.	CNB, SIP	ICA, REI
Action 10.7: Provide an early report in the USACE Upper Mississippi River - Illinois Waterway Navigation Study of environmental enhancement opportunities in the upper Mississippi River.	CNB	EE, REI
Action 10.8: Provide a report on the ecological effects of relocating navigation pool control points under the USACE Navigation Rehabilitation Study.	CNB	EE, REI

Table 13.1 Fiscal Impact of Actions Recommended by the Review Committee (concluded)

ACTIONS	ADDITIONAL COSTS TO FEDERAL GOVERNMENT	POTENTIAL SAVINGS
Action 10.9: The Administration Interagency Ecosystem Management Task Force should select an Ecosystem Management Demonstration Project within the upper Mississippi River Basin and establish a cross-agency ecosystem management team under the DOI to develop plans and budgets for the project.	CNB, SIP	EE, ICA
Action 11.1: The USGS should establish a federal clearinghouse for data gathered during preparation of the Review Committee report.	IC	ICA, IE, REI
Action 11.2: FEMA should investigate the costs and feasibility of completing a national inventory of floodprone structures.	CNB	ICA, IE,RDA, RFD
Action 11.6: The Administration should direct that scientific research be conducted to identify state-of-the-art techniques or applications for estimating and assessing environmental and social impacts.	CNB, SIP	EE, ICA, IE, REI
Action 11.7: The USACE and USDA, in collaboration with the DOI, should evaluate the effect of natural upstream storage and floodplain storage in such areas as wetlands and forested wetlands on mainstem flooding.	CNB, SIP	EE, ICA, RDA, REI, RFD

LEGEND:

COSTS

CBE: Cannot Be Estimated
CNB: Cost of Normal Business
IC: Increased Cost
SIP: Shift in Priorities

SAVINGS

EE: Environmental Enhancement
ICA: Improved Customer Assistance
IE: Increased Efficiency
RCP: Reduced Claims Payments
RDA: Reduced Disaster Assistance
REI: Reduced Environmental Impact
RFD: Reduced Flood Damages

Chapter 14

PERCEPTIONS, IDEAS, AND PROPOSALS

From the outset of this review, the Floodplain Management Review Committee has benefitted from the support of hundreds of individuals and groups, many of which had strong opinions on what should be done to solve the problems of the floodplain. With less than five months to complete its review, the Review Committee was unable to address each and every issue raised. Some concerns clearly merited further study, and Chapter 11 describes needed analysis and research.

Other issues were deemed beyond the scope of the Review Committee's charge, but nonetheless deserve consideration in the on-going debate about the management of the nation's resources. Should steps be taken to reduce or eliminate federal subsidies of floodplain activities? Have government programs induced inappropriate floodplain usage by shifting the consequences of certain actions from individuals to the federal government? Should the contribution of local interests to construction and repair of flood control structures be increased? Should disaster funding policies and procedures within the federal budget process be changed?

FEDERAL FARM PROGRAMS

Throughout the review, some federal economists and many non-federal groups have proposed phasing out federal subsidies in general and federal farm program payments in particular to floodplain activities, because they represent intrusions into the free market by distorting incentives and thus may encourage floodplain activity. The Review Committee did examine the role of federal farm programs as they influence individual farmer's decisions to farm in bottomlands. The study looked at both program payments and the support provided to farmers by federal levee repairs.

Each agricultural producer in the floodplain makes farming decisions based on a collection of factors, many of which differ from location to location. Input prices tend to be the same at all locations, but production practices and potential yields depend on the characteristics of the land. Cash receipts will depend on whether the farmer participates in a crop price support program. In addition the level of flood protection will determine whether a given year's yield will be realized and what the expected flood damages will be. From a farmer's perspective, the viability of farming a particular area depends on the net income that can be earned. Government programs for price and income support, levees, drainage, technical assistance, subsidized crop insurance premiums, and crop disaster assistance all serve to lower the cost of farming on the floodplain.

Many agricultural levees were constructed and maintained by local districts with no use of federal or state funds prior to 1993, so those flood control structures cannot be considered as part of a past subsidy to floodplain agriculture. If these levees are repaired with federal funds, the added benefit would reduce future production costs for the farmer. Farm programs offer a producer higher profits for growing certain crops, so the type of bottomland agriculture is also influenced by government policies. Farmers with lower levels of flood protection may switch to alternative crops such as growing biomass fuel. The economic viability of such choices is currently being studied. Site characteristics and government policies will determine a farmer's choices. Programs offering easements, levee set-backs, or "green" payments will have to take factors affecting farmer decisions into account.

Preliminary results from a study funded by EPA and being conducted by the Center for Agricultural and Rural Development at Iowa State University and the Center for National Food and Agricultural Policy at University of Missouri - Columbia indicate that in some areas participation in federal farm programs and the existence of levees will determine whether a crop is grown and which crop is chosen. In other areas of the floodplain, agriculture would be profitable even without participation in any farm or levee program.

Elimination of federal farm programs for floodplain farmers might make operations less viable and might influence some to leave the floodplain. It appeared to the Review Committee that it would be difficult to determine which floodplain farmers should not receive program payments. A substantial portion of American farming is in the floodplain. Much of the agricultural base of Missouri, Arkansas, Mississippi, and Louisiana exists in the floodplain. If the intent of removing payments or subsidies is to alter behavior that is believed to contribute to environmental problems, then it might be more productive to remove payments or offer "green payments" in areas where agriculture operates under less than optimal conditions, e.g., highly erodible land, drylands, etc.

While the issue of the merits of federal farm programs is important, it merits airing in a context larger than the floodplain and with a greater recognition of the difficulties of selective application of any such policy.[1]

MORAL HAZARD

In providing support for a range of floodplain activities, does government create a "moral hazard?" This phrase is used in the insurance industry to describe the situation when an insured party has a lower incentive to avoid risk because an enhanced level of protection is provided.

If an individual or government entity does not bear the financial consequences of an action there is little reason to mitigate the danger; therefore, the insured party is more likely to be at risk (or will expend too little effort to avoid risk) than one who has to bear all consequences. The insurance provider usually has few ways of observing whether proper care or precautions are taken. Private insurance companies deal with the moral-hazard problem by offering less than full coverage and requiring payments (deductibles) which increase the policyholder's incentive to take protective measures. Another way that insurance providers cope with moral hazard is to base each period's premiums on claims from previous periods. This method increases the policy holder's level of risk avoidance. Some federal provision of hazard insurance is subsidized through reduced premiums and administrative fees which lowers an individual's stake in avoiding harm. The availability of supplementary compensation diminishes the efficiency of insurance to encourage risk sharing. The Review Committee recognizes that through provision of disaster assistance and, in some cases, enhanced flood protection, the government may in fact be reducing incentives for local governments and individuals to be more prudent in their actions. The subject was discussed frequently in the field and with many of the Review Committee's advisors but without resolution. Some older studies have indicated that the presence of federal support does not create a disincentive to buy flood insurance. The Review Committee has sought to reduce the moral hazard through recommendations that limit disaster assistance and propose loans rather than grants for infrastructure upgrades. The Review Committee notes the potential for moral hazards to develop and cautions agencies involved in floodplain management to be aware of this potential.

FEDERAL FISCAL ROLE IN FLOOD CONTROL

Some people state that the federal government's role in funding flood control projects should be limited to paying costs related to federal benefits, with responsibility for costs associated with regional and local benefits falling to the local sponsor.[2] At present, under the provisions of the Water Resources

Development Act of 1986, cost-sharing for flood control projects is set at a local contribution of not less than 25 percent and not more than 50 percent, depending on the circumstances. Levee repairs, carried out under the provisions of PL 84-99 by the USACE, require a 20 percent local contribution, although the requirement for cost-sharing was determined by the Administration, not the Congress.

The federal interest in flood control was stated most clearly by the Flood Control Act of 1936, "...the Federal Government should improve or participate in the improvement of navigable waters or their tributaries...for flood control purposes if the benefits to whomsoever they may accrue are in excess of the estimated costs..." The rationale for this federal involvement was based in part on the magnitude of the physical threat and potential damages to the nation from flooding, and in part on recognition that navigable waters are interstate and activities in one area can have major effects on other areas.

The Congress, working with the Administration, has set cost-sharing rules based on congressional and Administration determinations as to the nature of the threat and the ability of state and local governments to bear the costs of projects rather than on the allocation of net benefits. The Review Committee recognizes that shifts in cost-sharing formulas would alter floodplain behavior but had neither the time to analyze nor the resources to develop any rationale for changing the existing cost-share arrangements.

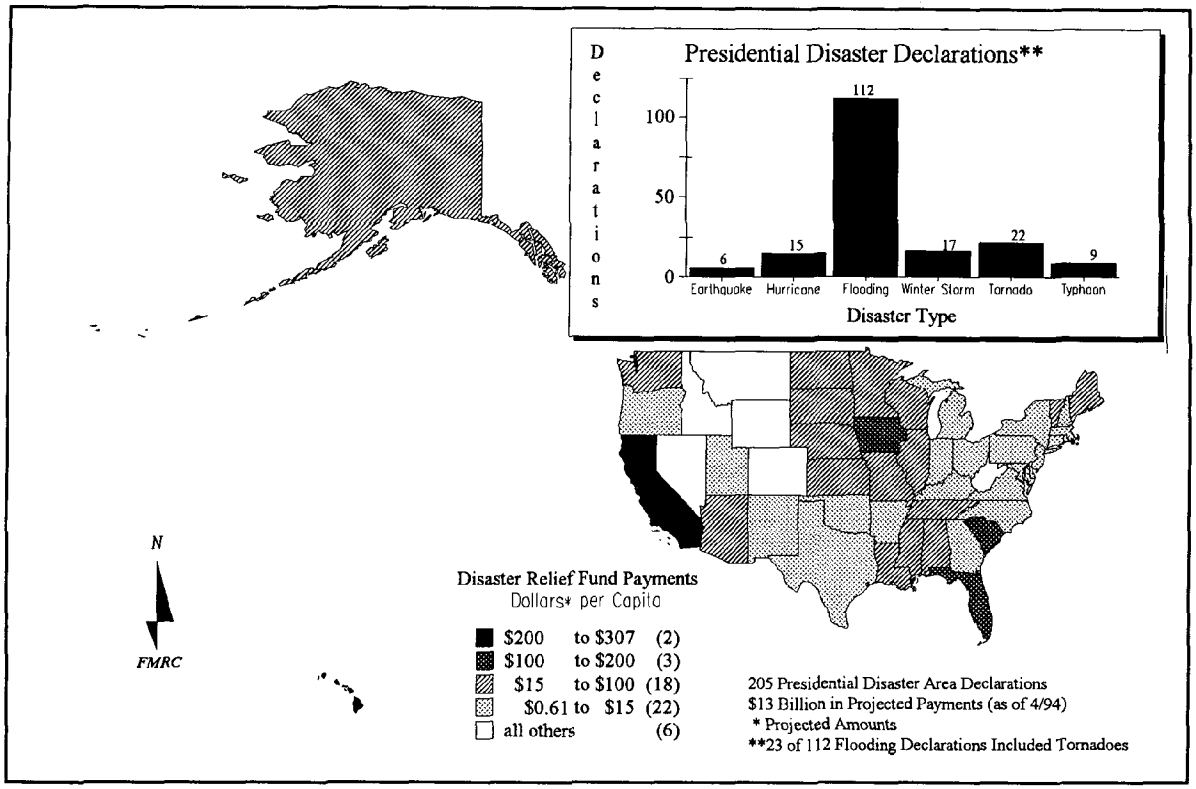
FUNDING DISASTERS

Natural disasters in the United States are costly events in terms of both human lives lost and property damaged. From FY 1989 through FY 1993, over $27.6 billion has been spent on federal disaster assistance programs. Figure 14.1 shows the number of Presidential disaster declarations over the past five years by disaster type and the dollars per capita that went to disaster relief payments for each state under the FEMA program. Although flood declarations comprised the majority of Presidential disasters declarations, earthquakes (California) and hurricanes (South Carolina, Florida) have caused greater per capita damage. All but six states experienced disasters severe enough to warrant Presidential declarations. States in the northeast battled coastal flooding while the south recovered from hurricanes and the midwest from floods.

The rising frequency and costs of natural disasters have prompted a variety of concerns. Some have questioned the federal government's role in funding disaster recovery, citing the potential for rising expenditures in an era of budgetary restraint, the possible incentives that federal relief creates for people to locate in disaster-prone areas, and the potential for elements of federal, state, and local government to rely on disaster relief for infrastructure repair. Others, assuming that a federal obligation to fund recovery exists, point to hazard mitigation as a cost effective alternative to providing disaster assistance. Funding preventive measures such as relocating structures out of the floodplain can decrease the demand for disaster relief.

Although congressional budgetary reform policies are outside the scope of this report, the Review Committee frequently heard concerns expressed about the current system of funding disaster relief through emergency supplemental appropriations, exempting disaster relief from the scrutiny received by other spending, while permitting it to add to the federal deficit. This situation also may create an incentive for federal agencies to accept backlogs in maintenance for activities in disaster prone areas, recognizing that an emergency spending opportunity for catching up may occur. The OMB should support study of and attention to the long-term implications of the 'above-cap' funding process.

Figure 14.1 Presidential Disaster Declarations, 1989-1993



Source: Federal Emergency Management Agency. April 1994.

PEOPLE, THE MEDIA, AND THE FEDERAL FLOOD RESPONSE

Compassion plays a major role in the way people respond to disasters and rush to provide disaster relief. The speed with which the entire nation learns of disasters is almost immediate. For example, because of the television coverage of the 1989 World Series, those watching had the experience of actually being present during a major earthquake. As for the 1993 floods, the nation can remember pictures carried by CNN of the house being swept away when a levee was breached. Viewers were left wondering how this could happen rather than why the house was there in the first place.

The best media flood-relief stories became those of suffering people and those complaining about the lack of quick government assistance. Politicians and decisionmakers were bombarded with calls and they responded by declaring additional counties part of the disaster area and by promising quick relief. FEMA Disaster Field Offices, set up in many cities and towns, were themselves flooded with applications for disaster relief. The media attention helped agencies get needed information to citizens, but also may have increased expectations about the level of assistance that was available or the speed at which help could be provided.

Human compassion and the way news is reported influences how Congress and the nation respond to disasters. A great push arose to replace levees along the Missouri River, many of which should not be replaced without careful design and engineering

considerations. If federal response to disaster relief is driven by the immediacy of an event, rather than by rational decisionmaking, the effort to put everything back to the way it was may increase future risk rather than reaching long-term solutions to risk reduction. In the haste of some disaster relief and under the pressure of the media effect, the nation may have subsidized some bad decisions and penalized some good ones, foregoing opportunities for change. A caring, supportive approach for disaster victims must never be lost; but there must be, in tandem, an effort to ensure decisionmaking that reflects long-term as well as short-term goals.

NON-URBAN LEVEES

Congressional and Administration support of the 1993 supplemental appropriations for PL 84-99 clearly indicates strong support for that program. Several groups in and outside the federal government, however, proposed eliminating all federal support of levee repairs under PL 84-99. Lack of federal post-disaster support probably would result in eventual economic failure for some previously protected land and a gradual conversion of formerly protected land from agriculture to natural areas, which in turn could provide additional flood storage and reduced future agricultural flood damages.

Before a levee can be repaired, on a cost-shared basis, under PL 84-99, the USACE or SCS must conduct an economic analysis indicating that the benefits of the repair outweigh the costs. This requirement mirrors the requirements for new construction, but looks only at the costs and benefits associated with the emergency repairs. Sponsors of levees that do not meet the benefit-cost test for repairs may not find it profitable to continue to farm, but the action that forced this decision was one based on accepted analysis practices rather than one based on a desire to reallocate the land. Provisions are available under current laws to obtain interest in such land from willing sellers (see Chapter 7).

MISSOURI RIVER BANK STABILIZATION AND NAVIGATION

Clearly, there is a relationship between the Missouri River Bank Stabilization and Navigation Project and the decline of habitat and ecosystems along that river. In recent years the USACE has made efforts to adjust operation of the system to better accommodate environmental concerns. Nevertheless during the course of its review, the Review Committee encountered many individuals and several conservation agencies that believe the economic and social benefits derived from the project do not outweigh the environmental costs associated with it. The Review Committee reviewed benefit-cost calculations for the navigation component of the project prepared by the USACE Institute for Water Resources using the current *Principles and Guidelines* procedures for the reach of the river between Sioux City, Iowa, and Kansas City. This analysis indicated that, using the existing procedures, there is a favorable ratio, even when navigation tonnage involving river operations and bank stabilization benefits are excluded. The Review Committee recognizes that the USACE is in the process of completing its multi-year study of the water control operations of the Missouri River main stem reservoir system and is about to release a draft Environmental Impact Statement (EIS) covering the program of releases from the reservoirs and their relationship to the ecology of the river, navigation, hydropower, flood control, water supply, and recreation. Discussions with the USACE indicate that the draft EIS will address many environmental concerns. The 'Master Manual' review study is being conducted under a full public involvement process in accordance with the NEPA. The Review Committee believes it would be appropriate for the USACE, after completion of the action on the 'Master Manual,' to conduct an analysis of potential modifications to the structural components of the navigation system to determine what benefits can be obtained through these actions. The USACE should also, under the recommended procedures for project review (Chapter 5), conduct an analysis, by reach, of the total benefits and costs of navigation operations on the Missouri River.

PROPERTY RIGHTS

Two senior members of Congress expressed to the Review Committee a concern felt by many individuals who also corresponded with the Review Committee.

> The respect and adherence to the rights of property owners as drafted in our Constitution are of central importance to the federal government's role in floodplain management. Any acquisition of lands, expansion of wetlands, and the purchase of easements and rights-of-way should be done with adequate compensation to the landowner. Likewise, the federal government should refrain from the use of condemnation when attempting to move residents out of the floodplain. Any expansion of buyout and relocation initiatives must be carried out on a willing-seller basis.

There has been no suggestion in this report that either land or property be condemned by the federal government. Sound floodplain management will result from a strong partnership among federal, state/tribal and local governments and the private citizens of the nation. Decisions on land acquisitions should result from consultations within this partnership. The recommendations of this report tie all federal acquisitions of land or property for environmental or relocation purposes to a willing seller scenario.

