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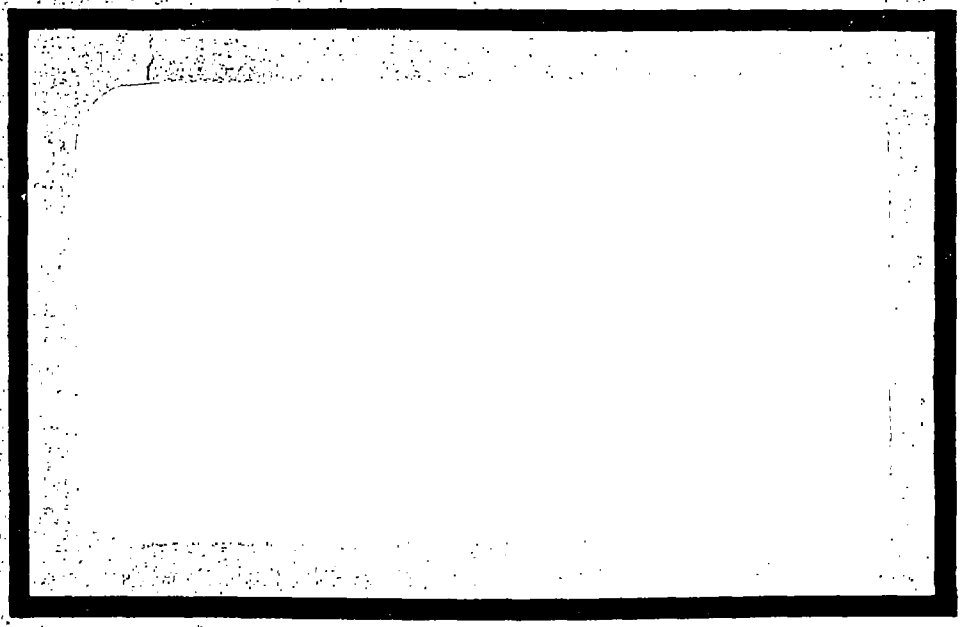

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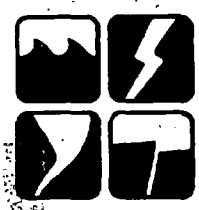

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Proceedings of a Seminar

EVALUATING THE EFFECTIVENESS OF FLOODPLAIN MANAGEMENT TECHNIQUES AND COMMUNITY PROGRAMS

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Special Publication
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Conducted April 30 - May 1, 1984
in Washington, DC

by

The Tennessee Valley Authority

In cooperation with

The Interagency Task Force on Floodplain Management

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FOREWORD

Is elevation on fill a more reliable and cost-effective long-term approach to mitigating flood damages in flood fringe areas than structural floodproofing or elevation on pilings? What are the possibilities for expanded use of local flood warning systems, self-help activities, and acquisition/relocation programs? Are communities adequately enforcing protection elevations and flood hazard mitigation measures or are they issuing variances and amendments whenever political pressures build? These are some of the unanswered or only partially answered questions facing flood loss reduction policy makers.

Despite extensive efforts at federal, state, and local levels to implement structural and nonstructural floodplain loss reduction measures in the last decade, there has been little "on the ground" evaluation of the effectiveness of different approaches and programs, particularly during actual flood conditions.

This seminar, "Evaluating the Effectiveness of Floodplain Management Techniques and Community Programs," was held in Washington, DC, April 30 and May 1, 1984. Sponsored by the Tennessee Valley Authority with the cooperation of the Interagency Floodplain Management Task Force, the goal of the seminar was to examine existing and alternative cooperative approaches for evaluating and monitoring floodplain management techniques and community programs. The seminar was intended to assess the "state of knowledge" on this important topic and to suggest some priorities for further interagency research and action.

Speakers, panelists, and other participants in the seminar were selected because of their practical experience in monitoring and/or

evaluating local programs. They included university researchers, federal agency staff, state and local government employees, and private consultants who had investigated the feasibility and effectiveness of various techniques or community programs.

This report is a collection of three products. Part I presents a brief overview of issues. Parts II and III are issue papers prepared prior to the seminar by Jacquelyn Monday with input from Jon Kusler, summarizing the state of knowledge concerning evaluation of the effectiveness of nonstructural floodplain management techniques and community programs. The issue papers were distributed to all speakers and participants prior to the seminar to stimulate discussion. Part IV contains papers presented by speakers and panelists in the seminar addressing specific issues. Part V, the conclusions and recommendations, and the executive summary were prepared by Jon Kusler and Jacquelyn Monday and based upon the issue papers, the papers presented at the seminar, and follow-up discussions with selected speakers and panelists.

ACKNOWLEDGEMENTS

The opinions expressed herein are those of the authors and do not necessarily represent those of the Tennessee Valley Authority, the Interagency Task Force on Floodplain Management or the various agencies at the seminar. Funding support from the Tennessee Valley Authority is gratefully acknowledged along with the helpful comments and assistance of Jim Wright and Ann McManamon. Special thanks is also due to the Task Force members, speakers and panelists for their help.

Jon Kusler
Seminar Director

Jacquelyn Monday
Seminar Coordinator

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EXECUTIVE SUMMARY

Conclusions

Very little "on-the-ground" study has been made in the last two decades of the effectiveness, particularly in an actual flood, of the various structural and nonstructural floodplain management techniques now in place. This is in sharp contrast with the considerable amount of sociological, geographical, political science, legal, and other policy-related research that has been conducted on floods. In other words, efforts have been made to diagnose the flood-prone patient's ills, suggest alternative medicines, study why or why not particular pills and surgery are selected, and monitor the patient's attitudes, but very little has been done to determine whether or not the various treatments are curing the disease.

The need for follow-up testing of approaches is essential as a basis for the establishment of flood insurance rates that reflect actual risk and the selection of cost-effective flood loss reduction techniques appropriate to particular contexts. The opportunities for follow-up have improved dramatically in the last decade due to, on one hand, the widespread adoption of nonstructural elevation and floodproofing, and, on the other, improved data gathering and analysis capability at the federal and state levels through NFIP community biannual reports, flood insurance policies, flood insurance claims, disaster assistance claims, post-disaster interagency team reports, environmental impact statements, sub-section 406 plans, and federal, state, and community program evaluation visits. There is considerable potential for combining this information with selected onsite surveys both before and after a flood. A careful setting of priorities for data gathering, coordination of data

PART I: SUMMARY AND OVERVIEW

Part I is based upon the issue papers, workshop presentations and follow-up discussions with Interagency Task Force members.

Need for Monitoring and Evaluation

Given the adoption of floodplain regulatory programs by 17,000 local governments since 1970 and the widespread application of nonstructural flood hazard loss techniques to date (an estimated 100,000-200,000 new structures each year), surprisingly little hard data have been developed about the precise causes of flood losses (e.g., flood stage, velocity, debris, erosion), the types of buildings and uses suffering direct and indirect losses, or the effectiveness of various mitigation techniques and construction designs under particular conditions. This lack of monitoring and evaluation is not confined to community programs and nonstructural approaches. Cost-benefit evaluations often have been carried out by federal agencies before construction of dams and levees, but rarely has there been detailed follow-up assessments to determine effectiveness of the structures in reducing losses.

How serious is this lack of "on-the-ground" testing or verification of effectiveness? In some instances, lack of hard data on effectiveness is seriously hindering policy making and mitigation. It places limitations upon:

(1) The selection of the most effective hazard mitigation techniques by individual landowners, communities, states and federal agencies;

(2) Establishment of performance standards for new uses and retrofitting existing structures by local governments, the states, and FEMA;

(3) Flood insurance rate-setting that reflect actual losses for specific types of uses;

(4) FEMA's enforcement actions for the National Flood Insurance Program including community suspension and subrogation law suits;

(5) Training and education and technical assistance programs at all levels of government;

(6) Congressional policy setting on particular structural and nonstructural techniques and the authorization of and appropriations for particular projects.

What information gaps and unanswered questions are limiting such efforts? Examples include:*

(1) Is structural floodproofing of particular types (e.g., waterproofing of a commercial structure by installing

* Note that this is only a preliminary list.

water-tight walls and closures) actually effective when a flood occurs? What are the expected losses in comparison with other approaches? There is some evidence that waterproofing is rarely effective for flooding more than a few hours in duration without back-up sump pumps and that the incidence of damages from a full range of floods may be much greater than for elevation on concrete pilings or fill. If so, how should this be reflected in regulatory guidelines and insurance rates?

(2) Does elevation on fill in the flood fringe actually provide a higher safety factor than elevation on wooden pilings or structural floodproofing? If so, how should this be reflected in regulations and insurance rates?

(3) What has been the actual performance of various structural flood damage reduction measures?

(4) How extensive are "unique" hazards such as alluvial fan zones, mudfloods, lake flooding and coastal erosion in terms of number of structures at risk, growth rates, and losses per structure? How effective (or ineffective) are current management approaches for other areas when applied to these problems?

(5) What percentage of flood losses are, in fact, storm water management losses from sheet flows, channel overflows, and flooding along small unmapped floodplains? How effective are existing criteria and designs for stormwater management?

(6) Has the NFIP actually reduced disaster payments for particular areas? If so, to what extent? Are there duplications in benefits?

(7) Are communities actually enforcing the standards of the NFIP, particularly for new buildings or for retrofitting after a disaster? If not, what are the implications of this for future flood losses? If so, what losses can nevertheless be expected due to the limitations of the techniques?

(8) Are local responsibilities for maintenance of structural control works being carried out?

(9) What are the implications of sea level rise and subsidence (assuming various rates) on the cost/benefit ratios for sea walls, groins, and beach nourishment?

(10) What types of communities have the most severe flood hazards in terms of threats to life and to property so as to qualify them for flood warning systems, evacuation planning, and technical assistance?

Overall, there has been limited on the ground testing or modelling of floodplain management techniques to determine (a) effectiveness in actually reducing losses in flood conditions and (b) cost-effectiveness.

Measures of Effectiveness.

"Effectiveness" can be measured by several yardsticks. Some measures applied to date include:

(1) Has a landowner agreed to apply a particular hazard mitigation technique consistent with certain standards and criteria? At the community, state or local level, has a unit of government adopted a program regulating land use, insuring property, or otherwise designed to reduce flood losses? During the early states of the NFIP communities were allowed to enter the emergency program based upon a statement of community intent and the adoption of regulations (in resolution or ordinance form). In a sense, this was an initial determination of "effectiveness" and compliance. Intent to adopt or even adoption of an effort or program itself does not, of course, guarantee that flood losses will be reduced.

(2) Has the landowner or unit of government actually applied the technique or implemented the program so that the flood hazard mitigation measures are designed, constructed, and maintained consistent with agreed-upon standards? Implementation of required regulations is important in determining community and landowner compliance with state and federal regulations and guidelines for the purposes of enforcement actions, payment of insurance claims, and initiation of subrogation suits. Consideration of on-the-ground implementation of particular standards is an important additional step in evaluating effectiveness but it will not insure reduction in losses unless the techniques are technically sound. For example, community adoption and enforcement of floodplain regulations allowing buildings on unreinforced pilings in an alluvial fan may comply with federal criteria but may not appreciably reduce flood losses from debris-laden flows moving at 15 to 30 feet per second.

(3) Has the landowner or unit of government adopted and implemented a mitigation approach that will actually achieve certain flood loss reduction levels? Actual

effectiveness in flood loss reduction is, of course, difficult to determine until actual flooding occurs. Efforts to assess reduction in losses are also complicated by difficulties in projecting what might have occurred in the absence of the technique or program.

(4) Is the adopted mitigation technique cost effective from a narrow flood loss reduction perspective or broader landowner, community or state cost/benefit perspective? Effectiveness in flood loss reduction does not in itself indicate cost effectiveness in a broader sense. Broader cost effectiveness considers the full range of benefits of the technique (e.g., pollution control) and costs (e.g., foregone opportunities costs) and relative cost effectiveness in comparison with other techniques.

Some efforts, discussed in the materials what follow, have been made to assess effectiveness both narrowly and broadly.

Impediments to Evaluation

Academic research and agency studies to date have rarely addressed the question: "How are techniques actually working in loss reduction?" This seems a bit curious since hundreds of geographical, sociological, psychological and political science oriented projects have been funded to examine other aspects of hazard response and preparedness. Such studies have led to improved understanding of landowner attitudes, community and individual response in times of disaster, and the working of government. But little empirical data have been generated about the actual long-term performance of various flood hazard mitigation techniques in reducing losses. Why?

Gathering of such data can be time-consuming and expensive since field studies are needed. It is difficult to predict when and where floods will occur, complicating the formulation and conduct of research projects. Traditionally, the National Science Foundation and other funding organizations have not emphasized "applied research" in their programs (although some certainly has been funded). Applied research has been primarily considered to be the task of the various regulatory and management agencies. Applied research that critically examines the agencies' own programs is rarely undertaken. In part, the problem is that regulatory and management agencies are often understaffed and underfunded. Equally important, agencies have a vested interest in the results of research. Will an agency faced with budget review and political pressures critically examine or publicly acknowledge that a dam, levee, structural floodproofing measure or flood warning system designed by the agency will not or is not functioning as represented? Sometimes agencies have discouraged critical evaluations or have disputed results that have been generated by others.

New Opportunities and Approaches for Determining Effectivenes

Fifteen years ago, only 400 communities had adopted floodplain regulations, and most of those were located in the Tennessee Valley. There was little quantified flood hazard mapping (e.g., the 100-year flood). Between 1970-1974 over 16,000 communities adopted floodplain regulations. Quantified flood data, including the 100-year flood elevation, were developed for over 8,000 communities.

As a result of this progress, at least 5,000-6,000 communities now have at least ten years of experience (1974-1984) with various nonstructural approaches that are consistent with overall state and federal standards. Floods are occurring each year in some of these communities. As they occur, they provide opportunities to determine the effectiveness of a variety of techniques. The potential for such analysis is enhanced by the gathering and computerization of certain types of data:

(1) Flood insurance policy data;

(2) Flood insurance claim data;

(3) Disaster assistance claim data; and

(4) Community annual and biannual report data.

In addition, information is potentially available from federal post disaster teams that have been sent into the field after federally declared flood disasters since 1979 to determine federal mitigation potential. Reports are filed by each team. States and communities are also undertaking post disaster mitigation surveys pursuant to Section 406 of the Disaster Relief Act of 1974 in order to qualify for disaster assistance.

These factors and existing data bases offer the potential for much improved determination of the effectiveness of community programs and individual floodplain management techniques.

PART II: EVALUATING THE EFFECTIVENESS OF NONSTRUCTURAL FLOODPLAIN MANAGEMENT TECHNIQUES IN REDUCING FLOOD LOSSES -- AN ISSUE PAPER

This issue paper is designed to stimulate discussion at the Monitoring and Effectiveness Seminar April 30 and May 1, 1984. Because of this, the issues presented herein are left unresolved and the ongoing efforts subject to discussion at the seminar have been described only briefly.

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Questions for Discussion at Seminar

- What has been concluded about the cost effectiveness of particular types of floodplain management techniques? What factors influence costs and benefits in a particular circumstance? What approaches appear most attractive from a cost/benefit perspective? How do the results of one study compare with those of another?

- How was the cost effectiveness determined (i.e., method)? What problems (if any) were encountered in determining cost effectiveness? What approaches are applicable in other situations?

- Given limited dollars, how could TVA, the Federal Emergency Management Agency (FEMA), or other agencies set up a system for monitoring the cost effectiveness of floodproofing systems?

The Need for Effectiveness Evaluation

Damages from riverine and coastal flooding can be reduced by flood control structures, floodplain management and zoning, building codes and flood proofing, stormwater management, coastal zone management, flood forecasting, evacuation and relocation. In addition, the costs of risk bearing of flood losses can be reduced or shifted by flood hazard insurance and post-disaster relief policies. . .

What is needed, however, is a series of benefit cost studies to justify the measures. . .

There is an immediate need to make an economic evaluation of the National Flood Insurance Program (NFIP). . . Evidence on the benefits and costs of [floodplain land use control] policies has not been developed. . . The economic methodology exists but the benefits and costs of flood forecasting and flood warning systems are not known. . . How else can we determine whether the costs of mitigation are worth incurring? (Milliman, 1983, pp 100-102)

Both the legislative and executive branches of government should be aware of the need for considering solutions other than the traditional ones for reducing flood damage. . . . One of the first requirements is to assure the study of alternatives to structural measures during the process of flood control or flood prevention surveys. . .

Survey reports should present, along with other information, the results of studies of --

(a) The effect on floodplain use of alternative measures such as regulation, improved forecasting, flood proofing, and public acquisition;

(b) Nearby areas suitable for development as an alternative to floodplain development;

(c) Alternative structural measures for protection against flooding; and

(d) Combinations of measures and degrees of protection which maximize the net benefits. (Task Force on Federal Flood Control Policy, 1966, p. 40)

> Achievement of the goals of floodplain management requires analysis of all alternative plans prior to selecting a course of action . . . There is a need to apply accepted techniques of analysis and evaluation consistently, regardless of the applicable legislation or level of jurisdiction involved. . . . These techniques should provide comparability for investment decisions and a full display of all alternative strategies and tools within the conceptual framework of floodplain management. (U.S. Water Resources Council, 1979, p. VII-13)

Efforts to Evaluate Effectiveness

Flood Warning Systems

The National Weather Service has in effect a flood watch and flood warning system for all coastal and inland waters. Modern technology has greatly enhanced the capability of issuing timely and accurate warnings that can save lives and reduce damages. This is particularly true for localities--especially those prone to flash floods--that have developed specific, supplemental warning systems. Already over 800 minicomputer warning systems are in use in the United States. The effectiveness of such systems depends, in large part, on proper responses by emergency operations personnel and the public in disseminating the warning, evacuating, and moving or securing property.

An evaluation of the effectiveness of a flood warning system can be made by balancing the costs of establishing and maintaining the system against the benefits derived thereby. Costs are fairly easy to pinpoint. The table on the next page shows the range of equipment, procedures and accompanying expenses for five warning systems.

EXAMPLES OF FLOOD WARNING SYSTEMS

Location	Technique for Prediction	Equipment	Original Cost to Local Governments	Annual Cost to Local Governments	Approximate Warning Time Provided	Accuracy of Predictions	Date System Installed
Wise County, Virginia	Use rainfall to predict flood levels. Use river gages to confirm predictions.	15 rain gages and 8 river gages read by volunteers.	$1,000	$100	4 hr.	"within inches"	1971
Swatara Creek, Pennsylvania	Use rainfall to predict flood level at one upstream point. Use crest-stage relationship to predict flood levels for lower points.	6 rain gages read by volunteers and 10 river gages (for system calibration).	—0—	—0—	from 2-3 hrs. at upper end to 10-15 hrs. at lower end of Creek	2 feet	1976
Howard County, Maryland	Use flash flood alarms to alert system. Use crest-stage relationships to predict flood levels. Use precipitation information to determine if water levels will continue to rise.	4 flash flood alarms, 20 river gages, and 9 precipitation gages.	$6,000[2]	$5,224[2]	6-8 hr. for Ellicott City	½ foot	1975
New Braunfels, Texas	Use rainfall to predict flood levels.	10 rain gages.	$100	$250	½ hr.	2 feet	1972
Santa Ynez Watershed, California	Use computerized rainfall-runoff model plus information on reservoir releases to predict flows.	10 automatic rain gages, 3 reservoir level gages, 10 gages on reservoir gates, 1 river gage, and 2 computers.	Approximately $35,000	$1,000	8-12 hrs.	"excellent"	1969

[1]As reported by operators of the warning system. Accuracy customarily improves with experience in system operation. Degrees of accuracy implied are not to be expected in newly established systems.

[2]Costs for purchase of 2 flash flood alarms and operation of 4 flash flood alarms. Remaining two flash flood alarms were donated by NWS.

(National Weather Service, 1980)

The benefits of a system are harder to specify. Owen and Wendell (1981) have classified potential benefits into three categories:

1. Safety, e.g., opportunity to evacuate and assist others to do so and to deploy emergency personnel, time to institute traffic controls and to institute emergency measures to avoid fire and explosion;

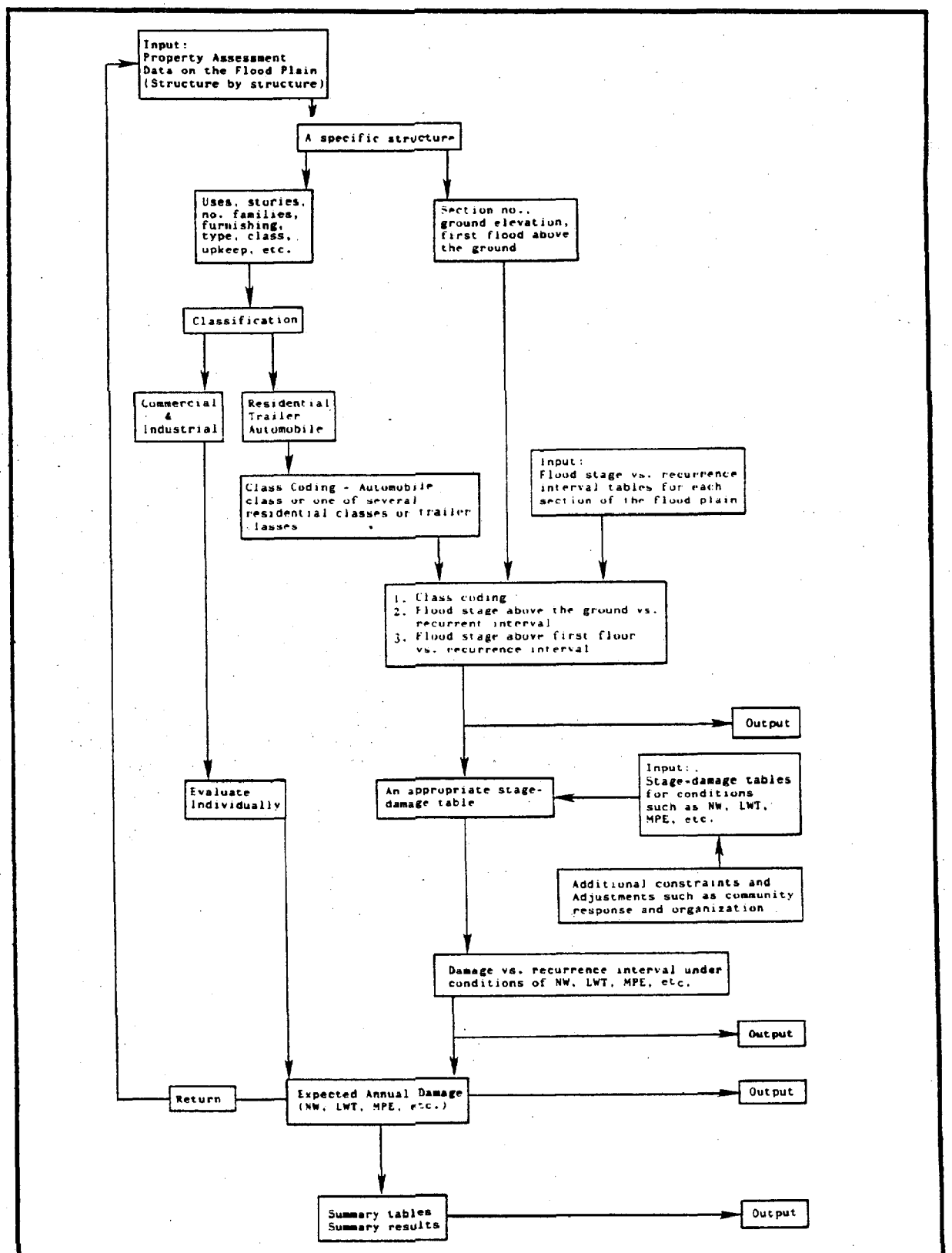
2. Reduction of property damage, e.g., movement of autos, furniture, livestock, etc., protection of fixed equipment by disconnection or wrapping, and protection of structures by sandbagging or intentional flooding of basements; and

3. Reduction of other losses, e.g., faster return to normal business operations, elimination of precautions found later to be unnecessary, reduced relief costs, and reduced risk of liability for injury or death to patrons, students, patients or employees.

Not all of these benefits can be quantified, but the result of estimating the dollar value of some of them and weighing that against the costs can yield an approximation of the effectiveness or worth of the system. Local officials were asked to do just that in one study of flood warning systems (Owen and Wendell, 1981). In New Braunfels, Texas, they estimated that moving city equipment after receipt of a warning would reduce damages by about $1 million, almost half of the public losses in a previous flood. Overall, advance warning is expected to enable a 25% reduction in total damages (1981, p. A-16). Damages at Vandenburg Air Force Base in California due to a January 1969 flood were about $3 million. Officials estimate that early warnings will cut future losses from a flood of that magnitude by one-half (1981, p. A-27).

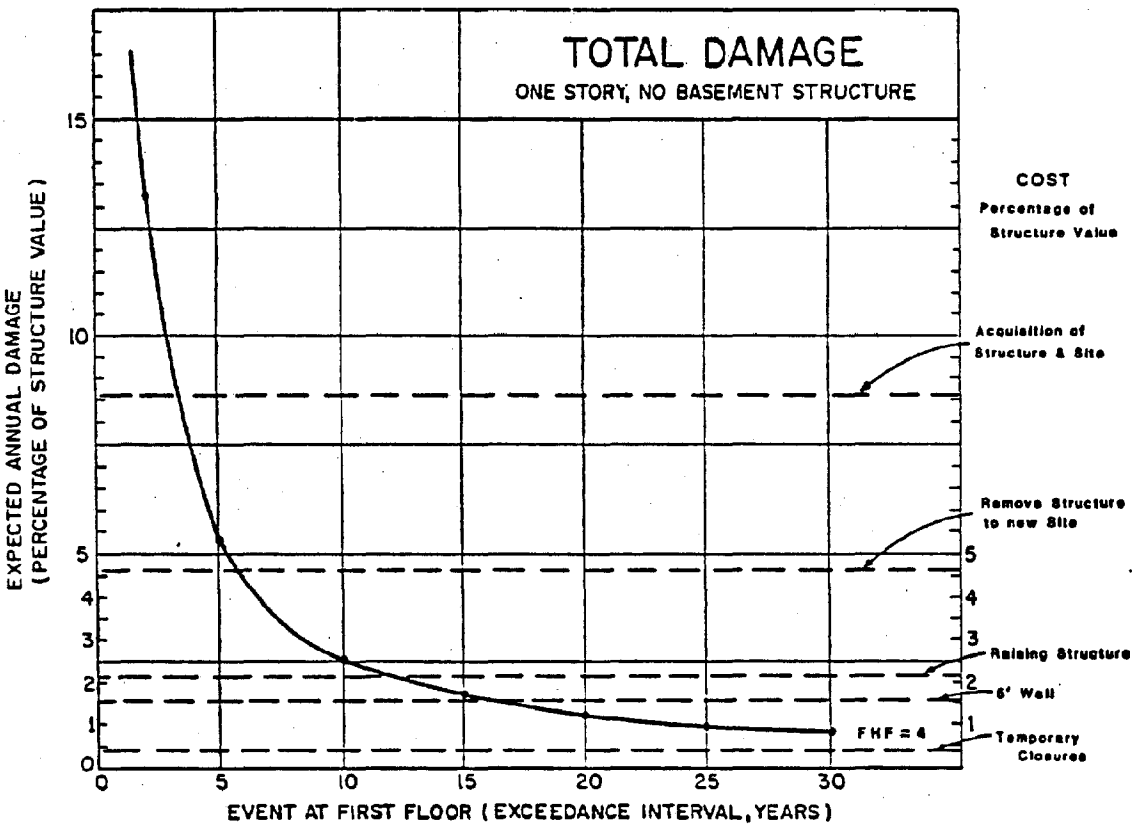
In Wise County, Virginia, 350 automobiles were saved by moving them to higher ground after a flood warning, and at least $25,000 were saved over one weekend by not overreacting to a potential flooding situation (1981, p. A-34). A 10-hour advance warning in Coeburn, Virginia, resulted in millions of dollars of savings, according to local officials, when fire and communication equipment, vehicles, graders and backhoes were moved, and the water and sewer system pumps were shut down for their protection (1981, p. A-35). Similiar actions by city officials in Appalachia, Virginia, saved $200,000 to $300,000 (1981, p. A-36).

In the case of real property, there is an accepted procedure for evaluating the benefits from reductions in flood losses. The same procedure is applicable to an evaluation of damages that have been avoided or reduced due to receipt of a warning, except that the concept of a specific level of protection is replaced as a variable by the lead time of the warnings and the degree of the response to them. The procedure, outlined by Day and Lee (1976) and applied to warnings by Owen and Wendell (1981), consists of constructing stage-damage curves for different categories of property and summing the damages prevented with various lead times and responses (see diagram on next page).



COMPUTATION PROCEDURES

(Owen and Wendell, 1981)



(Johnson and Davis, 1982)

The Susquehanna River Basin Commission reports that $3.5 million in losses have been avoided in the Swartara Creek Basin since a flood warning system was established there in 1976 (Bresenhan, no date). The State of Arizona uses satellite telemetry for flood forecasting. About $1 million was spent to install the system and state officials believe the system pays for itself whenever 50 mobile homes or 200 automobiles are moved out of the path of a flood (Bond, no date).

Elevating and Floodproofing Existing Structures

Raising residential or small commercial structures on fill or on open works such as walls, columns or piers is a common nonstructural technique for reducing losses both in coastal and riverine flood hazard areas. There are a number of options available for both "dry floodproofing" -- keeping floodwaters out of a structure -- and "wet floodproofing" -- intentionally allowing water to enter the basement or first floor to counteract the pressure of floodwaters on the exterior.

The costs of floodproofing or elevating an existing structure vary widely, and the cost effectiveness can vary even more, since it depends on the additional variables of the flood event. A number of different approaches have been taken to attempt to measure the costs and/or benefits of floodproofing and elevating buildings.

The results of one analysis by the Corps of Engineers are illustrated in the figure on the next page. The cost of elevation and other non-structural measures is shown as a percentage of the value of the structure. According to these data, elevating a structure is economical only if it is subject to high damages, in this case about the 15-year flood at the first floor (U.S. Army Corps of Engineers, 1978). This general conclusion was supported by the results of a study of the feasibility of floodproofing residences in Logan, Ohio. There it was determined that the stage-frequency relationship has a profound impact on the economic feasibility of raising a structure. The pertinent aspect of the stage-frequency relationship is the so-called flood hazard factor or FHF -- the difference in elevations between the 100-year and 10-year floods, expressed in tenths of a foot. In this analysis the benefit/cost ration improved as the FHF declined, suggesting that elevation is economically feasible when the FHF for the structure is low (McCoy, 1976).

Another study performed cost estimates for five non-structural measures for four sites in the Baltimore area. The figure shows a sample of the costs estimated for elevating a one-story house with a stone foundation to each of four heights. The table on the page following that illustrates how the costs of the various techniques can be compared to each other. No final conclusion was made with regard to the general advisability of pursuing one course over another, since each situation must be evaluated individually (U.S. Army Corps of Engineers, 1977).

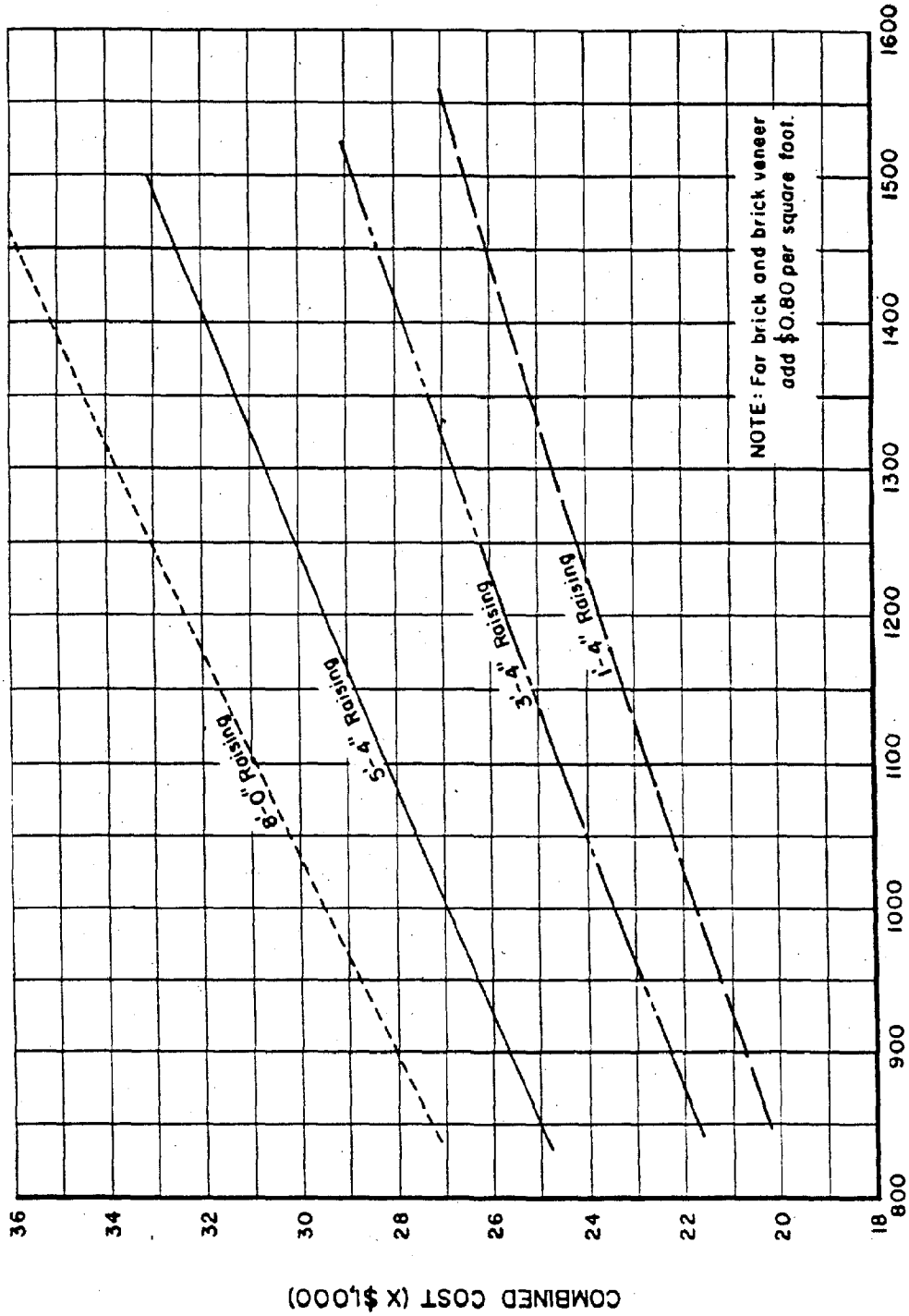


FIGURE III-O COMBINATION-ONE STORY W/STONE FOUNDATION

(U.S. Army Corps of Engineers, 1977)

Another Corps study compared the costs of elevating structures (a function of depth of expected flooding, height to which elevated, and size of structure) to the market value of the structure. Empirical data were derived from the Corps' Tug Fork Study. The resulting guidelines for the cost of raising a structure are described in this table (Carson, 1975).

Ratio of Floodproofing Costs to Value of Residential Structure

Condition	Floodproofing Height 2 feet	4 feet	6 feet
Sound	0.17	0.23	0.31
Deteriorating	0.65	0.75	0.90
Dilapidated	4.50	4.90	5.30

A homeowner's guide for floodproofing residential structures in DeKalb, Georgia, provides rough estimates of the cost of making certain modifications to a house and also of the savings to the owner in flood damages avoided. These figures are summarized in the following tables.

Wrapping house with polyethylene; sealing exterior walls. COST: $1,300 to $10,000

SAVINGS

House Value	Depth of Flood on First Floor 1/2' to 2'	3' to 5'
$30,000	$1,100 to 5,000	n/a
$50,000	$1,800 to 8,200	n/a

Moving utilities, elevating structure; landscaping.

COST: to raise 3 ft: $7,800 to 14,300
to raise 5 ft: $10,000 to 16,500

SAVINGS

House Value	Height of Raising	Depth of Flood on First Floor (before raising) 1/2' to 2'	3' to 5'
$30,000	3'	$1,100 to 5,000	$ 2,900 to 13,000
30,000	5'	$1,100 to 5,000	$ 4,000 to 18,000
50,000	3'	$1,800 to 8,200	$22,000 to 26,400
50,000	5'	$1,800 to 8,200	$23,800 to 34,600

(U.S. Army Corps of Engineers, 1979)

Sample Cost Comparison
One Story Frame - Brick Veneer W/Block Foundation
318 Essex Road, Baltimore, MD

Acquisition and Demolition			
Purchase Value of Land (from worksheet) (20,000 sq.ft.)		$ 8,000	
Purchase Value of House (from worksheet)		31,000	
Acquisition Expense		3,000	
Demolition and Site Reclamation (from Table III-6)		1,100	
Resettlement		8,500	
Total Acquisition and Demolition			$51,600
Relocation			
Relocation Cost (from graph)		$17,600	
Adjustment for Brick or Brick Veneer $0.80 x 1,200 (sq. ft. area) =		960	
Land Value at Existing Site	$ 8,000		
Land Value at Relocation Site	12,000		
Larger of the Land Values		12,000	
Value of Site Improvements		2,000	
Overhead Traffic Signals No. 3 x $250/disconnect =		750	
Overhead electric lines No. - x $1,500/disconnect =		-	
Tree Removal No. 1 x $400/removal =		400	
Septic Tank and Well System (if required)		-	
Supplemental Housing		-	
Total for Relocation			$33,710
House Raising - 5'-4"			
Cost of Raising (from graph)		$15,800	
Adjustment for Brick or Brick Veneer $0.80 x 1,200 (sq. ft. area) =		960	
Supplemental Housing		400	
Total Cost of House Raising			$17,160
Combination House Raising and Utility Relocation			
Cost of Combination (from graph)		$20,200	
Adjustment for Brick or Brick Veneer $0.80 x 1,200 (sq. ft. area) =		960	
Supplemental Housing		400	
Total For Combination			$21,560

(U.S. Army Corps of Engineers, 1977)

A few other general observations about the cost-effectiveness of flood proofing are worth noting.

> Economic feasibility increases with structure value and frequency of flood with most measures feasible for a $30,000 structure only if located within the 25 year floodplain and, in many cases, within the ten year floodplain. (U.S. Army Corps of Engineers, 1976)

> Floodproofing costs vary from 1-100 percent of the cost of existing structures. (White, 1975)

> In a sample of residences in Boulder Creek Flood Plain in Boulder, Colorado, only 33 percent of the residences exhibited positive net benefits from floodproofing. In a parallel study, the Corps of Engineers could identify only 24 homes out of 700 for which floodproofing was economically justified. (Flack, 1976)

Retrofitting industrial facilities can result in dramatic savings. A feasibility study of a manufacturing plant in New England projected the cost of a flood wall, water-tight doors, pumping system and related floodproofing measures to be about $200,000. Flood insurance on the existing building was about $380,000 annually, and would have been only $10,000 after the adoption of the loss reduction measures, for an annual savings of about $370,000 (Degen, 1979).

In another case, several industries in Lock Haven, Pennsylvania, were analyzed to determine the feasibility of making modifications to buildings to make them flood resistant and of constructing a levee to divert the flood waters. The projected costs are expressed in the table on the next page as a proportion of the damage experienced by the plant during the Agnes flooding in 1972 (Ulp, 1979).

Elevating and Floodproofing New Structures

Most of the principals applied to elevating and floodproofing already existing structures can be applied to buildings being contemplated for construction. Certain measures can be highly effective when incorporated into the building design, and often cost less than when added later.

A case study of different methods of floodproofing a new, small commercial building in Jersey Shore, Pennsylvania, demonstrated that so constructing the building in compliance with NFIP guidelines is "not unduly costly" and is "economically feasible." The three approaches examined (elevation on fill, partial elevation and equipping the building with watertight closures, and raising on columns) increased the cost of construction from 6 to 16 percent. Coupled with the accompanying reduction in flood insurance premiums and the reduction of expected flood losses, all three options resulting in a savings (Sheaffer and Roland, Inc., 1977). The benefit/cost ratios are summarized in the table on the second following page.

INDUSTRIAL FLOOD PROOFING STUDY EXAMPLES, LOCK HAVEN, PENNSYLVANIA

PLAN DESCRIPTION	AREA PROTECTED (ACRES)	NUMBER OF BUILDINGS PROTECTED	BUILDING AREA (SQ. FT.)	DAMAGE 1972 FLOOD LEVEL	FLOOD PROOFING COST	COST PER ACRE	COST PER S.F. BUILDING AREA	COST PER DOLLAR OF 1972 FLOOD LEVEL DAMAGE ELIMINATED
PIPER AIRCRAFT CORPORATION								
PLAN 1 - BUILDING MODIFICATION	11.25	1	490,000	N/A	$ 172,250	$15,310	0.35	N/A
PLAN 2 - RING LEVEE	33.00	5	600,000	$ 9,000,000 to 27,905,000	1,950,000	59,090	3.25	$.070 to 0.21
HAMMERMILL PAPER COMPANY								
PLAN 1 - BUILDING MODIFICATION	14.41	22	627,500	4,868,000	190,000	13,185	0.30	.039
PLAN 2 - RING LEVEE	138.00	22	627,500	4,868,000	850,000	6,160	1.35	.175
AMERICAN COLOR AND CHEMICAL CORPORATION								
PLAN 1 - RING LEVEE IMPROVEMENTS	20.00	50	310,500	865,000	29,925	1,500	0.10	.035

SOURCE: Erdman, Anthony, Associates, Inc.

N/A - Not applicable.

Benefit/Cost Ratios of Alternative Flood Proofing Solutions for a Small Commercial Building[a]

	ALTERNATIVE FLOOD PROOFING DESIGNS			
	Wet Flood Proofing[b]	Raised On Fill[c]	Partially Raised On Fill With Watertight Closures[d]	Raised On Columns[e]
Cost of Flood Proofing per Square Foot	$2.09	$1.60	$3.97	$3.91
Benefit/Cost Ratios[f]				
1. Reduction in Annual Insurance Premiums ÷ Cost of Flood Proofing	0	5.96	2.31	2.48
2. Reduction in Average Flood Losses ÷ Cost of Flood Proofing	0.25	3.46	1.39	1.53

[a]Based on a multi-store commercial building of 22,500 sq.ft. proposed in Jersey Shore, PA

[b]Allows entry of flood waters to equalize hydrostatic pressure on both sides of structural walls; does not meet minimum National Flood Insurance Program regulations and can not receive a reduction in flood insurance rates.

[c]Raised on fill 7 ft. to one foot above the 100-year flood

[d]Raised on fill 4 ft., equipped with 3 ft. of watertight enclosures

[e]Raised on columns 12 ft. (6 ft. above 100-year flood) to accomodate parking

[f]Compared to the basic building without flood proofing

Source: Sheaffer & Roland, Inc., Economic Feasibility of Flood Proofing: An Analysis of a Small Commercial Building; prepared for the Office of Policy Development and Research, Department of Housing and Urban Development (1977).

Elevating a new house to the wave crest level associated with the 100-year flood increases the construction costs from 3.6% to 7.5%, but this was more than offset by the reduction in insurance premiums and in damages anticipated. This was the conclusion of a study of several different types of construction and elevation procedures for residences in coastal areas (FEMA, 1980). A sample of the figures upon which the conclusions were based can be found on the following page. Another analysis of the costs of new, elevated construction also reveals such action to result in savings (FIA, 1977). Those calculations are illustrated in the diagram on the second following page.

The costs and benefits of "wet" floodproofing new structures are not so well defined. The Sheaffer and Roland study cited above (1977) found wet floodproofing to be uneconomical in the construction of a new commercial building. In a review of the wet floodproofing literature, however, Sheaffer and Roland (1979) note other contentions that incorporating wet floodproofing into new construction adds "little or nothing to the initial construction cost (Johnson, 1978, p.6; Jones, 1977, p. 5). That review also notes only one attempt to quantify the impacts of wet floodproofing on damages: Jones (1977a) estimated that a combination of approaches could reduce single-event damages up to 80% for shallow flooding and up to 55% for deeper water (see Sheaffer and Roland, 1979, pp. 35-39).

Acquisition and Relocation

After a severe disaster or repeated flooding, property can be purchased or otherwise acquired by the local, state or federal government, usually to be left in open space, used for flood storage or put to some other use compatible with the flood hazard. The damaged structure is sometimes demolished, and sometimes moved to a new, flood-free location. Even though acquisition and/or relocation are relatively expensive, both techniques have enjoyed rather widespread use, largely because they are attractive as permanent solutions.

A cost-benefit analysis conducted as part of a case study of the potential acquisition of flood damaged property in Panama City Beach, Florida, illustrates some of the problems inherent in determining the cost-effectiveness of this non-structural measure (Abeles, Schwartz and Associates and Ralph M. Field Associates, Inc., 1978). Because acquisition is a permanent solution, future annual costs must be taken into account. In this case, values are converted to present values using an annual discount rate of $6^{5}/_{8}$% over 50 years. In addition, the costs and benefits vary depending on whether one takes the position of the property owner, the local community or the federal government. In this analysis a benefit/cost ratio was calculated for each level separately, demonstrating that the proposed relocation is economically justified from the individual and local perspective, but not from the national or federal ones. See the table on the third following page.

Benefits Derived From Reduced Average Annual Damages At Gulf Shores, Alabama For Semi-Rigid Frame System (Griffith Assumptions)

	With Grade Beam					Without Grade Beam		
	Scour Zone	Nonscour Zone				Nonscour Zone		
Wave Crest Elevation:	18'	17'	16'	15'	14'	16'	15'	14'
Storm Surge Elevation:	11'	11'	11'	11'	11'	11'	11'	11'
Difference (Feet Below Wave Crest Elevation):	-7'	-6'	-5'	-4'	-3'	-5'	-4'	-3'
Cost of Added Elevation	$13,711	$13,206	$ 9,789	$ 9,350	$ 8,947	$ 8,719	$ 7,886	$ 7,031
Present Value of Reduced Average Annual Damages:	$36,597	$25,640	$17,250	$11,123	$ 6,734	$17,250	$11,123	$ 6,734
Benefit:Cost Ratio:	2.7	1.9	1.8	1.2	0.8	2.0	1.4	0.9
Payback Period (in years)[a]	10.0	13.3	14.3	22.2		13.3	18.2	

[a]Assuming a 20-year mortgage period at 7 percent interest per year with a present value factor of 10.594. New B:C ratios were calculated; there were than used to calculate the payback period: Payback in years = 20-year life ÷ B:C ratio.

(FEMA, 1980)

These tables show that for this home it would be less expensive to elevate to or above the base flood level than to build below it and suffer loss.

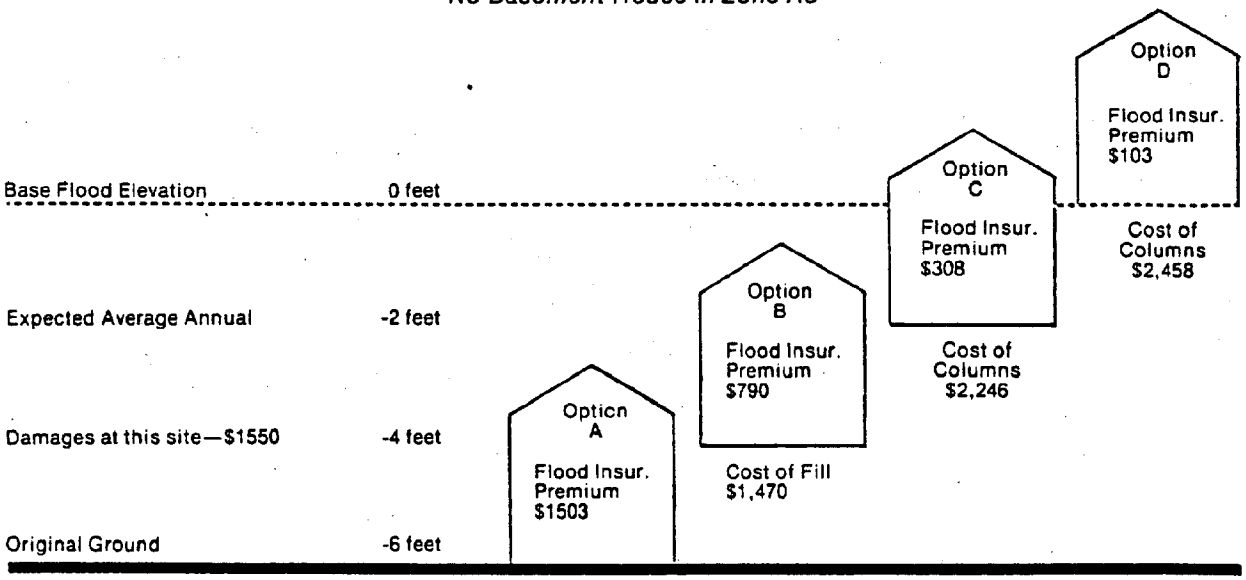
TABLE

Average Annual Damage

Floor Elevation Above Grade	Probable Average Annual Damage
0 Ft.	$1550
+2	625
+4	160
+6	50

TABLE

Economics of Elevation for a $25,000, One-Story, No Basement House in Zone A8



ANNUAL COSTS	A	B	C	D
Annual Flood Insurance Premium	$1503	$ 790	$ 308	$ 103
Additional Annual Cost of Elevation (30 yrs at 9%)		156	240	261
Total	$1503	$ 946	$ 548	$ 364
Average Annual Damages Expected	1550	1550	1550	1550
Net Annual Savings by Purchasing Insurance and	$ 47	$ 604	$1002	$1186

(FIA, 1977)

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BENEFITS AND COSTS OF ACQUIRING ALL 23 ELIGIBLE
RESIDENTIAL AND COMMERCIAL PROPERTIES
PANAMA CITY BEACH, FLORIDA
ANALYSIS OPTION I

Benefit/ Cost Accounts ($1,000's)

	National		Federal		Individual		Local Community	
	A	PV	A	PV	A	PV	A	PV
Total Benefits	131	2038	25	383	17	269	89	1386
Flood Damage Reduction	42	649	25	383	17	269	-	-
Recreation	89	1386	-	-	-	-	89	1386
Total Costs	147	2445	125	1922	3	42	31	481
Acquisition	144	2403	144	2403	-	-	-	-
Moving Expenses	3	42	-	-	3	42	-	-
Cost Sharing	-	-	(31)	(481)	-	-	31	481
B/C Ratio	0.83		0.20		6.40		2.88	
Net Cost	16	407	100	1539	(14)	(227)	(58)	(905)

A = Annual; PV = Present Value

Source: Abeles Schwartz & Associates/ Ralph M. Field Associates

In a study of the technical aspects of nonstructural alternatives, the Corps of Engineers (1975) concluded that economic feasibility for a relocation project might be demonstrated at the 10 to 15-year level of protection. Economic feasibility problems arise because of the high costs of purchasing damaged units -- expenses which become project costs. These fair market values, "when annualized over the life of a flood damage reduction project will usually be greater than the average annual reduction in flood damages" (U.S. Army Corps of Engineers, 1979). As the table on the following page shows, the break-even point usually occurs near the 15-year elevation. It is easier to justify relocating more expensive structures.

One well-known example of a successful relocation project took place at Soldiers Grove, Wisconsin. That case has been used to illustrate how a cost-comparison framework can be set up to analyze two different options -- relocating the town or constructing a levee for protection. The table shows a summary of the analysis, which supported the conclusion that relocation is cost-effective over the long term (David and Mayer, no date).

Baltimore County, Maryland, chose acquisition of properties on eight of its most hazardous floodplains rather than continue to pay for repairs and disaster assistance. The 6-year plan called for purchasing 246 homes and constructing four retention ponds, at an annual cost of $4.5 million, about the same amount the County had been spending annually on spot corrections and repairs. By the time the new strategy is fully implemented, however, the troublesome floodplains will have been cleared, virtually eliminating future damages and relief costs (Seyffert, 1977).

A study recently prepared for the Council on Environmental Quality revealed that 280,000 acres of barrier island land had been developed by 1980, and that development of these flood-prone areas is proceeding at the rate of 6,000 acres per year. At an average purchase price of $5,000 per acre, the report concludes, "estimates indicate that acquisition costs could be one-fifth or less of the costs to the federal government of continuing its current development programs on undeveloped barrier islands" (Sheaffer and Roland, 1981).

Problems With Evaluating Individual Techniques

As is evident from the preceding review, there have been numerous attempts to assess in some fashion the effectiveness of nonstructural floodplain management techniques in reducing flood losses. Not all of these attempts have produced satisfactory results, and it is still difficult, if not impossible, to say whether and to what extent a particular technique will minimize losses and prove cost-effective. The principal problems confounding the evaluation of nonstructural techniques are delineated below.

Variable Situations

The biggest and most pervasive problem is that the settings in which flood loss reduction techniques are needed vary so widely. Each waterway has its own hydrologic characteristics, each floodplain its own morphology,

Results of hypothetical 1-acre evacuation project using ER 1105-2-353 (1)

Level of protection(4)	Evacuation without relocation to a new site(2)				Evacuation with relocation to new sites(3)			
	$15,000 structures		$50,000 structures		$15,000 structures		$50,000 structures	
	Benefit-cost ratio	Average annual net benefits	Benefit-cost ratio	Average annual net benefits	Benefit-cost ratio	Average annual net benefits	Benefit-cost ratio	Average annual net benefits
10-year	0.77	-$1,400	1.08	+$1,100	0.95	-$700	1.3	+$7,100
20-year	0.40	-3,700	0.59	-5,100	0.80	-3,000	1.04	+900
50-year	0.15	-5,300	0.23	-9,500	0.69	-4,600	0.85	-3,500
100-year	0.05	-5,900	0.08	-11,400	0.65	-5,200	0.77	-5,400

(1) Benefits for reuse of the floodplain and the other unique categories are additives for specific projects.
(2) Structures demolished.
(3) Structures resold after relocation.
(4) Ground elevation surrounding structures.

(U.S. Army Corps of Engineers 1979)

Benefit/Cost Analysis of Protection from 100 Year Flood*
URS ($ 1975)

	Acreage Flooded: Amount Currently Flooded	Acreage Flooded: % of Total Development Acres	Protection Provided: Number of Structures: Commercial	Residential	Municipal	Non-Profit	Flood Protection Benefit: 3-1/8%	6-1/8%	Costs for Comparable Structures: Initial	Recurring	Equivalent Annual: 3-1/8%	6-1/8%	B/C Ratio: 3-1/8%	6-1/8%
1 Levee Federal Payments Local Costs Park Acquisition**	33A	50%	48	35	4	1	$112,300	$106,700	$3,592,000 3,283,000 309,000 [386,250]	$10,800	$128,600	$231,400	.87	.46
2 Evacuation & Relocation** Federal Payments Local Costs (by Definition not to exceed 20% of federal and to be "comparable" to levee alternative (p. VII-43)).	33A	50%	48	35	4	1	119,000	113,100	3,073,000 2,764,000 309,000	-0-	100,700	188,700	1.18	.60

	Appraisal Legal Costs	Moving Costs	Acquisition of New Site	Development Cost of Site	Restoration of Floodplain into Park	Total Associated Costs	Fair Market Value: Total Replacement	Less Rehabilitation Costs	Average Cost Per Structure	Number of Structures	Total Associated Costs	Implied Fair Market Value Estimate
3 Calculations												
Residential: per house	$100	$ 500 Relocation Assistance	$1,500	$6,000	$1,600	$ 9,700	$29,000	less $15,000 (maximum)	$9,700 + Fair Market Value	35	$339,500	+$1,930,400
Commercial per structure	100	6,000	1,500	6,000	1,600	15,200		-0-	$15,200 + Fair Market Value	48 =	$729,600	
Municipal & Non-Profit	100	2,500	1,500	6,000	1,600	11,700		-0-	$11,700 + Fair Market Value	5 =	$ 58,500	$3,073,000
Vacant Land 25% of total acreage is for roads; each lot is 1/4 acre.	0	0	0	0	0	0	-0-	-0-	-0- $1,500	NFS	$ 15,000	

4 Relocation: Total Costs

	Associated Costs: Appraisal	Moving	Acquisition of New Site	Cost of Development of New Site	Restoration for Park	Total Associated Costs	Fair Market	Total Costs
Residential Houses	$3,500	$ 17,500	$ 52,500	$210,000	$ 56,000	$ 339,500	?	?
Commercial, including apartments above stores	4,800	28,800	72,000	288,000	768,000	729,600	?	?
							?	?
Municipal and Non-Profit	500	12,500	7,500	3,000	8,000	58,500	$1,254,200	$3,073,000
	$8,800	$318,00	$132,000	$528,000 $660,000	$832,000	$1,818,800		

* Alternatives for Flood Reduction, U.S. Corporation, New York, October 1976, Volume B. pp. XI-5 to XI-15 and table following p. XI-84; also pp. VII-27ff.