The report recognizes that the federal government should not support fiscally the rebuilding of some flood damaged structures, to include levees and homes, when it does not make economic or engineering sense. To some, this failure to support rebuilding is seen as an abridgement of the rights of the owners of the property. The Review Committee does not see this to be the case. Some individuals have stated that the federal government's failure to repair their flood-damaged levees even though they were ineligible for participation in one of the emergency programs, constitutes an abridgement of their entitlement to these repairs and thus a violation of their property rights. The Administration has determined the eligibility criteria for each existing levee repair program. The Review Committee has endorsed the criteria being used by the USACE to determine eligibility for participation in levee repair programs (Action 8.2) and does not see the denial of repairs to be either an entitlement or a property rights issue.

Similarly, some individuals have complained that any restrictions on an individual's or a group's 'right ' to floodfight constitutes another possible abridgement of property rights. The Review Committee recognizes the rights of individuals and groups to protect their own property from destruction provided that their actions do not increase flood damages to other groups or individuals. The law concerning protection against a common enemy is complex and the rights and responsibilities of individuals and groups involved in such actions vary widely by state and locality. The Review Committee has recommended that before federal and state governments provide fiscal or in-kind support to floodfights, they ensure that the actions being taken will not have adverse impacts on other groups or individuals. Individuals and groups retain the ability to 'go it on their own' subject to state and community floodplain management regulations (including floodway regulations adopted by communities to participate in the NFIP). These individuals and groups are subject to whatever liability they generate as a result of their actions. Land use controls developed by a community as a result of participation in the NFIP represent community decisions.

Several individuals discussed with the Review Committee their concern that national environmental programs have resulted in a shifting of property from private ownership and that these shifts constituted a taking of sorts. Wherever possible, the Review Committee investigated the comment and could only identify programs in which there had been willing sellers.

ENDNOTES

1. A federal economist notes, in proposing an end to farm program payments, that major institutional changes can be very disruptive and transitions are important in order to minimize disruptions. "People make major investments based on market distortions introduced by subsidies. Eliminating existing subsidies is disruptive and equity requires that beneficiaries be given an opportunity to adjust to the correction of these distortions. However, not eliminating subsidies imposes an unfair burden on the rest of society. Living, working and investing in a floodplain is inherently risky. If people are not confronted with the full cost of such behavior, resources are misallocated and costly inefficiencies result. It is inequitable to ask Federal taxpayers to subsidize and finance such activities"

2. One economist notes, "The Federal Government should not be in the business of financing projects which produce local and/or regional benefits. The Federal Government should establish standards for management of the floodplain. Subject to budgetary constraints, if a proposed project has a benefit-cost ratio greater than one for Federal benefits, the Federal Government should pay for the provision of Federal benefits and locals should pay all other costs."

Chapter 15

INTO THE 21st CENTURY

The Midwest Flood of 1993 was a significant hydrometeorological event. In some areas it represented an unusual event; in most others, however, it was just another of the many that have been seen before and will be seen again. Flood flows similar to those experienced by most of the Midwest will continue to occur.

Excessive rainfall, which produced standing water, saturated soils, and overland flow, caused major damages to upland agriculture and some communities. In turn, runoff from this rainfall created, throughout the basin, flood events that became a part of the nation's 1993 TV experience. Damages overall were extensive; $12 - $16 billion that can be counted and a large amount in the unquantifiable impacts on the health and wellbeing of the population of the Midwest.

Human activities in the floodplains of the Midwest over the last three centuries placed people and property at risk. Local and federal flood damage-reduction and floodplain management programs reduced the annual risk, and, during the 1993 flood, prevented nearly $20 billion in potential damages. Some of these programs, however, have drawn the population to high risk areas and created greater exposure for future damages. In addition, flood damage-reduction, navigation and agricultural activities have severely reduced available floodplain habitat and have compromised natural functions on which fish and wildlife rely.

Over the last 30 years the nation has learned that effective floodplain management can reduce vulnerability to damages and create a balance among natural and human uses of floodplains and their related watersheds to meet the social and environmental goals of the nation. The nation, however, has not taken advantage of this capability.

The Interagency Floodplain Management Review Committee proposes a better way to manage the nation's floodplains. The report begins with establishing that all levels of government, all businesses, and all citizens interested in the floodplain should have a stake in properly managing this resource. All of those who support the risk, either directly or indirectly, must share in the management and the costs of reducing the risk. The federal government must lead by example; state and local governments must manage the floodplains; and individual citizens must adjust their actions to the risk they face.

The Review Committee supports an approach to floodplain management that replaces a focus on structural solutions with a sequential strategy of avoidance, minimization and mitigation. In many cases, by controlling runoff, managing ecosystems for all their benefits, planning the use of the land, and identifying those areas at risk, the hazard can be avoided. Where the risk cannot be avoided, damage minimization approaches, such as elevation and relocation of buildings, and construction of reservoirs or flood protection structures, are carried out only when they can be integrated into an overall systems approach to flood damage reduction in the basin.

When floods occur, damages to individuals and communities can be mitigated with a flood insurance program that obtains its support from those who are protected. Full disaster support for those in the floodplain is contingent on participation in these self-help mitigation programs. By internalizing these risks, the moral hazard associated with full government support is reduced.

To ensure a long-term, nationwide approach to floodplain management, the Review Committee proposes legislation to develop and fund a national

floodplain management program with principal responsibility and accountability at the state level. It also proposes revitalization of the federal Water Resources Council to better coordinate federal activities, limited restoration of some basin commissions for basin-wide planning, and reissuance of a Presidential Executive Order requiring adherence to floodplain management principles by federal agencies and their programs.

Recognizing that the existing developed condition of the upper Mississippi River Basin includes individually authorized federal flood control projects and levees built by local groups and individuals, the Review Committee also proposes a plan to identify and evaluate the needs of the basin, to ensure the integrity of a flood damage reduction system that meets the needs of the basin, and to restore natural floodplain functions on appropriate lands.

THE 21st CENTURY FLOODPLAIN

The vision of the 21st century floodplain described in Chapter 4 can become a reality.

Human activity in the floodplain will continue, but with the clear understanding that any activity is subject to the residual risk of flooding and that the costs of this risk are to be borne by the sponsors of the activity. All new activity will be evaluated for its economic, social, and environmental impacts and its effects on other activities in the floodplain.

The threat to urban centers whose existence depends on the river for commerce or whose locational advantage is tied historically to the floodplain will be reduced by a combination of upstream land treatment, floodways, and floodproofing. In some cases, levees and floodwalls will continue to provide part of the vulnerability reduction. Many sections of these communities, where frequent flooding had been a way of life for the residents, will become river-focused parks and recreation areas as former occupants relocate to safer areas on higher ground. Adherence to strict land-use regulations by the community will stop unwise development.

Those whose homes were at risk in low lying areas outside the urban centers will have moved to higher ground. Outside of the urban areas, industry will protect its own facilities against major floods. The water and wastewater treatment plants, power plants, and major highways and bridges that serve these centers will be elevated out of the flood's reach or protected against it. Much of this infrastructure, as well as the homes, businesses, and agricultural activities located behind most levees, will be insured against flooding through full participation in commercial or federally supported insurance programs.

The floodplain of the 21st Century will be rich in both agriculture and natural systems. At the upstream end of well-maintained levees, federally built water-control structures will permit controlled passage of river waters to keep sloughs wet throughout the year maintaining and restoring aquatic habitat with resultant benefits for fisheries, waterfowl, and other wildlife. Levees will be modified to provide for controlled overtopping in the event of high water, eliminating the catastrophic failures that occurred in the past. Participation in a federal crop insurance program will protect the agricultural investments.

Some of the lower land will be converted from row crops to alternative crops or silviculture or returned to a natural state under federal or state easements. Many levees that were frequently destroyed in the past by flood waters will be removed or relocated to ensure their integrity or provide for a floodway.

Upland of the floodplain, programs to improve the treatment of lands, control new runoff, and restore wetlands will reduce the flows during frequent floods and shave the peaks off larger events, improving conditions in the floodplain. Both commercial and recreational vessels will continue to ply the river's waters, operating in a navigation system that enhances riverine ecosystems through water-level adjustments and control.

The floodplain will meet the needs of both human and natural systems.

SHARING THE CHALLENGE

The Review Committee has suggested a bold yet realistic and straightforward approach to improving floodplain management:

- Share responsibility and accountability for accomplishing floodplain management among all levels of government and with the citizens of the nation. The federal government can not go it alone, nor should it take a dominant role in the process.

- Establish, as goals for the future, the reduction of the vulnerability of the nation to the dangers and damages that result from floods and the concurrent and integrated preservation and enhancement of the natural resources and functions of floodplains. These goals seek to avoid unwise use of the floodplain, mitigate vulnerability when floodplains must be used, and mitigate those damages that do occur.

- Organize the federal government and its programs to provide the support and the tools necessary for all levels to carry out and participate in effective floodplain management.

The tools, authorities and programs are available at the federal, state, tribal, and local level to move toward accomplishment of these goals. Many of the nation's past activities in the floodplain make sense, produce desirable results, and should be continued. Others do not and should be stopped. While many aspects of current programs are in need of modification, the problem is not one of lack of understanding of how to manage floodplains and their associated watersheds, it is a problem of will and organization. There are no silver bullets in the floodplain management business, no single actions that will suddenly reduce the vulnerability of those who are currently at risk or stave off placing others in the same position.

If the nation is to move ahead, it must do so in a manner that recognizes the many stakeholders in the floodplain management effort and appropriately divides the responsibilities among them. Many state and local governments have done a great job at floodplain management and the nation can build on that success; others need encouragement; all need support. Operating together with common goals, governments, businesses, and private citizens can make sound floodplain management a reality throughout the nation.

By giving the states and local governments more responsibilities and supporting their efforts, by improving the efficiency of federal efforts, and by ensuring that individuals recognize and assume their personal responsibilities for floodplain activities, the federal government can share the challenge of floodplain management and see to its accomplishment.

WHAT'S NEXT?

The Review Committee has proposed 60 actions and made recommendations concerning 28 other issues. These proposals represent a package whose interrelationships will continue to exist even if one or more of the components fail to be implemented. The Review Committee would caution that the strong linkages among the actions and recommendations require that, as any one is considered, it needs to be addressed in the context of those to which it relates.

Chapter 12 provided a road map for further action, assigning responsibilities to appropriate agencies for specific actions. Unless these actions are tracked by the Administration, the cohesion of the disparate actions could be lost.

The United States has a rare opportunity to make a change in floodplain management. It should not be missed.

Part V

REPORT OF THE SCIENTIFIC ASSESSMENT AND STRATEGY TEAM (SAST)

To be published separately

ACRONYMS & ABBREVIATIONS

ac-ft	Acre-feet
ACR	Acreage Conservation Reserve
ASCS	USDA Agricultural Stabilization and Conservation Service
BIA	DOI Bureau of Indian Affairs
BOR	DOI Bureau of Reclamation
CA	Cooperative Agreements
CDBG	Community Development Block Grant
CEA	EOP Council of Economic Advisors
CEQ	EOP Council on Environmental Quality
cfs	cubic feet per second
CFR	Code of Federal Regulations
CN	Curve Number
CNN	Cable News Network
CRP	Conservation Reserve Program
CVM	Contingent Valuation Method
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DOC	Department of Commerce
DOI	Department of the Interior
DOD	Department of Defense
DOT	Department of Transportation
EA	NEPA Environmental Assessment
EDA	DOC Economic Development Administration
EEP	Environmental Easement Program
EIS	NEPA Environmental Impact Statement
EMP	Environmental Management Program
EO	Executive Order
EOP	Executive Office of the President
EPA	Environmental Protection Agency
EROS	Earth Resources Observation System
ERS	Economic Research Service
ESA	Endangered Species Act
EWP	Emergency Watershed Protection Program
EWRP	Emergency Wetlands Reserve Program
FAA	DOT Federal Aviation Administration
FACTA	Food, Agriculture, Conservation and Trade Act of 1990 (the 1990 Farm Bill)
FCIC	Federal Crop Insurance Corporation
FCO	Federal Coordinating Officer
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FIPS	Federal Information Processing Standards
FIRM	Flood Insurance Rate Map
FmHA	USDA Farmers Home Administration
FMRC	Interagency Floodplain Management Review Committee
FR	Federal Register
FS	USDA Forest Service
FSA	Food Security Act
FWS	DOI Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information System
HEC	Hydrologic Engineering Center
HEL	Highly Erodible Land
HOME	HUD HOME Investment Partnership Program
HR	House of Representatives Bill
HUD	Department of Housing and Urban Development
IFSARE	InterFerometric Synthetic Aperture Radar for Elevation
LAWCON	Land and Water Conservation Fund
LIDAR	Light Detection and Ranging
LTRMP	Long Term Resource Monitoring Program
MARC	Midwest Area River Coalition
MLRA	Major Land Resource Area
MM&MR	Major Maintenance and Major Rehabilitation
MR&T	Mississippi River and Tributaries Project
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MRC	Mississippi River Commission
NASA	National Aeronautics and Space Administration
NBS	National Biological Survey
NED	National Economic Development

NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGO	Non-Governmental Organization
NHPA	National Historic Preservation Act
NOAA	DOC National Oceanic and Atmospheric Administration
NPR	National Performance Review
NPS	DOI National Park Service
NRI	National Resource Inventory
NWS	DOC National Weather Service
OMB	EOP Office of Management and Budget
P&G	Economic and Environmental Principles and Guidelines for Water and Related Land Resources
P&S	Principles and Standards for Planning Water and Related Land Resources
PL	Public Law
RCRA	Resource Conservation and Recovery Act
RDA	Rural Development Administration
RRSA	Refuge Revenue Sharing Act
S	Senate Bill
SAST	Scientific Assessment and Strategy Team (of the FMRC)
SAR	Synthetic Aperture Radar
SBA	Small Business Administration
SCS	USDA Soil Conservation Service
SPF	Standard Project Flood
TIGER	Topologically Integrated Geographically Encoded Reference
TVA	Tennessee Valley Authority
UCOWR	Universities Council on Water Resources
UMRBA	Upper Mississippi River Basin Association
UMRBC	Upper Mississippi River Basin Commission
UMRCC	Upper Mississippi River Conservation Council
UMR&T	Upper Mississippi River and Tributaries Project
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USGS	DOI U.S. Geological Survey
WRC	Water Resources Council
WRDA	Water Resources Development Act (of any year)
WRP	Wetland Reserve Program

GLOSSARY

100-year flood: A term commonly used to refer to the one percent annual chance flood. The 100-year flood is the flood that is equaled or exceeded once in 100 years on the average, but the term should not be taken literally as there is no guarantee that the 100-year flood will occur at all within a 100-year period or that it will not recur several times.

Acre-foot: A unit measure of volume equal to one acre covered to a depth of one foot; often used to describe reservoir capacity or the amount of water flowing past a point in a river over a specified time period. One acre-foot equals 43,560 cubic feet, or 326,700 gallons.

Actuarial rates: Insurance rates determined on the basis of a statistical calculation of the probability that a certain event will occur. Actuarial rates, also called risk premium rates, are established by the Federal Insurance Administration pursuant to individual community Flood Insurance Studies and investigations undertaken to provide flood insurance in accordance with the National Flood Insurance Act and with accepted actuarial principles, including provisions for operating costs and allowances.

Aggradation: The process of filling and raising the level of a streambed by deposition of sediment.

Agricultural levee: A levee for which the majority of benefits are derived from protection of agricultural lands.

Backwater lake: A lake connected to a river at its downstream end that fills principally from the rise of the river rather than from inflow from the lake's drainage area.

Backwater: a) A rise in upstream water level caused by an increase in flow downstream. b) An upstream water level rise caused by obstructions downstream, such as ice jams or debris.

Bank stabilization: Use of structural measures such as rock, concrete, or other material to stabilize channel banks against movement and erosion.

Bankfull stage: At a given location, the maximum elevation to which a river can rise without overflowing its banks. (*See* Flood stage).

Base flood: A flood of specific frequency and used for regulatory purposes. The NFIP has adopted the "100-year" flood as the base flood to indicate the minimum level of flooding to be used by a community in its floodplain management regulations.

Basin: A region or area drained by a river system. Also, the total land area that contributes runoff to any given point on a river or stream. Often called a watershed.

Biotechnical engineering: Channel or bank modification techniques that use vegetation in innovative ways in contrast to traditional bank sloping and riprap protection.

Bluff line: A steep headland or cliff which in some topographical settings defines the edge of a floodplain.

Bottomland hardwoods: Tree species that occur on water-saturated or regularly inundated soils. Classified as

wetlands, these areas contain both trees and woody shrubs.

cfs: The rate of flow (*see* Discharge) past a given point, measured in cubic feet per second. One cubic foot of water equals about 7 1/2 gallons.

Collaborative approach: A commitment to working collectively to solve complex, inter-related concerns. A collaborative effort requires more than consultation, coordination, and seeking public input.

Community Assistance Program (CAP): The program established by the Federal Emergency Management Agency and intended to assure that communities participating in the NFIP are carrying out the flood loss reduction objectives of the program. The CAP provides needed technical assistance to NFIP communities and attempts to identify and resolve floodplain management issues before they develop into problems requiring enforcement action.

Community Rating System (CRS): A program developed by the Federal Emergency Management Agency to encourage -- by use of flood insurance premium reductions -- community and state activities that go beyond the basic NFIP requirements; the CRS gives communities credit for certain activities to reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance.

Conservation tillage: Practices that reduce cultivation of soil, leave a protective vegetative layer on the surface, and thereby serve to reduce or minimize soil erosion.

Crest: The highest water level at a given location during a flood event.

Crop rotation: Growing crops in a cropping sequence designed to provide adequate residue for maintaining or improving soil condition.

Cumulative impacts: The impacts on the environment that result from the incremental impact of an action when added to other past, present and reasonably foreseeable actions; cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Dam: A structure built across a waterway to impound water. Dams are used to control water depths for navigation; or to create space to store water for flood control, irrigation, water supply, hydropower or other purposes.

Debris: Objects such as logs, trees and other vegetation, building wreckage, vehicles, shopping carts or dead animals carried by water in a flood (or by wind, as in a hurricane or tornado).

Degradation: A process of lowering the level of a streambed by scour and erosion.

Design flood: The maximum amount of water for which a flood control project will offer protection. Selection is based on engineering, economic and environmental considerations.

Dike: In most areas of the U.S., an earthen or rock structure built partway across a river for the purpose of maintaining the depth and location of a navigation channel. In others areas the term is used synonymously with levee.

Discharge: Rate of flow in a river or stream measured in volume of water per unit of time. (*See* **cfs**).

Drainage tiles: Short lengths of perforated pipe made of clay, concrete, or plastic installed in soil to remove free water for the purpose of crop production.

Drainage area: Total land area from which water drains to a point on a river. The upper Mississippi River *drainage area* comprises 23% of the land area of the 48 contiguous United States.