** Park Acquisition is included in Evacuation Alternative and should have been added in to the levee costs have comparable "protection" situations.

(David and Mayer, no date)

each flood its own duration and intensity, and each locality its own social, economic and political attributes, all of which figure in the ultimate effectiveness of a particular mitigative approach. In addition, everything changes over time. Even if one technique is adjudged "effective," such a conclusion may not be applicable in another situation.

Estimating Counterfactual Components

In determining whether the use of a particular technique has been worthwhile, it is often necessary to estimate what would have happened had the measure not been adopted. For example, if a structure has been floodproofed, a chief way to measure whether or not the action was cost-effective involves estimating the difference between the damages incurred during a flood and the damages that would have been sustained in the absence of floodproofing. The same sort of challenge occurs in projecting future development trends in and out of a flood hazard area.

Measurement of Savings

Tied to the difficulty of estimating monetary losses and/or savings in alternative scenarios is the even more elusive problem of quantifying non-monetary goals. The preservation of natural resources, wildlife habitat and open space is a worthwhile, not uncommon goal, but one for which it is a genuine challenge to assign an economic value. Beyond this, there are not even generally agreed upon, specific objectives for nonstructural measures, nor are there standards by which to judge their effectiveness in reaching those goals.

Systematic Methods

A variety of approaches to evaluating nonstructural measures has been adopted. Sometimes cost/benefit analyses are done before beginning a project; sometimes costs are monitored while a project is progressing and savings are projected; sometimes an independent investigation evaluates one or several projects in retrospect. Different standards of measurement, different costs, and different assumptions make results hard to compare and harder to generalize.

Lab Research

Although a few agencies such as the Corps have performed admirably in this regard, there has still been insufficient testing of techniques under "laboratory" conditions. Certain types of retrofitting and wet floodproofing approaches in particular need more thorough investigation.

Post-flood Assessments

One of the prime opportunities for gathering information on types and extent of damage, flood heights, and performance of protection techniques is in the immediate aftermath of a flood. Yet there has been no systematic attempt to gather such data. Once buildings are cleared or repaired, victims recovered and emergency operations personnel returned to regular duty the accuracy and volume of the information obtainable diminishes rapidly.

Funding

Insufficient funds have been allocated by federal, state, local and private agencies for evaluating the projects in which they are involved.

Options for Improved Effectiveness Evaluation

There are numerous possibilities for improving the present status of effectiveness evaluations. A few are outlined here.

- Systematic post-flood surveys should be conducted to capture as much information as possible about types and extent of damage, location of structure and depth of flooding, and the specific protection technique used. These surveys might be carried out through a team approach, modeled on the interagency hazard mitigation teams. They should adopt a standard method, means of measurement, and reporting technique and use the same ones for every flood disaster.

- Insurance claims data maintained by the Federal Insurance Administration and the disaster assistance claims data maintained by the Federal Emergency Management Agency should be refined to provide information more useful to determining kinds of losses and degrees of damage. It would be helpful, for example, to be able to compare claims for damaged structures with data on the age of the building and its elevation with regard to the flood hazard.

- There should be more laboratory testing of individual techniques for their performance under different flooding conditions.

- A guide book of evaluation methods would help to standardize at least some components of the various approaches, and prevent some duplication of effort.

- There should be a set of standards for quantifying such non-economic benefits as natural values, habitat preservation and storage capacity.

- Funds for on-going evaluation could be allocated as a small part of the budget of any nonstructural project.

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PART III: MONITORING THE EFFECTIVENESS OF COMMUNITY FLOODPLAIN MANAGEMENT PROGRAMS -- AN ISSUE PAPER

This issue paper is intended to stimulate discussion at the Monitoring and Effectiveness Seminar April 30 and May 1, 1984. Because of this, the issues presented herein are left unresolved and the ongoing efforts subject to discussion at the seminar have been described only briefly.

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Questions for Discussion at Seminar

- Given limited budget and staff resources, what technique or combination of techniques can a federal or state agency use to monitor the effectiveness of community floodplain management?

  Are mail questionnaires of any value? Are telephone surveys reliable or useful? Are on-site surveys essential?

  Are there shortcuts in conducting community surveys (e.g., meeting with community influentials)?

  Are there good lead questions in conducting a survey or holding a meeting?

  Can aerial photography be used effectively? If so, how? Are there other shortcut techniques?

  Is it useful and feasible to compare subjective information (e.g., "we have a good program") with objective information (e.g., survey of elevations of a number of structures in the floodplain)?

- What follow-up is needed to a particular approach or set of conclusions (e.g., letters sent to mayors and councilmen where violations are discovered, legal action, etc.)?

- How should a state or federal agency select communities to be monitored (e.g., random sample, number of structures in floodplain, number of building permits, number of insurance policies, recent flooding)?

- Could or should on-site, telephone, mail survey, or other monitoring efforts address such broader issues and needs beyond education and enforcement of regulations as community mapping, technical assistance, and public education? If so, why, how, and at what cost?

The Need For Community Monitoring

. . . a new start is necessary to provide essential information to an effective program of floodplain management. . . . it is important to show how much the Nation as a whole is losing because of floods. . . the most important use of flood damage data in the future will be for planning the use of floodplain lands, establishing land-use regulations, and developing flood insurance programs. . . .

One obvious solution would be to have data on all floods as they occur collected by a designated agency. . . A second possibility would be to maintain a continuing record of damages for reaches of streams and coastal areas constituting a stratified sample of the Nation's rivers, hydrologic environment and land use. . . It would be possible to . . . make damage studies only as needed for project evaluation and preparation of flood hazard reports . . . A more satisfactory solution would be to make . . . periodic appraisal[s] [that] would yield results by which the magnitude of the Nation's flood problem and the effectiveness of its flood damage prevention programs could be adequately assessed. (Task Force on Federal Flood Control Policy, 1966, pp. 19-21)

Local adoption of land use and construction controls is but the start of the regulatory process in floodplain management. To assure that these regulatory measures and objectives are readily understood and accepted by government officials and the public and thereby effectively carried out, there should be a continual assessment of local capabilities and need for assistance. (U.S. Water Resources Council, 1979, p. VII-9)

. . . it is a disservice to the public for legislators to ignore the need for resources to do comparative evaluations of programs. . . For [the National Flood Insurance Program (NFIP)] there is no current and reliable data set with which to conduct a systematic analysis of the effects of the program in reducing the national flood hazard. (Hutton and Mileti, 1979, p. III-8)

After 15 years, relatively little is known overall about how well communities in the flood insurance program are enforcing floodplain management regulations. GAO found that FEMA's monitoring program was limited, the method of selecting communities to visit was inadequate, and the results of community visits were not evaluated. (GAO, 1982)

Over the past several decades, concern with continually rising national losses due to floods has ripened into a maturing framework for both mitigating and coping with such losses. That nationwide framework calls for the participation of federal, state and local governments as well as providing for the contribution of the private sector and the participation of individual citizens. Congress and the federal agencies have developed a federal floodplain management policy incorporating both structural and non-structural techniques, and applying a national minimum 100-year flood standard. The NFIP has expanded to about two million policies, and is coordinated with disaster assistance programs. The entire nation has been mapped for approximate flood hazard and over half of the flood-prone communities have been mapped in detail. The states have assumed a pivotal role, providing technical assistance on flood loss reduction to communities, enacting floodplain land use regulations, coastal zone management programs and resource conservation statutes. Over 17,000 communities are enrolled in the regular or emergency NFIP, and have passed floodplain land use regulations as appropriate. Regional, state and local efforts to increase public awareness, to make productive and economic use of flood-prone lands, and to involve private enterprise in the overall process have become more and more common.

In short, considerable progress has been made toward the establishment of a comprehensive, coordinated approach to managing the nation's floodplains. It is too soon to tell whether flood losses nationwide are thereby being reduced or at least stabilized. In the meantime, whether or not the various components of the system are functioning as envisioned is a crucial question. If there are problems or deficiencies these must be remedied, or adjustments made. If all is going smoothly, the concepts upon which the program is based are reinforced; resources can perhaps be reallocated to where they are most effective. To obtain this knowledge, various aspects of the system must be monitored and as much information collected as possible.

The crux of sound floodplain management is the local progam. Even though some guidelines, standards, incentives and financial support are generated at federal and state levels, local governments are in the best position to implement floodplain management. They are closest to the flood problem since it affects most seriously their residents, employment levels, and tax base. They have authority to regulate, acquire, zone and tax property, and are routinely involved in the day-to-day procedures of land use management and other community operations. Most aspects of the current national framework for flood loss reduction, if not actually designed to be carried out at the local level, have an impact right in the community. It makes sense, therefore, to examine what communities are and are not doing to reduce flood losses, which approaches are successful and which are not, and how states and federal agencies can best assist the process. States and federal agencies agree that monitoring is necessary and should be designed to determine (1) how well communities are meeting their NFIP obligations; (2) how well FIA's program elements are working; and (3) how to deliver programs to overcome any problems that are revealed.

This paper discusses monitoring community floodplain management programs and assessing the effectiveness of those programs. The first section traces the development of community monitoring, describing some

past efforts and their conclusions. It also psets forth the main issues surrounding the monitoring process and relates how often conflicting goals and viewpoints complicate the procedure. The second section is a statement of the specific problems that confront any monitoring program. In the third section, current monitoring efforts by federal agencies, researchers, and states are described. Finally, some tentative options to improve community monitoring and to overcome some of the problems are presented.

The State of the Art

Background

Because systematic floodplain management is a fairly recent development, attempts to assess its nature and/or effects at the community level were made only rarely up until a few years ago. One of the early projects was carried out by a group of researchers at the University of Chicago, who were attempting to determine why flood losses continued to increase after the enactment of the Flood Control Act of 1936.

Relying on air photos, field surveys, secondary data from the Weather Bureau, Corps of Engineers, and the Department of Agriculture and developing case studies, they analyzed changes in floodplain occupance in the 20-year period from 1936 to 1957 in 17 urban areas. The study concluded that decisions by public and private property owners had resulted in a substantial invasion of flood-prone lands and a clear expansion of potential flood hazard areas in those communities (White et al., 1958).

Case studies also have been conducted by various individuals and agencies detailing the specific flood problems of a particular community. Often this was done as a precursor to a proposal for a structural flood control measure upstream or in the vicinity of the town. The two agencies usually responsible for such structural flood control measures, the U.S. Army Corps of Engineers and the Tennessee Valley Authority (TVA), have the longest histories of working with and providing technical assistance to communities. Although both the TVA and the Corps have for the most part maintained good working relationships with the communities in their jurisdictions and have remained apprised of the flood problems faced there, neither agency has had a real need to engage in actually monitoring the community programs. This is due to the fact that structural flood control measures, once implemented, require little active community involvement, and because both agencies operate by providing technical expertise and advice to communities when requested to do so, rather than dictating to the communities what actions they should be taking to manage their floodplains.

With the advent of the NFIP, and the accompanying requirements for increased action at the local level, more attention has been given to communities by researchers and agencies alike. A variety of approaches has been experimented with in attempts to assess, monitor and evaluate both the activities and impacts of community programs. Different tools are required to measure different aspects of program activities, and this is well illustrated by the diversity of approaches undertaken.

The management problems peculiar to small communities (under 10,000 population) were the focus of another study (National Institute for Advanced Studies, 1978). Mail surveys and on-site visits revealed that such communities are often lacking in awareness and understanding of NFIP information, partly due to the relatively rapid turnover of elected officials. There was a widespread desire for more "in-person" communication between federal personnel and local administrators, in part to relieve the common shortage of local personnel available and equipped to oversee the program. It was noted that even among small communities development pressures and trends vary considerably and hence must be taken into account when assessing the suitability and likely effectiveness of various management techniques.

Floodplain development pressures within communities and the relationship of those pressures to federal programs were investigated for the Environmental Protection Agency (EPA). Thirty-one localities, all recipients of grants through the EPA's "201" Wastewater Treatment Works Program, were the subjects of case studies of their population trends, floodplain characteristics, management techniques, and involvement with federal projects and programs. In each instance an assessment was made of the effect of federal programs in directing, encouraging, or inhibiting economic development on the floodplain (The Research Group, 1978).

As background for the preparation of a handbook on floodplain and wetlands management, the Massachusetts Department of Community Affairs (1977) conducted case studies of 18 eastern Massachusetts towns to determine what they were doing, if anything, to regulate wetlands and floodplains; how they were doing so, and why; how the local techniques paralleled state and federal programs; and whether local experiences could inform the administration of broader programs. Among other findings, the review demonstrated that while some of the variation in local programs is due to lack of guidance or resources, some of it can also be attributed to the differing levels of control communities are willing and able to handle.

Two studies by Cheatham (1977, 1979) focused on the local land use regulations required by the NFIP to determine whether they had succeeded in limiting exposure of structures to flood hazard and, in the second instance, had resulted in undesirable economic impacts. The information was obtained by surveying realtors, contractors and building officials in the participating communities and by doing case studies of each community's building permit records.

The process of community flood warning dissemination and response has been investigated in order to isolate the determinants of a warning system effective at the local level (Leik et al., 1981). The researchers interviewed community organizations and households in thirty-one (31) study sites and supplemented that information with lab experiments and the use of communication hardware.

Case histories of ten successful community floodplain acquisi tion programs were detailed in a project by Ralph M. Field Associates (1981). The authors pinpointed the elements of successful programs to isolate situations that favor acquisition of either developed or undeveloped parcels on the floodplain.

A major study of local floodplain management practices focused on changes in construction trends from the years before to the period after a community enrolled in the NFIP (Burby et al., 1980). The investigation operated on two levels. Local officials from 1,203 communities returned questionnaires through which they assessed the exposure to flood damage of their community's existing and future development, the social and economic problems of floodplain occupants, and the extent of human encroachment on natural areas. The second level of analysis entailed the conduct of case studies in three communities to determine what the community would be like in the absence of a floodplain land use management program.

Recognizing that waterways and hence floodplains do not respect political boundaries, one study investigated the effective ness of intergovernmental floodplain management practices. Using the case study approach, Platt (1980) uncovered the issues, obstacles and responses of jurisdictions that share flood problems in seven watersheds from Maine to Oklahoma. Intergovernmental conflicts arose over whether or not to adopt floodplain management measures; whether to rely on structural or nonstructural techniques; what level of protection to be reached; management of natural storage areas that lay in more than one jurisdiction; and the coordination of regulations and acquisition and relocation projects.

A number of options exist for achieving coordination among jurisdictions. The study found that the tendency of federal programs to treat each local unit separately provides no incentive for inter-community cooperation. The most appropriate level is the substate regional scale -- county governments, special districts, regional planning agencies or watershed commissions. Inter-local agreements, the exercise of extra-territorial powers, and litigation also contributed to coordinated action in the case study areas.

Communities with innovative flood plain management programs (those that exceed the minimum action required by the NFIP) were the subjects of 75 case studies conducted with the intent of identifying common problems faced by the communities, the keys to successful programs, and how the lessons learned might be applied to other communities (Kusler, 1982).

Often detailed study of one locality's flood problems and floodplain management approaches is made prior to the adoption of specific measures, federal or state involvement in a major project there, or as a pilot for other similarly situated communities. The Illinois Department of Transportation (1979), for example, reviewed the flood problems facing Wilmington, Illinois, and concluded by recommending no major structural control works be built there and instead that the city undertake a regulatory approach to keep flood problems from worsening and provide information and warning programs to help flood-prone residents help themselves.

Harlan County, Kentucky, was selected as the pilot jurisdiction for a detailed study of flood problems and management techniques in the Appalachian region. The goal of the project was to identify a comprehensive floodplain management approach that would help to limit or reduce flood losses while still encouraging the economic development so vital to the area. The case study findings and the final mitigation plan were released as a manual for use by other communities (Booker, 1981).

Issues

This review, while not exhaustive and purposely omitting research currently underway and on-going federal and state monitoring programs (these are discussed below), illustrates the diversity of approaches, methods, targets, and purposes for assessing community floodplain management. No single monitoring technique is appropriate for every community and every purpose. But the most effective, economical monitoring system will be one that is designed after taking careful account of all the various alternatives and addressing in advance those problems that may be anticipated.

Purpose

The most fundamental issue by far is the purpose for which the communities are monitored. The range of community response to flood hazard and the plethora of external factors that affect that response are so broad that, unless a deliberate effort is made at the outset to keep specific goals in mind, the information obtained will be so general and unfocused as to be nearly worthless. In addition, the purpose will to a large extent determine the data that are sought, the method used, and the communities that are investigated. Unless the purpose is defined as clearly and as narrowly as possible, the whole effort may well go awry.

The objectives of the projects outlined above varied from trying to discern differences in construction trends before and after community entry into the NFIP, to uncovering any economic impacts of local regulation of the floodplain, to describing the experiences of communities that had acquired floodplain land or undertaken other innovative projects, to analyzing how a community responds to a flash flood warning, to simply documenting the increase or decrease in the number of structures on a floodplain over a period of years. States and federal agencies are interested in answering different and somewhat narrower questions: whether or not a community has adopted an ordinance required by the NFIP, whether or not it is enforcing the ordinance it has on the books, how thoroughly it is complying with other state, federal or local standards, what kinds of technical assistance it needs, or what action the agency might take to help improve the local program.

Targets

The selection of the communities to be examined depends upon the objective of the project. For research efforts that seek to produce generalized findings, a random sample is usually drawn from communities with appropriate characteristics. For more specific intentions, communities would be selected because they have the attributes that bear investigation: recent flooding, special high hazard areas, a large (or small) number of flood insurance policies, or heavy development pressure on the floodplain. In a continuous monitoring program such as the CAPE process, certain communities might be scheduled for a visit every year or even every six months, in order to maintain pressure on them to continue enforcing their ordinances. It may be advisable to ensure private sector compliance as well by continuously monitoring property owner behavior. This could be accomplished by checking floor elevations of new, existing, and proposed structures.

Methods

There are a number of different approaches that may be used to examine local floodplain management. Questionnaires administered through the mail, over the telephone, or in person, have enjoyed widespread use, but researchers have recognized strengths and weaknesses inherent in this approach. Among the advantages, investigators note that survey research is capable of marshalling data from a large sample at a fairly low cost. Many individuals in numerous communities can be reached, allowing cross-sectional analysis and thereby improving the ability to identify and screen out the intrusion of exogenous factors. A statistical analysis of a number of communities makes it possible to identify causality between administrative elements of the program and its impacts.

Survey research conducted with questionnaires has its limitations, however. First, care must be taken to draw a representative sample. Second, there are limitations to the best sampling techniques and the possibility of response error should not be minimized. Unfortunately, valuable information may be unintentionally withheld because it is not specifically requested on the questionnaire or is in a nonquantifiable form. Even summarizing quantified data involves subjective evaluation. Finally, mail or telephone surveys may reflect faulty local perceptions of program effectiveness or even intentional misrepresentation and hence should be supplemented by field observations.

On-site studies provide the advantage of being able to combine information obtained through brief or in-depth interviews, personal observations, and local records. If sufficient time is invested, on-site observations may enable the identification of various exogenous or contextual factors at work in a community that other techniques might fail to illuminate. Some researchers are of the opinion that, in dealing with complex issues such as floodplain management with its wide range of administrative variables and often ill-defined community goals, such case studies are the only approach that can prevent the blurring of factors that results from large surveys or statistical analyses of secondary data sources. Case studies have been widely used to evaluate flood management programs in the past by, for example, Sheaffer and Roland (1981) and Ralph Field Associates (1981).

Chief among the drawbacks of the on-site study approach is its typically high cost in financial resources and in time. In addition, the degree to which the case study approximates reality and provides thoughtful analysis of causality is largely dependent upon the skills of the interviewer and the technical knowledge of the field observers. The absence of a large sample limits the ability to establish causal relationships. This latter drawback could be overcome by conducting a series of case studies guided by a uniform framework and designed to assure a stratified sample of communities, but the cost of such an effort would be quite high.

Aerial photography and satellite imagery can supplement other research techniques. Aerial photography is useful in determining changes over time in the number of structures in the floodplain, and in measuring open space and thereby reflecting the impacts of a local program. One study now in progress (Galloway and Costello, 1983) has successfully used air photos to monitor changes in land use in the Susquehanna River Valley in Pennsylvania.

Remotely sensed imagery and computer manipulation of information for change analysis are promising techiques, as well. They have been used on a small scale and will likely play a larger role in coming years.

Data Sources

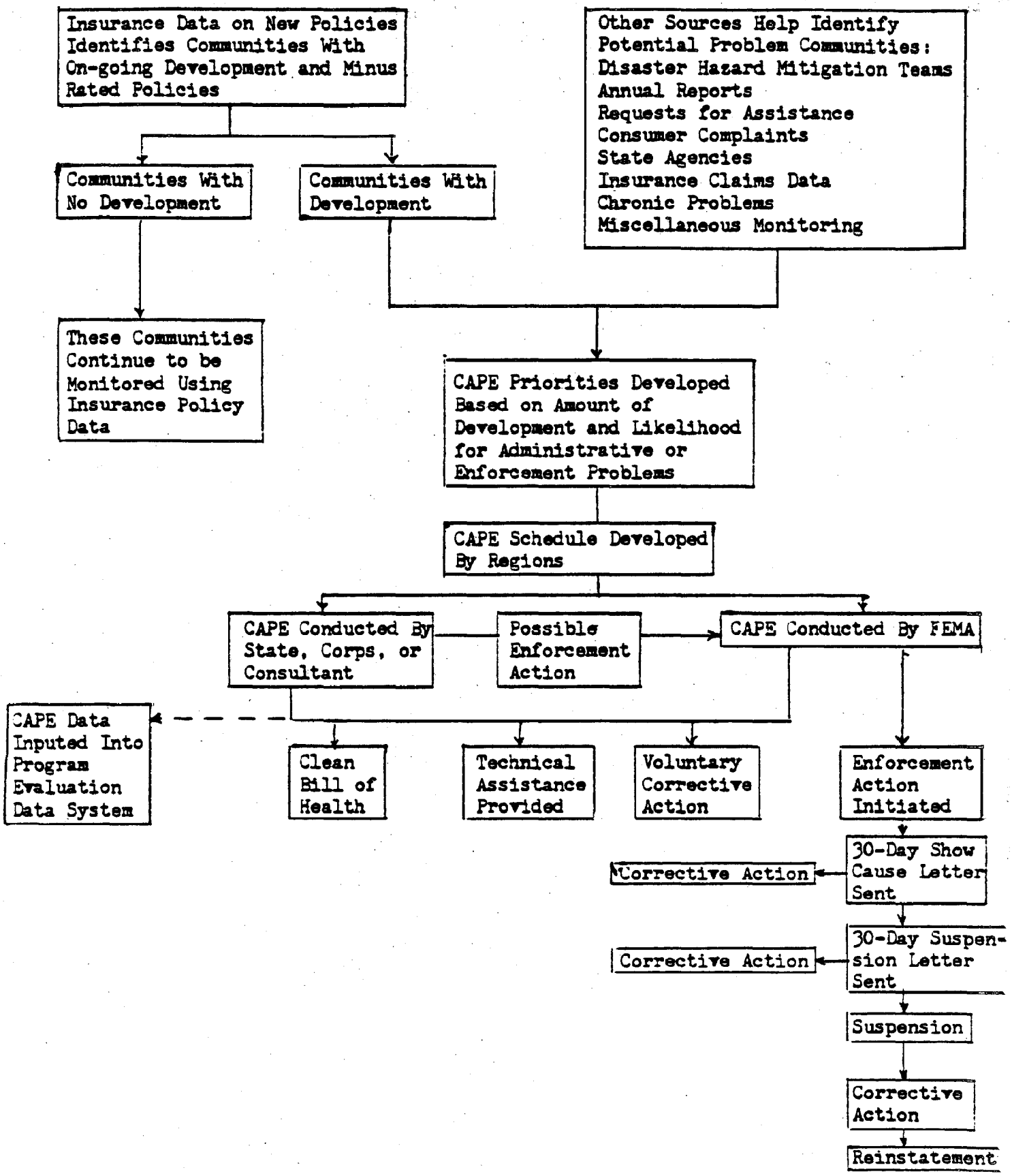
In each of the methods outlined above, primary reliance is placed on data generated in the course of the investigation itself. Typically, however, such approaches begin with assumptions drawn from data that have already been collected, and proceed to combine secondary data from different sources along with the newer information. Analyses are obviously only as good as their data. Some secondary sources are fairly reliable, while others are not. Problems arise when several sources of data are used to enrich each other unless compatibility exists from one source to another.

Often the levels of aggregation differ, or are not appropriate to the level of evaluation. For example, flood disaster data from the Red Cross are aggregated at the Chapter level, FEMA's NFIP annual report data are aggregated at the community level, and almost no data are easily accessible at the individual level as a result of restrictions imposed by the Privacy Act of 1971.

In addition to the problem of compatibility and level of aggregation of data is the fact that the kinds of data that are collected change as floodplain management becomes more sophisticated and complicated. For example, a figure on the number of structures located in a given floodplain might not be as useful a piece of information today as it was five or ten years ago because now some of those buildings are likely to be elevated or floodproofed and thus are subject to less risk than their location might indicate. Data collection efforts begun with the best of intentions can become unusable within a matter of a few years as management practices, techniques, technology and agency goals shift.

Follow-up

Almost all social science research investigations of local floodplain management are carried out on a one-time only basis. An exception is the early White study of change in occupance on floodplains, which was replicated in part twenty years later to see what further changes had taken place (Gruntfest, 1981). State or federal agency monitoring, which is geared more towards ensuring compliance and improving local programs, needs continuity or repetition to be effective. There are several avenues to this achievement. One way to obtain practically constant monitoring of some aspects of the local program is to set up a system whereby data are reported and stored at a central location. Some states require that building permits, for example, be filed with the appropriate state agency. This can clue state personnel immediately about potential problems. A new procedure being instituted by FEMA will provide that insurance data from new policies in the NFIP be automatically transferred to the regional offices to alert them about the variance specifications for a building under construction, for example (see table next page). This process will also help to identify communities with ongoing development and better enable regional offices to allocate resources toward community visits.


Insurance Data on New Policies Identifies Communities With On-going Development and Minus Rated Policies
Other Sources Help Identify Potential Problem Communities:
Disaster Hazard Mitigation Teams
Annual Reports
Requests for Assistance
Consumer Complaints
State Agencies
Insurance Claims Data
Chronic Problems
Miscellaneous Monitoring
Communities With No Development
Communities With Development
These Communities Continue to be Monitored Using Insurance Policy Data
CAPE Priorities Developed Based on Amount of Development and Likelihood for Administrative or Enforcement Problems
CAPE Schedule Developed By Regions
CAPE Conducted By State, Corps, or Consultant
Possible Enforcement Action
CAPE Conducted By FEMA
CAPE Data Inputed Into Program Evaluation Data System
Clean Bill of Health
Technical Assistance Provided
Voluntary Corrective Action
Enforcement Action Initiated
30-Day Show Cause Letter Sent
Corrective Action
30-Day Suspension Letter Sent
Corrective Action
Suspension
Corrective Action
Reinstatement

The most common approach for community visits is for a state or FEMA regional office to plan to do a certain number of communities each year, selecting these either at random or according to the level of activity or degree of risk in the community. In these cases, some sort of follow-up is needed. Problems discovered in a community might result in its receiving further attention in the way of technical assistance from a state or federal agency. The community might be targetted for a return visit within six months or a year, or if growth and development pressures are strong, it might be a candidate for a site evaluation every year. In some situations more detailed examination of apparent problems would be required. Except in a few areas such as New Jersey and FEMA's Region I, there simply are not sufficient human and financial resources to conduct on-site visits of each flood-prone community at regular, frequent intervals. This makes specialized follow-up procedures vital, and dictates that communities that are having problems be identified for particular attention.

Problems

Efforts to monitor community floodplain management programs have been plagued by these problems. Current and future monitoring programs should address as many of these as possible.

Unclear Goals

States, federal agencies and researchers all have had one and sometimes several of the following purposes in mind: ensuring compliance with regulations; encouraging adoption and enforcement of ordinances; assessing mapping, education, and technical assistance needs; determining the cost-effectiveness of various nonregulatory measures; determining the effectiveness of regulations in reducing flood losses or in meeting other goals; isolating those factors that contribute to the success or failure of particular techniques; and understanding the processes at work in community programs.

Limited Funds and Insufficient Human Resources

This is, of course, a perennial problem.

No Systematic Approach to Gathering Data

Information on flood insurance policies, claims data, disaster assistance figures, community program annual reports, CAPE reports, state-supervised programs and various research projects all is collected through different procedures, at different levels of aggregation, at different and irregular intervals, and stored--if at all--at different sites.

No Systematic Assessment and Testing of Monitoring Methods

A number of different approaches are used, making comparability difficult, and it is not known which techniques produce the best results.

Little Comparison of Subjective Measures with Objective Ones

Certain aspects of local floodplain management, such as number of structures at risk, can be measured objectively. For others, an informed judgement may be the most accurate measure possible. It would be useful to correlate these as monitoring proceeds. That is, how does a local, state or federal official's assessment that a certain community has an "active" or "good" program square with data on building permits in the floodplain or number of flood insurance policies in force?

Political Opposition

Sometimes communities resent federal and state interference in local affairs.

Current Monitoring Projects or Programs

Sketches of efforts currently underway are presented below. During the second day of the seminar, speakers described these and discussed how they or their agencies coped with the issues and problems that confront monitoring programs.

TVA Evaluation Project

The Tennessee Valley Authority conducted a one-year pilot study (with a second year anticipated) to evaluate the effectiveness of the local floodplain management programs in its jurisdiction as well as its own services in assisting those communities. The TVA's approach, based on a method developed by a panel of experts under the direction of the Natural Hazards Research and Applications Information Center, calls for two staff people (one planner and one engineer) to visit eight communities per year for two to three days each. Local officials and community leaders are interviewed, local records are reviewed and the floodplain is inspected. These primary data are combined with a wide range of other information obtained from TVA files, NFIP data bases, the state planning office and other federal agencies.

The TVA's project assumes three main goals for floodplain management: (1) protecting life and property; (2) enhancing economic development; and (3) protecting natural resources. It adopts the administrative concept presented in Chapter Four of A Unified National Program for Floodplain Management. The investigation isolates the administrative tools used by the communities to try to achieve those goals and then assesses the extent to which they are successful and possible reasons why that may be so.

On-site Evaluation

Over the past few years individual researchers have developed methods to evaluate the uses being made of floodplain lands, particularly in urban areas. Case studies or "mini case studies" permit an assessment of the extent to which the flood hazard area is integrated into the overall community development strategy.

Survey Research

A National Science Foundation-sponsored study is being conducted at the University of North Carolina and North Carolina State University. Using information and methods derived from a previous study, which involved an extensive mail survey of communities, this effort will gather data on the role of the states in floodplain management and measure the effectiveness of their efforts.

Subrogation Surveys

In 1981 the Federal Emergency Management Agency sued two Louisiana localities and several builders, developers and levee boards to recover over $93 million paid out in federal flood insurance claims. The lawsuit is based on the legal theory of subrogation which permits FEMA, as the carrier of the insurance policies, to "stand in the shoes" of the insureds and bring legal action against those allegedly negligent parties that caused the losses.

The General Counsel's Office of FEMA is now more systematically collecting information about conditions in other communties, in anticipation of bringing further subrogation actions if warranted.

Initial investigations of possible subrogation actions in flooded communities are based on numerous sources of information: claims adjusters' reports, damage survey and interagency team reports, citizen complaints, LEXIS searches of lawsuits underway, CAPEs, annual reports, the number and size of map amendments locality has received, repeated disaster claims, and monitoring of the 150-200 communities to which the most insurance claims are paid. The next step is to go to the appropriate FEMA regional office for specific data on the community's program--copies of maps and ordinance, and the dates of the maps. The issue is what the community knows about its flood problem and when they knew it. After consideration of an engineering analysis, the nature of the evidence available and the likelihood of success, a decision will be made whether or not to request the Department of Justice to file a suit. So far 30-40 suits have been brought or joined.

Although a subrogation lawsuit may request relief in the form of a judgement to be paid by the community to FEMA, the main goal of such suits is the improveament of floodplain management, not the recovery of funds paid. The lawsuit approach has several strengths: the cost and embarrassment of a lawsuit can deter communities from violating NFIP requirements; the discovery process provides an avenue for obtaining a good deal of information about the community; a suit can be brought anywhere claims have been paid--not just within the 100-year floodplain; and unlike with the §1316 suspension alternative, in a lawsuit only the guilty parties suffer the penalty. On the other hand, subrogation suits can only be brought "after the fact," when damage has already been done; filing a lawsuit is perceived as a heavy-handed alternative and not especially advantageous to the agency's reputation; and establishing proximate causation to win the case is always particularly difficult when flooding is involved.

The subrogation surveys provide a means by which the several hundred most frequently flooded communities are monitored. Subrogation could become more widely used if CAPEs entailed questioning local officials about lawsuits that had been filed by private parties; if windshield surveys were done of the B and C zones; and if better information exchange occurred among FIA, the states, thae regional offices, and FEMA General Counsel.

CAPEs

In most areas of the country the Community Assistance and Program Evaluation visits (CAPEs) have been the chief means of monitoring local programs. CAPEs are conducted either by regional FEMA staff or by state personnel, usually with SAP funds. The FEMA regions conduct about 1,000 CAPEs each year. Each FEMA regional office takes a slightly different approach to the conduct of CAPEs, depending on the needs and particular situation in that region. A sample evaluation form from one region can be found on the next page.

Region VII has developed a system to select and screen communities to determine which should be the targets of CAPE visits. Besides conserving limited staff resources, this procedure also allows the region to identify potential problem communities before serious violations occur. Each community in the region was evaluated on the basis of five factors: development pressure, large percentage of variances to permits, five years without a CAPE or over one year from conversion, no annual reports for three years, and travel savings and efficiency. Communities with the highest aggregate rating are contacted by telephone to determine if an actual CAPE visit is indicated.

Over the past eight years Region IV has conducted 230 onsite, in-depth CAPE visits which last about 2½ days and involve at least two staff members. The region believes that thorough, face-to-face investigation and discussion with local officials is the single best way to cope with the administration problems posed by the NFIP. Their follow-up activities emphasize education, regulatory measures and the potential liability of the local government along with the risk of suspension from the NFIP.

Recently, one district of the Corps of Engineers conducted a series of CAPEs as a pilot effort. The Soil Conservation Service does not participate in CAPEs and has no interest in monitoring communities, but does see a real potential for linking the results of CAPEs to SCS's regular activities. The Corps could also provide data from its technical assistance visits to FEMA to help alleviate its data gathering burden in the conduct of CAPEs.

Several states have assumed the major responsibility for carrying out the CAPE process for communities in their own jurisdictions. For two years, Wisconsin piggy-backed the CAPE procedure with their own community audit process. Likewise, Illinois has conducted over 60 CAPEs on behalf of FEMA's Region V office. California's interview report form (see the second following page) shows issues commonly covered during a CAPE visit.

The Association of State Floodplain Managers and FEMA Region VIII have conducted a survey of the states to assess their willingness and capability

FLOOD PLAIN MANAGEMENT REPORT

Chatam N.J. (Community Name)	340504 (Community ID#)	Morris (County)	N.J. (State)

NFIP Status: [X] Emergency [ ] Regular Date of Entry _____

Purpose of Visit: Technical Assistance & Monitoring

A. Statistics

1) Population of entire community: [ ] 0-4,999 [X] 5,000-9,999
[ ] 10,000-24,999 [ ] 25,000-49,999 [ ] 50,000 or more
2) Approximate population located in SFHA 297
3) Approximate number of structures in SFHA 72
4) Total number of permits issued in SFHA 0 ; for new construction 0
5) Number of variances issued in SFHA 0 ; for new construction 0
6) Number of insurance policies in force 49 ; new policies in force _____

B. Brief Summary of Findings and/or Discussions

Community officials appeared to be very environmentally concerned about flooding and its empacts.

C. Resolution

		Anticipated Resolution date	Actual Resolution date
1)	[X] No Problem		
2)	[ ] Ordinance update completed		
3)	[ ] Enforcement procedures modified		
4)	[ ] Building violations corrected		
5)	[ ] FIRM and FHBM revised		
6)	[ ] Community put on "probation"		
7)	[ ] Community suspended		
8)	[ ] Other _____		

D. Background

1) Has there been flooding within the last year? [ ] No [X] Yes
2) Is there pressure to develop in the 100-year flood plain? [X] No [ ] Yes
3) Are there alternative sites available for development outside flood plain? [ ] No [X] Yes
4) Are federally-funded construction projects or actions taking place in the flood plain? [X] No [ ] Yes

E. Innovations

1) Are structures being relocated out of the flood plain? [ ] No [X] Yes
2) Has there been any innovation(s) in the local FPM Program? [X] No [ ] Yes

F. Enforcement

1) Is the community's ordinance compliant with NFIP Regulations? [ ] Yes [X] No
2) Has the community submitted its annual report to the RO? [X] Yes [ ] No

CALIFORNIA
COMMUNITY INTERVIEW REPORT
FOR
NATIONAL FLOOD INSURANCE PROGRAM

A. BACKGROUND

1. Community Name _____
2. Status in Program: ☐ Emergency Phase ☐ Regular Phase
3. Date of Entry _____
4. Total number of permits issued in A Zone or V Zone areas during last 12 months for all new or substantially improved structures _____
5. Number of variances issued _____
6. Reason(s) for variance(s) _____
7. Have permits been issued for filling, dredging, or grading in the A Zone areas? ☐ No ☐ Yes
8. Has there been any recent flooding? ☐ No ☐ Yes

B. ORDINANCE

1. Cite current city ordinance(s) pertaining to regulating the use and development of property in flood hazard areas _____, adopted _____.
2. Are you experiencing problems interpreting any part of your ordinance? ☐ No ☐ Yes

C. PERMIT PROCESS

1. Who determines if development is within the flood hazard areas?

   _____

   _____
2. Who reviews permits? _____
3. Who makes periodic inspections? _____

   _____
4. Who maintains records of building permits? _____

   _____
5. Are the building permits that are issued in A Zones maintained separately? ☐ No ☐ Yes
6. Does the community have a system of periodic inspections to find out if structures have been altered or substantially improved? ☐ No ☐ Yes

D. ELEVATION CRITERIA

1. Are structures being elevated to/or above the Base Flood Elevation?
   a. Residential structures ☐ Yes ☐ No
   b. Nonresidential structures ☐ Yes ☐ No
   c. Mobile homes ☐ Yes ☐ No
2. Who determines the base flood elevation? _____

   _____
3. What documents are used? _____
4. Does the minimum required lowest floor elevation appear on the permit, plans, or postconstruction elevation certificate? ☐ Yes ☐ No
5. Who inspects flood plain development to verify the lowest floor elevations? _____

   _____

   a. How? _____

_____

6. Is the community recording the lowest floor elevation for all new or substantially improved structures?

☐ Yes ☐ No

Where?_____

E. FLOODPROOFED STRUCTURES

1. Is the community recording the elevation of floodproofing when used on nonresidential structures?

☐ Yes ☐ No

2. Is the community obtaining the required certification from a registered engineer or architect?

☐ Yes ☐ No

F. FLOOD PLAIN INFORMATION

1. Is there pressure to develop in the 100-year flood plain? ☐ No ☐ Yes
2. Are there alternative sites available for development outside the flood plain? ☐ No ☐ Yes
3. Are any federally funded construction projects or actions taking place in the flood plain? ☐ No ☐ Yes
4. Are any existing structures in the flood plain being relocated, floodproofed, or elevated? ☐ No ☐ Yes

G. FLOODWAY DATA

1. Has any development occurred in the floodway? ☐ No ☐ Yes
2. Is future development allowed in the floodway? ☐ No ☐ Yes

H. MOBILE HOMES

1. Are mobile homes allowed in the:
   a. Flood Plains ☐ No ☐ Yes
   b. Floodway ☐ No ☐ Yes
   c. High velocity coastal areas ☐ No ☐ Yes
2. Are anchoring or tie-downs required for new or substantially improved mobile home installations in the flood plains? ☐ Yes ☐ No

I. OTHER

1. Is there a local review of all subdivision plans in flood plain areas? ☐ Yes ☐ No
2. Are environmental documents reviewed for planned subdivisions in the flood plain? ☐ Yes ☐ No
3. Have there been any local innovations implementing your flood plain management programs? ☐ No ☐ Yes

   If yes, describe_____

   _____
4. Have there been any structural channel improvements that affect the flood plains and streams, etc.? ☐ No ☐ Yes
5. Does the community have the current Flood Insurance Rate Maps, Flood Boundary and Floodway Maps, and Flood Insurance Studies? ☐ No ☐ Yes
6. Is a review, revision, or update of the community's maps necessary? ☐ No ☐ Yes
7. Do you have any questions regarding insurance rates or forms? ☐ No ☐ Yes
8. Do you have any questions about the NFIP procedures for appeals, map revisions, or Letters of Map Amendments? ☐ No ☐ Yes

to perform CAPEs or other kinds of monitoring site visits. With 39 states responding, the survey showed that the benefits of state performance or assistance in CAPES are perceived to far outweigh the drawbacks. States believe that they have a better understanding of local situations and problems than the federal government does and therefore can conduct more effective monitoring and evaluation. Most states do not want to involve themselves in enforcement follow-up to CAPEs, however, and no state conducts CAPES without the aid of FEMA funds (Matulik et al., forthcoming).

State Monitoring

Wisconsin, North Dakota, Illinois, and Louisiana each have undertaken their own monitoring programs. Wisconsin's effort was launched last year with the design and test of a data collection and analysis system to evaluate the effectiveness of local programs and to augment the pre-existing community auditing process. Wisconsin's program calls for each community to be audited every four years. The new data base, which will continue to be supplemented with new census, revenue and NFIP data, will enable the state to measure changes in local management as years pass. North Dakota has also begun to develop a format for evaluating its local floodplain management capabilities.

The State of Illinois' Division of Water Resources has conducted over 500 community assessment site visits over the last eight years, some of them through contracts with regional planning commissions field advisors. Using checklists, field advisors tour the floodplain and review office procedures of the responsible local officials. Follow-up activities include letters, requirements of corrective measures and public meetings.

The State of Louisiana is completing the development of a comprehensive computer data base called the SAFE system (systematic analysis for floodplain evaluation). Containing over 5,000 pieces of information on floodplain management techniques and funding opportunities, the system is designed to assist communities in assessing the suitability of their present efforts and in designing the optimal program for their specific local problems (Louisiana Department of Urban and Community Affairs, 1983).

Options

It is evident that there is a number of different ways to monitor community floodplain management programs. Any effort is composed of some combination of the elements listed in the table on the following page. The purpose is the most overriding of these, and determines which of the other alternatives is selected. Once the purpose or purposes are clear, the communities to be monitored can be selected and the frequency with which that is to be done can be determined. The data that will be needed to conduct the analysis also will be a function primarily of the purpose, as will the decision about who is to conduct the monitoring. After the purpose, targets, frequency and data needs have been identified, the appropriate method or combination of methods can be chosen. The mode of follow-up will be a result of the original purpose and of the findings uncovered during the investigation.

Although in theory almost any combination of these elements is possible, in practice some work better than others, and any option will be tempered by limitations in personnel, time, funding and political realities. Besides the periodic assessments of various aspects of floodplain management that will doubtless continue to be made by individual researchers, at present three options for community monitoring seem most feasible.

1. FEMA or FEMA and other federal agencies could conduct a community monitoring program.

   If this were to be the case, which would be the target communities? How frequently would an evaluation be done? With what method? What data would be needed? What follow-up should take place? (See table next page.)

2. States could conduct their own community monitoring programs.

   If this were the case, the same questions posed above would need to be answered. Also, how would the state's efforts relate to federal programs like the NFIP?

3. Communities could be monitored through a cooperative state/-federal program.

   Again, the questions of approach must be answered. In addition, how are the various tasks to be apportioned between the states and the federal government? Could regional agencies play a role? Could communities conduct self-evaluation?

ALTERNATIVE ELEMENTS IN COMMUNITY MONITORING

PURPOSE

- adoption
- enforcement
- technical assistance needs
- understanding process

TARGET	FREQUENCY	CONDUCT	DATA NEEDS
° every community	° continuous	° locals (self-evaluation)	° primary data (see method)
° random sample	° every 6 months	° states	° local records
° recent flooding	° every year	° FEMA regopms	° state files
° high risk areas	° random intervals	° Corps	° FEMA region files
° development pressure	° one time only	° TVA	° FEMA data files (annual reports)
		° other federal agencies	° other agency data
		° private firms	° disaster assistance data
		° researchers	° insurance information
			° air photos

Method

- mail survey
- phone survey
- on-site visit
- case study
- field inspection
- local records
- air photography
- secondary data

FOLLOW UP

- none
- self-evaluation by locals
- periodic repeat
- selected repeat
- subjective reporting modes
- monitoring by private group
- technical assistance
- more detailed survey
- NFIP suspension
- subrogation
- legal action
- aerial photography

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PART IV: SPEAKERS' PAPERS -- EFFECTIVENESS OF INDIVIDUAL TECHNIQUES

COST-EFFECTIVENESS OF LOCAL FLOOD WARNING SYSTEMS

Curtis B. Barrett
National Weather Service

In determining the cost-effectiveness of local flood warning systems, many factors must be evaluated. These factors include:

1. hydrologic characteristics of the river basin (e.g., time to crest);

2. frequency of flooding;

3. population and structures located in the floodplain (potential flood damage, actual loss of life and suffering);

4. lead time required for response actions;

5. type of flood warning system selected;

6. present level of warning service;

7. need for data and hydrologic model analysis for purposes other than flood warning: agricultural (multi-meteorological sensors); water management; reservoir management; drought analysis; and water quality.

These factors should be fully evaluated in deciding whether a local flood warning system is economically justified and what type system is required to meet the community needs. Unfortunately, very rarely is a rigorous analysis conducted by a community to determine the benefits vs. costs. In most instances, community officials are quite aware of a flood problem and approach the National Weather Service (NWS) for advice and assistance in implementing a local flood warning system. In almost all cases, the community will purchase and maintain the flood warning system.

Very few studies are available in the literature which analyze the cost-effectiveness of local flood warning systems. According to Bartfield and Taylor (1980), a $50,000 ALERT (Automated Local Evaluation in Real Time) system prevented $5 million in damages from a flood that occurred in Ventura County, California, in 1980. The Susquehanna River Basin Commission has published reports indicating that the Lycoming County manual local flood warning system, coupled with floodproofing measures, has reduced flood damages by 90 percent. The key to effective local flood warning systems is providing sufficient lead time so that actions may be taken to reduce flood damages and save lives. In addition, flood warnings must be of sufficient accuracy to provide credibility and reliability for actions to be taken. Finally, the lead time and accuracy must be accompanied by an effective response system.

The relationship between potential lead time (time between the initial occurrence of rainfall and the occurrence of flooding) and damage reduction has been studied. This relationship has been expressed as a graph depicting damage reduction as a function of lead time. Figure 1 shows a typical

graph for a suburban community located in a floodplain. Each community will have a unique curve. This curve can be used to estimate the benefits (flood damage reduction) by increasing the lead time. The effect of increasing lead time can be quantitatively transferred to damage reduction. However, the quantitative relationship between increasing lead time and saving human life is unknown. One can only assume that by increasing lead time loss of life will be reduced. This problem needs to be investigated.

Accuracy of flood warnings affects the credibility of the warning (whether people will take action or not) and the extent of actions to be taken (degree of evacuation). Accuracy varies according to the type of local flood warning system selected, the quantity and quality of the data input to the warning system, the procedure or hydrologic model adopted and the hydrologic characteristics of the river basin. In general, the greater the accuracy, the more cost-effective the system will be.

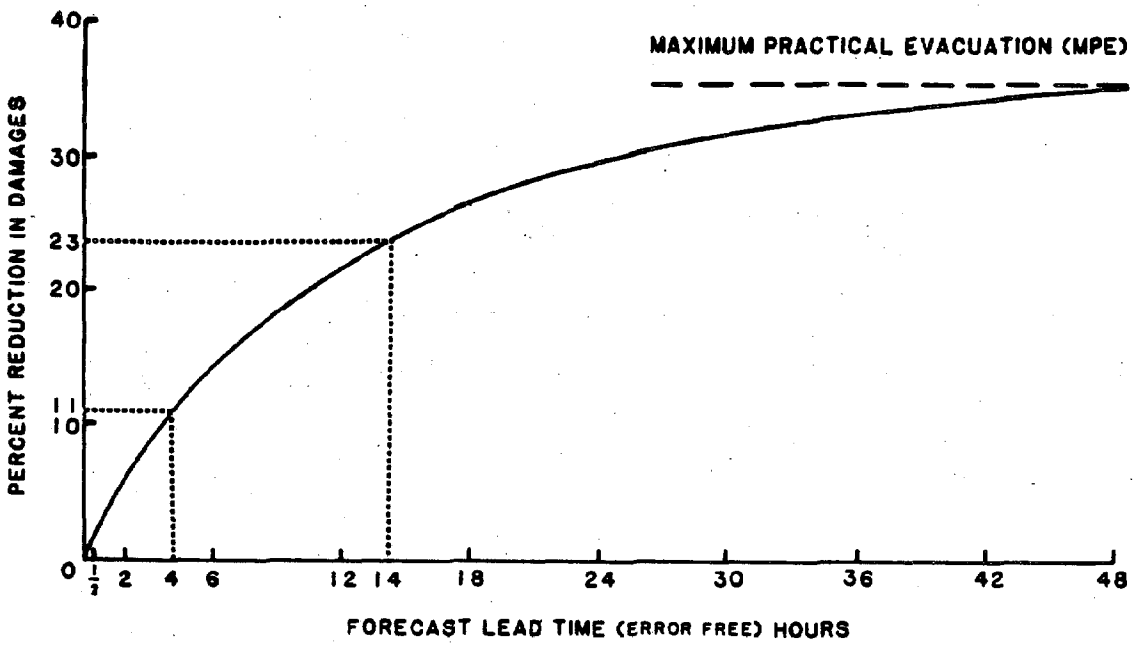
A flood warning response system is an integral component of a local flood warning system. A timely and accurate forecast is of little use if it does not reach flood-threatened residents. Extensive planning and preparation are vital to the effectiveness of flood warning systems.

Local flood warning systems can be categorized into manual and automated systems. Approximately 550 manual systems are in operation around the country. These systems are cost-effective in the sense that little capital costs are involved in their installation and operation. However, these systems require constant attention or they break down. According to Burnash and Bartfield (1980), who compared the cost effectiveness of manual systems to automated systems, automated systems become more cost-effective after six years of operation (see Figure 2). Approximately 100 automated flood warning systems are in operation or are being developed. Automated systems consist of flash flood alarm gages, ALERT systems, and IFLOWS (Integrated Flood Observing and Warning System). Automated systems are not only more cost effective in the long term, they provide reliable state-of-the-art warning capabilities to communities with flood problems.

The cost-effectiveness of flood warning systems can be determined by providing estimates of flood damage reduction and comparing these benefits (reduced costs) to system costs (capital costs and maintenance). Flood damage reduction can be determined by estimating forecast timeliness, accuracy and response.

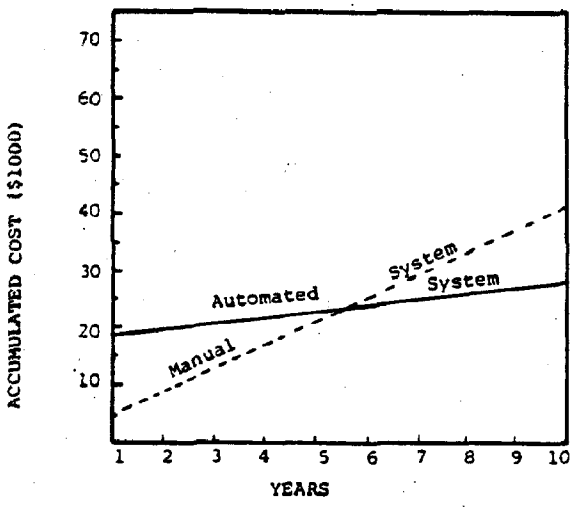
A computer program written by Dave Curtis while at the NWS Northeast River Forecast Center computes economic benefits when considering the cost-effectiveness of implementing a local flood warning system. A source listing of this program is available from that office.

One economical technique would be for the Tennessee Valley Authority, Federal Emergency Management Agency, or other agencies to develop a ranking system of communities vulnerable to flooding. Such a ranking system would use such variables as potential flood damages, frequency of flooding, interest of the community, available funding, and degree of flood preparedness of the community. The State of Maryland is currently attempting to develop such a ranking system in order to implement a cost-sharing procedure for installing automated flood warning systems.



DAMAGE REDUCTION = F (LEAD TIME)

FIGURE 1



Comparison of accumulated real costs of Automated System vs fully Manual System using cooperators

FIGURE 2

SELF-HELP FLOOD DAMAGE REDUCTION IN THE SUSQUEHANNA RIVER BASIN

Stewart K. Wright, Program Manager
Susquehanna River Basin Commission

Background

There are nearly 1,250 municipalities enrolled in the National Flood Insurance Program in the Susquehanna River Basin. There are 55,000 insurance policies with $1.9 billion coverage. Annual premiums exceed $5 million.

Floods in the Susquehanna River Basin are frequent. There have been eight major floods in 100 years and numerous smaller floods. There have been three floods since December 1983.

Soon after its organization, the Susquehanna River Basin Commission began a search for a solution to flooding problems. Several basin-wide federal studies have been completed and investment of $460 million has been made in structural projects, but annual average flood damages continue at $40 million. The floods of 1972 and 1975 spurred a search for new flood damage reduction approaches.

Two efforts were initiated. A large number of flood insurance studies were completed. In addition, a study of the basin's flood warning system was completed and recommendations for improvement were implemented. Improvements in the National Weather Service River Forecasting System were recommended. Over 70 self-help flood forecast and warning systems were organized. The self-help systems now provide flood warning for over one million people in an 11,000 square mile area (about 40 percent of the basin).

We have learned some important things from working with communities. Many communities, especially smaller ones, have given up on the big federal solution. They have come to the conclusion that if they are going to reduce flood damage they are going to have to take the lead themselves and undertake a self-help damage reduction program. Demolition and clearing flood-prone areas after flooding, floodplain management, strict regulations, and locally constructed levees have all been part of the approach. The development of locally-operated self-help flood forecast and warning systems and emergency preparedness plans and actions have completed this thrust. The result is that in the Susquehanna River Basin a comprehensive nonstructural flood damage reduction program is just beginning to show results.

Self-help Flood Forecast and Warning Systems

Self-help forecast and warning systems are simple and inexpensive to organize and operate. Volunteers play a major role in keeping costs low. Forecasting procedures supplied by the NWS are simple to operate. After a few storms accuracy can be increased. One county organized five self-help watershed warning systems for less than $500 of county funds. The NWS assisted with a field survey, inexpensive plastic rain and stream gages and a forecast procedure.

Benefits have been substantial. There are accurate flood forecasts for areas that did not have them before. These systems provide an accurate and timely flood warning complement to NWS systems. We have concluded that if it floods in less than 12 hours after heavy rainfall, you should use a self-help system rather than rely completely on the NWS systems.

A survey of two self-help systems following a flood identified over $4 million in flood damages avoided. One industry developed an evacuation plan that saved $3 million in damages and they were back in business three days later.