Ecosystem: Biological communities (including humans) and their environment (or watershed) treated together as a functional system of complementary relationships, including transfer and circulation of energy and matter.

Ecosystem integrity: Maintenance of the structural and functional attributes characteristic of a particular locale or watershed, including normal variability.

Ecosystem management: Management of the biological and physical resources of an ecosystem or watershed in an attempt to maintain the stability of its structural, functional, and economic attributes, including its normal variability.

Emergency spillway: *See* Spillway.

Emergency: Any instance for which, in the determination of the President, federal assistance is needed to supplement state and local efforts and capabilities to save lives and protect property and public health and safety or to lessen or avert the threat of a disaster in any part of the United States.

Encroachments: Activities or construction within the floodway, including fill, new construction, substantial improvements, and other development, that may result in an increase in flood levels.

Environmental assessment: An examination of the beneficial and adverse impacts on the environment of a proposed action, such as a water resources project, and alternative solutions.

Executive Order 11988: The Floodplain Management Executive Order, issued in 1977, specifying the responsibilities of the federal agencies in floodplain management. EO 11988 directed federal agencies to evaluate and reflect the potential effects of their actions on floodplains and to include the evaluation consideration of flood hazards in agency permitting and licensing procedures.

Federal Interagency Floodplain Management Task Force: The Task Force established in 1975 to carry out the responsibility of the President to prepare for the Congress a Unified National Program for Floodplain Management; member agencies are the Department of Agriculture, Department of the Army, Environmental Protection Agency, Federal Emergency Management Agency, Department of the Interior, and the Tennessee Valley Authority.

Federal trust resources: As applied in this report, these resources include migratory birds, federally listed threatened and endangered species and species that are candidates for listing, interjurisdictional fisheries and wetlands. Such resources are protected by international treaty, and/or federal law in recognition of their ecological and/or commercial significance.

Field borders: A strip of perennial vegetation established on the edge of a field. It involves plantings of herbaceous vegetation or shrubs.

Flash flood: Flood with a very rapid rate of rise that is caused by intense rainfall. During flash floods the time between peak rate of rainfall and peak flow is very short.

Flood/flooding: A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of river and/or tidal waters and/or the unusual accumulation of waters from any source.

Flood control structures: Structures such as dams, dikes, levees, drainage canals, and other structures built to modify

flooding and protect areas from flood waters.

Flood discharge: The quantity of water flowing in a stream and adjoining overflow areas during times of flood. It is measured by the amount of water passing a point along a stream within a specified period of time and is usually measured in cubic feet of water per second (cfs).

Flood frequency: The frequency with which a flood of a given discharge has the probability of recurring. For example, a 100-year frequency flood refers to a flood discharge of a magnitude likely to occur on the average of once every 100 years or, more properly, of a magnitude that has a one-percent chance of being equaled or exceeded in any year. Although calculation of possible recurrence is often based on historical records, there is no guarantee that a 100-year flood will occur at all or that it will not recur several times within any 100-year period.

Flood hazard: The potential for inundation that involves risk to life, health, property, and natural floodplain values.

Flood Hazard Mitigation Teams: Teams consisting of representatives of the 12 federal agencies that signed an interagency agreement to provide technical assistance to states and communities for nonstructural flood damage reduction measures. The teams are typically employed after each major flood disaster declared by the President to provide technical assistance and guidelines to communities and states affected by the disaster.

Flood Insurance Rate Map (FIRM): An official map of a community on which the Federal Emergency Management Agency has delineated both the special hazard areas and the risk premium zones applicable to the community. FIRMs typically identify the elevation of the one-percent annual chance flood and the areas that would be inundated by that level of flooding; they are used to determine flood insurance rates and for floodplain management.

Flood insurance: The insurance coverage provided through the National Flood Insurance Program.

Flood of record: The highest flood historically recorded at a given location.

Flood-pulse advantage: The amount by which fish yield is increased by a natural predictable flood pulse.

Floodplain management regulations: Zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances that cover, for example, floodplains, grading, and erosion control and other regulations to control future development in floodplains and to correct inappropriate development already in floodplains.

Floodplain management: A decision-making process whose goal is to achieve appropriate use of the nation's floodplains. Appropriate use is any activity or set of activities that is compatible with the risk to natural resources and human resources. The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to watershed management, emergency preparedness plans, flood control works, and floodplain management regulations.

Floodplain resources: Natural and cultural resources including wetlands, surface water, groundwater, soils, historic sites, and other resources that may be found in the floodplain and that provide important water resources, living resources (habitat), and cultural/historic values.

Floodplain: Low lands adjoining the channel of a river, stream, watercourse, lake, or ocean, that have been or may be inundated by floodwater and other areas subject to flooding.

Floodproofing: The modification of individual structures and facilities, their sites, and their contents to protect against

structural failure, to keep water out, or to reduce the damaging effects of water entry.

Flood stage: A site-specific river level at which flood damage may start to occur; usually at or above the top of the riverbank. Flood heights are often measured relative to the flood stage elevation. (*See* Stage).

Flood storage pool: A volume of space in a reservoir reserved for storage of flood water.

Floodwall: Reinforced concrete walls that act as barriers against floodwaters thereby helping to protect floodprone areas. Floodwalls are usually built in lieu of levees where the space between developed land and the floodway is limited.

Floodway: The channel of a river or other watercourse and the adjacent land areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevation more than a designated amount. The floodway is intended to carry deep and fast-moving water.

Flowrate: Rate of flow (discharge) at a specific location in a river or floodplain.

Freeboard: A factor of safety usually expressed in feet above a flood level for purposes of designing flood protection facilities and for floodplain management. Freeboard tends to compensate for the many uncertain factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge obstructions, and the hydrological effect of urbanization of the watershed.

Gated outlets: Conduits, such as pipes or box culverts, in which mechanical gates are placed for the purpose of controlling the discharge.

Geographic Information System (GIS): A computerized system designed to collect, manage, and analyze large volumes of spatially referenced and associated attribute data.

Greenway: A protected linear open-space area that is either landscaped or left in its natural condition. It may follow a natural feature of the landscape, such as a river or stream, or it may occur along an unused railway line or some other right of way.

High energy erosion zones: Areas on the floodplain, such as the location of a former channel, that are subject to extensive scour and sediment transport during overbank flows.

Hinge-control points: Points in slackwater navigation pools where the water level is used as an index to establish gate settings at navigation dams for maintaining navigable depths.

Hydraulics: The science dealing with the mechanical properties of liquids that describes the specific pattern and rate of water movement in the environment.

Hydrology: The science dealing with the properties, distribution, and circulation of water on and below the surface of the land and in the atmosphere.

Interjurisdictional Fisheries: Fish and shellfish resources whose habitat includes waters shared by two or more states.

Land treatment measures: Measures used to reduce runoff of water to streams or other areas; techniques include maintenance of trees, shrubbery, and vegetative cover; terracing; slope stabilization; grass waterways; contour plowing;

and strip farming.

Levee: A linear earth embankment used to protect low-lying lands from flooding. A levee extends from high ground adjacent to a floodprone area along one side of a river to another point of high ground on the same side of the river.

Lock: A structure adjacent to a dam or in a canal to allow passage of vessels from one water level to another. The lock consist of a chamber with gates at either end, in which water is raised or lowered. Navigation lock and dams normally do not store flood water.

Lower Mississippi River Basin: The portion of the Mississippi River Basin that drains into the Mississippi River from its confluence with the Ohio River to the Gulf of Mexico.

Lower Mississippi River: The reach of the Mississippi River from the confluence of the Ohio River at Cairo, Illinois, to the Gulf of Mexico.

Major disaster: Any natural catastrophe or, regardless of cause, any fire, flood, or explosion in any part of the United States which, in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Middle Mississippi River: The reach of the Mississippi River between its confluence with the Missouri River at St. Louis, Missouri, and its confluence with the Ohio River at Cairo, Illinois.

Mitigation: Any action taken to permanently eliminate or reduce the long-term risk to human life and property and the negative impacts on natural and cultural resources that can be caused by natural and technological hazards.

Mitigation lands: Lands acquired to offset adverse impacts of water resource (or other) projects

National Wetlands Inventory Project: Wetlands mapping on a national basis performed by the U. S. Fish and Wildlife Service to provide scientific information on the extent and characteristics of the nation's wetlands and consisting of detailed maps and status and trends reports.

Natural resources and functions of floodplains: Include, but are not limited to, the following: natural flood and sediment storage and conveyance, water quality maintenance, groundwater recharge, biological productivity, fish and wildlife habitat, harvest of natural and agricultural products, recreation opportunities, and areas for scientific study and outdoor education.

Navigation channel: The channel maintained in a body of water for the purpose of assuring a depth adequate for commercial vessels.

Nonstructural measures: A term originally devised to distinguish techniques that modify susceptibility to flooding (such as watershed management, land use planning, regulation, floodplain acquisition, floodproofing techniques and other construction practices, and flood warning) from the more traditional structural methods (such as dams, levees, and channels) used to control flooding.

One-percent annual chance flood: A flood of a magnitude that has a one-percent chance of being equalled or exceeded in any given year. Often referred to as the 100-year flood or base flood, the one-percent annual chance flood is the standard most commonly used for floodplain management and regulatory purposes in the United States.

Permanent vegetation: Perennial vegetation such as grasses, shrubs,and trees which provides cover to soil and prevent erosion.

Principles and Standards/Principles and Guidelines: "The Principles and Standards for Planning of Water and Related Land Resources" is a Presidential policy statement issued in September 1973 that established a framework for improved planning for the use of water and related land resources based on the objectives of national economic development and environmental quality. The "Principles and Standards" were revised and issued in 1983 as the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources for Implementation Studies."

Quad Cities: The metropolitan area comprised by Davenport, Iowa; Bettendorf, Iowa; Rock Island, Illinois; and Moline, Illinois.

Recurrence interval: The average interval in which a flood of a given size is equaled or exceeded as an annual maximum.

Regulatory floodplain: The area adjoining a river, stream, lake, or ocean that is inundated by a regulatory flood. In riverine areas the floodplain usually consists of a regulatory floodway and regulatory flood fringe (also referred to as a floodway fringe). In coastal areas the floodplain may consist of a single regulatory floodplain area or a regulatory high-hazard area and a regulatory low-hazard area.

Regulatory floodway: The area regulated by federal, state, or local requirements to provide for the discharge of the base flood so the cumulative increase in water surface elevation is no more than a designated amount (not to exceed one foot as the minimum standard set by the National Flood Insurance Program).

Repetitive loss: A flood-caused loss of more than $1,000 to a repetitive loss structure.

Repetitive loss structure: A structure for which two or more losses of more than $1,000 (building and contents combined) have been paid since 1978.

Riparian ecosystems: Distinct associations of soil, flora, and fauna occurring along a river, stream, or other body of water and dependent for survival on high water tables and occasional flooding.

Riparian vegetation: Hydrophytic vegetation growing in the immediate vicinity of a lake or river.

Riparian zone: The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The area is typically subject to frequent, short duration flooding.

Risk: The probability of being flooded.

Rock closing dams: In reaches of rivers where multiple channels are formed by islands, rock dikes that span the side channel, generally where it departs from the main channel, are called rock closing dams. They serve to direct flow to the main channel.

Scour hole: Erosional holes developed as a result of breached levees. Locally called blow, blew, or blue holes.

Scour: Process of eroding surface soil by flowing water which results in gullies in the landscape.

Section 409 Hazard Mitigation Plan: A plan prepared as required by Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 by any jurisdiction that receives federal disaster assistance.

Sediment and debris basin: Retention structure constructed on or adjacent to a watercourse to store sediment and debris.

Side channel: A stream or channel to the side of the major channel or stream.

Slackwater navigation dam: A dam placed across a river for the purpose of creating water depth sufficient for navigation. The term slackwater refers to the relatively low velocity in the navigation pool compared to an open river.

Slough: A swamp, march, bog or pond as part of a bayou, inlet or backwater.

Spillway: A feature of a dam allowing excess water to pass without overtopping the dam. Usually a spillway functions only in a large flood.

Stage: The height of the water surface in a river or other body of water measured above an arbitrary datum, usually at or near the river bottom.

Standard project flood: A very large (low frequency) design flood standard applied to the design of major flood control structures and representing the most severe recombination of meteorological and hydrological conditions considered reasonably characteristic of a particular region.

Strip cropping; Growing crops in a systematic arrangement of strips or bands along a contour.

Structural measures: Measures such as dams, reservoirs, dikes, levees, floodwalls, channel alterations, high-flow diversions, spillways, and land-treatment measures designed to modify floods.

Substantial improvement: Any repair, reconstruction, or improvements of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either before the improvement or repair is started or if the structure has been damaged and is being restored, before the damage occurred.

Substantial damage: The amount of damage to a structure caused by flooding that may be sustained before certain regulatory and flood insurance requirements are triggered. As defined in NFIP regulations, a building is considered substantially damaged when the cost of restoring the building would exceed 50 percent of the market value of the structure.

Tailwater: The reach of stream or river located immediately below a water control structure such as a dam. In contrast, headwater is the term applied to the pool immediately above a dam.

Terrace: A raised bank of earth having vertical or sloping sides and a flat top used to control surface runoff.

Upper Mississippi River Basin: The portion of the Mississippi River basin that is above the confluence of the Ohio River. It includes the Missouri River Basin.

Upper Mississippi River: The reach of the Mississippi River from its confluence with the Missouri River at St. Louis, Missouri, upstream to its headwaters at outlet of Lake Itasca in Minnesota.

Watershed: A region or area contributing ultimately to the water supply of a particular watercourse or water body.

Wetlands: Those areas that are inundated by surface or groundwater with a frequency sufficient to support and, under normal circumstances, does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include bottomland hardwoods, swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflow, mud flats, and natural ponds.

Wing dikes: Rock wing dikes or dams, closing dams, wood pile dikes, and bendway weirs are types of channel training structures used to divert river flows toward a single main channel used for navigation. Generally constructed perpendicular to flow, and constructed to various submergent of emergent elevations, these structures usually function most effectively at lower flows.

APPENDIX A

CHARTER OF THE FLOODLAIN MANAGEMENT REVIEW COMMITTEE

THE WHITE HOUSE

WASHINGTON

TO: BG Gerald E. Galloway, Jr.

FROM: Administration Floodplain Management Task Force --
T.J. Glauthier, Associate Director, Office of Management and Budget
Kathleen McGinty, Director, White House Office of Environmental Policy
James R. Lyons, Assistant Secretary of Agriculture for Natural Resources

SUBJECT: Directive on the Establishment of an Interagency Floodplain Management Review Committee

The purpose of this directive is to establish an Interagency Floodplain Management Review Committee and to designate you as Executive Director of the Committee. The Committee will undertake an intensive review to: determine the major causes and consequences of the Great Flood of '93; evaluate the performance of existing floodplain management and related watershed management programs; and, make recommendations as to what changes in current policies, programs, and activities would most effectively achieve risk reduction, economic efficiency, and environmental enhancement in the floodplain and related watersheds. As appropriate, the Committee should identify legislative initiatives that might be proposed by the Administration.

Because floodplain management involves a complex intergovernmental system of Federal, State, tribal, and local responsibilities, you will ensure outreach to and consultation with other levels of government and the public. You should conduct your activities and deliberations in an open environment.

The Review Committee will include a multi-disciplinary and interagency group of experts in fields relevant to floodplain management. The individuals listed at Attachment 1 have been assigned by their agencies to the Committee. As necessary, you are authorized to request additional assistance, on an ad-hoc basis, from those agencies and from activities not currently represented on the Committee. The Council of Economic Advisors staff will assist in coordination of economic analysis support. The Justice Department will provide legal assistance. FEMA will coordinate public affairs and Congressional and intergovernmental relations for the Committee. The Scientific Assessment and Strategy Team, which was established by a White House directive dated November 24, 1993, (Attachment 2), is further assigned to the Review Committee and will operate under the Committee's direction.

Resources to support the salaries of individuals assigned to the Committee will be provided by parent agencies. You will be provided an appropriate budget to support the travel and other activities of the committee. As coordinated by OEP and OMB, you will be provided a three-person administrative support staff, office space, and supporting equipment.

For the period of this study, you will be assigned to the White House and will report directly to us. You will serve as the primary representative of the Committee for purposes of public outreach and communications and will have executive responsibility for organizing and executing the work of the Committee.

Not later than February 1, 1994, you will submit to us for approval a detailed mission statement for the Committee and a time-phased work plan. The mission statement should reflect coordination with as broad a segment of interested activities as possible. Not later than May 1, 1994, you will provide a preliminary report to us on the results of the review. A final report will be issued t the public by June 1, assuming expeditious review by the Administration. Every 3 weeks, or more frequently if required, you will provide us with in-process-reviews of the effort.

Attachments (2)

APPENDIX B

FLOODPLAIN MANAGEMENT REVIEW COMMITTEE MEMBERSHIP AND ACTIVITIES

COMMITTEE MEMBERS AND ACTIVITIES

Washington, DC-based Members

US Military Academy
BG Gerald E. Galloway - Executive Director

US Department of Agriculture
Dr. Margriet Caswell, Economic Research Service, Washington, DC
Thomas Wehri, Soil Conservation Service, Washington, DC

US Department of Army (Army Corps of Engineers)
Richard DiBuono, Washington, DC
Arnold Robbins, Vicksburg, MS
Harry Shoudy, Washington, DC

US Department of the Interior
Robert Clevenstine, Fish and Wildlife Service, Rock Island, IL
Jerry Rasmussen, Fish and Wildlife Service, Columbia, MO

Environmental Protection Agency
Shannon Cunniff, Washington, DC
Joseph Ferrante, Washington, DC
Lewis Rosenbluth, Washington, DC

Federal Emergency Management Agency
Mary Jean Pajak, Washington, DC
Michael Robinson, Washington, DC

Sioux Falls, SD-based Members Scientific Assessment and Strategy Team

US Geological Survey
Dr. John Kelmelis, Reston, VA, Team Leader

US Department of Agriculture
David Buland, Soil Conservation Service, Huron, SD
Dr. Maurice Mausback, Soil Conservation Service, Lincoln, NE
James Reel, Soil Conservation Service, Des Moines, IA

US Department of Army (Corps of Engineers)
Dr. Gary Freeman, Vicksburg, MS
S.K. Nanda, Rock Island, IL
Tim Peterson, Omaha, NE

US Department of the Interior
Dr. John Dohrenwend, U.S. Geological Survey, Menlo Park, CA
Ron Erikson, Fish and Wildlife Service, Twin Cities, MN
John Evans, U.S. Geological Survey, Reston, VA
Dr. David Galat, National Biological Survey, Columbia, MO
Dr. William Kirby, U.S. Geological Survey, Reston, VA
Mark Laustrup, National Biological Survey, Onalaska, WI
Tim Liebermann, U.S. Geological Survey, Carson City, NV

Thomas Owens, National Biological Survey, Onalaska, WI
Wayne Rohde, U.S. Geological Survey, Sioux Falls, SD

Environmental Protection Agency
Milo Anderson, Chicago, IL
Cathy Tortorici, Kansas City, KS

Federal Emergency Management Agency
Mark Whitney, Washington, DC

Additional Support Provided to the FMRC by:

Council on Environmental Quality
Kathleen Gallagher
Patty Leppert-Slack

US Department of Agriculture
Valerie Parich
Tammy Short

US Department of Commerce
Alma Ripps

US Department of the Interior
Yvette Pryor

US Department of Justice
Ted Bolling

Environmental Protection Agency
Charlynne Boddie

Federal Emergency Management Agency
Daniel Cotter
Paige Darden
Mary Jo Vrem
Mark Whitney

Tennessee Valley Authority
Curt Goff

Additional Support Provided to the SAST by:

Federal Emergency Management Agency
Daniel Cotter, Washington, DC

U.S. Geological Survey
Byron Stone, Reston, VA
Charles Trautwein, Sioux Falls, SD

Hughes STX Corporation
Norman Bliss, Sioux Falls, SD
Ron Risty, Sioux Falls, SD

INFORMATION GATHERING ACTIVITIES

Meetings with Federal Agencies

Department of Agriculture - Agricultural Stabilization and Conservation Service
Department of Agriculture - Farmers Home Administration
Department of Agriculture - Federal Crop Insurance Corporation
Department of Agriculture - Rural Development Administration
Department of Agriculture - Soil Conservation Service
Department of the Army - Corps of Engineers
Department of the Army - Institute for Water Resources
Department of Commerce - Economic Development Administration
Department of Commerce - National Weather Service
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior - Bureau of Indian Affairs
Department of the Interior - Bureau of Reclamation
Department of the Interior - Fish and Wildlife Service
Department of the Interior - U.S. Geological Survey
Department of the Interior - National Biological Survey
Department of the Interior - National Park Service
Department of Transportation
Environmental Protection Agency
Federal Emergency Management Agency
General Accounting Office
Office of Management and Budget
Small Business Administration

Meetings with National and Regional Organizations

Advisory Council on Historic Preservation
American Farm Bureau Federation
American Rivers
American Society of Civil Engineers
Association of American State Geologists
Association of State Flood and Stormwater Managers
Association of State Floodplain Managers
Association of State Wetland Managers
Coalition to Restore Aquatic Ecosystems
Coalition to Restore Urban Waterfronts
Environmental Defense Fund
Interstate Council on Water Policy
National Association of Conservation Districts
National Association of Home Builders
National Association of Realtors
National Corn Growers Association
National Fish and Wildlife Foundation
National Governors Association
National Trust for Historic Preservation
National Wildlife Federation
Natural Disaster Coalition
MARC 2000
Sierra Club
The Nature Conservancy
Upper Mississippi River Basin Association
Working Group on Sustainable Redevelopment
World Wildlife Fund

OUTREACH ACTIVITIES

Attendance at Conferences, Meetings and Workshops

Association of State Floodplain Managers Conference - Tulsa, OK
Fish and Wildlife Interagency Committee Meeting - Rock Island, IL
Governor's State Floodplain Workshop - Springfield, IL
Governor's Task Force on Floodplain Management - Jefferson City, MO
Illinois Association for Floodplain and Stormwater Management Conference - Lisle, IL
Iowa Flood Recovery Workshop - Davenport, IA
Lower Mississippi River Conservation Committee - Little Rock, AR
Mississippi Interstate Cooperative Resource Association - Overland, KS
Minnesota Water '94 Conference - Minneapolis, MN
SCS State Conservationist Meeting - Kansas City, MO
State Floodplain Task Force Meeting - Madison, WI
State Floodplain Task Force Meeting - Minneapolis, MN
State Flood Task Force Meeting - Des Moines, IA
State Task Force Meeting - Lincoln, NE
State Task Force Meeting - Pierre, SD
Technical Workshop - St. Louis, MO
Upper Mississippi River Basin Association Meeting - St. Louis, MO
Upper Mississippi River Conservation Committee - LaCrosse, WI
USACE Floodplain Management Assessment Public Meeting - St. Paul, MN
USACE Floodplain Managers Meeting - Reno, NV
Upper Mississippi River Flood Control Association - Quincy, IL
World Wildlife Fund Conference - Jefferson City, MO
World Wildlife Fund Conference - Rock Island, IL
World Wildlife Fund Conference - Winona, MN

Visits with State, County and City Officials and Other Local Interests

Iowa

Governor Terry Brandstad
Ames, Iowa
Audubon, Iowa
Audubon County, Iowa
Carter Lake, Iowa
Cherokee, Iowa
Council Bluffs, Iowa

Des Moines Water Works, Des Moines, Iowa
Dickinson County, Iowa
Eddyville, Iowa
Hamburg, Iowa
Iowa Department of Economic Development
Iowa Department of Natural Resources
Iowa Levee District 16
Keokuk, Iowa
Lee County, Iowa
Marshall County, Iowa
Marshalltown, Iowa
Ottumwa, Iowa
Pottawattamie County, Iowa
Sibley, Iowa
Spirit Lake, Iowa
Wappello County, Iowa

Illinois

Governor Jim Edgar
Alexander County, Illinois
Beardstown County, Illinois
Brown County, Illinois
Calhoun County, Illinois
Fults, Illinois
Grafton, Illinois
Greene County, Illinois
Havana, Illinois
Hull, Illinois
Illinois Farm Bureau
Jackson County, Illinois
Jeresy County, Illinois
Maeystown, Illinois
Mason County, Illinois
Monroe County, Illinois
Morgan County, Illinois
Niota, Illinois
Pere Marquette State Park, Illinois
Pike County, Illinois
Pulaski County, Illinois
Quincy, Illinois
Randolph County, Illinois
Shawnee College, Illinois
Southwest Illinois Planning Commission
Sny Levee District, Illinois
Springfield, Illinois
Valmeyer, Illinois

Kansas

Governor Joan Finney
Elwood, Kansas
Kansas State Legislators Flood Recovery Task Force
Manhattan, Kansas
Topeka, Kansas

Minnesota

Austin, Minnesota
Cottonwood County, Minnesota
Mower County, Minnesota
Windom, Minnesota

Missouri

Governor Mel Carnahan
Jefferson City, Missouri
MARC 2000 - St. Louis, Missouri
Missouri Agricultural and Land Management Resources Institute
Missouri Department of Conservation
Missouri Department of Natural Resources
Missouri Farm Bureau
Missouri Levee Districts
St. Charles County, Missouri
St. Louis County, Missouri
St. Joseph, Missouri
Ste. Genevieve, Missouri

Nebraska

Beatrice, Nebraska
Lincoln, Nebraska
Papio-Missouri River Natural Resources District, Nebraska
Sarpy County, Nebraska

North Dakota

Fargo, North Dakota
State Hazard Mitigation Team, North Dakota

South Dakota

Madison, South Dakota
Montrose, South Dakota

Wisconsin

Black River Falls, Wisconsin
Darlington, Wisconsin
Eau Claire, Wisconsin
Eau Claire District Office, Wisconsin Department of Natural Resources

Options Review Meetings

Kansas City, MO
Springfield, IL
St. Paul, MN

CONGRESSIONAL BRIEFINGS AND MEETINGS

US Senate - Members

Senator Bond (R - MO)
Senator Simon (D - IL)

US Senate Members Represented by Staff

Kathy Ruffalo/Senator Baucus (D - MT)
Committee on Environment and Public Works

Steve Knorr/Senator Bond (R - MO)

Rocky Kuhn/Senator Bumpers (D - AR)
Committee on Appropriations, Subcommittee on Agriculture, Rural Development and Related Agencies

Sue Masica/Senator Byrd (D - WV)
Committee on Appropriations, Subcommittee on Interior and Related Agencies

Jean Louver, Dan Delish/Senator Chaffee (R - RI)
Committee on Environment and Public Works

Eric Terrel/Senator Daschle (D - SD)

Ira Paull/Senator D'Amato (R - NY)
Committee on Banking, Housing and Urban Affairs, Subcommittee on Housing and Urban Affairs

Greg Schnecke/Senator Dole (R - KS)

Jeff Harrison/Senator Durenberger (R - MN)

Stephen Kohasi/Senator Gramm (R - TX)
Committee on Appropriations, Subcommittee on Veterans Affairs, Housing and Urban Development, and Independent Agencies

Doug Stout/Senator Grassley (R - IA)

Paul Reinecke/Senator Harkin (D - IA)

Proctor Jones/Senator Johnston (D - LA)
Committee on Appropriations, Subcommittee on Energy and Water Development

Jonathan Wyner/Senator Kerry (D - MA)
Committee on Banking, Housing and Urban Affairs, Subcommittee on Housing and Urban Affairs

Patrick Westoff/Senator Leahy (D - VT)
Committee on Agriculture, Nutrition and Forestry

Carrie Apostolou/Senator Mikulski (D - MD)
Committee on Appropriations, Subcommittee on Veterans Affairs, Housing and Urban Development, and Independent Agencies

Maria Petaros/Senator Moseley-Braun (D - IL)

Sherrie Cooper/Senator Nickles (R - OK)
Committee on Appropriations, Subcommittee on Interior and Related Agencies

Jafar Kardu/Senator Pressler (R - SD)

Kriss Warren/Senator Sarbanes (D - MD)
Committee on Banking, Housing and Urban Affairs, Subcommittee on Housing and Urban Affairs

Tricia Haneghan/Senator Simon (D - IL)

US House of Representatives - Members

Representative Calvert (R - CA)
Representative Costello (D - IL)
Representative Danner (D - MO)
Representative Durbin (D - IL)

Representative Emerson (R - MO)
Representative Ewing (R - IL)
Representative Furse (D - OR)
Representative Kennedy (D - MA)
Representative Leach (R - IA)
Representative Lightfoot (R - IA)
Representative Marzullo (R - IL)
Representative McKeon (R - CA)
Representative Mineta (D - CA)
Representative Minge (D - MN)
Representative Nussle (R - IA)
Representative Regula (R - OH)
Representative Skeen (R - NM)
Representative Skelton (D - MO)
Representative Smith (D - IA)
Representative Talent (R - MO)
Representative Volkmer (D - MO)
Representative Weldon (R - PA)

US House of Representatives Members Represented by Staff

Ken Kopocis, Scott Slesinger/Representative Applegate (D - OH)
Committee on Public Works and Transportation, Subcommittee on Water Resources and Environment

Bob Schmidt/Representative Bevill (D - AL)
Committee on Appropriations, Subcommittee on Energy and Water Development

Darby Becker/Representative Costello (D - IL)

Beth Phillips/Representative Danner (D - MO)
Dan O'Grady/Representative Durbin (D - IL)

Roxanne Smith/Representative Evans (D - IL)

Tom Meluis/Representative Fields (R - TX)
Committee on Merchant Marine and Fisheries, Subcommittee on Environment and Natural Resources

Miguel Gonzalez/Representative Glickman (D - KS)

Sarah Dahlin/Representative Johnson (D - SD)

Barry Scanlon, Brian Doherty/Representative Kennedy (D - MA)
Committee on Banking, Finance, and Urban Affairs, Subcommittee on Consumer Credit and Insurance

Frank Purcell/Representative Lightfoot (R - IA)

Ann Swartz/Representative Marzullo (R - IL)

Bill Warfield/Representative McDade (R - PA)
Committee on Appropriations, Subcommittee on Interior

Lara Battles/Representative Skelton (D - MO)

Dan Ashe, Barbara Polo/Representative Studds (D - MA)
Committee on Merchant Marine and Fisheries, Subcommittee on Environment and Natural Resources

APPENDIX C

U.S. FARM PROGRAM

PRODUCTION ADJUSTMENT/PRICE SUPPORT

The Food, Agriculture, Conservation, and Trade Act of 1990 (The 1990 Farm Bill) continued the market orientation of its predecessor, the Food Security Act of 1985. The stated goals of the 1990 Farm Bill were to ease financial stress for farmers, reduce government costs, reduce crop surpluses, maintain export competitiveness, and enhance environmental quality. The most widely known features of farm policy are the Production Adjustment/Price Support Programs administered by the Agricultural Stabilization and Conservation Service of the USDA. These programs are aimed at supporting farm income and keeping agricultural production in line with anticipated needs. In general, farmers enrolled in the program are given a price support for growing specified commodities. Not all agricultural crops are included. If an acreage reduction program is in effect, farms are required to place a specified proportion (set-aside) of their acreage based on previous cropping history (base acres) in conservation uses (acreage conservation reserve - ACR). Two major floodplain crops, wheat and corn, are in the acreage reduction program, but soybeans are not.

Price support programs were first authorized in 1933. Support can be through loans, purchases, payments, or a combination of these methods. A deficiency payment rate is calculated as the difference between the "target" price which is currently set by the Secretary of Agriculture at the statutory minimum level, and the higher of the actual market price per crop unit or the loan rate. The total payment to the farmer is the payment rate multiplied by the eligible production. The eligible production is calculated as the payment acres (base acres minus set-aside/ACR acreage minus 15 percent normal flex acres) times the program yield which is a fixed amount based on past production averages.

Even in its most simplified form, the program is complex. There are other important factors that determine profitability for an individual farmer. For example, there may be a cost associated with maintaining a cover crop on the set-aside acres. A farmer can grow a crop other than corn on the normal flex acres (15 percent) which would change the per-acre calculations. If land quality and productivity vary on the farm then the average yield per acre may differ when the farmer participates in the program. Such considerations are important to individuals, but make discussions of federal farm programs unnecessarily confusing. Therefore, the following example is presented to illustrate the importance of farm productivity, market prices, and farm program parameters such as the set-aside rate, target price, and program yield in determining whether a farmer will participate and the level of government payments. Table C.1 shows a simplified example of how a corn farmer would compare his/her income with and without participation in the USDA Commodity Program.

Table C.1 Example of Accounting Method for Evaluating Participation in the Federal Farm Program for Corn.

		Not Participating in Program	Participating in Program
Production Calculations			
Base acres	acres	100	100
Set-aside/ACR	acres	na	10
Permitted acres	acres	na	90
Maximum pay. acres	acres	na	75
Planted acres	acres	100	90
Actual yield	bu/acre	135	135
Total production	bushels	13,500	12,150
Market price	$/bu	2.10	2.10
Revenue from sale	$	28,350	25,515
Total production cost	$175/acre	17,500	15,750
Payment Calculations			
Program yield	bu/ac	na	115
Program production	bushels	na	8,625
Deficiency pay. rate	$/bu	na	.65
Program payment	$	na	5,606.25
Farmer Income			
Total net income	$	10,850.00	15,371.25

Notes: "na" means not applicable for farmer not enrolled in Commodity Program. Calculations were made using parameters similar to those used in the 1993 Corn Program: Set-Aside rate = 10%; Program Yield = 115 bushels per acre based on a national average; and Target Price = $2.75 per bushel. Program production is [(100*0.85)-(100*0.10)]*115. The deficiency payment rate is the target price minus the market price (2.75-2.10 = 0.65). For simplicity, the loan rate is not included in the analysis. Planted acres are equal to the base acres less the set-aside acres.

APPENDIX D

FLOODPLAIN MANAGEMENT ACT

FUNDAMENTAL COMPONENTS OF PROPOSED LEGISLATION

The Interagency Floodplain Management Review Committee recommends that the Administration propose enactment of a law with the following components:

1) A national policy on floodplains and floodplain management which:

a) Encourages actions to avoid or minimize vulnerability to floods, and to mitigate flood losses;

b) Recognizes that fundamentally, floodplain management must be implemented from the bottom up;

c) Promotes comprehensive systems approaches to floodplain management;

d) Encourages participation in the National Flood Insurance Program;

e) Encourages linkage between state emergency, floodplain, natural resource, and coastal zone managers;

f) Recognizes and encourages the link between management of watersheds, ecosystems, and floodplains;

g) Establishes that all federal agencies will address the new vision of floodplain management in undertaking their activities; and

h) Recognizes and encourages the link between pre-disaster planning and hazard mitigation in floodplain management.

2) Incentives for states to develop a capacity for and commitment to floodplain management including:

a) Multi-hazard mitigation grants to states for planning and implementation activities. States could pass grants along to communities.

b) Research and technical assistance grants for floodplain management to assist states in carrying out research, including mapping, and training required with respect to floodplain management. States could pass grants along to communities.

c) Federal projects would have to be consistent, to the maximum extent practicable, with state floodplain management plans.

d) Participation in on-going, non-disaster flood damage reduction and mitigation activities could be withheld from those states that do not undertake floodplain management planning.

3) Guidelines for states as to what essential elements are required for a state floodplain management plan to receive federal approval (establishes a 5-year period to complete a floodplain management plan). Essential elements for federal approval of state floodplain management plans include:

a) Use of the standard project flood and one percent per annum floodplain to set priorities for planning and decisionmaking;

b) Consistency with NFIP requirements;

c) Mechanisms to achieve greater participation in NFIP by individuals;

d) Definition of what constitutes appropriate land and water uses within the floodplain that have a direct significant impact on flood stage (level of significance to be defined by states but not less than NFIP floodway requirements);

e) An inventory and designation of areas of particular concern within the floodplain and watersheds (inclusive of aquatic areas) affecting flooding;

f) Identification of the means by which states propose to exert control over the land and water uses referred to above (such as a state permit program);

g) Broad guidelines on priorities of land uses in particular areas, including those uses of lowest priority; and,

h) Watershed management plans.

4) Cost-sharing. Establishes the amount of any grant made pursuant to this Act as initially not exceeding 80 percent of the state's cost of undertaking the activity of the grant and will decrease over ten years to a 50 percent share. Establishes greater funding priority given to states with documented individual participation in NFIP in excess of a minimum percentage, e.g., 50 percent.

ESTIMATED RESOURCE REQUIREMENTS

It is estimated that implementation of the Act would require an increase of the FEMA staff by 15 individuals nationwide to distribute grants and oversee the program. The total annual federal cost of the program, for staffing and grants, is estimated as $70 million. Grants would be used to supplement state efforts and would therefore represent a sharing of the costs of building and implementing floodplain management programs meeting federal standards.