Flood Warning Response Evaluation Factors

A flood warning system does not operate by itself. These factors contribute to warning and preparedness.

1. What has been the previous experience of the community with flood warning and action programs to reduce damages?

2. Compare the amount of warning time that is available with the amount of time available for evacuation then design a warning system that best fits the needs of the community.

3. The warning system must be able accurately to predict flood height and onset of flooding. The community must then understand what the incremental flood impact will be. The flood stage forecast maps produced by the Susquehanna River Basin Commission help accomplish this.

4. The warning function and the response function cannot be isolated from each other. The warning system must be able to respond to unusual situations, and prepare rapid forecast updates as a storm progresses. The key to this is redundancy in trained people.

5. The community must have alternative means of communications for both warning and managing emergency actions.

6. As warning reliability is improved so will the potential benefits from a phased evacuation plan that considers the special needs of elderly, sick, public facilities, and industry.

7. Do not count on outside assistance. Use the resources that are available.

8. Do a post-flood evaluation and make adjustments in the plan.

COST-EFFECTIVENESS OF ELEVATING AND FLOODPROOFING NEW STRUCTURES

Larry Flanagan
U.S.Army Corps of Engineers

The cost-effectiveness of locating new structures in the floodplain and using elevation or other forms of floodproofing as a damage reduction technique involves many variables.

One of the most basic factors involved is locational advantage. In some situations, the question is not a location outside the floodplain vs. a floodplain location: the floodplain location is essential. The question becomes how to best minimize the costs associated with floodplain occupancy. Examples of this can be seen in the shipbuilding industry and other riverine and oceanic transportation businesses that must choose floodplain locations, and in sewage treatment plants that often are located in flood hazard areas because of functional necessity.

Another type of locational advantage involves businesses that service existing floodplain development. Ocean-front lodging facilities have compelling economic reasons for floodplain locations and in many cases only a few flood-free years will allow complete recovery of the initial capital investment.

Floodplain developers with strong locational advantages such as those described above are obviously prepared to pay a higher price for floodproofing than the developer who simply has an opportunity to purchase floodplain land less expensively than flood-free land. The point is that locational advantage, either real or perceived, is often the driving force in choosing a floodplain location, and economic comparisons with non-floodplain sites are not necessarily made.

Assuming the decision is made to locate a floodproofed structure in the floodplain and local floodplain regulations do not limit the options, the developer has several alternatives available. She/he can elevate the structure with fill, piers, piling, or a wall foundation, use a levee or floodwall, or use closures and sealants. She/he can also choose wet floodproofing or a combination of two or more of those methods.

One of the most critical considerations of which technique to select from both an economic and functional standpoint is the character of the floodplain and the flood itself. Rate of rise, duration, depth, velocity, and warning time are key factors. In a flash flood, the short warning time may preclude the use of any measures requiring human intervention. High velocities may preclude the use of fill because of erosion and could also limit alternatives to raising on piers or piling. Long duration floods also create problems for most floodproofing techniques except elevation. Levees become waterlogged, underseepage becomes a bigger problem, and pumping failures are more likely to occur as the duration increases.

The likelihood of the design level being exceeded is of particular concern. If, for example, a 100-year design is used, the question remains as to how much higher floodwaters can go. This is a very important ques-

tion, because if the 500-year flood is only 0.5 feet above the 100-year flood, one can be very comfortable with the 100-year level of protection. However, if the 500-year flood is 10 feet higher, catastrophic failure and increased hazards must be considered.

Where it is practical, protection of new construction by raising has by far the most general appeal. This method is essentially maintenance free in many cases, very inexpensive, and exceedance of the design level does not necessarily result in costly losses. For example, if a 4-foot levee or floodwall over tops by 0.5 feet, the protected structure could be severely damaged. Conversely, the raised structure would receive only minor damage. Raised construction is often the only method allowed by local ordinances. Raising on piling or piers has the added advantage of not restricting flood flows or reducing floodwater storage areas.

Most of the Corps' work in floodproofing has involved floodproofing existing structures. In Corps project planning, consideration is given only to structures presently sustaining damages, and according to Principles and Guidelines under which projects are formulated, it is assumed that all new construction will be built at or above the 100-year flood level. For that reason, the Corps has not become involved in cost studies for floodproofing new structures, although the Flood Plain Management Services organizations do provide general guidance on the various alternatives available to the prospective floodplain developer.

Through its Flood Plain Management Services the Corps has attempted to monitor the cost and functional effectiveness of floodproofing systems. A Corps publication, "Examples of Flood Proofed Structures," is presently in final draft form. It presents a sampling of both successful and unsuccessful floodproofing attempts from around the United States, and as much factual information as possible will be presented for each example, including cost and experienced effectiveness. In the survey from which the examples are drawn, it is interesting to note that only about 50 percent of the floodproofing attempts were considered successful.

In another rather unique project, the Corps, through the Waterways Experiment Station (WES) and Tulsa District, is planning to demonstrate the effectiveness of commercially available floodproofing systems by making a house in Tulsa County, Oklahoma, available for testing. This project was advertised in the Commerce Business Daily in February 1984, and two companies have expressed interest in testing their products. One company uses a rubber sheet that is pulled up around the house during the flood, and the other uses a paint-on sealant for walls and closures over doors and windows. Both companies limit their system to three feet of protection to avoid structural damage. The Corps will provide a levee and water for flooding the structure, and will document the results in a WES Technical Report which includes this and previous floodproofing research.

Louisiana State University Cooperative Extension Service has been working closely with the Corps' Lower Mississippi Valley Division Office in providing floodproofing assistance to home owners. They have recently completed and documented a demonstration project showing floodproofing techniques and are currently considering demonstrations of the effectiveness of various types of low block and concrete floodwalls. Information

sharing and joint funding of such projects by those involved could be handled by a small interagency committee.

FLOODPROOFING BUILDINGS IN ILLINOIS

French Wetmore
Illinois Division of Water Resources

Being a very flat state, most of Illinois is subject to shallow, low velocity flooding. This flooding can be frequent but often does not cause substantial damage to a building. Floodplain residents are not subject to high hazards and are not ready or willing to move their minimally damaged building out of the floodplain. After a flood buildings are not substantially damaged, making it difficult for floodplain regulations to mandate relocation or other protection measures. The most appropriate response for these properties is floodproofing.

In order to meet the needs of these residents, the Division of Water Resources has undertaken a floodproofing advisory program designed to assist as many people as possible. In 1979, we printed our first version of Protect Your Home From Flood Damage. This manual advises residents on everything from flood insurance to floodproofing, safety precautions, cleanup, and financial assistance. Our approach is to distribute the manual to reach as wide an area as possible and then provide technical assistance on request. The manual has been rewritten practically every year as we learn more lessons from research, new floods, and discussions with floodplain property owners.

In 1982, we conducted our first floodproofing open houses. We distributed the manual to every person, presented a slide show of houses protected with the techniques discussed in the manual, and invited local contractors to set up displays and talked to those attending. We have also shown the slide show around the state, adapting it to meet local flood conditions.

In 1982, we used supplementary State Assistance Program funds to perform two related projects. One was to conduct the basic research for a more detailed manual that focused on elevating and relocating buildings. The second was an extensive assessment of public information programs and what impact they had on floodplain residents' attitudes and behavior. One interesting point is that this research found that residents that were aware of flood protection measures perceived them to be economical. (The one exception to this was flood insurance.)

As a result of this research and our direct contacts with floodplain residents through the open houses and site visits, we have concluded that it is not so important to stress the cost-effectiveness of flood protection measures. The most important reason for this is that the funding for these projects is coming from the property owners themselves. They are not bound to conduct any detailed investigation and they will make their decision based on their perceived need compared to the actual cost. Therefore, we do not stress detailed cost benefit examinations but our manuals do provide a general idea of the total cost of the projects and sources of financial assistance.

Accordingly, for this paper, I would like to focus on the various techniques of flood protection and where they are most appropriate. In 1983, we used supplemental State Assistance Program funding to hire the

firm of Sheaffer & Roland to prepare a technique to survey buildings that would tell us which flood protection measures are most appropriate for them. This technique would be used as an initial planning tool in a local flood mitigation effort.

We identified six categories of flood protection which are listed in order of providing the most protection to the least: demolition, relocation, elevation, levee or floodwall, dry floodproofing, and wet floodproofing. Sheaffer & Roland identified the key factors that determine whether a building can or should be protected by the measures. Following field tests in three communities, we refined the work and published Local Assistance Series 3A, Surveying Buildings For Flood Hazard Mitigation.

The key factors for this first round planning effort are characteristics of the building and the flood hazard. Characteristics of the building include:

- General condition (unsound buildings are recommended for demolition);
- Whether the building is large or small (small 1-story or 2-story buildings can be moved or elevated easily);
- Foundation type (buildings on a crawl space or basement can be moved and elevated easily, while buildings on slab can be dry floodproofed; and
- Type of siding (masonry siding can be dry floodproofed while other sidings make for a lighter building which is easier to elevate or move).

Given Illinois' riverine flood situation, we focused primarily on two types of flood hazard: velocity and depth. Data for both of these are in flood insurance studies. Because there are many areas in Illinois where the floodway has a low velocity and shallow flooding occurs even during the 100-year flood, we did not automatically consider every floodway as a high hazard area. We did decide that average floodway velocities of greater than five feet per second should be consider a high hazard and buildings should not be floodproofed or protected by levees in such areas.

We were concerned with flood depth in increments of three feet over the first floor:

- 0.3 feet meant that masonry sided buildings on slab could be dry floodproofed;
- 6 feet is the practical limit for a local floodwall or levee;
- elevation was not considered feasible at depths greater than nine feet.

The most difficult piece of information to collect is the depth of the 100-year flood over the first floor. For this we developed a technique using a hand level and known ground elevations in the area to be surveyed.

This is the one part of the survey that is subject to the greatest error and several warnings are included in the manual. One way to overcome this shortcoming is to conduct the survey immediately after a flood and use the high watermarks to calculate the depth of the 100-year flood. A separate set of instructions are written in the manual for the postflood situation.

Once all the field data are collected on the survey forms the surveyor traces each building through a flow chart. The flow chart identifies the appropriate flood mitigation measures in order of preference. The surveyor is advised to plot the results on a map of the neighborhood to provide the basis for a general concept plan. Needless to say, the survey results need to be reviewed with the property owners. In many cases interior inspections by an engineer or house mover are needed before final decisions are made.

In our latest version of Protect Your Home From Flood Damage, we discuss only five or six protection measures because we did not feel that property owners are interested in demolition. The manual covers the key factors in lay terms and includes a comparative table summarizing how the factors affect each measure (see next page). The cost ranges for elevation and relocation are detailed in the manual, Elevating and Relocating a House to Reduce Flood Damage. They are based on recent projects in Illinois as well as discussions with house movers.

Where do we go from here? I have three recommendations. First, continue to promote property owner self protection with "popular" handbooks, slide shows, and workshops. There should be established a repository or library of public information materials and some review of what has been successful.

Second, we need more research on the technical aspects of small levees and floodwalls and wet and dry floodproofing. The Corps' Waterways Experiment Station in Vicksburg and Hydrologic Engineering Center in Davis should continue their excellent work. Other federal agencies should chip in, particularly FEMA, which has over $100 billion at risk. There should also be some focal point such as the Natural Hazards Center in Boulder to prioritize research needs and prevent duplication of effort.

Finally, I am convinced that financial assistance is needed as the final motivating factor to get property owners to protect themselves. There are several federal agencies willing to spend millions of dollars on flood insurance claims, disaster assistance, and structural flood control projects, who should amend their rules and spend some of their money on these flood protection measures. Detailed recommendations on how this should be done were presented at the 1984 meeting of the Association of State Floodplain Managers.

Comparative Table on Permanent Flood Protection Measures

Key Considerations	Relocation	Elevation	Levee/wall	Dry floodproof	Wet floodproof
Condition of Building	small, wood frame, on crawlspace or basement	small, wood frame, on crawlspace	large lot	masonry walls, on slabs	unfinished basement or garage
Flood Hazard	all types	depth up to 9 feet, lower velocities	depth up to 6 feet, shorter duration	depth up to 3 feet, lower velocities	depth up to bottom of first floor joists, lower velocities
Floodplain Regulations	no restrictions	may be required to elevate to 100 year flood level	may be prohibited in floodway	major projects (substantial improvements) may be prohibited	no restrictions
Human Intervention	no	no	usually: to close openings and start pumps	yes: close openings and valves	yes: to move contents and turn off utilities
Technical Expertise	house mover	house mover	soils expert (engineer if high velocity)	structural engineer	not required
Cost Range	$22,000 to $67,000	$10,000 to $42,000	minimal to $15,000	minimal to $10,000	minimal to $5,000
Other Benefits	eliminates worry	insurance premiums reduced	surrounding area not inundated	contents stay dry	structural loads reduced
Other Considerations	new site	dynamic pressures on foundation	erosion, overtopping	overtopping, static pressures on walls and floor	warning needed, basement purposefully flooded

NOTE: *This table only highlights certain factors to consider. For example,* any type of building can be elevated, it is just easier and cheaper to elevate small, frame buildings on crawlspaces. Additional technical expertise such as electricians, plumbers, and engineers is recommended for all the categories.

COST EFFECTIVENESS CONSIDERATIONS OF ACQUISITION/RELOCATION IN FLOODPLAIN MANAGEMENT: THE SOLDIERS GROVE, WISCONSIN EXPERIENCE

Thomas Hirsch
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Introduction

Located in southwestern Wisconsin's "Driftless Area," Soldiers Grove started planning its acquisition of floodplain properties in 1975. By the end of 1976, the community adopted a comprehensive program for revitalization which included four floodplain elements:

1. Public acquisition and clearance of all floodway properties;

2. Floodproofing of flood fringe residences;

3. Continuation of floodplain zoning to protect future development from flood damage; and

4. Maintaining eligibility of property owners for flood insurance during project implementation.

Although it took a one percent flood event in 1978 to convince the federal government of the wisdom of the community's plan and to muster the required federal assistance, by 1982 the program was substantially complete and had received widespread acclaim for its effectiveness in addressing one percent flood protection, resolution of other serious threats to public health and safety in housing, business and community facilities, community redevelopment and economic revitalization, responsiveness of government, wise energy management, and environmental enhancement.

Cost Effectiveness

As proposed and implemented, nonlocal costs were similar for both structural and nonstructural solutions. This was later verified by the David and Mayer article referenced in the issue paper. From the community's viewpoint the overall benefits of the nonstructural approach outweighed the costs even though the local costs were far greater than they would have been under a structural approach. The perceived benefits were in large part non-quantifiable (and therefore were not included in traditional federal benefit: cost analyses) but nonetheless real. The local perception of the benefits depended in part on location: non-floodplain property owners tended to discount benefit claims and to predict onerous tax burdens. Nonlocal agency perceptions of benefits tended to be limited to their agencies' "missions."

A number of costs associated with floodplain occupancy that units of government experience under a "do nothing" scenario were not quantified at Soldiers Grove because this scenario was not acceptable from other than cost considerations. When other communities consider such floodplain management alternatives as a small relocation program or permitting in-fill development in a flood fringe, the "do nothing" costs will need to be laid

out for local and nonlocal decisionmakers. The more marginal the proposed project is, the more critical these costs will be. They would include incremental construction and maintenance costs of sewer, water, roads, public and private utilities facilities, emergency services and flood related health costs. These costs are ongoing, and represent current public costs of floodplain occupancy.

Factors That Influence Benefits and Costs

Efficiency in planning nonstructural programs can be achieved by planning before a disaster. One of the most critical and cost-effective contributions is that of the public, particularly those to be affected by the project. Waiting until after a flood disaster means trying to get those persons to make imaginative and far-reaching decisions under conditions of shock and loss -- something not likely to happen. Other lesser cost factors include property appraisal values and other taking costs; relocation assistance costs which in turn are dependent on the costs of comparable replacement properties; the availability and affordability of supplemental capital (particularly for commercial properties where relocation benefits are frequently inadequate); and the perceived ability to achieve functional equivalency at the relocation site.

Recommended Approaches

For planning phases, timing is especially critical, as discussed above -- predisaster planning with or without a phased implementation. Because of the commercial nature of most of the displaced properties at Soldiers Grove, minimum "down time" was important as well as the mutual timing of any businesses which depended on each other. Participatory planning by those who will be affected and those who will pay for the project is essential so that common understandings are reached as early as possible. Finally, the nature of the plans should stress appropriate technologies to control costs and enhance local private debt capacity. For implementation phases, sympathetic, on-site counseling is essential to achieve successful relocations and to protect the integrity of public assistance.

Transferability of the acquisition/relocation approach will depend on three additional factors:

1. scale, in both manageability and impacts;

2. municipal legal powers and obligations; and

3. the community's ability to pay and its interest in doing so.

Do Other Studies Agree?

The 1984 Winter issue of the Journal of the American Planning Association contains an economic analysis comparing the costs of the structural and nonstructural alternatives at Soldiers Grove ("Comparing Costs of Alternative Flood Hazard Mitigation Plans," David and Mayer, pp 22-35). Total project costs were found to be roughly equivalent (levees $8.1 million vs. acquisition/relocation $7.0 million, 1980 dollars), ignoring who paid for which parts.

How Was Cost-Effectiveness Determined?

The small scale and cohesiveness of the community allowed a local evaluation of alternatives on a comprehensive basis, one which included quality of life considerations in addition to economic factors. This was important because of the project's impact on the community. Local officials made their decisions in a traditional manner, based on local priorities (which at many meetings meant that dogs in the neighbors' gardens were discussed as much as the relocation project), intuitively including many nonquantifiables, and considering multiple purposes.

Nonlocal governmental decisions, by contrast, typically were single purpose, short term, non-risk taking, and limited to quantifiable considerations. The same criteria persist today and are institutional barriers any nonstructural project will have to overcome.

Recommended Monitoring System

Given an acceptable data base, stage damage studies could begin to define alternative cost scenarios. The costs of "doing nothing" discussed previously also need to be enumerated. Any data base will need complete structure inventories, which could be difficult on a large scale. Site visits are essential to collect data and desirable as well so local officials can understand the data system and use it in their decisionmaking. Agencies must develop attitudes of assistance and not project control. Such assistance is best provided close to a community, by a regional or state agency. This implies that FEMA should encourage state and local efforts to develop this capability.

ASSESSMENT OF ANNUAL FUNDING NEED FOR PURCHASE OF FLOOD DAMAGED PROPERTY UNDER SECTION 1362

Report to the Senate Appropriations Committee from the Federal Emergency Management Agency

Purpose

The purpose of this report is to review program experience and provide an estimate of national need and associated funding level to acquire properties in flood prone areas that are subject to heavy and/or repetitive flood damages. Section 1362 of the National Flood Insurance Act of 1968, as amended, P.L. 90-448, authorizes such acquisition of property.

This report has been prepared for and at the request of the Chairman, Subcommittee of HUD Independent Agencies, Committee on Appropriations, United States Senate. The request was generated as a result of concern by residents and representatives of Mississippi River Basin States and elsewhere that program funds have not been adequate to meet program needs.

Background

Section 1362 is an important part of the National Flood Insurance Act of 1968, as amended, which established the National Flood Insurance Program (NFIP). The NFIP is a federal program enabling property owners to purchase flood insurance. The program is designed to reduce the escalating costs of property damage caused by flood and the increasing federal disaster assistance outlays for flood disasters. The program is based on an agreement between participating local communities and the federal government. This agreement provides that the federal government will make flood insurance available to property owners in communities which implement and enforce programs to reduce future flood losses through effective land use and construction practices.

The federal government sets minimum standards, which a community must meet in order to participate in the program. These standards are principally directed at new construction in the floodplain. Existing structures built prior to a community's participation in the NFIP need only comply following subsequent flooding which results in damages exceeding 50 percent of the building's value or when improvements of this value are made, regardless of the reason. Yet these existing structures are eligible for flood insurance immediately upon a community's participation in the NFIP, and premiums are subsidized by the federal government.

However, already developed areas can be subject to heavy and repetitive flood losses. Consequently, actions are often warranted to reduce exposure to flood risk. In these cases three basic approaches have been employed:

1. Constructing structural measures; e.g., dams, levees, etc., designed to reduce the flood risk;

2. Floodproofing through retrofitting; e.g., elevation of an existing structure designed to protect the structure from flooding; and

3. Relocating structures out of the floodplains.

In passing §1362 of the National Flood Insurance Act, Congress recognized the efficacy of acquiring and removing structures from a flood risk area as part of the overall federal strategy for reducing flood losses. It was determined that the public interest could be served by purchasing insured properties that have incurred significant repetitive flood damage, been substantially damaged in a single casualty, or cannot be repaired because a regulation precludes the repair or permits repair only at a significant increase in costs.

The following objectives have been established by FEMA for the §1362 program to meet the statutory criterion of serving the public interest:

1. To reduce future flood insurance and disaster assistance costs by removing repetitively and/or substantially damaged structures from flood risk areas;

2. To provide an opportunity for owners of repetitively and substantially damaged structures to be permanently removed from flood risk areas and to reduce risk to life from flooding; and

3. To complement federal, state, and local efforts to restore floodplain values, protect the environment, and provide recreational and open space resources.

These objectives support the overall goals of the NFIP to reduce the future costs of flood damages and to provide protection for property owners against potential losses. As the next section will illustrate, not only has the §1362 program resulted in cost savings to the taxpayers, but has provided incentives to flood prone communities to help themselves in addressing their flooding problems and strengthening their efforts in effective local floodplain management.

The regulations implementing §1362 require that an application must:

1. Show evidence that individual properties meet the statutory eligibility criteria;

2. Include an agreement by the jurisdiction to remove the damaged property without cost to FEMA; and

3. Show evidence of the state or local jurisdiction's legally binding commitment to take title to and manage the property in a manner consistent with sound land management and the objectives of the §1362 program.

Other factors important in deciding whether a project should be funded include: the potential reduction in future costs associated with flood damages, the jurisdiction's commitment to floodplain management, the extent to which the properties proposed to be acquired are contiguous, the quality of the jurisdiction's plan for the acquired property, and the commitment of other financial resources by the jurisdiction to complement §1362 funds.

Based upon experience, FEMA intends to improve the selection process by developing a more systematic and objective method of evaluating the potential cost savings for proposed projects and the other factors according to their contribution to achieving the program's objectives.

Program Experience

Funds were appropriated initially in FY 1980 for the acquisition of flood damaged properties under §1362. The program is now in its fifth year. Table 1 provides a summary of the first four years of program activity. Table 2 provides a summary of the project applications received for FY 1984 and the total amount requested. Determinations on all of these applications have not yet been completed. To date, commitments have been made for Baytown, Texas; Mansfield, Connecticut; and South Ogden, Utah.

During the first four years of operation, the §1362 program has accomplished much in relation to each of the program's objectives. In general terms, substantial expenditures in repeated flood insurance claims and recovery efforts have been saved. Expensive flood control or flood proofing projects have been avoided where they would not be cost effective. State and local initiatives to reduce existing flood problems have been a direct result of several projects. Funds from other federal agencies have been used in combination with §1362 funds to expand the scope of a number of projects. Other community benefits such as improved recreational opportunities have resulted.

The extent of the actual cost savings resulting from any acquisition project is difficult to estimate. Projections of future savings in flood insuranee claims and premium subsidies and federal, state, and local recovery efforts have not been attempted in any systematic way. Accurate figures or estimates of public expenditures prior to acquisition, upon which to make current or future cost benefit judgments, are not readily available. Nevertheless, based upon partial data and estimates, it can be reasonably inferred that substantial savings in public (and private) resources have been and will continue to be realized.

In the first §1362 acquisition project undertaken in 1980 in Clay County, Minnesota, six properties were purchased for $556,000. Insurance claims alone from three floods in 1975, 1978, and 1979, totaled $530,000. Based upon the location of these structures (the lowest floor elevations were an average of 20 feet below the 100-year flood elevation) and the statistical probability of future flood damages, it has been estimated that these properties would incur future flood damages of $1.0 million to $2.5 million over the next 20 years.

In 1980, 117 properties in Lake Elsinore, California, sustained flood insurance losses of about $2.0 million. Insurance claims do not accurately reflect actual damages (estimated to be $4.0 million) since the city was then in the emergency phase of the NFIP with the coverage limit of $35,000. As a result of this flooding, the city adopted regulations which prohibit the structural repair of any buildings with lowest floor elevations below the 1980 peak lake level. Also, 36 of the most severely damaged properties were acquired for $2.3 million.

TABLE 1

Section 1362 Program Properties Purchased
FY 1980-FY 1983

Projects	Properties	Funds Obligated
Fiscal Year 1980		
Clay County, MN	6	556,000
Gulf Shores, AL	5	1,068,400
Arnold, MO	34	831,334
San Bernardino, CA	22	1,639,364
Phoenix, AZ	7	336,822
N. Stratford, NH	1	58,000
Scituate, MA	9	446,650
Cowlitz County, WA	16	914,879
Project Administration	--	63,997
Subtotal	100	5,915,446
Fiscal Year 1981		
Lake Elsinore, CA	36	2,231,886
Belmont County, OH	2	38,182
Hull, MA	3	126,800
Peoria, IL	7	364,500
Lodi, NJ	6	395,900
Hamilton, WA	8	185,963
Lost Creek, WV	7	78,340
Project Administration	--	171,397
Subtotal	69	3,592,968
Fiscal Year 1982		
Mobile, AL	20	1,031,000
Saraland, AL	2	74,115
Adams County, CO	1	25,500
Burton, MI	8	179,101
Project Administration	--	107,000
Subtotal	31	1,416,716
Fiscal Year 1983		
Mobile, AL	24	1,845,051
Scotts Valley, CA	1	102,090
Lake Elsinore, CA	1	76,829
Estes Park, CO	4	289,340
Chillecothe, IL	9	307,883
Lansing, IL	1	44,652
Peoria, IL	2	148,500
Tazewell, IL	2	102,289
Arnold, MO	38	536,605
Fenton, MO	3	24,000
Independence, MO	16	248,663
St. Louis County, MO	13	218,002
Whatcom County, WA	3	443,000
Project Administration	--	384,294
Subtotal	117	4,771,198
TOTAL	317	$15,696,328

TABLE 2

FY 1984 Applications for Section 1362 Funds

	COMMUNITY	# OF PROPERTIES		COST
	Mobile, Alabama (III)	35		820,655
	Saraland, Alabama (II)	30		1,656,152
	Satsuma, Alabama	14		1,278,750
+	Mansfield, Connecticut	3		170,000
	Browning, Illinois	2		26,000
*	Chillicothe Park District, Illinois (I)	2		61,398
	Chillicothe Park District, Illinois (II)	1		29,943
	DuPage Co., Illinois	7		442,700
*	Grafton, Illinois	3		59,000
	Kampsville, Illinois	1		16,609
	Project 13	3		38,500
	Project 10	3		30,000
	Project 11	1		85,000
	Project 12	1		12,000
	Project 14	1		30,000
	Liverpool, Illinois	3		51,300
	Rome, Illinois (II) (#1)	1		55,000
	Project # 2	1		40,000
	Project # 3	2		150,000
	Project # 7	1		55,000
	South Wilmington, Illinois	1		22,701
	Village of Thebes, Illinois	10		116,700
	Jackson, Mississippi	6		350,000
	Vicksburg, Mississippi	9		325,000
	Warren County, Mississippi	119		1,799,000
*	Arnold, Missouri (II)	4		21,992
	Arnold, Missouri (III)	30		1,600,000
*	Fenton, Missouri (I)	1		7,000
	Jefferson County, Missouri	9		550,000
*	St. Louis County, Missouri (I)	5		70,300
	St. Louis County, Missouri (II)	100		2,000,000
	Valley Park, Missouri	33		660,000
+	Baytown, Texas	250		1,500,000
+	South Ogden City, Utah	1		30,000
	Hattiesburg, Mississippi	9		115,000
	Canton, Mississppi	6		100,000
	Fenton, Missouri (II)	8		84,000
		716	TOTAL	$14,459,700

* Carryovers from FY 1983
+ Committed for FY 1984

Just three years later, the lake rose to nearly the 1980 level flooding the same area. By this time the city had also entered the regular phase of the NFIP allowing for substantially higher flood insurance coverage amounts. Had the city and FEMA not taken the actions they did in 1980 to purchase those 36 properties, the direct losses to the NFIP alone are estimated to have been over $2 million.