APPENDIX E

FEDERAL POLICIES AND PROGRAMS FOR FLOODPLAIN MANAGEMENT

ADMINISTRATIVE GUIDELINES

Floodplain Management

Executive Order 11988, 24 May 1977 requires federal agencies to provide leadership and take action to: (1) avoid development in the base (100-year) floodplain unless it is the only practicable alternative; (2) reduce the hazards and risk associated with floods; (3) minimize the impact of floods on human safety, health and welfare; and (4) restore and preserve the natural and beneficial values of the floodplain.

Protection of Wetlands

Executive Order 11990, 24 May, 1977 directs federal agencies to provide leadership in minimizing the destruction, loss, or degradation of wetlands. Section 2 of this order states that, in furtherance of the National Environmental Policy Act of 1969, agencies shall avoid undertaking or assisting in new construction located in wetlands unless there is no practicable alternative.

Principles and Guidelines

The Principles and Guidelines established by the Water Resources Council and approved by the President on February 3, 1983, prescribe a single federal objective, national economic development (NED), and do not specifically characterize other plans that must be in the array of alternatives considered by federal agencies in planning water resources development projects. They do, however, allow for display of potential impacts in four accounts: NED, environmental quality (EQ), regional economic development (RED) and other social effects (OSE). Alternative plans formulated must include a plan that reasonably maximizes net national economic development benefits, consistent with the federal objective. This plan is identified as the NED plan and is the one to be recommended for federal action, unless the Secretary of a department or head of an independent agency grants an exception to this rule. Exceptions may be made when there are overriding reasons for recommending another plan, based on other federal, state, local and international concerns. The Principles and Guidelines are applicable to USACE implementation studies for civil works water project plans and to similar plans of the SCS, TVA, and BOR. They have no standing as Administrative Rules.

U.S. DEPARTMENT OF AGRICULTURE

Agricultural Stabilization and Conservation Service

Agricultural Conservation Program: The Soil Conservation and Domestic Allotment Act of 1936 provides cost sharing to farmers and ranchers to encourage them to carry out conservation and environmental practices on agricultural land that result in long-term public benefits. Practices eligible for cost sharing include: establishment or improvement of permanent vegetative cover, contour or strip-cropping systems, and terrace systems; development of springs,

seeps and wells; installation of pipelines, storage facilities, and other measures intended to provide erosion control on range or pasture land; installation of water impoundment reservoirs for erosion control, conservation, and environmental and wildlife enhancement; planting trees and shrubs and improving timber stands for protection against wind and water erosion and for timber production; and development of new or rehabilitation of existing shallow water areas to support food, habitat, and cover for wildlife. Practices that are primarily production-oriented are not eligible for cost-sharing.

Agricultural Water Quality Protection Program: The Food Security Act of 1990 authorizes USDA to enter into 3- to 5-year agreements with farm owners and operators to develop and implement plans to protect water quality. These agreements do not preclude crop production on the enrolled acreage. Eligible lands include wellhead protection areas within 1,000 feet of public wells, areas of karst topography where sinkholes convey runoff water directly into groundwater, critical areas having priority problems resulting from agricultural non-point sources of pollution, areas where agricultural non-point source pollution is adversely affecting threatened or endangered species habitats, and other environmentally sensitive areas identified by the USDA, the EPA, DOI, or state agencies.

Conservation Reserve Program: The Food Security Act of 1985, as amended, encourages farmers, through 10-15 year contracts with USDA, to stop growing crops on cropland subject to excessive erosion or that contributes to a significant water quality problem and plant it to a protective cover of grass or trees. A conservation plan describing the conservation measures and maintenance requirements to be carried out by the owner or operator during the term of the contract must be agreed to by the participant and the district conservationist.

Disaster Payments: The Agriculture Consumer Protection Act of 1973 authorized disaster payments to compensate farmers for prevented plantings and unusually low yields due to natural disasters, adverse weather, and other conditions beyond a producer's control. The program covered wheat, barley, corn, sorghum, rice and cotton. Prior to enactment of the Federal Crop Insurance Act of 1980, the disaster payments program compensated eligible farmers for losses due to natural disasters. The Act ended the disaster assistance program for those counties in which Federal Crop Insurance was available. However, the Secretary of Agriculture has the discretion to issue disaster type payments to counties if he thinks the situation warrants it. Disaster payments to an individual under the wheat, feed grains, upland cotton, and rice programs combined cannot exceed $100,000.

Emergency Conservation Program: The Agricultural Credit Act of 1978 provides emergency funds for sharing with farmers and ranchers the cost of rehabilitating farmland damaged by wind erosion, floods, hurricanes, or other natural disasters, and for carrying out emergency water conservation measures during periods of severe drought. The natural disaster must create new conservation problems, which, if not treated, would (1) impair or endanger the land; (2) materially affect the productive capacity of the land; (3) represent unusual damage which, except for wind erosion, is not the type likely to recur frequently in the same area; and (4) be so costly to repair that federal assistance is or will be required to return the land to productive agricultural use. Conservation problems existing prior to the disaster involved are not eligible for cost-sharing assistance. Cost-share agreements are required, and federal assistance cannot exceed 65 percent of the actual, average, or estimated cost of performing the emergency induced work.

Forestry Incentives Program: The Cooperative Forestry Assistance Act of 1978 encourages landowners to plant trees on suitable open lands or cut over areas and to perform timber stand improvement work for production of timber and other related forest resources. Cost-share agreements between the landowner and the Secretary of Agriculture are based on forest management plans developed by the landowner in cooperation with and approved by the State forestry agency. Cost-sharing assistance cannot exceed 65 percent of the cost of work under approved plans.

Price and Income Support Programs: Commodity Credit Corporation (CCC) programs support and stabilize farm prices and income and maintain stable levels of supply. These goals are accomplished through CCC payments, purchases, and acreage reduction programs. Price and income support programs began with the Agricultural Adjustment Act of 1933 which introduced a number of new policies including payments to farmers for voluntary acreage reductions, on-farm storage, and marketing agreements. All subsequent farm legislation has continued to emphasize price and income supports for major crops.

a) Nonrecourse Commodity Loans: Congressionally-established loan rates provide minimum crop prices through nonrecourse loans to farmers. A nonrecourse loan is one which farmers are not obligated to repay; they can simply forfeit the collateral (the crop). A farmer can place the crop in storage and receive a loan from the government based on the established loan rate. If the market price rises above the loan rate, the farmer can sell the crop on the market and repay the loan, interest, and storage costs. If the market price does not rise above the loan rate, the farmer can default on the loan (without penalty) and turn the crop over to the government. Consequently the loan rate places a floor under the commodity price for a participant.

b) Deficiency Payments: Congressionally established target prices for certain crops enable participating farmers to receive "deficiency payments" from the CCC for eligible program commodities when commodity prices fall below the target price for specified periods of time. The legislative deficiency payment rate is the target price minus the higher of: (1) the loan rate, or (2) the national average market price for the first five months of the marketing year. Deficiency payments are based on "program yields" rather than actual yields. Program yields are established by the Agricultural Stabilization and Conservation Service (ASCS) county committees and are a function of the farm's historical yields. Deficiency payments are multiplied by a program allocation factor. In years when program expenditures are high, the Secretary of Agriculture can invoke the program allocation factor in order to reduce expenditures. The program allocation factor is legislated to be between 0.8 and 1.0, but its actual value is not known by farmers at sign-up time.

Sodbuster Provision: The Food Security Act of 1985, as amended, discourages the conversion of highly erodible land to agricultural production. If highly erodible grassland or woodland is used for cropland production, producers may lose eligibility for: price and income supports, crop insurance, FmHA loans, CCC storage payments, farm storage facility loans, and other programs under which USDA makes payments. Sodbuster applies to highly erodible land which was not planted to annually tilled crops from 1981-85. To maintain eligibility for USDA program benefits, producers must have a conservation plan approved by their local conservation district for any highly erodible land broken out for crop production after that date.

Supply Restriction Programs: Acreage reductions, set-asides, paid land diversions, and payment-in-kind programs have been the primary means of restricting supply. The general goal of these policies is to reduce the number of acres planted and thus reduce crop production. If an acreage reduction or set-aside is in effect, producers must reduce their plantings by a specified percentage of the acreage base for each enrolled commodity to be eligible for CCC loans, purchases, and payments.

Swampbuster Provision: The Food Security Act of 1985, as amended, discourages the conversion of natural wetlands to cropland use. With certain exceptions, if producers converted a wetland area to cropland after December 23, 1985, they lose eligibility for several USDA program benefits (see list above under sodbuster provision).

Wetlands Reserve Program: The Food Security Act of 1990 provides financial incentives for restoration and protection of wetlands if farmers agree to long-term (30-year or permanent) easements.

Farmed or converted wetlands (must have been converted prior to December 23, 1985), adjacent functionally related lands, and riparian areas that link wetlands are eligible for enrollment. In addition, farmed wetlands and adjoining lands enrolled in the conservation reserve may be permitted to be enrolled if they have high wetland functions and values, were not planted to trees under a Conservation Reserve Program (CRP) contract, and are likely to return to production after they leave the CRP. The federal government will provide not less than 75 percent cost-share for restoration, plus lump sum payment for easement.

Water Bank Program: The Water Bank Act of 1970, as amended, provides for preservation and improvement of major wetlands as habitat for migratory waterfowl and other wildlife; conservation of surface waters; reduction of runoff, soil and wind erosion; flood control; improved water quality; improved subsurface moisture; and enhancement of the natural beauty of the landscape. Under this program, wetland owners enter an agreement with the ASCS promising not to drain, burn, fill, level, or use the wetland for a 10 year period. The Water Bank Program agreements extend protection to and require conservation measures on adjacent upland habitat. In exchange, the landowner receives an annual payment designed to reflect local real estate values. If the land is also under a FWS agreement, the annual payment is reduced by 20 percent. When accepting an area into the program, ASCS tries to maintain a 3:1 or 4:1 ratio of uplands to wetlands. The term "wetlands," for purposes of carrying out the program include: seasonally flooded basins or flats, fresh meadows, shallow fresh marshes, deep fresh marshes, open fresh water, shrub swamps, and wooded swamps. Participants in the program enter in to 10-year agreements, with provisions for renewal, and receive payments for approved conservation work.

Soil Conservation Service

Cooperative River Basin Program: Section 6, PL 83-566, provides for technical assistance to Federal, State, regional, and local governments in formulating and carrying out plans for conservation use treatment measures, nonstructural measures, and development. Plans may include management and structural measures, or combinations thereof. There are no cost sharing requirements.

Emergency Watershed Protection Program: Section 216, PL 81-516 and Section 404, Title IV, PL 95-331 provided the Soil Conservation Service with authorization for disaster relief funding in repairing damages to waterways and watersheds. Work includes debris removal and erosion control for waterways, levee repair and relocations.

Emergency Wetland Reserve Program: The same authority as Emergency Watershed Protection Program provides for the purchase of easements from persons owning cropland who voluntarily agree to restore farmed, converted, or potential wetlands. The combined cost of restoring the land and levees must exceed the fair market value of the affected cropland to be eligible for the program. The easements are purchased to promote wetland values such as hydrology and vegetation, and protect the functions and values of wetlands for wildlife habitat, water quality improvement, flood water retention, floodway enhancement, environmental education, and other values determined appropriate by SCS. Use of the easement lands for cropland is prohibited.

Watershed Protection: Section 3, Watershed Protection and Flood Prevention Act of 1954; PL 83-566 provides for technical assistance to state and local governments in planning and carrying out works of improvement to protect, develop, and utilize the land and water resources in small watersheds under 250,000 acres in size. Conservation land treatment, and structural, and nonstructural measures are used to address problems related to watershed protection, flood prevention, and agricultural and nonagricultural water management. Nonstructural measures are preferred. Projects must be sponsored by entities legally organized under state law, or any Indian tribe or tribal organization, having authority to carry out, operate, and maintain works of improvement. Cost-sharing requirements are variable, depending on the nature of the project.

Farmers Home Administration

Debt Cancellation Conservation Easements: FmHA can forgive debt in exchange for conservation easements on environmentally sensitive portions of a borrower's property. A conservation easement may be obtained for a period of not less than 50 years. A perpetual easement will usually be recommended. Both current and delinquent FmHA borrowers are eligible to participate in the debt restructuring conservation easement program. The borrowers must have loans secured by real estate. The easements can be established for conservation, recreational, and wildlife purposes on farm property that is wetland, wildlife habitat, upland, or highly erodible land. Non-program borrowers are not eligible to participate. There is no cost sharing.

Loans: Below market rate ownership and operating loans are available directly to farmers through the FmHA. The relatively low rates reduce the cost of capital and may encourage farmers to expand the size of their operations. The loans are made primarily to family farmers who cannot obtain private credit to finance operations or make farm improvements. In addition the FmHA increasingly has been providing disaster emergency loans that can reduce the risk of farming in flood prone areas. The FmHA issued regulations in 1983 (7 CFR Part 1940.301) stating that FmHA loans are not to be allowed for activities that would directly or indirectly affect wetlands, unless there is "no practical alternative." In addition, FmHA will soon publish regulations implementing the farm debt restructure and conservation set-aside provisions of the Food Security Act of 1985 (section 1318). This program will allow a farmer who is unable to repay his loan to have a portion of his FmHA loan cancelled in exchange for a conservation easement of at least 50 years. The percentage of the debt forgiven will be equal to the percentage of the farm acreage (secured by the loan) which is placed under easement.

Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes: Under the Consolidated Farm and Rural Development Act, FmHA can transfer certain inventory farm properties to Federal and State agencies. The transfer must be for conservation purposes. The property must have marginal value for agricultural production, be classified as environmentally sensitive, or be of special management importance. Properties containing important resources such as wetlands, floodplains, riparian zones, historical sites or endangered species may qualify. Inventory farm properties that are inholding, lie adjacent to, or occur in proximity to, federally- or state-owned lands may qualify. There is no cost share involved.

DEPARTMENT OF THE ARMY, U.S. ARMY CORPS OF ENGINEERS (USACE)

Fish and Wildlife Enhancement: Section 906, Water Resources Development Act of 1986, PL99-662 provides that for any project measures recommended to enhance fish and wildlife, costs will be entirely federal when the benefits have a national character and, where they do not, non-federal interests shall reimburse 25 percent of the costs. The non-federal share of operations, maintenance and rehabilitation costs will, in all cases, be 25 percent.

Flood Emergency Operations and Disaster Assistance: PL 84-99 covers emergency activities pursuant to PL 99-84, as amended by the Flood Control the Flood Control Act of 1962 and further amended by PL 93-252 and PL 95-51. It provides for flood fighting and rescue operations; post flood response; emergency repair and restoration of flood-damaged or destroyed flood-control works such as levees; emergency protection of federally authorized hurricane and shore protection works being threatened; the repair or restoration of federal hurricane or shore protection structures damaged or destroyed by wind, wave, or water action of other than an ordinary nature; emergency supplies of clean water to any locality confronted with a source of contaminated water causing or likely to cause a substantial threat to the public health and welfare of the inhabitants of the locality; and emergency water supplies for human and livestock use in areas determined to be drought distressed. Provision

of advance flood damage-reduction measures by the USACE is supplemental to individual and local community efforts, rather than a replacement for them. USACE protective and preventive measures are generally of a temporary nature designed to meet an imminent flood threat. Permanent rehabilitation work to protect against the threat of future disasters is considered separately from advance measures. A declaration of a state of emergency or written request by the governor of a state is a prerequisite to furnishing advance measures under PL 84-99. Local interests are required to remove temporary works provided as advanced measures.

It is USACE policy to obtain local assurances for assistance. Local cooperation for accomplishment of advance measures and rehabilitation works require local assurances to: (1) provide without cost to the United States all lands, easements, and rights-of-way necessary for the authorized emergency work; (2) hold and save the United States free from damage due to the authorized emergency work; and (3) maintain and operate all the rehabilitation work after its completion. Under PL 84-99, emergency funds may be expended directly by the USACE for authorized purposes. PL 84-99 does not authorize reimbursement of local interests for any of their costs for emergency operations accomplished on their behalf. Also, PL 84-99 authority and funds are not used in lieu of other USACE authorities. The Corps may perform emergency work on public and private lands and waters for a period of ten days following a governor's request for assistance. This work must be essential for the preservation of life and property, including, but not limited to, channel clearance, emergency shore protection, clearance and removal of debris and wreckage endangering health and safety, and temporary restoration of essential public facilities and services. In the event of a Presidential declaration of a major disaster or emergency declared by the Director of the Federal Emergency Management Agency, the USACE can provide assistance to state and local governments in essential recovery operations when and as directed by the President through FEMA under provisions of PL 93-288. The Corps fully responds to all requests from the FEMA director or regional director.

Flood Plain Management Services Program: Section 206, Flood Control Act of 1960, as amended, provides for the USACE to furnish floodplain information and technical assistance to states, counties, and cities for prudent use of land subject to flooding from streams, lakes, and oceans. Services include: developing and interpreting flood and floodplain data such as flood hazard mapping; providing a broad assessment of the impact of structural and nonstructural flood damage-reduction measures; providing technical assistance on floodproofing systems and techniques; and assessing the possible impacts of land-use changes on the physical, socio-economic, and environmental conditions of the floodplain.

Planning Assistance to States: Section 22, Water Resources Development Act of 1974, PL 93-251 authorizes cooperation with states and federally recognized Indian Tribes in the preparation of comprehensive plans for the development, utilization, and conservation of the water and related resources of drainage basins located within the boundaries of the state and submitting to Congress reports and recommendations with respect to appropriate federal participation in carrying out the plan. Typical activities studied under this program are flood damage reduction, water supply, water conservation, water quality, hydropower, erosion, navigation, and methodologies to evaluate wetlands or other resources. Expenditures in any one state cannot exceed $300,000 in any one year, as amended by Section 921 of the Water Resources Development Act of 1986. Federal input to the state planning program is on an effort- or service- sharing basis in lieu of an outright grant. The non-federal share of costs is 50 percent; in-kind services are not accepted.

Project Modifications to Improve Environment: Section 1135, Water Resources Development Act of 1986; PL 99-662 provides for modifications of the operation of completed USACE projects for the purpose of improving environmental quality. The program can be used to protect, restore, or create wetlands, provided the work involves modification of a water resources project constructed by the USACE. Types of projects that could be considered include: installation of gaged culverts in USACE levees; opening oxbows cut off by USACE levees or navigation features; or realignment of a levee to allow areas

between the levee and the channel to revert to historic floodplain habitat. The non-federal sponsor is responsible for 25 percent of the cost of study and implementation, which includes any necessary lands, easements, rights-of-way, relocations, and disposal areas. No work-in-kind is creditable. The non-federal sponsor is also responsible for 100 percent of incremental operation and maintenance costs.