A similar situation where subsequent flooding has already occurred following a §1362 acquisition is in Arnold, Missouri. In 1980, 34 properties were acquired for $831,334. Insurance claims and disaster funds totalled about $1 million. At that time estimates of future damages over the next 50 years ranged from $1.2 million to $3 million. In December 1982 a devastating flood struck the same area. An additional 57 properties in Arnold, Fenton, and St. Louis County have been acquired for approximately $800,000. Insurance claims for these newly acquired properties totalled $1.4 million. The cost to the NFIP and to the disaster fund would have been much higher had the earlier properties in Arnold not been acquired.

A final illustration of where substantial future cost savings can be anticipated is the Brownwood Subdivision in Baytown, Texas. Formerly a middle income subdivision of about 300 homes, subsidence since 1940 has been 9¼ feet placing most structures zero to two feet above average high tide and 14 to 16 feet below the base flood elevation. As a result, frequent flooding has caused millions of dollars in damages, including an estimated $3 million in NFIP claims, and dramatic deterioration of the area. Homes with a replacement value of $80,000 or more now have a fair market value of less than $30,000.

In August 1983 when hurricane Alicia struck, the whole area was inundated and many houses were totally submerged. Insurance claims are expected to reach $6 million. Another $1.5 million will probably be spent for temporary housing and individual assistance. An estimated $1.5 million would have been required to repair such public facilities as sewers and water lines. With the continuing subsidence and frequency of storms (since 1980 hurricanes have struck the Texas coast an average of once every 2½ years), losses in the future would be in the millions even if the NFIP requirements could be met.

Because nearly all the properties had flood insurance and claim payments were equal to or greater than the fair market value, it was possible at a fairly modest cost to break the cycle of a situation that would continue to deteriorate. Although the final costs have not been determined, it is expected that all eligible properties (290) will be acquired for approximately $2 million.

The direct cost savings to the NFIP and disaster recovery efforts are not the only economic benefit of the §1362 program. Another is that it often offers a less costly alternative to other loss reduction measures. Even where flood control or floodproofing approaches are possible, they are often prohibitively expensive. In Phoenix, Arizona, for example, where seven properties were acquired for $337,000, a study by the Bureau of Reclamation and the Corps of Engineers estimated structural measures to protect the area, which included these seven properties, would cost nearly $100 million. Although it is apparent that a flood control project of this

size would involve more than seven properties, this example does illustrate the order of magnitude that can enter into flood loss reduction decisions.

Similarly, engineering solutions to the situation in Baytown, Texas, even if possible, would be extraordinarily expensive; nor would elevating the six homes in Clay County, Minnesota, 20 feet be very practical.

A second major payoff of the program has been the leverage effect on actions of other agencies or units of government. Local ordinances have been passed that are more restrictive and comprehensive than those required by the NFIP thus directing unwise development from the floodplain. New programs have been undertaken to further alleviate the flooding problems. State and/or federal funds have been used in combination with §1362 funds to increase the number of properties acquired or to broaden the benefits to the community.

The adoption of a comprehensive stormwater management program by the City of Mobile demonstrates this leverage effect. Following heavy flooding in 1981, a major acquisition effort was undertaken on the recommendations of FEMA and the Federal Interagency Hazard Mitigation Team. FEMA initially committed $1 million to purchase 22 properties. HUD agreed to contribute $1.9 million of discretionary Community Development Block Grant money to fund additional acquisitions and cover relocation expenses for the FEMA acquisitions. In 1983, FEMA funded the acquisition of 23 additional properties and is currently reviewing an application for 35 more. As part of the overall plan to reduce flood losses in Mobile, the city agreed to undertake the comprehensive stormwater management program.

In the Clay County, Minnesota, project discussed above, the acquisition of the six homes was the key ingredient for the continuing effort to acquire 11 vacant and adjoining lots and the creation of a regional park. All of these lots have been acquired for delinquent taxes, or by donation, or soon will be. The state has also appropriated funds to assist in this effort.

Other examples of the leverage effect of the §1362 program are:

1. The ordinance adopted by Lake Elsinore prohibiting the structural repair of any buildings having their lowest floor located below the 1980 peak lake level;

2. The purchase of six properties in Lodi, New Jersey, is a small part of a redevelopment project involving federal, state, and local funds to clear some of the floodplain and convert it to recreation and open uses. This project will also result in the construction of new moderate income housing outside the floodplain connected with green space fronting on the Saddle River in a park-like setting; and

3. In North Stratford, New Hampshire, $58,000 of §1362 funds were combined with HUD Community Development Block Grant funds to acquire property and relocate 60 families in an area frequently flooded by ice jams on the Connecticut River.

These examples illustrate the range and magnitude of the benefits resulting from the §1362 program. Most of the discussion has focused on savings to the NFIP and disaster recovery efforts or the benefits to the larger community through the creation of open space, recreational opportunities, and the like. Of course the ultimate benefit is to the individual home owner particularly those who want to sell and cannot. These are owners who see their equity diminishing, cannot afford adequate insurance coverage, or do not have the resources to do adequate flood proofing. Most of the owners of properties purchased through the program were in one or more of these circumstances, particularly those who occupied their properties. This was true for middle income as well as lower income owners. Many of these people purchased these properties with little or no knowledge of the flood hazard and its consequences. For many of these people, public acquisition programs such as §1362 are their only reasonable option.

Assessment of Annual Funding Need

In order to arrive at an estimate of the annual need for funding, a variety of factors must be considered. The two most important are the eligibility requirement(s) as defined by the statute, and the cost-benefit of removing eligible properties from the flood risk area vis-a-vis such other loss reduction approaches as flood proofing and elevation. Combining these two factors with the property owner's willingness to sell and the appropriate unit of government's commitment to accept title and appropriately maintain the property, the program need is converted to what might be more accurately called demand.

An estimate of annual funding, therefore, would reflect the number of properties meeting each of these four conditions and the average cost per property to be acquired. Average cost per property during the first four years of the program has been $47,447. This figure includes a few relatively high-priced properties, particularly during the program's first year. In 1983 the average cost per property was $39,000. Therefore, for purposes of this estimate, an average cost of $40,000 will be assumed.

In the absence of data upon which to project future demand, an approach will be used which builds upon a study completed in 1981 on the implementation of §1362 (Abeles et al., 1981). More current data and program experience will be incorporated. This approach will begin with an attempt to define the universe of properties meeting statutory eligibility and then reducing this number to reflect each of the remaining conditions; i.e., cost effectiveness, owner willingness to sell, and state/local government's acceptance of title.

Using claims information from 1970 to 1979, the aforementioned study concluded that, on an annual basis, approximately 0.1 percent of all flood insurance policies for structures built prior to community adoption of minimum federal standards for floodplain construction will meet the statutory eligibility requirements for §1362. As of 1984, according to a study prepared by the Federal Insurance Administration of FEMA (1983), there will be approximately 1.8 million policies in force covering structures built prior to community adoption of minimum Federal standards for floodplain construction. Based on the information provided in these studies the potential number of candidates for §1362 acquisition is approximately 1,800 structures annually.

As a check on this estimate of statutorily eligible properties, a review of claims information on single family dwellings for the period January 1, 1978 to September 30, 1982 was made. Using $36,000 as the average value of the building (the value used in the 1981 study), there were 7,324 claims over $18,000 during this period. This is an average annual rate of nearly 1,550 claims. Theoretically this number of properties would have met the 50 percent damage criterion.

Data are not available to estimate how many properties would qualify on the basis of the other two statutory criteria. The 1981 study indicated that 98 percent of the properties would qualify on the basis of the 50 percent damage requirement. Program experience confirms that this is the predominant qualifying criterion; however, the circumstances in Clay County, Minnesota; Arnold, Missouri; and Mobile, Alabama, suggest that qualification on the basis of repetitive damages is higher than two percent. Likewise, the experience in Lake Elsinore, California, and Baytown, Texas, indicates that actions by local government may qualify some properties that do not otherwise meet the specific damage threshold. In these cases, repair and/or reconstruction of the substantially damaged buildings was prohibited and building permits denied.

Though the exact number of structures which statutorily qualify on average per year cannot be determined, claims data for the period 1970 to 1982 and program experience indicate that 1,500 to 1,800 claims is a reasonable estimate. Of this number there is a substantial percentage that do not meet the other conditions.

For example, a building which receives 50 percent damage from a 100-year flood may be eligible for purchase but may not be cost-effective to purchase since the statistical probability of another flood of the same magnitude occurring during the remaining life of the building is low. This would be particularly true when previous flooding was relatively infrequent and minor. Program experience indicates that as many as 25 percent of the total number of potential §1362 candidates would not be cost effective on the basis of the low probability of a future event causing significant damage.

In addition, many of these structures damaged greater than 50 percent may be able to be retrofitted (either elevated or flood proofed) at a cost less than that required for acquisition. FEMA is undertaking a study to determine the feasibility and costs associated with retrofitting existing residential structures for protection against flooding. Structures that can be economically retrofitted may not be attractive candidates for §1362. As many as 25 percent of the eligible candidates are likely to fall into this category. Applying these reductions of 50 percent to the 1,500 claims (the low end of eligible range) properties which meet statutory eligibility requirements in an average year yields 750 properties that it would be cost effective to purchase and remove from the nation's floodplains.

Without a systematic prospective process for identifying potential projects it is very difficult to establish the expected frequency of owner and/or state/local government unwillingness to participate in a §1362 acquisition. Historical experience indicates that using a 50 percent factor for these two conditions would be a conservative estimate. Applying

this 50 percent factor to the 750 properties which are statutorily eligible and cost effective to purchase, the final estimate for the number of properties to be acquired in an average year is 375.

Comparing this figure with recent experience of the program, indicates that 375 properties is a realistic estimate. Total properties acquired, in process of being acquired, or for which preapplications or applications have been received from the beginning of FY 1983 to February 1, 1984, total 837 properties. Though not all of these properties have been evaluated, it has been determined that the majority are good acquisition candidates.

The screening that normally occurs prior to the submission of a formal preapplication would suggest that 750 to 800 of these properties would meet the four conditions discussed earlier. From prior experience and knowledge of preliminary work on potential acquisitions, it can be expected that 50 to 100 additional qualified properties could be entered into the process in time for acquisition in FY 84, were funds available. Thus for FY 1983 to to FY 1984, 800 to 900 properties is a fairly accurate estimate of good acquisition candidates.

In summary, based on historical claims information and relatively short history in implementing §1362, FEMA estimates conservatively that an average of 375 properties which meet eligibility criteria, are cost effective to remove, and for which community and property owner participation could be expected, would be appropriate candidates for purchase. At an average cost of about $40,000 per property, including administrative costs, this would generate the need for approximately $15 million per year in funding to meet program needs.

Length and Flexibility of Funding

The total number of floodplain properties which would qualify for §1362 acquisition and would be cost effective to purchase cannot be determined based upon currently available data. However, it can be reasonably anticipated that funding will need to be maintained at the level identified in this report for the foreseeable future given the fact that the total number of existing structures which do not conform to adequate floodplain construction standards is not expected to diminish significantly until after the turn of the century (Abeles et al., 1981).

A factor almost as important as the amount of funding available is the way in which it is available. At present, funding is provided on a two year basis. This eases some of the administrative problems associated with responding to random acts of nature and carrying out a program requiring long lead times with the need to obligate funds by September 30 of each year. It does not, however, address problems of long-term flooding cycles. Two high flood years consecutively could generate needs which the available funding would be unable to meet. Alternative funding methods are suggested below to make the program more responsive when this situation occurs.

1. Supplemental Appropriations The precedent for making additional funds available to disaster related programs in unusually high demand years, is nonetheless clear. A system of appropriations could be established whereby an additional level of

funding could be appropriated through the normal process but only used when the basic appropriation was exceeded and some Congressional notification had occurred.

2. No-Year Funding By not requiring funds appropriated in any one year to be obligated by any particular date in the future, FEMA could manage appropriations to allow the accumulation of a reserve up to some maximum amount (for example, the reserve could be limited to two times annual appropriations). The President's Disaster Fund, established to allow governmental response to random acts of nature, is a good model for the §1362 program. The ability to respond more flexibly to needs as they arise will allow better long term planning of property purchase as a part of overall NFIP objectives and will allow better scrutiny to be used in the selection of properties. This alone will generate better return on the current level of investment. For the long-term it may be desirable to fund the program at a higher level, with even more flexibility.

Conclusion

This report attempts to arrive at a reasonable estimate for annual funding need for the §1362 Property Acquisition Program. Although reliable data upon which to project program need with a high degree of confidence are, for the most part, not available, the approach taken is believed to be supportable and logical. Those data that were used, though incomplete, were consistent with the logic of the analysis. Where data were missing with respect to a particular factor, conservative assumptions were made. As a result, the estimate of the annual average number of properties to be acquired (375) is probably on the conservative side.

References

Evaluation of Alternative Means of Implementing Section 1362 of the National Flood Insurance Act of 1968, research report prepared by the Joint Venture of Abeles, Schwartz, Haeckel and Silverblatt, Inc.; Ralph M. Field Associates, Inc.; Federal Emergency Management Agency, March 1981.

"Impacts of Section 1362 Property Acquisition on the Insurance Component of the National Flood Insurance Program," Office of Insurance Support Services, Federal Insurance Administration, Federal Emergency Management Agency, May 20, 1983.

PART IV (cont'd): SPEAKERS' PAPERS -- MONITORING

COMMUNITY PROGRAMS

MONITORING OPTIONS: QUESTIONNAIRES, TELEPHONE AND ONSITE SURVEYS

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The choice of survey methods depends upon the types of data agencies would like to obtain from communities and the weight attached to each of five key questions that should be considered when evaluating alternative data collection procedures. Each of the major data collection alternatives -- onsite interviews and observations, telephone interviews, and mail surveys -- has advantages and disadvantages in relation to each question. Which technique is best? The only straight forward answer is "It all depends."

The first issue that agencies considering monitoring community floodplain management need to resolve is this: Is onsite observation of floodplain development necessary to provide the information needed? In some cases that may be so. For example, if agencies want to determine the amount of error in meeting building elevation requirements, there is probably no alternative but either to visit a sample of communities to measure building elevations or to contract with a local firm to do that work. In either case, there is little need to consider further the use of telephone and mail survey techniques, since once someone is onsite, face-to-face interviews can easily be conducted at relatively little additional expense.

In many cases the data agencies will want to obtain to monitor and evaluate local floodplain management do not require onsite observation, but can be provided by local officials or other persons involved in or affected by the floodplain management process. That type of information can be obtained through face-to-face interviews, telephone interviews, or mail surveys. The choice of methods depends on answers to these five sets of questions: How important is it that data be obtained from a representative sample of communities and/or affected individuals and firms? How much information is needed and how complex is it? What degree of accuracy is needed? How soon is the information needed? and How much money can be spent to obtain the information? Each of these questions is discussed briefly as it affects the choice of survey method.

Obtaining a Representative Sample

In most cases, agencies will want to monitor and evaluate a representative sample of communities so that they will have some idea how well floodplain management is being conducted and whether problems detected are general in nature or unique to specific jurisdictions. Confidence in data from a sample is much higher if random samples of communities or individuals are selected for study. As a rule of thumb, samples of 100 or more units of observation provide reasonable accuracy for generalizing to the entire population. Random samples can be obtained from lists of the entire population of interest using each of the survey methods. Obtaining a large enough sample to have confidence in the results, however, sometimes affects the choice of method when there is a budget constraint. Face-to-face interviews usually cost 10 to 20 times more to conduct, and telephone

interviews three to four times more, than mail surveys. Other issues involved in obtaining a representative sample are summarized in the table below. Face-to-face and telephone interviews are about equivalent and both have certain advantages over mail surveys. The major problem with mail surveys is lower response rates (60 to 80 percent for a 12-page questionnaire versus 80 to 90 percent with telephone and face-to-face interviews) and higher item non response. Also, it is more difficult to control who actually provides information (fills out the questionnaire) with a mail survey. Techniques are available to minimize those problems, however.

Amount and Complexity of Information Needed

A very large amount of information may be obtained from face-to-face interviews (interviews lasting several hours are possible with committed respondents, such as agency heads). Telephone interviews may last up to an hour with a very low proportion of respondents terminating an interview by hanging up. In the case of mail surveys, response rates typically begin to drop when questionnaires exceed 11 pages or 125 items. In addition to requiring shorter data collection instruments, mail surveys require very careful questionnaire construction and are not very useful in obtain open ended responses or responses to items requiring prior screening to identify appropriate respondents.

Degree of Accuracy Needed

Mail surveys have advantages over both face-to-face and telephone interviews in obtaining accurate information. Because respondents can complete mail surveys as time permits, if adequately motivated they will look up needed data in agency records, make onsite observations, and take other steps to insure that information provided is accurate that are not possible with face-to-face and telephone interviews. Face-to-face interviews also suffer from a higher potential for what is termed "social desirability bias" and interviewer distortion and subversion. Social desirability bias refers to the tendency for respondents in face-to-face situations to say what they think the interviewer wants to hear; in the case of floodplain management, respondents would tend to respond in professionally appropriate ways, regardless of whether that was in fact the situation existing in their community. With an anonymous mail survey, candid responses are more likely to be obtained. Where face-to-face interviewing is conducted by independent contractors there is the potential for interviewer distortion and subversion; for example, interviewers may not word questions appropriately or may fabricate interviews and data. That is not an isolated occurrence in survey research; systematic checks are necessary to insure that interviews were actually conducted.

Time Available for Survey

When the time available to gather data is a consideration, telephone surveys have definite advantages over face-to-face interviews and mail surveys. With face-to-face interviews, time is required to travel to the site and only about three to four interviews per day can comfortably be completed per interviewer or agency staff person. If local interviewers are used, time must be allotted for training and onsite supervision. Mail surveys require approximately eight to ten weeks to be conducted properly

(original mailing, postal card follow-up, plus two follow-up letters with replacement questionnaires). In that time, 3,000 telephone interviews can be completed, assuming a bank of 15 telephones and calling during working hours. Thus, once the number of interviews to be conducted exceeds several thousand, the time required for mail and telephone surveys becomes comparable.

Personnel and Financial Requirements

Mail surveys do not require highly trained personnel to administer them (though highly trained personnel are needed for sampling and questionnaire design and construction) and can be conducted fairly inexpensively ($3 to $5 per respondent for administration). Telephone surveys require trained interviewers or knowledgeable agency staff. However, since interviewers can be closely supervised and monitored, less highly trained persons than needed for face-to-face interviews can be used. Telephone surveys generally run in the range of $10 to $20 per interview. Face-to-face interviews require trained personnel, since interviewers are on their own once they are in the field, and are expensive. Household surveys involving face-to-face interviews often cost $100 to $150 per completed interview. Surveys of local government personnel, which may involve travel and per diem expenses, may be even more expensive.

In summary, each of the three major data collection techniques reviewed here has advantages and disadvantages. The appropriate technique to use depends upon data collection objectives and available personnel and financial resources. In many cases, a combination of techniques can be used (e.g., direct observation of floodplain construction plus mail surveys of local government personnel and community business and institutional leaders) in order to improve the efficiency of data collection.

COMPARISON OF FACE-TO-FACE INTERVIEWS, TELEPHONE INTERVIEWS, AND MAIL QUESTIONNAIRES

Performance Characteristics	Face-to-Face Interviews	Telephone Interviews	Mail Questionnaires
1. Obtaining a Representative Sample			
a. Known opportunity for all members of population to be included in sample.	High	High	High
b. Control over selection of respondents within sampling units.	High	High	Medium
c. Likelihood that selected respondents will be located.	Medium	High	High
d. Response rates.			
1. Heterogeneous samples (e.g., general public).	High	High	Medium
2. Homogeneous, specialized samples (e.g., agency directors, ministers, students).	High	High	High
e. Likelihood that unknown bias from refusals will be avoided.	High	High	Low
2. Questionnaire Construction and Question Design			
a. Allowable length of questionnaires.	High	Medium	Medium
b. Type of question.			
1. Complexity.	High	Low	Medium
2. Open-ended questions.	High	High	Low
3. Screen questions.	High	High	Medium
4. Controlling sequence in which respondent sees items.	High	High	Low
5. Success with tedious or boring questions.	High	Medium	Low
c. Success in avoiding item non-response.	High	High	Medium
d. Insensitivity to questionnaire construction procedures.	High	Medium	Low
3. Obtaining Accurate Answers			
a. Likelihood that social desirability bias can be avoided.	Low	Medium	High
b. Likelihood that interviewer distortion and subversion can be avoided.	Low	Medium	High
c. Likelihood that consultation will be obtained when needed.	Medium	Low	Medium
4. Administrative Requirements			
a. Likelihood that personnel requirements can be met.	Low	High	High
b. Potential speed of implementation.	Low	High	Low
c. Keeping costs low.	Low		
1. Overall potential for low per interview costs.	Low	Medium	High
2. Insensitivity of costs to increasing geographical dispersion.	Low	Medium	High

SOURCE: Don A. Dillman, Mail and Telephone Surveys: The Total Design Method, New York: John Wiley, 1978.

WISCONSIN'S MONITORING OF COMMUNITY PROGRAMS

LuAnne Hansen and Thomas Hirsch
Wisconsin Department of Natural Resources

In 1968 the Wisconsin Legislature enacted floodplain zoning requirements for local governments. The Wisconsin Department of Natural Resources (DNR), Bureau of Water Regulation and Zoning, is charged with administering this state program by setting minimum state-wide standards and monitoring local programs where zoning is actually implemented. Zoning is just one element of comprehensive floodplain management; many of these other elements are under the aegis of other state agencies and bureaus with DNR. In 1983 the state decided to evaluate the effectiveness of its floodplain management program by analyzing first local zoning programs and next, state agency efforts and coordination in achieving the goals and objectives of floodplain management. This total evaluation is a necessary first step in choosing new or additional policy directions.

The Department of Natural Resources has monitored local programs by visiting with local officials on periodic audits. The present system of community audits was initiated in 1980. A district staff person spends one-half to two days in the community touring the floodplain, inspecting files, and interviewing the community's floodplain administrators. These audits are intended to provide technical assistance to the community as well as monitoring their progress. For two years the Wisconsin audits were conducted jointly with FEMA's CAPE process. Each year 25 percent of Wisconsin communities will be targeted for audits; thus the audit cycle will be completed every four years.

The audit data formed the central focus for the DNR's effectiveness study of local floodplain management efforts. The data were supplemented with secondary data from census, revenue and NFIP sources. Additional original data were collected from local community officials through a mail survey. Telephone follow-ups were necessary to complete the partial information supplied by many communities. Eventually 62 percent of the surveys were acceptably completed. These data were entered into a computer data base to facilitate statistical analysis. As new census, revenue, NFIP and audit data become available they will be added to the data base, as supplements rather than replacements to the existing data. This will allow us to measure changes over time within individual communities.

Q. Given limited budget and staff resources, what technique or combination of techniques can a federal or state agency use to monitor the effectiveness of community floodplain regulations?

A. To conserve agency resources, state and federal agencies should piggy back their efforts with other groups. FEMA's CAPE forms were easily filled out as part of Wisconsin's audit process because we asked many of the same questions. Not all communities can be audited. It is desirable to set priorities based on critical needs. Wisconsin used easily obtained secondary data sources to determine priorities for visits.

Q. Based upon your experience, are mail questionnaires of any value? Are telephone surveys reliable or useful? Are onsite surveys essential?

A. Our experience showed that mail surveys often needed telephone follow-up. In the future we hope to mail the forms out, then fill them in by interviewing the local official over the phone after he/she has had time to gather the necessary data from office files. Onsite visits are essential for accurate monitoring. We found that floodplain tours turn up problems that might be glossed over in the files or interviews.

Q. Can aerial photographs be used effectively? If so, how?

A. Aerial photographs could be used to identify buildings within the floodplain limits and to roughly determine uses (open space, residential, industrial) of the floodplain. But elevations cannot be determined from aerial photos, so in Wisconsin where properly elevated flood fringe development is allowed, the photos could not help us identify how many structures are actually "at risk."

Q. Did you compare subjective information with objective information?

A. We tried comparing subjective information (mostly from the yes/no questions on the CAPE form) with objective observations (variances granted, disaster rates, new at-risk development). We were unable to find any significant correlations between the subjective and objective measurements. Our staff were asked to rate community effectiveness on a subjective scale. Again the staff ratings could not be correlated with objective measures of floodplain management effectiveness. Wisconsin continues to research this subject.

Q. What follow-up is needed to a particular approach or set of conclusions?

A. Wisconsin's audit follow-up involves recording recommendations (new maps, ordinance changes) then assigning deadlines and staff personnel to implement the recommended steps. The follow-up procedure is on a spread sheet in our main computer file so both central and district staff can note task assignments and record their progress in achieving those.

Q. How should a state or federal agency select communities to be monitored?

A. Wisconsin will seek to monitor every ordinanced community at least once every four years. For some communities this may be only a 30 minute drive-through and drop-in visit. But we will also use a priority system to select communities that will be visited more often or communities to receive an extended technical assistance visit. The audit priority system will be built around such measurements as: population, extent, type, and changes in floodplain development; recent floods, insurance claims, and future growth predictions.

Q. Could or should onsite telephone mail survey or other monitoring efforts address such broader issues and needs beyond education and enforcement of regulations such as community mapping, technical assistance, and public education? If so, why, how, and at what cost?

A. Combining monitoring and technical assistance in one community visit has both advantages and disadvantages. The combination approach saves on staff time and travel expenses. The staff person's approach for a truly objective monitoring interview would be much different than if that person were trying to inform and educate. Monitoring efforts need to be standardized among various interviewers. This means the questions in the interview need to be asked in order and as written. The monitoring interviewer needs to remain a neutral observer and recorder to keep from adulterating the respondents answers with his/her own ideas. While the goal of each kind of interview is to stimulate discussion, the program monitor must remain more neutral than the trainer. Similarly the local official being interviewed is going to react differently if he/she knows he/she is being monitored than if the goal is education. The image and authority of the interviewing agency (regulatory vs. assistance) will also influence the local official's responses. FEMA and the states need to reconsider this issue of mixing the two functions. While the two might be effectively combined, we need to know how monitoring results will be affected.

MONITORING FLOODPLAIN MANAGEMENT TECHNIQUES AND COMMUNITY PROGRAMS

Mary Fran Myers
Illinois Division of Water Resources

Monitoring the effectiveness of local floodplain management programs is appropriate for federal and state agencies involved in floodplain management for two reasons. First, these agencies should promote objectives directed at the wise development of this nation's floodplains and the reduction of susceptibility to flood damages. Since local floodplain management programs make or break the objectives, by monitoring the locals the agencies evaluate themselves.

Second, if local governments are not doing their job, then some states have the explicit authority (others have implied authority, and some none at all) to manage floodplains themselves. Where the state does not fill in this gap, the federal government has responsibility -- at least in ensuring that federal tax dollars do not return to lackadaisical communities. If local governments are not monitored, how do state and the federal governments know when they must assume this responsibility?

The big question is to determine how to monitor local governments within the limits of the budgetary constraints set by various legislative bodies. This paper addresses these issues from the perspective of a small, rural state.

The best technique to monitor communities is through one-on-one contact with those communities. While this process is costly and time consuming, it is the only way to get a truly accurate picture of a community's floodplain management program. Until that initial face-to-face contact has been made, effective communication with local governments cannot be achieved.

Once the contact has been made and assuming a good rapport is established with the community, then monitoring with less expensive, less time consuming methods can be used. For example, annual reports can be employed; maintaining contacts with regional planning organizations can supply useful information; and region-wide workshops or seminars can be beneficial to target areas for closer monitoring attention.

Mail surveys do have some value. This is particularly true when the person completing the survey has already had the opportunity to have personal contact with the responsible agency, and to know the purpose of floodplain management programs. Mail surveys can also be beneficial by providing basic information (such as the data collected in NFIP annual reports) and in identifying areas in need of help (such as those that respond "yes" to the question on the annual report, "Are you in need of technical assistance?").