Regulation of Dredged or Fill Material into U.S. Waters: Section 404, Clean Water Act of 1977 requires a USACE permit for discharges of dredged or fill materials into the waters of the United States. Such discharges, to qualify for a permit, must be in compliance with the guidelines published by the Environmental Protection Agency to implement Section 404(b)(1) of the Clean Water Act. Section 404(c) of the Act authorizes the Administrator of EPA to prohibit or restrict the use of a disposal site whenever it is determined that the discharge of such materials will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas.

Regulation of Navigable Waters: Section 10, River and Harbor Act of 3 March 1899 prohibits the unauthorized obstruction or alteration of any navigable water of the United States. A USACE permit is required for the construction of any structure in or over any navigable water of the United States or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters.

Water Resources Development Projects: The USACE is the principal Federal agency with responsibility for flood control and navigation projects, which in some cases include other purposes such as water supply, recreation, hydroelectric power, and fish and wildlife enhancement. Such projects, with certain exceptions, require specific authorization by Congress. Examples of exceptions include small, single-purpose projects for flood control or navigation which can be carried out under several continuing authorities such as Section 205 of the Flood Control Act of 1948, as amended, and Section 107 of the Rivers and Harbors Act of 1960, as amended. For flood control projects, the minimum local cost-share is 25 percent. The value of any lands, easements, and rights-of-way count as part of the 25 percent, but a minimum cash contribution must be made for structural flood control projects and must be equal to five percent of the construction cost. Since all lands, easements, and rights-of-way necessary for the construction of a project are the non-federal sponsor's responsibility, it is possible for the non-federal share of a structural flood control project to exceed 25 percent; however, the non-federal share cannot exceed 50 percent. The non-federal cost-share for navigation projects varies, depending upon project depth. The Water Resources Development Act of 1986 (PL99-662), which established current cost sharing for Federal water resources development projects, also requires 50-50 sharing of costs of feasibility studies conducted by the USACE which lead to the development of water projects, and makes the non-federal sponsor responsible for all operations and maintenance costs of flood control projects authorized in and after the 1986 Act. Reconnaissance studies leading to feasibility studies are conducted at full federal expense. Under the Pick-Sloan Missouri River Basin Program (authorized by the Flood Control Act of 1944), the USACE constructed five large dams and reservoirs along the main stem Missouri River during the 1950's and 1960's. Four of these are in South Dakota, while Garrison is in North Dakota. The USACE operates these main stem dams and reservoirs for multiple purposes: flood control, irrigation, navigation, recreation, wildlife, municipal and industrial water supplies, and hydroelectric power. Tributary projects are constructed and operated by both the USACE and the Bureau of Reclamation.

U.S. DEPARTMENT OF COMMERCE, ECONOMIC DEVELOPMENT ADMINISTRATION (EDA)

The EDA flood relief program provides for grant awards to assist communities, industries, and firms

adversely impacted by the flood of 1993 and other disasters to assist in the long-term economic recovery of the affected area. Grant awards can be used to respond to emergency infrastructure needs as well as unmet needs for public infrastructure improvements that are not adequately addressed by FEMA or other federal agencies. The 1993 Supplemental Appropriation provided $200 million to EDA through September 30, 1995, to carry out this effort. Non-federal cost sharing requirements are 25 percent for economic adjustment and technical assistance grants, and 20 percent for public works direct grants.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Control of Non-point Pollution: Section 319, Clean Water Act provides for grants to state agencies to implement restoration activities that control non-point pollution. There is a 40 percent state match.

Wastewater Treatment Plants: Capitalization grants for state revolving funds provide for loans to local municipalities to repair, replace, or relocate waste water treatment plants damaged by the floods of 1993. There are no cost sharing requirements. The municipalities receive loans against state revolving funds and repay 100 percent plus interest.

Wetland Protection: State development grants provide for grants to states and federally recognized Indian tribes to develop new or refine existing state and tribal wetlands protection programs. Only state agencies and federally recognized Indian tribes are eligible. Some funds can be passed through by state and other entities, but the state must have a major role in the project. Funds cannot be used for relocation of farm or urban structures or to support construction activities. The project sponsor must provide 25 percent of total cost.

FEDERAL CROP INSURANCE CORPORATION (FCIC)

Federal crop insurance was established by the Federal Crop Insurance Act of 1938, but essentially operated as a pilot program for four decades. The Federal Crop Insurance Corporation Act of 1980 greatly expanded the program to make it the major policy for protection from crop failure. The federal government subsidizes the premiums and administrative costs of the insurance program. A variety of coverage levels are available. The higher the yield guarantee level and the higher the price election, the higher will be the premium the farmer will pay. If at harvest time, farm yields are below the yield guarantee level, an insurance adjuster will visit the farm and determine the indemnity which the farmer is entitled to receive. Crop insurance reduces the risks involved in agricultural production, protecting farmers against yield losses from a variety of natural causes, including flooding, which is likely to occur on cleared bottom land areas. Under Swampbuster farmers who plant on newly converted wetlands are ineligible for crop insurance coverage on all planted acreage.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

Hazard Mitigation Grant Program: Section 404, Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, provides for grants to state and local governments, certain private non-profit organizations or institutions, and Indian tribes for hazard mitigation actions after a Presidentially declared disaster. Funds can be used for projects to protect either public or private property. Examples of projects include: structural hazard control, such as debris basins; retro-fitting, such as elevation or flood proofing to protect structures from future damage; acquisition and relocation of structures from hazard-prone areas; and development of state or local standards to protect new and substantially improved structures from disaster damage. The non-federal sponsor is required to pay 25 percent of the project's total eligible costs.

National Flood Insurance Program (NFIP): The National Flood Insurance Act of 1968, as amended, makes flood insurance available to protect the individual in participating communities from financial loss in the event of a flood. Under the NFIP insurance is subsidized, up to an amount specified, for existing buildings in areas designated as flood hazard areas by FEMA. New buildings pay the full actuarial cost of flood insurance. The land-use control measures required of communities to gain and maintain eligibility for flood insurance are complementary to other floodplain management efforts. Section 202 of PL 93-234 states that no federal officer or agency shall approve any financial assistance for acquisition or construction purposes after July 1, 1975, for use in any area identified by FEMA as an area having special flood hazards unless the community in which such area is situated is then participating in the National Flood Insurance Program. Section 402 of WRDA 1986 expands the prohibition against federal participation in flood hazard areas by including federal participation in construction of local flood control projects.

Purchase of Floodplain Property: Section 1362 of the National Flood Insurance Act of 1968 provides for federal acquisition of previously flood-damaged property located in flood risk areas to give property owners the opportunity to relocate to non-flood-prone areas. To be eligible, the property owner must have a flood insurance policy in force when the damage occurs, and at least one of the following criteria must be met: (1) the currently damaged structure must have been damaged by at least three previous floods over a 5-year period, with an average damage of 25 percent or more of the value of the structure; (2) a single flood has damaged the structure 50 percent or more of its value or beyond repair to its pre-flood condition; and (3) any single event has left the structure damaged and irreparable, either due to local ordinance limitations or significantly increased building costs. Communities participating in the program must agree to accept title to purchased property and manage it for open space or other non-development purposes. The property owner may retain ownership of buildings by moving them to another location.

U.S DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

Community Development Block Grant Program: This program provides for formula grants to metropolitan cities and urban counties and to States for use in non-entitlement areas which do not receive entitlement grants. All funded activities must meet one of three broad national objectives, to benefit low and moderate income persons; to eliminate slums and blight, or to meet urgent community development needs.

HOME Program: This program provides for formula grants to states and larger cities and urban counties for permanent housing for low-income persons. Funds can be used for acquisition, new construction, rehabilitation, and tenant-based rental assistance.

Section 108 Loan Guarantee Program: This program provides for loan guarantee assistance to states to finance: acquisition of real property; relocation of property, homes, and businesses; rehabilitation of publicly owned real property, including repair and reconstruction of public utilities, such as water and sewer systems; housing rehabilitation, including elevation of properties; and economic development.

U.S. DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Established by the Reclamation Act of 1902, the Bureau constructs, operates, and maintains multipurpose water projects in the 17 western States primarily for irrigation, hydroelectric power generation, and municipal and industrial water supply. Projects also provide flood control and recreational benefits, but these are generally not primary project purposes. The Bureau also manages any water distribution facilities associated with the USACE projects constructed under

the Pick-Sloan Missouri River Basin Program. As with the USACE projects, the non-federal cost burden has increased recently for Bureau projects. On new projects the Bureau requires the non-federal sponsors to contribute 50 percent of feasibility study costs and finance up-front a portion of the construction costs for the project (as opposed to delaying reimbursement until after construction is completed and the project is operating, as was the historical practice. Further the Bureau's approach to any new hydroelectric projects has been tightened significantly: the entire construction cost must be paid by the non-federal sponsor during the construction period.

Fish & Wildlife Service (FWS)

North American Wetlands Conservation Fund: Provides for Federal cost-share funding on a 50-50 basis to states, local governments, businesses, and individuals to protect, restore, and manage a diversity of wetland habitat for migratory birds and other wildlife.

Partners for Wildlife: This program provides for grants and technical assistance to private landowners interested in restoring wetlands and riparian habitats on their land. Landowners enter into a binding agreement with the FWS to restore and protect the site. Agreements are for a minimum 10-year period, but landowners are given a higher priority for funding if they intend to protect the area perpetually. Cost sharing is negotiated. The FWS can cost share with the Agricultural Stabilization and Conservation Service, State agencies, conservation organizations, and others.

Small Wetlands Acquisition Program (SWAP): Under this program the FWS can either purchase wetlands and surrounding upland areas outright or enter into a perpetual easement agreement which places restrictions on the wetlands. In the case of an outright fee purchase, the FWS buys the land at the current market value. This valuation is performed by examining recent land sales where land sold contained wetlands. When purchasing a wetlands area,the FWS seeks to obtain a ratio of 2:1 upland to wetland. In the case of an easement purchase, the landowner gives up rights and responsibilities to drain, fill, burn, or level the wetlands. All other ownership rights and responsibilities remain. Uplands are not restricted with a FWS lease as in the purchase. Easement payments are made on a one-time, lump sum basis, with the payment varying according to land values in the immediate area and the development potential of the wetlands.

National Park Service (NPS)

Federal Land Transfer, Federal Land-to-Parks Program: This program provides for technical assistance and transfer of available surplus federal real property to states and local governments for the purpose of establishing state and local parks for recreation and open space. Properties must be made available by the General Services Administration.

Rivers and Trails Conservation Program: This program provides for NPS staff assistance to communities for river and trail corridor planning and open space preservation efforts. Cost-sharing is variable, usually in the form of in-kind services.

SMALL BUSINESS ADMINISTRATION (SBA)

SBA makes disaster loans to non-farm, private sector owners of disaster damaged property for uninsured losses, including homeowners and renters, businesses of all sizes, and nonprofit organizations. Loans can be used by a property owner to restore any property including wetlands damaged by flooding. Owners of non-farm, flood damaged properties may use loan funds to help fund acquisition of a replacement property at a different site. In cases of forced relocation or substantial damage (as defined by the National Flood Insurance Program administered by the Federal Emergency Management Agency) in a special flood hazard area, the damaged property may be treated as a total loss, making the property owner eligible for full

replacement value. Loans generally have an interest rate of 4 percent and terms up to 30 years, depending on borrowers ability to repay. Borrowers, such as businesses, able to use their own resources to meet disaster needs without hardship pay a higher interest rate (generally 8 percent) and their loans are limited to a three-year term. Business loans and those to nonprofit organizations are limited to a statutory maximum of $1.5 million, except that SBA has authority to grant a waiver for businesses that are major sources of employment. Loans to homeowners are limited to $100,000 for real estate, $20,000 for personal property, $100,000 for refinancing of prior liens, and $24,000 for additional mitigation devices not required by code.

RURAL DEVELOPMENT ADMINISTRATION

Water and Water Disposal Loans and Grants: This program provides for loans and grants (75 percent of project costs) to public entities such as municipalities, counties, special-purpose districts, Indian tribes, and non-profit corporations to develop water and waste disposal systems in rural areas and towns with a population less than 10,000. It also provides for technical assistance and training grants, solid waste management grants, and emergency community water assistance grants. The emergency community water assistance grants can be made in rural areas and cities or towns with a population not in excess of 5,000 and a median household income not in excess of 100 percent of a state's non-metropolitan median household income. Additional funds are available through June 30, 1994, to assist rural areas and cities and towns, with a population not in excess of 15,000, to cover costs that are a consequence of the Midwest floods or other Presidential declared disasters that occurred in 1993.

Business and Industrial Guaranteed Loans: Business and industrial guaranteed loans may be made in any area outside the boundary of a city of 50,000 or more and its immediate adjacent urbanized areas with population density of no more than 100 persons per square mile. Priority is given to applications for projects in open country, rural communities, and towns of 25,000 and smaller. Any legal entity, including individuals, public and private organizations, and federally recognized Indian tribal groups, may borrow. Additional funds are available to guarantee loans made by private lenders to cover costs arising from the consequences of Presidential declared disasters. The maximum loan amount that can be guaranteed is $10 million.

Community Facility Loans: This program provides for loans to public entities such as municipalities, counties, special purpose districts, nonprofit corporations, and Indian Tribes to construct, enlarge, or improve community facilities for health care, public safety and public services.

TENNESSEE VALLEY AUTHORITY (TVA)

Among other objectives, the 1933 TVA Act charged the agency with controlling destructive floodwaters along the Tennessee River and its tributaries. TVA has a unique dual approach to flood risk reduction that combines a system of dams and reservoirs with proactive floodplain management. TVA's Flood Risk Reduction Program reduces flood damage potential in the Tennessee River Watershed in a manner which reduces property damage and the threat to loss of life, supports appropriate economic development, preserves natural floodplain values, and enhances effective multipurpose reservoir operations. TVA develops and provides flood risk data which includes flood flows, flood elevations, and flood risk mapping. It conducts engineering analyses to determine impacts of proposed floodplain development and evaluate the effectiveness of proposed flood damage reduction alternatives. Where appropriate, TVA designs and implements flood damage reduction projects. It supports state and local floodplain management efforts through educational and technology transfer activities.

APPENDIX F

STATE FLOODPLAIN MANAGEMENT PROGRAMS

The text and table in this appendix are taken from a special report by the Association of State Floodplain Managers, Inc., entitled *Floodplain Management, 1992, State and Local Programs*, and were reprinted by permission.

The Nature of State Floodplain Management

State governments derive their authority to plan and implement floodplain management actions from the police power that is vested in them by the U. S. Constitution. The principal roles played by states in floodplain management today include coordination of the National Flood Insurance Program (NFIP) for the activities within their jurisdictions; planning and implementing programs and projects for managing their own floodplains, including state-level regulations; providing technical expertise of all kinds to individuals and to other levels of governments, especially localities; coordinating local and regional programs within their jurisdictions; entering into agreements with other states to cope with multi-jurisdictional flood problems; and acting as liaisons with the federal government. Sometimes states compensate for the inability or unwillingness of local governments to take certain actions to reduce their flood risk or preserve the natural functions of their floodplains. Direct state regulation of some aspects of land use, of selected types of lands, and of certain kinds of activities is becoming more typical.

Most states have floodplain management programs that are a composite of varied activities undertaken by different agencies and other entities within the state. The central office is usually the one that coordinates the NFIP for that state. In 33 states that function is housed in a department for natural resources, water resources, or environmental protection. In nine states it is within an emergency preparedness agency, in six with a department of community affairs, and in two states with a state planning office. Two states manage their floodplains principally out of a transportation department. Sometimes most or all of the activities related to floodplain management are organized into one office or department, and sometimes they are scattered throughout state government, necessitating careful coordination.

The myriad of programs that affect floodplain management -- emergency preparedness and response, natural resources protection, environmental quality, structural control measures, planning, and economic development -- along with the wide variety in local and regional efforts, makes the floodplain management picture of each state unique.

Table F.1: Summaries of State Floodplain Management Activities, 1991 (Source: Adapted from Association of State Floodplain Managers, 1992)

	Budget: State Contribution/Total (in $1000)	Programs for Mapping Floodplain Areas	Riverine Regulatory Standards exceeding NFIP Minimums	Regulations for Areas Behind Levees	Programs for Acquisition & Relocation Program Fundng	Cooperative Projects to Protect Floodplain Resources
Alabama	30/95					M,F,W,B,Q,O
Alaska	---				A/L	M,B,Q
Arizona	60/152	X	X		L	B,Q
Arkansas	21.3/85.3					M,Q
California	---		X			
Colorado	150/200	X			H	W,B
Connecticut	---		X			
Delaware	250/300	X				
District of Columbia	25/25					
Florida	63.9/246.9	X	X	X	P/S,L	M
Georgia	28/112					M,F,W,B,Q
Guam	---					
Hawaii	145/354	X				
Idaho	19.3/77.3					
Illinois	> 150	X	X		H/L	
Indiana	---	X	X		H	W,B
Iowa	300/300		X	X		
Kansas	588/769		X			W
Kentucky	950/1034		X			M,W,B
Louisiana	44.1/176.4				P/S,L	M,B,Q
Maine	31.7/136.7	X	X		H	M
Maryland	---	X	X		H,P/S,L	M
Massachusetts	17.3/147.3		X		P,A	W,O
Michigan	546.8/857.4	X	X	X	H,P,A/L	M,F,W,B,Q,O
Minnesota	615/2400		X	X	H,P/L	M,F,W,B,Q.O
Mississippi	20.6/82.6	X			H,P	W
Missouri	34.4/137.4					W,Q
Montana	50/100	X	X			M
Nebraska	97/157	X	X	X		
Nevada	16/64.8					
New Hampshire	---		X			
New Jersey	97/546	X	X			M
New Mexico	---					
New York	620/780		X			M
North Carolina	---					
North Dakota	30/90	X	X			
Ohio	80/190					M
Oklahoma	30.7/122.9	X				M,W,O
Oregon	---		X	X		
Pennsylvania	200/260		X			M
Puerto Rico	---	X	X	X	A/S	
Rhode Island	26.6/45.9				P/L	
South Carolina	16.8/62					
South Dakota	0					
Tennessee	---					
Texas	54/216					M,W,B,Q,O
Utah	20/80		X	X		M,F,W,B,Q
Vermont	20/75					
Virgin Islands	---	X				
Virginia	200/320				P,A	M
Washington	2100/2190		X			M
West Virginia	0					
Wisconsin	1000/1108	X	X	X	A	M,Q,O
Wyoming	0					

---= Data not available A = Other acquisition program (erosion-prone structures, etc.) B = Fish and Wildlife F = Forestry O = Other
M = Multi-objective management of watersheds P = Give priority to floodplains in acquisition H = Help localities obtain 1362 funds
Q = Water quality L = Loans or grants for local purchase S = Direct state purchase W = Wetlands

APPENDIX G

EXECUTIVE ORDER ON FLOODPLAIN MANAGEMENT

Executive Order 11988, issued in 1977, represented an effort by the executive branch to coordinate federal activities to reduce the impact which federal activities have on the nation's floodplains. In the course of its work, the Review Committee determined that the Executive Order brought about a significant and beneficial change in federal floodplain activities. It also determined that certain weaknesses had become apparent which require a revised order to be issued. A new Executive Order would reaffirm the basic principles of the former order and address newly uncovered issues.