There are two problems with mail surveys. First, not everyone fills them out. A 50 percent return on a survey is considered a great response. That may be true when gathering general information in an entire area, but it is not true when you want to monitor Community X's compliance efforts,

and Community X happens to be one of the 50 percent that did not respond to your survey.

The second problem, particularly with surveys long and complex, is that people will not take the time to carefully fill them out. Two examples come to mind. The one conducted by Ray Burby at UNC was fairly lengthy and asked some thought-provoking questions. Of the four copies of the survey sent to people at the State Water Commission in North Dakota, two were not completed. People were simply too busy to take the time needed to adequately answer the questions. The other survey is the ASFPM Map Initiatives Project survey. The time needed to carefully review the sample maps and answer the survey is considerable. In Illinois, to combat this problem, the questionnaire was shortened and distributed at a building officials' conference. By doing this, at least some input was acquired from the people who use the maps to manage floodplains.

I believe there are short cuts in conducting community surveys. In doing one-on-one meetings, it is possible to conduct several per day. By spending a week on the road, it is possible to hold 10 to 15 meetings. I believe that is very cost-effective.

It is important to meet with the right people. It is necessary to meet both with the person with the authority to make decisions and policies, and the person with the responsibility for implementing those decisions. If possible, a community monitoring meeting should involve both groups to be truly effective.

Perhaps the best time and cost saving device is to draw some conclusions from a few community monitoring efforts and forget about monitoring others. It is likely that 95 percent of small rural communities participating in the NFIP all have the same problem: they are not aware of their floodplain management responsibilities. Rather than taking the time to review each and every community, it might be more constructive to turn our resources toward combating the problem: more technical assistance, more detailed data, and more public education.

In conducting meetings and surveys, I am a firm believer in trying to get off on a positive note. It is very important to remember that state and federal governments exist to serve the people and not vice versa. State and federal agencies must be aware of local needs and problems. Every effort should be made to mold government programs to fit the unique conditions at the local level rather than ask local governments to work around rigid, inflexible bureaucratic regulations.

If aerial photography is available, perhaps it can be helpful in monitoring, but only in a limited sense. Comparison photos would be required in order to do any good. I do not believe the expense in acquiring those is worth it.

In monitoring a community's compliance with the NFIP, it is essential to look both subjectively and objectively. A community's enforcement (or lack of enforcement) of a floodplain ordinance is not always the best indicator of effective floodplain management programs. The City of Grand Forks, North Dakota, provides an example. Grand Forks has a floodplain

ordinance which allows the construction of residential basements. They do not have a basement exception. FEMA Region VIII is aware of this situation, yet no effort has been made to CAPE the community or somehow otherwise encourage them to come into compliance with the NFIP. The State of North Dakota does not condone the Grand Forks ordinance, yet that city is heralded as a model for other communities. Why? Because Grand Forks is the only city in the state that actually levies taxes for floodplain management. They have a one mill levy targeted specifically for that purpose. They have a comprehensive flood fighting and emergency preparedness plan. They have developed and are in the process of implementing a major acquisition/-relocation plan on their own. They are not relying on outside help from the state or federal government. So, in monitoring their activities, we must look beyond the number of basements in the floodplain and their less-than-perfect ordinance. We have to look at the whole picture and compliment them for their efforts.

Another reason to look subjectively at community floodplain management programs is that the NFIP regulations are not always the whole answer. Jim Considine, Illinois Division of Water Resources, notes in a paper about floodplain management in the Chicago metropolitan area, that many communities have adopted more stringent floodplain management regulations than the NFIP requires as well as regulations dealing with stormwater management, wetlands, and soil and erosion control. He attributes this trend to the fact that ". . . the floodplain requirements of the NFIP are not adequate for the metropolitan area. Communities have recognized the need to adopt other regulations so as to mitigate the effects of urbanization on flood elevations." One might conclude that if a community in the metropolitan area only has the minimum NFIP regulations adopted, then their floodplain management program is probably not very effective. Any monitoring activity should reveal that inadequacy.

I believe that whatever type of follow-up is needed to a monitoring effort is what should be supplied. There is little sense in monitoring if no actions result from it. We should strive toward providing technical assistance and working with a community to correct any deficiencies as much as possible instead of taking the more formal, legal action. Legal proceedings can be costly and time consuming. In Illinois, for example, the Division of Water Resources with its current staff can only conduct four enforcement hearings a year for violations of the state floodway law. CAPEs, as well, can be long, unproductive, time consuming affairs.

State and federal agencies should work to be as consistent as possible with follow-up. If FEMA CAPEs a community and discovers violations, then not only the sanctions that come with suspension should apply, but also the state should invoke whatever penalties are appropriate (i.e., denying state aid for flood control projects or disaster aid). The full ramifications of federal and state executive orders relating to floodplain management should be applied by all state and federal agencies.

Potential for flood damage along with potential for new floodplain development should be the main criteria for selection of communities to be monitored. The reason is obvious: it is in these communities that proper enforcement of floodplain regulations might make a difference.

Monitoring efforts should address issues beyond regulations. The effectiveness of floodplain regulations is intertwined with several factors: the adequacy of the data, the level of community awareness, the status of other local land use regulations, the existence of other structural and nonstructural floodplain management measures. Situations in communities are not so cut-and-dried that regulation effectiveness can be separated from these other factors. Nor can state agencies afford the time to separate them. With limited staff and budgets, states must concentrate on more than just monitoring. They must provide the best service possible to meet the overall objective of reduced flood damages. With proper planning, all of the tools available to meet that objective (monitoring, data, assistance, and education) can be balanced.

MONITORING LOCAL FLOODPLAIN REGULATIONS IN ILLINOIS

French Wetmore
Illinois Division of Water Resources

The Illinois Division of Water Resources has monitored and assisted local regulatory programs for the last eight years. We have assisted in Community Assistance and Program Evaluation (CAPE) meetings, we have conducted over 60 CAPEs on behalf of the regional office, and we have conducted over 500 community assessment site visits. Over the last few years, the bulk of this work has been performed by regional planning commissions field advisors under contract to us and funded by the State Assistance Program.

Priority for Monitoring Work

Communities that request assistance in enforcing their ordinance are the ones who receive top priority for an assistance or assessment visit. Second priority for a visit are those that we have heard have regulatory problems, either from a citizen's complaint or notice from the state floodway regulation staff. Third priority in scheduling a visit is based on a classification system we developed a few years ago. Every community in the state was given a score based on factors such as population, growth, severity of flood problem, number of flood insurance policies in force and disaster payments. While the system is not a refined method of telling exactly how bad a community's problem is, it definitely separates high priority communities from low priority communities.

The Northeastern Illinois Planning Commission surveyed local officials and asked if their field advisor could be of assistance. This survey did help identify some communities who needed help. Some field advisors have also used the NFIP annual reports to prioritize communities for monitoring work. Some of the problems with the annual reports have been improved in the last year by FEMA regional staff following up on inaccurate reports.

I have some reservations about relying on surveys and annual reports because I do not think that they are going to tell us what we need to know. It is hard to expect an honest answer when a federal agency asks a local official to evaluate himself. Further, there will be more responses from the better organized, more active and interested communities. Those who are not doing anything will not respond. If a community reports a low number of permits or variances, it does not mean that it is regulating properly. It may mean that the local officials do not bother to document improper construction by requiring a permit or following the variance process.

The only way to be sure that a community is requiring proper construction is to look at what has been built. This requires a site visit that includes a tour of the floodplain and a review of office procedures. We have developed a two-page field advisor's checklist for these site visits which is similar to the one FEMA uses for CAPEs. A sample of the checklist is included at the end of this paper.

Floodplain Tour

The first step in a site visit is a driving tour of the floodplain which is usually done without the local officials. The field advisor is free to see any part of the floodplain and he looks for any new development, in particular filling and new buildings with basements. New buildings are easy to spot if one looks for recent landscaping. From the tour he can get a feel for the area and sites to check in the permit files.

The floodplain tour could include a check of first floor elevations but we have not done that yet. We have worked with the firm of Sheaffer & Roland and developed a quick and simple survey technique for obtaining first floor elevations. This is explained in the manual, Surveying Buildings for Flood Hazard Mitigation (Local Assistance Series 3A). This technique involves sighting with a hand level from a car that is located over a known elevation such as a flood insurance study reference mark. This method can be used to quickly check one or two buildings.

As an alternative, one could check the elevation of every building in the floodplain but this requires more preparation of a reference map as explained in the manual. The use of this hand level technique is subject to inaccuracies of one or two feet. It is a good method to see if there is an obvious problem but no real enforcement action should be taken until a more accurate method is used to check the building elevation.

Office Visit

In many communities there has been little construction since passage of thea regular program ordinance and the office visit is the only way to ensure strict regulations. The initial office visit should only include the building official or whoever is the person responsible for the ordinance. He is the one who must know what he is doing. Sometimes the mayor or manager will want to sit in and we have no problems with that. However, we have found that often building officials are more honest about their communities' regulatory shortcomings, particularly if they are new or are receiving pressure from above to issue permits.

Section 4 of the Field Advisor's Checklist is the key to discerning whether the local official knows what he is doing. The important thing on our office visit is to ask the appropriate leading questions. For example, the field advisor should not ask "Where is your flood insurance map?". He should say "How do you decide if a property is affected by your floodplain ordinance?." If the building official does not refer to a map, we know we have a problem.

It is important during community monitoring to keep in mind the complexity of the NFIP to a part-time local official who has many other job responsibilities. We try to simplify the requirements and not focus on minutiae that may exist in the federal regulations.

Particularly in rural communities that have had little floodplain development, we know we have an effective local system if we can answer the following four questions in the affirmative.

Is the community using the latest appropriate flood insurance map?

Is the local official requiring permits for all development, particularly including filling?

Are floodway development projects being forwarded to the state floodway regulation office?

Is the community keeping records of as-built first floor elevations?

These four questions summarize the NFIP in Illinois in a nutshell. If the community is not doing any one of these, extra work and follow-up are needed.

Follow-up

After the site visit, the field advisor should send a letter to the mayor with a copy to the building official. The letter summarizes major shortcomings and identifies specific correction measures that need to be taken. Often we include deadlines. We also send a letter to the mayor if we find that the local program is especially well-run.

It is very important that we devote resources necessary to follow-up on these letters. This can be in the form of having the community submit documents by the stated deadlines, telephone folow-up later on or even a repeat site visit. Sometimes we need to have meetings with the superiors and, in some cases, we have had public meetings with the city council or county board. If the community is truly errant and needs pressure put on it to reform, we have found the public meetins with media coverage to be very successful. Even if the community is doing everything properly, follow-up visits or telephone calls are necessary every year or so. Which technique to use and how soon to follow-up depends on the development potential.

FIELD ADVISOR'S CHECKLIST

COMMUNITY: French Ford AS OF: Oct. 26, '81

1. FLOOD PROBLEM

Historic Floods: 1941 Flood of Record, no one remembers it
1979 - 30 homes damaged. County declared disaster area by SBA.

100 Year Floodplain:
Number of residences: approx 40
Number of non-residential buildings: 7
Special Features: 100 year floodplain includes nursing home. 1979 flood cut off all access to Northeast part of city

Floodplain development potential: In the city the floodplain is mostly already built up. Just North of city limits the farmland has been considered for subdivision.

2. FLOOD DATA

Floodplain boundary map used: FIRM, June 10, 1980

Source(s) of 100 year flood elevations: FIS profiles for Wise Creek
No source for approximate A Zone ponding areas.

Source(s) of floodway determination: FIS - Floodway Map

Other flood studies done on the area: IDOT-OWR Recon Study, 1978 - Concluded that there was no feasible structural project.

3. ORDINANCE

Basis: DWR model (1980 LAS 2C)

Local Standards that differ from DWR & NFIP requirements:
1 foot freeboard required

Community: Frenchford

4. DEVELOPMENT REGULATION SYSTEM

Yes Is the permit official familiar with his ordinance?

Yes Is he using the most recent version of the regulatory floodplain maps adopted in the ordinance?

Yes Does the community ensure that all floodplain development, including dumping and filling, is regulated? If so, how?
Building official lives in the area and periodically checks it for unauthorized construction or filling.

No Is there an application for permit form that notes whether the property is in the floodplain? If so, include a copy.
Application form does not reference floodplain.

Yes Is there a permit form issued for approved projects? If so, include a copy.

(No) Are possible obstructions to the flow of floodwaters being forwarded to the Division of Water Resources for a Section 70 permit? No floodway projects since ordinance passed. Building official knows about Section 70.

Yes Are records of as-built elevations and floodproofing certificates for new buildings being kept? If so, how?
Locally developed form provided to banks and insurance agents, copy attached

5. PERSONNEL

	NAME	PHONE
Engineer:	Lightning Engineers, Inc. (Consultants)	
Planner:	None	
Attorney:	Clarence Darrow	
CEO:	John Burn, Mayor	
Zoning/Building Official(s):	Bill D. Best	

MONITORING LOCAL FLOODPLAIN MANAGEMENT

Marguerite Whilden
Maryland Department of Natural Resources

Most critical in monitoring local floodplain management is the need to develop a national policy including specific standards and resources with which to monitor. Since the federal government has the largest investment in floodplains by virtue of having underwritten billions of dollars in insurance coverage, it would benefit it most to have an organized local monitoring program. Most states with floodplain management programs in force should be assisting with the monitoring; however, it is not the states that have the most at stake.

FEMA's CAPE program provides authority and justification for the federal government to conduct an ongoing effort to address the proper enforcement of floodplain regulations and improve community understanding of the National Flood Insurance Program (NFIP). The CAPE process has been under-utilized and in general not taken very seriously in the past. It seems logical at this point, with a reduction in the federal flood study effort, that an emphasis on CAPEs would be in the overall FEMA work plan.

At the state level, we appreciate the efforts of FEMA to provide funding through the State Assistance Program and other funding programs for the purpose of conducting CAPEs; however, these efforts have been piecemeal with no assurance for continuation. Furthermore, these funding programs are not addressing the need for a national policy on monitoring.

Maryland is a strong advocate of federal/state cooperation in monitoring local floodplain management. In those states where flood hazard management is a major concern, monitoring and enforcement should be a major effort of the state resource protection function. Accordingly, Maryland has participated in the CAPE process since its implementation in 1976, thereby gaining valuable perspectives on how its own natural resources protection measures are perceived at the local level. Most importantly, local officials have realized that there is a cooperative partnership in existence among federal, state, and local governments that can produce effective flood hazard management.

Once a national monitoring program has been developed, each region should have the leeway to develop a CAPE process that meets its own needs. The important thing to keep in mind is the goal of a CAPE: to assure that all communities understand the NFIP and that they are meeting the minimum requirements of the program. The achievement of this goal should be left up to the regional level with proper support and funding from the central office.

The National Flood Insurance Program depends largely on proper federal policy and action. For its own benefit, FEMA should enchance the federal, state, and local partnership. This could be in the form of a memo of understanding to the governor of each state or director of each coordinating agency. States in turn could actively support NFIP and integrate these regulations into other state programs. Local municipalities and counties can expand on this partnership and utilize national floodplain management

objectives and requirements to extinguish complaints of over zealous floodplain regulations and implement an equitable resource management program at the local levels.

Techniques

One person from the federal region and one from the state are capable of conducting a proper CAPE. Make arrangements beforehand to be driven around the community by a local employee. The federal and state people can check elevations during the first day and split up to check banks and insurance agents on the second day. If questionable development is discovered, return to the local official on the third day to resolve any concerns. This procedure is very simple and inexpensive. Three-day CAPEs are required in large counties.

Mail Surveys

Mail questionnaires and telephone surveys should be conducted by the state coordinating agency. State coordinators should know their communities and make annual recommendations to FEMA for CAPEs. Such inquiries are useful and show a sincere state effort to help with community implementation of the NFIP. Onsite surveys are essential by the federal/
state team and are most effective when the assistance element of the CAPE is stressed rather than the floodplain detective end of it. Most onsite surveys involve an informal discussion with local officials which can reveal some very interesting and innovative activities in the community. For the most part, we are pleasantly surprised by the level of conscientious floodplain management. The violations that are discovered are generally due to a misunderstanding of the regulations or individual property owners who are unaware of the floodplain regulations.

Shortcuts

There are shortcuts to monitoring the extent and type of floodplain development by involving other state and local agency officials. Often we are made aware of pending development through the Executive Order 11988 review process. There are several other activities within local municipalities and counties which rely on site inspection. We have begun working with the Soil Conservation Service in areas with wetland protection inspectors. These other inspectors should be made aware of the purpose of the NFIP and in turn could provide information back to the state coordinating agency. These shortcut techniques do not satisfy the need for periodic technical assistance and general updating on changes to the NFIP. Therefore, the task before us should be to explore ways of conducting informative and thorough CAPEs for less money.

Techniques in Conducting CAPEs

The best technique in conducting a CAPE is to stress the assistance element and explain that lenders and insurance agents will also be included to determine if the NFIP is meeting the needs of the people for which it was developed. A good CAPE will always remind local officials that development is not precluded and that amendments to both the map and the regulations are possible. Also, if the resources are available it is always good

to offer specific assistance on individual permit applications. This is a service we believe the state coordinating office should provide with assistance from the FEMA region whenever possible.

Aerial Photographs

Aerial photographs can be useful for evaluating land use changes over a longer period of time and for large areas. Where reliable photography is available this method could be used to determine where CAPEs are necessary, but considering the effort involved in evaluating and comparing aerial photos, this time and effort might better be spent on telephone surveys or actual field work. For the most part, aerial photography surveys do not address the need for continuing community assistance in the federal/state partnership. If time and effort is going to be spent reviewing maps, the tax maps from the assessor's office would be a good source of information.

Objective/Subjective

In my experience with Maryland communities, those with seemingly unimaginative floodplain management programs turn out to be some of the most innovative and airtight enforcement programs around. My favorite example is Dorchestor County which originally fought the NFIP tooth and nail. In a recent CAPE we learned that they not only require an elevation reference point on the site before the permit is issued, but a county employee actually checks the finished floor elevation before a certificate of occupancy is issued. In the same process the county is also providing the elevation certificate for insurance purposes. The County used Coastal Zone Management funding to establish elevation reference points throughout the jurisdiction and now implements one of the more efficient flood hazard management programs in the state.

In most cases, Maryland communities think they have a good program and in reality they do. There are a few, however, which have developed a capricious attitude towards floodplain management. In cases where structures are placed in floodplains without the required state permits, we are prepared to notify the owners of their violation status and as such are ineligible for flood insurance. This is another area where FEMA must develop a consistent policy with regard to how they would support the state when a §1316 determination is requested.

Follow-up

When Region III was better funded to conduct CAPEs they sent back to the community a very thorough evaluation of the local floodplain management program. In most cases this evaluation praised the community for the excellent program they were implementing. In those cases where violations are found, FEMA and the state must follow-up with the community to assure that the community is well aware of why the development constitutes a violation and what measures could be implemented to mitigate flood damages at the site. In one case where the state had discovered a violation to our floodplain encroachment law, provisions were made by the property owner to install a sophisticated flood warning system in the underground parking facility of the structure.

In general, the state tries to work with the situation to make the construction more effective for flood hazard management and resource protection purposes. We are not all that familiar with legal action for removing the structure, but we are pursuing the use of §1316 for a particular project which has potential for being altered by the owner. We have assumed that once a structure is denied flood insurance coverage it would also be ineligible for any disaster assistance. This is another issue we would like to have clarified by FEMA.

Selection of Communities

Every year FEMA Region III asks the state to prepare a priority list for CAPEs. We believe that as state coordinators we have a better idea where the development is occurring. Ocean City is always on our priority list. The best indicator would be the rate of development, which can be obtained from the number of permits. In those communities with highly developed floodplains at the time they entered the program, we must monitor renovation activities as well. The FEMA annual report can assist greatly with selecting communities for CAPEs. In all cases, the state should be included in the selection as well as the actual CAPE.

Monitoring and the Broader Issue

We should strive to integrate the NFIP regulations into existing local programs and make the monitoring effort more of a learning process for the local community in which they can become aware of new federal and state programs which can enhance other local concerns. In Maryland we have used the community meeting as a mechanism of informing local communities of our flood management grant program, the watershed management program, sediment and erosion controls, floodplain encroachment permits, emergency management and many other state resource protection activities. While reviewing a development in Charles County, the developer agreed to place excavation signs in the field and provide an area for cars during excavation.

When a national policy is developed for monitoring community floodplain management on a regular, continuing basis, these community visits can become the catalyst for many other environmental, social, and economic governmental programs. It is not possible to do away with the community visit. However, if we look at this effort in a different light the costs involved are much easier to justify.

The National Flood Insurance Program is the only federal program that is intimately involved in local land use issues. The NFIP has many other unique qualities that should be capitalized upon. We could down-play the evaluation part of a CAPE and stress the assistance part of it. Through local floodplain management monitoring, the federal and state government can enhance their relationships with local governments.

MONITORING LOCAL GOVERNMENT NFIP ADMINISTRATION

Rick Mayson
FEMA, Region IV

After more than 10 years experience in working with local governments on floodplain management issues, I am convinced that the majority of communities participating in the National Flood Insurance Program do not effectively administer floodplain management regulations. I am further convinced that the most effective way not only to monitor local floodplain management regulations, but also to provide the technical assistance necessary to assist local governments in administering an effective program is through an onsite, face-to-face basis.

On March 13, 1976, the first formal Community Assistance and Program Evaluation visit was conducted in Region IV. Since that first monitoring visit some eight years ago, we have conducted 230 CAPEs. While the total numbers are low in comparison to the need, we simply cannot sacrifice quality for quantity. Our philosophy is that when we leave a community both we and they know all deficiencies and, more importantly, how to correct those deficiencies and preclude future occurrence of them.

We have been able to find no short cuts that will provide us with the quality product that I just mentioned. Rather, we have found that our effort has doubled in staff time and budget costs per community from our earlier process to the one we use currently. Each CAPE is conducted by one planner and one engineer from our staff. We have survey equipment and a camera, which is transported to the site and utilized to verify and record elevations of selected buildings. The average time spent in the community is two and one-half days -- two days with community officials and one-half day with lenders and insurance agents. Extensive time is devoted to preparation for the meeting and with our follow-up to correct or abrogate deficiencies. Attached is a skeletal outline of our CAPE manual used by all staff members and states in Region IV that conduct CAPEs through State Assistance Program.

We have an extensive network of telephonic and written correspondence with local governments -- usually site-specific, one-issue technical assistance matters. We use these records along with biannual reports, citizen complaints, insurance policy data, state coordinator recommendations, and flood disaster history to determine priorities for our annual CAPE schedule.

Our records indicate that approximately 57 percent of the communities monitored had deficiencies in the administration of their programs. Approximately 14 percent were considered to have major deficiencies which required abrogation measures and extensive follow-up monitoring. I would venture to say that each one of these communities thought that they "had a good program" before we monitored them.

The three most frequently encountered deficiencies are inadequate inspections, i.e., failure to properly verify code requirements; improper records; and excessive and improper approval of variances.

From our experiences we have reached the conclusion that many communities have inadequate programs due to ignorance, inexperience or inadequate training, but the majority of community officials simply are not committed to the principles of sound floodplain management. Most local officials do not believe that a serious flood can occur in their town or county. Most believe that our minimum standards are excessive. Most perceive the program as an insurance mechanism. And most do not consider our regulatory standards to be as important as their other health, safety, and welfare codes.

Our monitoring efforts and follow-up activities emphasize the regulatory aspects and in particular, the potential liability of the local government as well as the possible suspension from the NFIP. We always follow up with a letter to the chief executive officer of the community which states our findings as well as identifies corrective measures that must be accomplished within a stated time period. We also utilize the probationary status approach for some communities with special reporting requirements that allow follow-up monitoring without additional costly visits to the community.

I am firmly convinced that our monitoring effort is the single most important activity of our program. Without the knowledge and commitment at the local level we will never accomplish our goal of reducing flood damages in this country. There really are no short cuts to this costly and time consuming effort. It requires trained staff and adequate travel budgets. This year three of our state coordinators are undertaking this monitoring effort. We are hopeful that next year additional states will take on this challenge so that our monitoring efforts in FEMA Region IV can be doubled by the end of Fiscal Year 1985.

PREPARATION FOR THE CAPE MEETING

I. Contact Local Official (Coordinator) to set up meeting.

II. Determine areas of major development.

- A. Obtain good base map
- B. Discuss with Local Contact

III. Send meeting letter to CEO.

- A. Date and Time
- B. Where
- C. Nature of meeting
- D. Copy local contact and State Coordinator

IV. Review Community file for problems or unique situations.

V. Review Flood Damage Prevention Ordinance for deficiencies.

- A. Prepare checklist.
- B. Be prepared to discuss deficiencies in meeting.
- C. Establish time limit for corrections in CAPE follow-up letter to community.

VI. Review Flood Insurance Study

- A. Take copies of FIRM's and FBFW maps.

VII. Determine Preliminary sites to visit.

- A. Areas of major development.
- B. FIRM's and FBFW maps.
- C. Recon on 1st day

VIII. Secure Annual Report

- A. Check number of permits and variances issued.

IX. Secure latest insurance information.

- A. Number of policies in force.
- B. Total coverage (whole dollars).

X. Prepare to visit banks and insurance agencies.

- A. Check with official
- B. Check yellow pages
- C. Request list of high volume insurance agencies from CSC.
- D. Select at least two banks and insurance agencies to visit.

XI. Prepare meeting agenda (optional)

XII. Call to reconfirm meeting.

CAPE AGENDA

I. INTRODUCTION

A. Reason for meeting

II. ADMINISTRATION AND ENFORCEMENT

A. Procedures for enforcement
B. Floodways
C. # Permits issued - since last visit.
D. Subdivision Review
E. Mobile homes
F. Variances
G. Ordinance Review (obtain copy)
H. Levee Policy
I. V-Zones
J. Annual Report
K. Floodproofing
L. Record Keeping
M. "A" zones
N. Breakaway Walls

III. VERIFICATION OF "AS-BUILT" ELEVATIONS, V-ZONE CERTIFICATIONS, FLOOD-PROOFING CERTIFICATIONS AND NO-RISE CERTIFICATIONS.

A. Procedure Used
B. Check records in-house (assign person).
C. Field checks
D. Bench marks available + base map.

IV. ADEQUACY OF DATA

A. Has there been alteration in flood plain (floodway)?
B. Do they have the appropriate maps (FHBM, FIRM, FBFW)?
C. Revisions required.

V. DIFFICULTIES ENCOUNTERED BY COMMUNITY

A. Suggestions

VI. CAPE QUESTIONNAIRE

VII. VISIT BANKS AND INSURANCE AGENTS

VIII. VISIT CHIEF EXECUTIVE OFFICER

VERIFYING COMMUNITY COMPLIANCE
(44 CFR, 60.3)

I. DISCUSS COMMUNITY'S PROCEDURE FOR VERIFYING

A. What type verification?

1. Certificate from registered land surveyor or engineer.
2. Verified by Building Official (using BM at site)
3. Certified on "As-Built" plans.

B. When do they require certification?

1. Immediately after lowest floor is completed?
2. Prior to issuance of Certificate of Occupancy?

C. If later, suggest a time period be added to their ordinance.

1. For example, Region IV's Sample Ordinance.

II. REVIEW PERMIT FILES FOR VERIFICATION

A. Do the files contain documentation?

1. If so, select a few sites to verify.
   If not, select a number of sites to verify.
   a. Review community ordinance and 44 CFR, 60.3(b)(5) with community officials.

III. FIELD CHECK OF "AS-BUILT" ELEVATIONS

A. Select projects under construction.
B. Verify others that have been verified.
C. Utilize local bench marks.
D. Field Surevy Report.

IV. ANCHORING CERTIFICATIONS (V-ZONES ONLY)

A. Is documentation in file?

1. If not, review with local officials the section in their ordinance and 44 CFR, 60.3(e)(4).

B. Mangroves and Sand Dunes
C. Breakaway Walls

V. FLOOD-PROOFING CERTIFICATIONS

A. Is documentation in file?

1. If not, review with local officials the section in their ordinance and 44 CFR, 60.3(c)(4).

VI. FLOODWAY "NO-RISE" CERTIFICATION

A. Is documentation in file?

1. If not, review with local officials the section in their ordinance and 44 CFR, 60.3(d)(3).

VII. DOCUMENT NON-COMPLIANCE

A. Pictures
B. Names and Addresses
C. Type of Violation

FIELD SURVEY REPORT

Name of Owner (if available): _____

Address of Structure: _____

Type of Structure: _____

Provide intersecting streets on either side: _____

_____

Distance from edge of street to front of structure: _____

Flood Zone: _____

Base Flood Elevation: _____

Actual Lowest Floor Elevation: _____

If in a V-Zone or floodway, does it meet FEMA construction standards

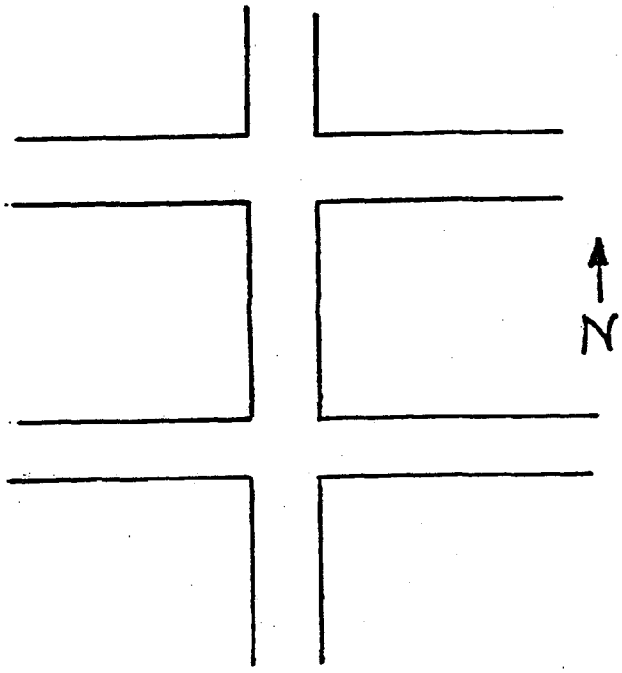
_____if not, explain: _____

_____

_____

Development Permit # _____

Date of Issue: _____



(PICTURE)

FEMA REGION VII EXPERIENCE WITH COMMUNITY ASSISTANCE AND PROGRAM EVALUATION

Patricia K. Stahlschmidt
Federal Emergemcy Management Agency

The purpose of the Community Assistance and Program Evaluation (CAPE) program is both to provide technical assistance to the communities participating in the National Flood Insurance Program (NFIP) and to evaluate the floodplain management enforcement efforts of these communities. Due to time and staff constraints, Region VII has focused its CAPE activities on regular program communities. The Region's basic goal has been to CAPE each of these at least once every five years.

This paper focuses on the method developed by Region VII to select and screen CAPE candidates. By following the procedures described below, the Region attempts to gain maximum benefit from its CAPE program. Another important advantage to these procedures is that they allow the Region to identify potential problem communities before serious violations occur.

Identification and Selection of CAPE Candidates

In FY 1982, Region VII developed a method for selecting communities to be CAPEd that fiscal year. The method assigned points to communities based on the five factors shown below. Those communities having the greatest number of points were selected in this manner. The remaining CAPEs were selected on a discretionary basis throughout the year, as the need arose. The five factors and their point values are:

FACTOR	POINT VALUE
Development pressure	5
Large percentage of variances to permits	4
Five years with no CAPE or over one year from conversion	3
No annual reports received for the last three years	2
Travel savings and efficiency	1

After using this priority ranking system for two consecutive years certain problems emerged. The principal problems involved the difficulty in

identifying development pressure, and particularly development potential in the flood hazard areas; variances were not always recorded or accurately reported; and, using the date of the last CAPE as a factor lead the Region to select small communities which had little floodplain activity or need for a CAPE.

In FY 1984, Region VII revised its CAPE selection criteria to provide more flexibility and a less quantitative approach to CAPE selection. The Region determined that any community meeting one or more of the following criteria would be considered a potential CAPE candidate.

1. The community's annual report, or the absence of one, was the principal factor used to select CAPE candidates. Any community meeting the following conditions was automatically reviewed by the CCO as a possible CAPE candidate:

   - No annual report received for the past two reporting periods.
   - Any community that requested assistance on the annual report.
   - Any community that granted a suspect number of variances.
   - Any community that indicated that floodplain development was occurring.

2. In addition to annual report data, and for those years when annual reports are not received, the following criteria would be used for selection of possible CAPE candidates:

   - Floodplain development pressure or potential for development was judged using the best available information such as personal knowledge, information from another federal agency (HUD or EPA), or information obtained from the state coordinator. Communities exhibiting floodplain development pressure or the potential for such development were given one ranking point.
   - Number of NFIP policies. Any community having over ten flood insurance policies was given one ranking point. Insurance policies are an excellent indicator of floodplain activity or flooding problems.
   - Size of the SFHA. Any community with a special flood hazard area over 25 percent of the total area was given one ranking point. If the SFHA was in an area suitable for future development a point was also given for development potential.
   - Number of structures in the SFHA. Any community having over 10 percent of its structures in the floodplain was given one ranking point.

- Date of last CAPE. Any community that had not had a CAPE or had not been reviewed for a CAPE within the last five years was given one ranking point. The Region VII master CAPE list assured that no community was completely overlooked, regardless of the total number of ranking points.

Using the system described above, Region VII identified 224 possible CAPE candidates. Since available staff and travel resources normally limit Region VII to approximately 70 CAPEs each year, the actual FY 1984 CAPE Plan was developed through the telephone screening process described below.

CAPE Telephone Screening

CAPE screening calls allowed the staff to contact all of the 224 communities that the CAPE Priority Ranking System indicated to be in need of a CAPE visit. The specific purpose of the calls was to determine which communities were actually in need of a CAPE visit, and which communities needed only a phone contact and possibly a follow-up letter to serve as a CAPE contact. Where necessary additional information on communities was obtained from the state coordinator, a regional planning commission, or the CCO's own personal knowledge of the community. Specific screening procedures and a copy of an actual screening call memo are attached.

The CAPE screening effort was conducted during the first quarter of FY 1984. The telephone screening successfully met a number of objectives and was felt to be an extremely worthwhile effort. Specifically, the screening effort accomplished the following:

1. A more productive FY 1984 CAPE Plan was developed by allowing the staff to screen out the lower priority CAPEs and communities not found to be in need of a CAPE.

2. Sixty-six communities were identified that were in need of a CAPE contact but that did not warrant an actual CAPE visit. These were generally direct conversion communities with little or no floodplain development activity.

3. Nine larger communities were identified in which on going technical assistance or other contact replaced the need for a CAPE visit.

4. A FY 1985 CAPE Plan was also developed. Sixty-three of the communities screened were found to be in need of a CAPE within the next two years, but could not be accommodated in the FY 1984 Plan.

5. Forty-one communities screened were determined not to be in need of assistance at this time.

6. The screening effort allowed the staff to follow-up on all requests for assistance on the 1982 Annual Reports.

The major benefit of the screening effort was that it allowed the identification of the areas of greatest need and the direction of limited staff resources to those areas. In addition, the screening effort enabled

the staff to annually contact if not actually visit 20 percent of its Regular Program communities for CAPE purposes. Actually, in this first year, 224 of the Region's 541 Regular Program communities that have a FIRM were screened (41 percent). This effort cleared the backlog of those communities that had been in the Regular Program at least five years and had never had a CAPE contact. Future screening efforts are expected to be somewhat less extensive.

Conclusion

Region VII has used and refined the procedures for identifying and selecting CAPE candidates, as described in the first part of this report, for several years. This has proven to be a very workable and productive system of CAPE selection. Admittedly there are some problems with obtaining accurate and reliable data, such as when trying to identify potential floodplain development pressure in a community, but such problems exist with any system of data collection. The data used in this CAPE selection process is easily updated on an annual basis, and the system ensures that no community is overlooked in the CAPE selection process. Region VII feels that its selection of CAPE candidates is defensible, systematic and sound.

The telephone screening process is new and has not been evaluated over a long period of time. However, this process also appears to be quite successful and definitely fills a need. Neither Region VII nor any other FEMA region can continue to CAPE Regular Program communities at the same rate as in the past. The telephone screening process provided a workable and effective method of reaching even the smallest community. Unlike a mail survey, the telephone screening assured a 100 percent return rate from community contacts. The exchange of information in a telephone conversation also better reveals the true capability and understanding of floodplain regulations among local officials, as indicated in the sample screening report attached to this paper. With the continuing and inevitable staff and travel limitations faced by each FEMA region it appears that telephone screening could be an important part of any CAPE program.

PROCEDURES FOR SCREENING

The purpose of the CAPE screening is to narrow our number of potential CAPE candidates to a manageable workload by screening out those communities which are not now in need of a CAPE visit. The Annual Report Data Sheets indicate that 212 of the region's 542 Regular Program CAPE candidates (approximately 40%) meet one or more of the following criteria and are in need of a screening call. (Communities which have had a recent CAPE were not included in the screening list.)

1. Five or more years since entry in the Regular Program and/or date of last CAPE.

2. No Annual Report received for the past two years.

3. Community request for assistance.

4. Questionable number of variances granted.

5. Number of permits, policies or size of SFHA indicates that flood plain development may be occurring.

A CAPE Screening Report (copy attached) must be completed for each community on the screening list. The report form is fairly open-ended and is designed to be flexible. It is essential that each CCO make adequate comments on this report for it to be useful. At a minimum, each community contact should cover the following points:

1. Does the community have and know how to use the FIRM and Floodway Map?

2. What is the general use of land in the flood plain at this time?

3. Does the community have current development activity in the SFHA?

4. Does the community have development potential in the SFHA?

5. Does the community have a flood plain development permit system in force?

6. Discuss the reason for the screening call (as shown on the report) and indicate how this problem can be resolved.

Each Screening Report should end with a recommended action. Either an FY-84 CAPE is needed, an FY-85 CAPE is needed, other technical assistance can resolve the problem (explain), the problem has been resolved with the screening call, no problem actually existed and no CAPE is needed, etc. This screening will hopefully allow us to identify those communities which are in the Regular Program but have no flood plain development and therefore do not warrant a CAPE visit even though the community may not have enforcement procedures in place. We will follow-up with these communities by sending a standard letter advising them to contact this office for assistance if it should ever experience flood plain development. By phoning and sending this follow-up letter, the Regional Office will be able to demonstrate CAPE related contact with communities at least once every five years without spending our limited CAPE time on unproductive visits.

August, 1983
Patricia Stahlschmidt

FY-84 CAPE SCREENING REPORT

Community Ogden State Kansas

Signer of Most Recent Annual Report:

Etta P. Harris, City Clerk 5-6-83
(Name) (Title) (Date)

Phone Contact for CAPE Screening:

Name same Date 10-28-83

Title Phone 913 539 0311

City Building
Drawer C
Ogden, Ks 66517

Reason for Screening Call:
Reg Prog 10-15-81. No CAPE. Issued 12 permits. Req for assistance.

Findings from Call:
SFHA consists of trailer courts. There are a few empty lots which are used for gardens. The 12 permits shown on the annual report are for garages or car ports. She ~~she~~ said there was no major development. Does not have a flood plain development permit. She asked me what we did with the elevations which told me they do not understand the program. "Ogden is a 3rd class town without the finances to hire people to enforce the program" is a quote from the city clerk.

FY-84 CAPE Needed: Yes X No ~~X~~ Other _____ (see comments)

Comments/Recommended Action:
City Clerk wants a CAPE meeting. Does not completely understand the NFIP.

The State Coordinator also recommends a CAPE for Ogden.

CCO Waller 121

THE CAPE PROCESS IN FEMA REGION III

Walter Pierson
FEMA Region III

The CAPE process has been very useful in assessing the degree of activity at the local level. Because of travel fund limitations, Region III of FEMA will this year be completing only a small fraction of what we have during the past, as far as CAPEs held in the field. We will also be experimenting with a questionnaire-telephone contact CAPE. Another technique could be a straight "fill in the blanks" questionnaire, relating to compliance with the regulations.

We do not have any specific experience with mail questionnaires or telephone surveys. As far as onsite surveys being essential, we will have to reserve judgment until we do have experience with the former two items. If the annual reports are any indication of effectiveness of mail questionnaires, we are probably in trouble. It seems that each respondent interprets those reports in a different way, and we have results that are not consistent. In the majority of the communities in Region III, the local officials usually do not have any idea of how many structures are located on the floodplain. The estimates vary widely, even between officials in the same community.

It does not appear that there are any effective shortcuts to conducting community surveys. Past CAPEs reveal that community officials are not always aware of the extent of the floodplain as shown on FEMA maps, nor are they aware of the construction that is taking place on the floodplain in their communities. They were almost never aware of filling that has taken place.

The first question in any survey would be "How many permits have been issued in the floodplain area since last CAPE or entry into the regular program?" In some communities these permits are annotated and kept in good order. In many communities it may be necessary to search through volumes of material to try to get to those permits which are pertinent. In many cases it is easier to ride the floodplain and note the structures that appear to be fairly new and go back and ask for the permits on those. It is also a good idea to ask the community official about verification of first floor elevations once the structure is completed. He/she should also be queried as to the internal monitoring program to detect non permitted construction or modifications on previously permitted buildings. The key to the CAPE program, as well as to the National Flood Insurance Program, is the building permit system. An elementary question that we always ask the community officials is "Do you have a copy of your floodplain management ordinance?" A significant percentage do not, and we are usually prepared to supply them with a copy. The same holds true for the study and associated floodplain maps provided by FEMA.

In Region III we have never had the opportunity to use aerial photographs for monitoring activities. It has some interesting possibilities. Many of the studies we have conducted have included aerial photogrammetry. It may be possible to retrieve some of these photographs from the contractor or the repository, and with some training and some equipment purchases we

would be able to orient ourselves to the ground in various communities to at least determine which construction has been performed since the photographs were taken. Obviously this takes a trip to the field or a second set of aerial photographs. At a time when we are very short of not only travel funds but study funds, it does not appear that the agency will be prepared to spend money on hundreds of miles of aerial photography to assist in a monitoring phase; nevertheless, it is undoubtedly a good idea, the question being can we afford to do it.

Since the inception of the CAPE program, we have always made surveys in the field. This included not only a windshield survey to see that all structures have been permitted and appear to be elevated, but we have gone so far as to purchase a surveyor's level and associated paraphernalia so that we can actually check elevations in the field. This equipment has been used many times in the region to good effect. Oftentimes the community that thinks it has a good program finds out as a result of the CAPE that they do not have the control that they thought. It is a premise of the CAPE program that we cannot take anything for granted.

PART V: RECOMMENDATIONS

Part V is based upon the issue papers, workshop presentations, and follow-up discussions.

Overall Recommendations

Given budget limitations, what are the most promising approaches for answering immediate questions and providing a solid long-term data base for evaluation of individual floodplain management techniques and community programs?

(1) Post-flood surveys. Floods provide a "laboratory" for testing the effectiveness of various floodplain management techniques. After floods, selected field surveys should be conducted for particular conditions and types of communities to determine:

(a) The precise nature of the flood damages (e.g. water damage alone due to depth of inundation, collapse of basement, destruction of wiring, pollution of well, erosion, etc.);

(b) The structures and activities to which damages have been sustained (i.e., public roads, sewage treatment, water supply, other infrastructure; private, commercial, and non-commercial uses);

(c) The protection or mitigation measures in place at the site (levee, seawall, elevated structure), level of protection (100-year event), degree of maintenance, etc.;

(d) The particular degree and type of risk (alluvial fan, floodway, high velocity flow).

Small teams of experts, modelled on and working with the Interagency Flood Hazard Mitigation teams, should go into stricken areas and gather information. Efforts to determine effectiveness of techniques could perhaps best focus initially on areas such as the Susquehanna River Basin for which considerable "baseline" data already exist about numbers and types of structures, their condition, mitigation measures, and date of adoption. States could assist in such post-disaster surveys under Section 406 of the Disaster Relief Act of 1974. Comparisons should be made of disaster assistance versus flood insurance claims data. Industries that have suffered losses could be asked to make estimates of physical damage, loss of inventory, loss of production, and length of down time.

Follow-up assessments both one year and five years later should be conducted for some of these areas to determine how disaster and insurance funds were ultimately used, the extent to which mitigation measures were actually incorporated in reconstruction, and whether such mitigation measures reduced losses during subsequent flooding.

(2) Modelling and Laboratory Testing Techniques. Actual testing of various flood loss reduction techniques by modelling and by laboratory testing (e.g. flooding buildings with particular designs) should be enhanced. Models and scenarios could be used more extensively to predict potential losses. Consultants marketing various flood loss reduction systems should be encouraged or required to test the effectiveness of these systems.

(3) Refinement of Data Gathering and Analysis as Part of FEMA's Flood Insurance and Disaster Assistance Programs. Refinements are needed in the types of data gathered on the flood insurance policy form, on flood insurance claims, disaster assistance claims and the community bi-annual reports. All data should be formated and stored in a "compatible" form to facilitate analysis. Additional data such as population growth should also be included.

(4) Combining Telephone Surveys, Questionnaires and Onsite Visits for Monitoring Communities. Additional onsite monitoring of selected communities is needed for enforcement of NFIP and state standards, to convince communities that regulations have "teeth" and to determine the effectiveness of programs in actually reducing flood losses. Priorities should be set for onsite studies of communities based upon numbers of insurance policies, insurance claims, disaster claims, population growth, area in the flood plain and other factors.

The costs of onsite monitoring could be reduced not only through careful preliminary screening of communities but also by:

(a) Using telephone surveys and written questionnaires to gather a portion of the needed information;

(b) Focusing on post-disaster situations in which federal and state staff are usually already heavily involved;

(c) Utilizing regional agencies and states to conduct monitoring (greater familiarity with local conditions, lower travel costs); and

(d) Use of time series air photos, which can be used to locate new development.

Although it may be cost effective to combine community monitoring and technical assistance as has been done in the past, arguments can be made in favor of separating these functions. FEMA is often in the best position to monitor and enforce NFIP requirements; states and other federal agencies are often in the best position to provide planning, ordinance drafting, and engineering assistance. If monitoring and technical assistance are to be separated, technical assistance may best be handled through a multiagency effort involving

federal, regional, and state governments and including FEMA, the Corps of Engineers, the TVA, and the SCS.

Gathering and Analyzing Data

FEMA is perhaps in the best position to coordinate and sponsor efforts to determine the effectiveness of community programs and individual techniques although other federal agencies, the states, and universities should assist such efforts and in some instances should undertake the actual analysis:

(1) Post-disaster assessments of communities and individual techniques may best be undertaken by FEMA with the assistance of the Corps, the states and consultants since FEMA has been assigned the lead in the federal post disaster team effort and since it administers the major federal disaster assistance program and the NFIP.

(2) Laboratory testing of techniques may best be undertaken by the Corps, private consultants and universities.

(3) Monitoring communities for enforcement purposes may best be undertaken by FEMA, working with the states and other agencies.

(4) Monitoring of communities to determine the broader effectiveness of techniques may be undertaken by universities the TVA, the Corps or private consultants with the support and sponsorship of FEMA.

(5) The gathering, storage and analysis (for certain purposes) of disaster claim data, flood insurance data, community annual reports and Section 1362 data should be undertaken primarily by FEMA. Independent analyses may also be helpful.

Data Needs

Data gathering and analysis should be sufficiently focused to address specific management needs while also creating a long-term analytical base suitable for answering other questions. Post flood information and on-the-ground field evaluations are a necessary component of each of the following issues.

(1) Levees. How serious are losses behind levees due to poor internal drainage? Overtopping? Seepage? Inadequate maintenance? Do 25, 50 or 100-year levees reduce damages sufficiently to justify decreased insurance rates or special management policies?

Lack of even elementary "effectiveness" data gave rise to fragmented recommendations of the National Academy of Sciences Committee on Levee Policy in 1979 and to highly divergent policies for even neighboring states: Wisconsin gives virtually no credit for levees in its floodplain regulations while Illinois gives substantial credit.

Need for Data. Rate-setting for the NFIP, regulatory standard-setting and building design criteria at federal, state and local levels all would benefit from additional data on the performance of levees..

Data Gathering. Flood insurance and disaster assistance data should be analyzed on a selected basis for areas behind particular levees after floods of various magnitudes.

(2) Unique and High Risk Area Flood Problems. It was assumed in the late 1960s that most flood damage was due to clear water flooding of limited duration with limited velocities and relatively stable channels. Flood stage, therefore, became the major damage factor considered in mapping, regulatory standard-setting, and building design. However, it is now clear that other damage factors are important, if not paramount, for alluvial fans, mudfloods, lake flooding, combined coastal erosion/flooding, subsidence, liquefaction, areas below unsafe dams and behind unsafe levees, ice jams and high gradient streams. How much development is located in these areas? How much flood insurance versus disaster assistance is presently being spent on such areas? How effective (or ineffective) have existing regulatory guidelines or building practices been for these areas?

Need for Data. Mapping criteria and priorities should be established at federal, state and local levels. Improvement should be made in rate-setting for flood insurance; redrafting 406 planning criteria for states; and establishing upgraded regulatory and building code standards.

Data Gathering. Reports of post-disaster teams should be analyzed to determine the percentage of losses from unique or high risk area problems. These data should be compared with flood insurance and disaster assistance data for these areas including premium versus loss data. New post-disaster assessments should be carried out on the ground by teams of experts. Refinements should be made in flood insurance application forms and claim forms to help identify high-risk area losses. Refinements in disaster assistance claims are also needed to identify sources of the loss.

(3) Stormwater Management Versus "Flooding". What percentage of flood problems are, in fact, stormwater management problems? How effective are existing designs for stormwater management?

Need for Data. Flood insurance rate-setting for areas outside of mapped floodplains; flood mapping priorities and criteria; stormwater management regulatory and planning guidelines at federal, state, local levels; and technical assistance to communities all need improved data.

Data Gathering. Flood insurance and disaster assistance should be analyzed and compared for communities suffering flood losses. Insurance policy data and various types of claim and flood loss data should be aggregated on a community-wide basis (as has been done already on a limited basis) for both unmapped and mapped hazard areas. Field investigations are needed to determine the percentage of losses due to drainage, and the effectiveness of various drainage planning and management strategies.

(4) Relative Effectiveness of Nonstructural Floodplain Management Approaches. How effective are individual nonstructural floodplain management techniques in reducing flood losses? For example, how much is structural floodproofing actually reducing flood damages when a flood occurs, given the maintenance problems with such an approach and recent findings that it is very difficult to make a large structure watertight if flooding persists for more than a few hours? What measure of protection is provided over a 20, 50, or 100-year period by elevation on pilings in areas of erosion, high winds, or natural deteriorating forces such as termites, salt, water or "dry rot"? Does elevation on fill in riverine and coastal flood fringe areas have such built-in safety factors (e.g., no deterioration over time, often limited damages when the design flood is exceeded) that favorable insurance rates should be provided? How great are the losses to public infrastructure (roads, sewer, water supply) when flooding occurs for an area with nonstructurally protected individual structures?

Need for Data. Establishing flood insurance rates; establishing and upgrading regulatory guidelines at state, federal and local levels; providing technical assistance to communities and private individuals; and the design of structures and uses all would benefit from improved and expanded data.

Data Gathering. Post flood surveys, modelling and laboratory testing are needed for individual techniques under particular flood stage, velocity, erosion and other conditions. Maintenance and inherent safety factors for multihazards and the full range of anticipated flood events should be considered. Flood insurance applications and flood insurance claim forms as well as disaster assistance forms could be amended to require additional data. This would facilitate future broader analysis.

(5) Flood Insurance Premiums Versus Losses. What premiums have been paid and what losses have occurred for particular types of uses, with particular levels of flood protection, in particular settings? Considerable analysis is already underway but refinements are needed.

Need for Data. Additional data would assist in refining flood insurance rates; upgrading regulatory and building design standards; guidance and technical assistance to individuals, and communities; and targeting communities for federal or state technical assistance.

Data Gathering. Flood insurance policies, insurance claims and disaster assistance claims could be more effectively used for analytical purposes if refinements were made in insurance applications, insurance claims, and disaster assistance forms to more specifically identify the nature of hazard, nature of loss, type of use, and protection measures.

(6) Community Enforcement. To what extent are communities administering and enforcing the standards of the NFIP? What factors have led to such enforcement or lack of enforcement?

Need for Data. Data would benefit enforcement actions by FEMA and the states; and technical assistance and training and education by the states, and federal agencies.

Data-Gathering. Additional evaluation is needed of flood insurance claims, insurance policies, disaster assistance claims, community reports, permits, variances, and map amendments. More detailed "on site" evaluations are also needed. These could be conducted by states as well as federal agencies.

(7) Effectiveness of Community Loss Reduction Measures. How effective have community floodplain management programs been in reducing losses to new buildings and

infrastructure? To existing buildings and infrastructure? What approaches have been most cost-effective individually or in combination? What factors have led to effective community approaches?

Need for Data. Additional data would guide policy-makers at federal, state and local levels in selecting particular techniques or combinations of techniques; and help federal and state agencies design and carry out technical assistance and training and education programs.

Data Gathering. Detailed examination is needed of overall community programs, particularly in a post-flood context. Such evaluations can be accomplished through a combination of on-site surveys, questionnaires, telephone surveys; and analysis of flood insurance and disaster assistance data.

(8) Dams. Given the high rates of sedimentation, increased runoff, possible seismic activity, and growing maintenance problems in many areas of the country, what are the actual benefits of dams when projected over a 200- or 300-year period? Is the enhanced development below dams placed at higher risk after 75 or 100 years due to sedimentation and natural deterioration of the structure? Could such development occur initially at upland sites, and, if so, what are the net costs on benefits of relocation outside of the floodplain in contrast with protection by dams?

Need for Data. Design criteria for construction and maintenance of dams; implementation of cost-benefit analyses for dams; comparisons of techniques; and evaluation of federal/state dam safety programs all would benefit from expanded data.

Data Gathering. Post-flood damage estimates should be compared with initial projections and cost/benefit ratios. Modelling should be done for sedimentation, earthquakes, and areas subject to inundation by dam failures.

(9) Subsidence and Sea Level Rise. Given the future high rates of sea level rise predicted by some experts, what will the effects be over the next 100 years on coastal flood damages? More specifically, how will such a rise affect the costs and benefits of groins, levees, sea walls, beach nourishment, evacuation planning and other techniques?

Need for Data. Additional data would aid in the preparation of evacuation plans; revision of regulatory criteria and guidelines for coastal construction; calculation of erosion rates; and the conduct of cost-benefit analyses for flood control measures.

Data Gathering. Flood losses over the last 100 years for various areas should be compared, and different scenarios should be modelled.

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1 Population and Housing in Special Studies Zones. Claudia Grow and Risa Palm. 1981. 51 pp. $3.00.

2* Regulation of Flood Hazard Areas to Reduce Flood Losses, Volume 3. Jon Kusler. 1982. 300 pp. $8.00.

3* Strengthening State Floodplain Management, Appendix A to Volume 3. Patricia A. Bloomgren. 1982. 123 pp. $8.00.

4* Innovation in Local Floodplain Management, Appendix B to Volume 3. Jon Kusler. 1982. 262 pp. $8.00.

*SP #2, SP #3, and SP #4 can be purchased as a set for $21.00.

5 Floodplain Regulations and the Courts 1970-1981. Jon Kusler. 1982. 51 pp. $5.00.

6 The Human Environment: Penultimate Problems of Survival. Robert W. Kates. Gustavson Memorial Lecture. 1983. 48 pp. $3.50.

7 Preventing Coastal Flood Disasters: The Role of the States and Federal Response. Proceedings of a National Symposium, Ocean City, Maryland, May 23-25, 1983. 386 pp. $10.00.

8 Addresses, Topics of Interest, and Geographic Distribution of Professors Working on Landslides in the United States. Earl E. Brabb and Ann FitzSimmons. 1984. 33 pp. $3.50.

9 Improving the Effectiveness of Floodplain Management in Western State High-Risk Areas: Alluvial Fans, Mudflows, Mud Floods. Proceedings of a Workshop, Palm Springs, California, February 15-16, 1984. 97 pp. $7.00.

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