Content of the Revised Executive Order

The floodplains which adjoin the nation's inland and coastal waters have long been recognized as having special values to U.S. citizens. They have provided wildlife habitat, agricultural and forest products, vital ecosystem functions, and park and recreation areas. Unwise use and development of our riverine, coastal, and other floodplains, however, not only destroys many of the special qualities of these areas but can pose a severe threat to human life, health and safety.

Since the adoption of a national flood control policy in 1936, the federal government has invested billions of dollars in structural protection from floods. The vulnerability of floodplain inhabitants and their property persist, federal expenditures for disaster relief and recovery do not diminish, river dependent ecosystems decline, and environmental deterioration continues.

The problem arises mainly from unwise land use practices. The federal government must acknowledge its influence over floodplain development and set the example for floodplain management. Federally funded or assisted construction and improvements, property management, financial and technical assistance, and permits and licenses for federally regulated activities must be consistent with the goals of floodplain management: reducing the vulnerability to damage and protecting and enhancing the environment.

In addition to minimizing danger to humans in floodplains and maintaining and enhancing natural resources, sound floodplain management protects the federal investment and represents responsible business practice. It seeks to avoid the potential loss of human and other natural resources and reduce the risk of flood damage to properties benefiting from federal assistance.

Because unwise floodplain development can lead to the loss of human and natural resources, it is simply a bad federal policy and should be avoided. In order to avoid, to the greatest extent possible, the adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, a revised Executive Order on floodplain management is necessary. The Review Committee recommends that the Administration should direct that:

Each agency provide leadership and take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial functions of floodplains in carrying out, in a manner which furthers national economic and environmental goals, its responsibilities for:

> (1) acquiring, managing, and disposing of federal lands and facilities;
>
> (2) providing federally undertaken, financed, or assisted construction and improvements;

(3) conducting federal activities and programs affecting land use and water resources planning; and

(4) permitting and licensing federally regulated activities.

Each agency would have a responsibility to prescribe procedures to implement the policies and requirements of the revised Order. These policies and procedures should evaluate the potential economic, social and environmental effects of any actions the agency may take in a floodplain and ensure that its planning programs and budget requests reflect consideration of flood hazards and the principles of sound floodplain management.

Each agency should determine whether a proposed action will occur in a floodplain. This determination should be made according to floodplain maps issued by the Federal Emergency Management Agency, or a more detailed map of an area, if available. If such maps are not available, the agency should develop the appropriate information to make the determination of the location of the floodplain and obtain FEMA's concurrence. For major federal actions significantly affecting the quality of the human environment, the evaluation will be included in any statement prepared under Section 102(2)(C) of the National Environmental Policy Act (NEPA).

Prior to undertaking or assisting in the repair, maintenance, improvement, or rehabilitation of any structure or facility in the floodplain, the agency should conduct an assessment of the vulnerability of that structure to flooding and the feasibility of lessening such impact through mitigation techniques.

The agency should consider all alternatives to avoid development in the floodplain for any activity the agency has determined to, or proposes to, conduct, support, or allow in a floodplain. If the head of the agency finds that the only practicable alternative consistent with the law and the Executive Order requires development in a floodplain, the agency should, prior to taking action, design or modify the action to reduce to the maximum extent practicable, the potential harm to or within the floodplain consistent with regulations issued in response to a revised Executive Order.

Each agency should send a notice, not to exceed three pages in length including a location map, to the state and appropriate area-wide clearinghouses for the geographic areas affected. The notice should include: (i) the reasons why the action is proposed to be located in a floodplain; (ii) a statement indicating whether the action conforms to applicable state or local floodplain protection standards; and (iii) a list of the alternatives considered. Agencies should endeavor to allow a brief comment period prior to taking any action.

Agencies should provide FEMA with a notice that includes: (i) the reasons why the action is proposed to be located in a floodplain; (ii) a statement indicating whether the action conforms to applicable state or local floodplain protection standards; and (iii) a list of the alternatives considered. Whenever practicable, agencies should provide this notice concurrent with a brief comment period prior to taking any action. If FEMA determines that the proposed action is inconsistent with the revised Executive Order, then FEMA can refer the issue to the Water Resources Council.

Each agency should also provide opportunity for early public review of any plans or proposals for actions in the floodplain in accordance with Section 2(b) of Executive Order No.11514, as amended, including the development of procedures to accomplish this objective for federal actions whose impact is not significant enough to require the preparation of an environmental impact statement under Section 102(2)(C) of the NEPA of 1969, as amended.

Any requests for new authorizations or appropriations transmitted to the Office of Management and Budget should indicate, if the action proposed is located in a floodplain, that the proposed action has been reviewed for alternatives and minimization of adverse impact in accord with the revised Executive Order.

Each agency should require that: (1) all of its water and land use plans comply with the terms of this order; (2) its regulations and operating procedures require an evaluation and consideration of potential flood hazard prior to the issuance of licenses, permits, loans, or grants-in-aid for programs that they administer; and (3) its regulations provide appropriate guidance so that

applicants for federal licenses, permits, loans, or grants can incorporate, in their applications, the evaluation required above.

Each agency should issue or amend existing regulations and procedures within one year to comply with the revised Executive Order. These procedures should explain the means that the agency will employ to pursue risk reduction and environmental enhancement in connection with its activities in the floodplain. To the extent possible, existing processes, such as NEPA, should be utilized to fulfill the requirements of the revised Executive Order. Agencies should prepare their procedures in consultation with the Water Resources Council, FEMA, and Office of Environmental Policy and should update such procedures as necessary.

All federal agencies with responsibilities for construction or operation of federal real property and facilities, or licensing or permitting of federally regulated facilities, should take the following measures:

The regulations and procedures established by the Executive Order should, at a minimum, require the construction of federal structures and facilities be in accordance with the standards and criteria of the National Flood Insurance Program, except that all facilities or infrastructure which can be reasonably considered as critical to the health and safety of the public and the environment should be required to have protection capable of withstanding the standard project flood. They should deviate only to the extent that the standards of the National Flood Insurance Program are demonstrably inappropriate for a given type of structure or facility, or its location.

If, after compliance with requirements of the Executive Order, it is determined that there is no practicable alternative to placing new construction or rehabilitating structures or facilities in a floodplain, at a minimum the requirements of the National Flood Insurance Program should be applied. To achieve flood protection, agencies should, wherever practicable, elevate structures above the base flood level rather than filling in land.

If property used by the general public has suffered flood damage or is located in an identified flood hazard area, the responsible agency should provide on such structures, and other places where appropriate, conspicuous delineation of past and probable future flood height in order to enhance public awareness of and knowledge about flood hazards.

When property in the floodplain is proposed for lease, easement, right-of-way, or disposal to non-federal public or private parties, the agency should (1) reference in the conveyance those uses that are restricted under identified federal, state, tribal, or local floodplain regulations; and (2) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successors, except where prohibited by law; or (3) withhold such properties from conveyance.

Comply to the maximum extent practicable with state, tribal, or local rules or regulations for development in floodplains of each jurisdiction within which a federal facility is located or proposed to be located if such rules or regulations provide for more stringent levels of flood protection or require mitigation measures more extensive than those required by the National Flood Insurance Program.

Agencies which guarantee, approve, regulate, or insure any financial transaction which is related to an area located in a floodplain should, prior to completing action on such transaction, inform any private parties participating in the transaction of the hazards of locating structures in the floodplain.

The Water Resources Council should develop guidance for implementing the provisions of the revised Executive Order within six months of its being signed. The head of each agency should submit a report to the Office of Environmental Policy and the Water Resources Council regarding the status of their procedures and the impact of the Executive Order on the agency's operations. Thereafter, the Water Resources Council should periodically evaluate

agency procedures and their effectiveness.

The proposed Executive Order should not apply to assistance provided for emergency work essential to save lives and protect property and public health and safety, performed pursuant to Sections 402 and 403 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (PL 93-288). To the extent the provisions of the Executive Order would be applicable to projects covered by Section 104(h) of the Housing and Community Development Act of 1974, as amended (88 Stat. 640, 42 USC 5304(h)), the responsibilities under those provisions may be assumed by the appropriate applicant, if the applicant has also assumed, with respect to such projects, all of the responsibilities for environmental review, decisionmaking, and action pursuant to the NEPA of 1969, as amended.

The executive order should apply to all federal agencies and federally owned corporations.

APPENDIX H

PROPOSED FEDERAL PROGRAM FOR MAJOR MAINTENANCE AND MAJOR REHABILITATION OF LEVEES

The concept of and the actions necessary for establishing a federal program to ensure the integrity of levees in the upper Mississippi River Basin are presented in Chapter 10 and in the Action Plan. Specific elements of the proposed program as it pertains to both federally built/locally maintained levees and locally built/locally maintained levees are presented here.

DETAILS OF THE PROGRAM

Levee districts/owners desiring to participate in the USACE major maintenance and major rehabilitation (MM&MR) program would submit requests, through their state, to the USACE within a three-month period following initiation of the program by the Administration. The USACE would then group these requests into a project that would be submitted to the Congress for authorization. Levees would be placed in an Upper Mississippi River and Tributaries (UMR&T) project, which includes the Missouri River Basin, to be established as a line item in the USACE program.

Federally Built, Locally Maintained Levees Currently in the USACE PL 84-99 Emergency Repair Program

Eligibility. On approval by the Congress, the USACE would become responsible for major maintenance and major rehabilitation (MM&MR) of levees. To become eligible for participation in these programs, states and local sponsors would agree to:

a. Participate in the National Flood Insurance Program (NFIP).
b. Continue responsibility for routine maintenance and control of the levees.
c. If the levee affords less than one percent annual chance (100-year) flood protection, require all development behind the levee to comply with provisions of the NFIP.
d. If levee provides less than standard project flood (SPF) level protection, require all structures and crops behind the levees be insured.
e. Not raise the height of the levee during floods without the agreement of the USACE.
f. In the event of any required repair, renewal, or realignment, pay 25 percent of the cost and provide the necessary borrow material and any required lands, easements, and rights-of-way. The non-federal share shall not exceed 50 percent of the total project cost.
g. In coordination with the appropriate federal and state agencies, assist in developing, at minimal cost to the land owners or the local sponsors, appropriate environmental enhancements to the land behind the levees.

Major Rehabilitation Survey. The USACE would conduct a review of all levees in the program to determine long-term rehabilitation requirements and potential for upgrade. The primary determinant of eligibility for major rehabilitation and/or upgrade would be the results of an expanded benefit-cost analysis under revised *Principles and Guidelines* which includes, in addition to economic factors, the social and environmental benefits and costs. The review would also include an assessment of the impacts of any rehabilitation on the hydraulics of the river. State and local sponsors would agree to:

a. Pay 25 percent of the expense of any major rehabilitation, renewal, or upgrade.

b. Include appropriate environmental enhancements or operating measures in any major rehabilitation or renewal projects. The costs of these enhancements would be shared by the non-federal sponsor only in so far as the benefits could be assessed as local. For enhancements that are of regional or national significance, the non-federal share would be provided by the state, private organizations, or other authorized federal agency.

Locally Built, Locally Maintained Levees Currently in the USACE PL 84-99 Emergency Repair Program or Designated by Either the SCS or the EDA for Inclusion

Initial Eligibility. Since locally built levees may not have been constructed in accordance with sound engineering practices and at hydraulically appropriate locations, the USACE initially would screen all levees proposed for inclusion in the MM&MR program to determine any potential problems. Levee sponsors, whose levees failed to meet the USACE engineering standards, would be required to bring those structures up to standards at sponsor expense prior to inclusion in the federal MM&MR program. Those located at hydraulically inappropriate locations would not be eligible. To become eligible, states and local sponsors would agree to:

a. Participate in the NFIP.

b. Continue responsibility for routine maintenance and control of the levees .

c. If the levee is determined by the USACE to provide protection against less than the one percent annual chance (100-year) flood, require all development to comply with the NFIP.

d. Require that all structures and crops behind the levees be insured.

e. Not raise the height of the levee during floods without the agreement of the USACE .

f. In the event of any required repair, renewal, or realignment, pay 25 percent of the cost and provide the necessary borrow material and any required lands, easements, and rights-of-way. The non-federal share shall not exceed 50 percent of the total project cost.

g. In the event of levee failure, share the cost (25 percent) and provide the lands, easements, and rights-of-way necessary to ensure the future stability of the levee.

h. In coordination with the appropriate federal and state agencies, assist in developing, at minimal cost to the land owners or the local sponsors, appropriate environmental enhancements to the land behind the levees.

Major Maintenance and Major Rehabilitation: On approval by the Congress, the USACE would become responsible for future major maintenance and major rehabilitation of those levees accepted into the federal MM&MR program.

Major Rehabilitation Survey. The USACE would conduct a review of all levees accepted into the program to determine long term rehabilitation requirements and potential for renewal. The primary determinant of eligibility for major rehabilitation would be the results of an expanded benefit-cost analysis under revised *Principles and Guidelines*

which include, in addition to economic factors, the social and environmental benefits and costs. The review would also include an assessment of the impacts of any rehabilitation on the hydraulics of the river. State and local sponsors would agree to:

a. Pay 25 percent of the expenses of any major rehabilitation, renewal, or upgrade.

b. Include appropriate environmental enhancements or operating measures in any upgrade or renewal projects. The costs of these enhancements would be shared by the non-federal sponsor only in so far as the benefits could be assessed as local. For enhancements that are of regional or national significance, the non-federal share should be provided by the state, private organization, or other authorized federal agency.

Appendix I

COORDINATION MECHANISMS

WATER RESOURCES COUNCIL

Purpose

The revitalized Water Resources Council should launch and promote cooperation among the federal agencies and the states. It should exist as a mechanism to bring together appropriate policymakers to address key water resources issues. The WRC should align federal floodplain management goals with other broad national goals; provide a single point of focus to assist coordination and resolution of interstate water resource management issues; serve as an innovative planning and technology center (including intergovernmental data gathering and dissemination activities); and resolve federal agency disputes. The WRC should operate under a clarified set of responsibilities compatible with Title I of the 1965 Act and capitalize on the experience of the previous Council. Should the WRC prove an ineffective organization for accomplishing these activities, it should be abandoned.

Membership

Participation in the Council, currently chaired by the Secretary of the Interior, needs to be broadened to include the Administrator of the EPA and the Director of FEMA -- two agencies that did not exist at the time the WRC was first conceived. The participation of these agencies is critical for addressing floodplain management issues. Because EPA's program responsibilities include restoration and enhancement of the nation's water quality, and FEMA's responsibilities include administration of the NFIP and flood recovery, they both merit a role in the Council. Therefore, the Secretary of the Interior should request that the Administrator of EPA and the Director of FEMA become full-time participants on the Council. In addition to the Secretary of the Interior, EPA and FEMA, membership of the Council should be the Secretaries of Army; Agriculture; Commerce; Housing and Urban Development; Health and Human Services and the Chair of the Federal Energy Regulatory Commission. Other agency heads may be called upon by the Chair when matters affecting their responsibilities are considered by the Council.

Staffing

The Secretary of the Interior, as Chair of the Water Resources Council, should restaff the Council. A small staff to support the Council's mandate is suggested. A Director, five professionals and one administrative support/secretary is suggested as the minimum desirable staffing level. Two professionals are envisioned for a Floodplain Management Division.

Budgeting

As authorized in the Act, the Council shall request a budget for professional and support staff and necessary office space, equipment, travel, and contract fund. A budget of $950,000 is envisioned for this purpose.

BASIN COMMISSIONS

Designation

The President should establish basin commissions as a forum for coordinated federal and state planning across basin(s) and within sub-basins (as determined appropriate). The WRC should, in coordination with states, define the geographic reach of the commissions. Section 201 of the Water Resources Planning Act of 1965 (PL 89-80) describes how basin commissions can be requested by either the Water Resources Council or states and then declared by the President.

Purpose

Each basin commission should serve as the principal agency for the coordination of federal, state, interstate, local, and non-governmental plans for their designated areas and operate under a clarified set of responsibilities compatible with Title II of PL 89-80, but building upon the lessons learned from the previous commissions. The basin commissions will actively lead collaborative efforts that focus beyond traditional water management challenges to undertake integrated examination of ecosystem management, biodiversity conservation, flood control, water supply, navigation, water quality, and sustainable development issues. The focus of these commissions is on action not on oversight.

Membership

The basin commissions would be co-chaired by a representative of a federal agency and a representative of a state governor. To clearly advance state leadership in floodplain management, the voting role of federal agencies should be limited. The Governor of each basin state shall appoint a member that serves at the pleasure of the Governor.

Staffing and Budgeting

Organization of the basin commissions using existing federal and state programs and budgets to accomplish tasks will increase coordination, cooperation and leveraging of limited funding and achieve a comprehensive approach to issue resolution. The basin commission would create an environment where agencies' activities are orchestrated to achieve multiple benefits for the basin. One means of ensuring this approach is to keep actual basin commission staffing to a minimum. A director and a staff of 3 to 4 full-time professionals is suggested; these would not be federal employees. Where appropriate, the current basin association staffs could assume this responsibility. Average annual budgets of $400,000 are estimated for the Upper Mississippi River Basin Commission and the Missouri River Basin Commission and would be cost-shared by the federal government. As special projects require additional funding to the federal and state agencies, the river basin commission may request appropriations from Congress and/or the state legislatures.

EXPANDED MISSISSIPPI RIVER COMMISSION

Purpose

The current Mississippi River Commission (MRC) provides a necessary connection between the public, a construction, operations and maintenance agency, and the executive branch of U.S. government, as well as implementation oversight of a range of water resources activities. The MRC has established a record of expertise and accomplishment, has a clear charter in the basin, and has established processes to make recommendations to the Administration and Congress, and to have funds appropriated for implementation. The purpose for the expansion is to link the entire Mississippi River Basin together to provide a system-wide approach. The composition of the Commission should be expanded to include the additional responsibility of program integration between the construction and environmental missions of the USACE and the ecosystem stewardship missions of the DOI.

Membership

The current Commission has, by Presidential appointment, seven members. There are 3 USACE and 3 Civilian members and one member from the NOAA Coast and Geodetic Survey. The President should seek approval from Congress to add a member from DOI and should nominate a membership which ensures appropriate distribution of decision-making authority among action agencies, as well as ensuring representative authority to follow through on plans and projects approved by the Commission and authorized by Congress. A possible membership is provided on the next page.

EXPANDED MISSISSIPPI RIVER COMMISSION

Current MRC	Expanded MRC
Authorities from headwaters to Head-of-Passes, La., including all tributaries.	In consultation with Congress, include tributaries in the upper basin.
Current focus is MR&T project.	Includes UMR&T.
Seven Presidentially appointed members - 3 USACE, 3 Civilians, 1 NOAA (C&GS).	Add DOI from Assistant Secretary level. NOAA should be at large.
Advisory to the Chief of Engineers.	Advisory to both Chief of Engineers and the Secretary of the Interior.
President is a Corps officer who is responsible for MR&T and reports to the Chief of Engineers.	Adds UMR&T responsibility.
USDA advises.	USDA and EPA advise.
Duties include: -Recommend policy and work program of MR&T. -Study and report on project modifications. -Comment on matters authorized by law. -Conduct inspection trips and hold public hearings.	Additional duties: -Integrate ecosystem and watershed management strategies into currently authorized projects for flood control and navigation. -Study and report on natural resource conditions and improvements realized by integrated river management.
Has established processes to recommend administrative approval and/or Congressional authorization of specific proposals, and to have funds budgeted and appropriated for implementation.	Include DOI proposals and programs.
Uses MRC/LMVD and District staffs to develop plans and implement actions.	Include Corps Divisions and Districts in the upper Mississippi River Basin. Also include FWS Regions III, IV, and VI; NBS; GS; BOR; and BLM staff to collaborate and integrate natural resource management plans. Develop recommendations for state application.
Activities include general investigations, design, construction, and operations and maintenance.	Add oversight of refuge operations, inter-jurisdictional fisheries, Migratory Bird Program, and research.

Appendix J

SUMMARY OF COMMENTS

The Review Committee provided a draft copy of its report to federal agencies, members of Congress from the flood-affected area and leading key committees and subcommittees involved with subjects addressed by the report, the governors of the nine Midwest states, and a number of non-governmental organizations that had worked with the Review Committee during its fact finding and outreach phases. This review was intended to seek feedback from the above parties and was not intended as a substitute for a broad-based public comment period. Considerable interest, however, was expressed in the draft document and over 650 copies were distributed. Despite the very brief comment period, nearly 100 comments were received via facsimile, mail, and telephone by June 16, 1994. Five of the nine Midwest governors commented to the Review Committee; other Midwest governors assigned a lead agency to provide state comments.

The nature of comment letters ranged from full endorsement to opposition. Many of those who commented endorsed the report, or a subset of the actions and recommendations, or requested clarification. Conversely, some of those who commented opposed the report or a subset of the actions and recommendations. Others provided their thoughts regarding certain general issues and asked that their concerns be considered by the Review Committee. Some comments indicated that the reviewer had misinterpreted the Review Committee's intended message. Many of those who commented provided additional data, technical corrections, or pointed out typographical errors. Some noted that their comments were limited to the Executive Summary or only sections of the report due to the short review period. Some comments were general in nature and not reflective of the themes and specific proposals contained in the draft report; the Review Committee is, therefore, led to believe that the comments are reflective of perceptions of the report based on inaccurate summaries of the report by the media or some group.

The Review Committee reviewed all comments and made corrections, clarifications, and additions where warranted. The comments led to development of a better report and the efforts made by those who provided comments were appreciated. Where appropriate the Review Committee responses to comments appear below, in italics, to guide readers to particular clarifications or changes made in the final document.

Many individuals and organizations endorsed the report's themes and vision for what needs to be done to implement floodplain management. Many more organizations and individuals endorsed large numbers of the recommendations and actions while raising questions, concerns and/or objections to others. Summarizing the nature of the comments is difficult because the absence of opinion expressed on particular proposals may indicate support.

There was nearly universal comment that the Review Committee developed, within a short time frame, a comprehensive report addressing a wide variety of improvements needed to enhance the nation's approach to floodplain management. Nearly all commented that additional time to review the draft report would have been appreciated. Several indicated a desire to comment on the final document.

Nearly all made comments on areas where they believed the report could be strengthened or where they perceived omissions. Many raised concerns regarding the costs associated with the report as a whole and with specific recommendations -- many indicating that their support was dependent, at least in part, on the cost trade-offs.

MAJOR THEMES OF COMMENTS

Several areas of the report generated the majority of the comments; however, not all comments reflected the same opinion.

Support for change

There was nearly universal support for a need to change the nation's approach to floodplain management; not surprisingly, there was a divergence of opinion regarding the means to achieve flood damage reduction. There was hesitation on the part of some reviewers to endorse the direction and approach made by the Review Committee. Nearly all agreed that a systems approach to floodplain management was needed to replace uncoordinated ad hoc efforts.

Treatment of watersheds

Many made comments regarding the draft report's treatment of watersheds. Some found that the report unduly emphasized the role, value, and significance of watershed and ecosystem planning with respect to achievement of floodplain management and flood damage reduction goals. Several of those who commented reflected concerns that the draft report did not adequately tie together preservation and restoration of aquatic ecosystems and watersheds with floodplain management. Several indicated that watershed management was not sufficiently integrated into floodplain management and that nonstructural alternatives to flood damage reduction were not given enough support.

Structural approaches

Many of those commenting felt that the existing structural approach to flood damage reduction had proven its value and not enough credit was given to the predominantly structural approach the nation has, in the past, taken to reduce flood damages. Many felt that nonstructural approaches were experimental and their merit uncertain. However, others were concerned that the report over-emphasized structural solutions; some feared that the report might further broad interest in a widespread construction program consisting of large levees.

Administrative and organizational structures

Many comments reflected concern about the number of organizations proposed, the designation of leadership responsibilities, and the interaction and relationships among these organizations. These concerns reflected uncertainties about the costs of such proposals (which were not characterized in the draft) in comparison to the added value of these organizations. Other concerns reflected hesitation to endorse some or all of these proposals until a dialogue had been opened and charters proposed to further specify responsibilities, functions, and working relationships. While these concerns were expressed, many also recognized the need for better coordination at the federal and interstate levels.

Streamlining disaster relief and improvement of the NFIP

While not every one commenting agreed with all of the proposals, support for streamlining disaster relief and the actions and recommendations aimed at improving the NFIP was widespread.

Infringement of property rights

Some of those who commented raised concerns that proposals in the Review Committee draft report would infringe on property rights.

> *[To clarify its intent and to address these concerns, the Review Committee added additional text in the report emphasizing the voluntary nature of buyouts and clarifying that limits to floodfighting would not prevent floodfights consistent with state and local floodplain management regulations.]*

COMMENTS ON ACTIONS AND RECOMMENDATIONS

Many of the comment letters reflected specific objections or concerns with proposed actions and recommendations; others focused on proposals that they supported. Summarized, below, are those actions and recommendations for which at least six of those commenting provided definitive statements of either support, concern or objection.

Basin Commissions, Upper Mississippi and Missouri River Basin Commissions (Actions 5.3 and 10.2)

No other proposal in the report generated so many specific comments as the basin commissions. Many of the comments expressed a desire not to create basin commissions in the same form as those that existed in the late 1960s and the 1970s.

> *[The Review Committee concurs that new basin commissions should take on a different function and approach and both learn from and build upon the lessons of the previous basin commissions. This was the basis for the proposed changes to the previous basin commissions' function and structure. The Committee has also altered Figures 5.1 and 10.1 to clarify the relationships between the Water Resources Council, the basin commissions, and the Mississippi River Commission.]*

Many of those who commented expressed confusion regarding the relationships between the Mississippi River Commission and the Upper Mississippi River Basin Commission. Some comments reflect further confusion in that they were considered the same organization.

> *[The Review Committee has made changes to further clarify the relationships between these organizations. Figure 10.1 has been changed to distinguish between lines of "command" or oversight and lines of coordination. It is unfortunate that the names of these organizations are so similar -- to try to further distinguish them, the final document refers to basin commissions as opposed to river basin commissions.]*

Many of those who commented reserved endorsement of basin commissions until further dialogue on their purpose, functions, and methods of operation was pursued.

Increase the state role in all floodplain management activities (Recommendation 5.2)

This recommendation generated a large number of specific comments with half supporting the recommendation and half against. The general reason for not supporting the recommendation reflected a concern that interjecting the states between levee districts or local communities would increase bureaucracy and slow response. Supporters generally expressed that states need to exercise their responsibilities and their involvement would add value to efforts to achieve floodplain management goals.

Mississippi River Commission (Action 10.2)

Many comments were also received regarding the Mississippi River Commission. Overall, most comments expressed reservations about this proposal, but for a variety of reasons. Some comments arose from concerns about the nature of activities of the Commission in the past (prior to the last decade) and the Commission's ability or interest in taking on a broader nonstructural approach to floodplain management. Others arose from not wanting to broaden the Commission's membership and charter to address related ecological resource issues or not trusting the Commission's interest in pursing these issues. Others objected to extending the geographical extent of the Mississippi River Commission's authority.

[The Review Committee added new text to clarify the legislative authority of the Mississippi River Commission which already assigns the Commission's authorities to extend from the river's mouth near the Head of Passes to its headwaters. The Review Committee feels that further dialogue on the relationship between basin commissions and the Mississippi River Commission and the functions and duties of the Mississippi River Commission could allay some concerns and develop support for this action.]

Water Resources Council (Action 5.2)

The proposal to revitalize the Water Resources Council generated numerous comments. Generally there was broad support for the WRC or a similar entity to provide a mechanism for interagency, policy level coordination. Several were hesitant to support the proposal until further operational and administrative issues had been developed. Some questioned the political desire to renew the Council.

Floodplain Management Act (Action 5.1)

Several comments specifically indicated support for a floodplain management act to define governmental responsibilities, strengthen federal-state coordination and assure accountability and fund state floodplain management programs.

New Executive Order on Floodplain Management (Action 5.4)

Overall comments supported this action. Several comments, however, indicated that the executive order was an inappropriate Administration action circumventing Congress. Some comments indicated that FEMA oversight of compliance with the EO was unnecessary.

[The Review Committee notes that the existing Executive Order on Floodplain Management has been in place since 1977 without objection from Congress. The Review Committee's proposal is intended to reaffirm Administration support for floodplain management and to clarify certain federal responsibilities to undertake a sequence of avoiding floodplain development, minimizing the adverse effects from flooding and to the floodplain, and finally mitigating potential flood damages. It does not represent a departure from congressional policy on floodplain management. The Review Committee agreed with comments indicating that FEMA's role should include resolution of disagreements over EO compliance and that FEMA should only refer to the Water Resources Council those issues where significant attempts to reach resolution had failed.]

Principals & Guidelines (Actions 5.10 and 5.11)

Many of those specifically commenting on Actions 5.10 and 5.11 reflected support for establishing co-equal objectives for the *P&G*. A few expressed concern regarding the mechanism used to evaluate environmental quality and compare alternative courses of action. Several noted the difficulties inherent in both quantifying and monetizing attributes contributing to environmental quality. The establishment of an interdisciplinary, interagency review of other aspects (including application of the *P&G*) raised objections regarding the application of the *P&G* to specific types of actions, including those to which the current *P&G* now apply.

[The purpose of the interdisciplinary, interagency review is to discuss and address whether the revised P&G could and should be applied to a broader array of federal decisions and to develop guidelines for application of the principles.]

Develop common procedures for buyouts (Action 8.4)

Most comments registered support for this concept. Some expressed concerns regarding whether there could be common procedures for programs with different purposes.

Hazard Mitigation Grants as block grants (Action 8.5)

Most comments regarding this Action reflected support. Concern was raised regarding means to ensure that states used the funds appropriately.

Establishing the USACE as the principal levee construction agency (Action 8.1)

Of those commenting on this Action, nearly all supported it. Concern was raised regarding the continued role of the USDA with respect to agricultural levees.

> *[The Review Committee has added clarifying language to better reflect the relationship of the USACE to USDA and other federal agencies considering levee projects.]*

Extend 5-day waiting period for flood insurance coverage (Action 9.7)

All those commenting on this action supported the extension of the time period. Several supported further lengthening the time period beyond the 15 days recommended by the Review Committee to account for the potential for flood crests moving further downstream on the Mississippi. Concern was noted that the waiting period should not apply when a home is being purchased.

> *[Text was added to clarify that there would be no waiting period associated with purchase of flood insurance at closing after purchase of a home].*

Expansion of conservation and voluntary acquisition programs in 1995 Farm Bill (Action 6.3)

There was broad support for continuing these programs.

DOI coordinating environmental acquisition (Action 7.1)

Some concerns were raised regarding whether DOI had the in-house capability to perform this function. Others raised concerns regarding the extent of DOI responsibilities and applicability of this proposal to dual purpose acquisitions. Some pondered the federal interest in additional land management responsibilities.

> *[The Review Committee reviewed the language of this and related actions to ensure that DOI's function was one of coordination of acquisition. Agreements between agencies would be developed to determine specific procedures and applicability of those procedures. The text already indicates that lands acquired in fee will not necessarily be held or managed by the DOI or the federal government.]*

Limiting public assistance grants for communities not participating in the NFIP (Action 5.7).

Most all of those who commented on this Action indicated support.

Integration of flood response and recovery under FEMA (Recommendation 9.1)

Of those commenting, most supported the proposal. One suggested that FEMA needed Presidential support to achieve cooperation from cabinet-level agencies.

> *[The Review Committee believes that response and recovery require leadership from a single knowledgeable agency, just as land acquisition for environmental purposes and levee construction requires leadership and coordination by knowledgeable agencies. The Review Committee sees these delineations of clear responsibility as critical to providing a streamlined, responsive, and efficient program for response, recovery, and overall floodplain management.]*

Multi-objective watershed management task force (Action 6.1)

There was general support for this proposal although a few thought it was unnecessary.

ANALYSIS OF COMMENTS BY ORIGINATORS

Congress

Congressional reaction to the report was mixed. While all felt the report to be balanced, concern was raised by some members regarding the impact of the recommendations on their constituents. Some members indicated interest in sponsoring legislation to implement some of the proposals in the draft report.

Federal Agencies

Federal agencies provided comments ranging from full support to specific technical comments that neither indicated specific support nor opposition to the proposals in the draft report. A few comments reflected hesitation to alter current policies, approaches, and responsibilities without further dialogue with or guidance from Administration leadership.

States

Comments were received from all but one Midwest state and were generally supportive of the report and its vision. One state from outside the Midwest noted general support for the proposals. Several states indicated their readiness and willingness to take on the challenges and responsibilities articulated in the draft report. Some concerns were raised about organizational and administrative mechanisms. A few raised concerns about the level of funding and technical assistance that would be provided to states. A few comments were received from state legislators. These letters reflected that the report was recommending cessation of levee repair work in their jurisdiction and were concerned that the proposals in the report would adversely impact navigation and farming along the rivers.

Levee and drainage districts and individual farmers

Several reflected concerns that the Review Committee draft report was calling for a unilateral buyout of bottomland agriculture to restore wetlands. Many reflected a concern that the report emphasized environmental protection over flood hazard protection to bottomland activities. However, many also expressed support for recommendations and actions contained in the report. Some were deeply concerned with what they perceived in the report to be a prohibition against all floodfighting. Some noted that property rights of farmers and others needed to be more carefully considered. Several noted concerns about the impact of buyout and acquisition on the local and regional economy and the impact on tax roles.

Environmental non-governmental organizations

Strong support for reestablishment of the Water Resources Council was noted in all comments made by these organizations. While some environmental organizations supported the report, many expressed serious concerns that the report did not sufficiently emphasize restoration of aquatic ecosystems, watershed management and nonstructural approaches to floodplain management. Many comments also reflected concerns about issues that the report failed to address including the role of federal programs influencing bottomland farming and navigation issues on the Missouri River. Concerns were raised about the efficacy of the Mississippi River Commission to pursue new mandates. Concerns were raised that the report appeared to support a new levee construction program on the Upper Mississippi and Missouri rivers.

Other non-governmental organizations

A number of non-governmental organizations, including several professional affiliations, and regional planning and coordination organizations commented on the draft. As might be expected, there was considerable divergence of opinion on specific proposals. The opinions summarized on the draft report reflect the differences of the many non-governmental organizations. Several indicated long-standing support for several of the recommendations in the report. Some commented that the report was "anti-agriculture" and one commented that the report was "anti-city".

Others

Comments were received from a wide variety of other organizational entities consisting of state agencies, cities, and individuals, including public school teachers; academics from across the nation in the fields of water resources, natural hazards, and hydrology; land-owners in the Midwest; and, other interested parties. As with comments from other sectors, their were a variety of viewpoints expressed which ranged from endorsement of the report to objections to specific recommendations.

Appendix K

LIST OF PHOTOGRAPHS

Cover: Missouri River: view from the Missouri state capitol, Jefferson City, Missouri (Source: Missouri Department of Conservation).

Page xxiv: Chesterfield Valley, St. Louis County, Missouri (Source: Missouri Department of Conservation).

Page 2: Hartsburg Bottoms, Boone County, Missouri (Source: Missouri Department of Conservation).

Page 5: Hannibal Missouri (Source: Missouri Department of Conservation).

Page 7: Eddyville, Iowa (Source: USDA-SCS).

Page 16: Eddyville, Iowa (Source: USDA-SCS).

Page 17 (L): Muscatine, Iowa (Source: USDA-SCS).

Page 17 (R): Valley Junction, Iowa (Source: USDA-SCS).

Page 18: Jefferson City, Missouri (Source: Missouri Department of Conservation).

Page 20: Springfield, Minnesota (Source: FMRC).

Page 22: St. Louis, Missouri (Source: USACE).

Page 36: Des Moines, Iowa (Source: USDA-SCS).

Page 43: Upland land treatment, unknown location (Source: USDA-SCS).

Page 44: Wetland, unknown location (Source: USDA-SCS).

Page 48: Agricultural levee, unknown location (Source: USDA-SCS).

Page 92: Festus, Missouri (Source: USACE).

Page 96: Watershed, Brown County, Kansas (Source: USDA-SCS).

Page 104: Wetland, unknown location (Source: USDA-SCS).

Page 154: Scientific activity at Sioux Falls, South Dakota (Source: SAST).

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