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Association of State Floodplain Managers, Inc.

AND

Arizona Floodplain Management Association

Present A Conference on Arid West Issues

OCTOBER 19 – 21, 1988

ALADIN HOTEL-CASINO
LAS VEGAS, NEVADA

80.0-00-0-10/88

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ARID WEST COMMITTEE
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OCTOBER 19 – 21, 1988
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ARID WEST CONFERENCE

AGENDA

Wednesday, October 19

Noon to 1:00 p.m.	REGISTRATION
1:00 to 1:15 p.m.	WELCOME
1:15 to 2:00 p.m.	Challenge to Floodplain Managers in Arid Regions By Doug Shakel, Professor of Geology, Pima College, Tucson, Arizona
2:00 to 2:15 p.m.	BREAK
2:15 to 3:00 p.m.	Albuquerque Flash Floods, 1988
3:00 to 4:45 p.m.	Plenary Session, Panel of Developing Area Officials Addressing Floodplain Management in 1988 Moderator: Brian Hyde, Colorado Panelists: Jim DeGrood, Pima County, AZ Art Krueger Riverside County, CA James R. Hogg, Kern County, CA
5:00 to 7:00 p.m.	ICE BREAKER SOCIAL, Cash Bar

THURSDAY, OCTOBER 20

8:00 to 9:45 a.m.	Plenary Session, Panel of Developing Area Officials Addressing Floodplain Management in 1990 Moderator: Andy Lee, California Panelists: Virginia Valentine, Clark County, NV Charles Laird, San Bernardino, CA Joseph Hill, San Diego, CA
9:45 to 10:00 a.m.	BREAK
10:00 to Noon	BREAKOUT SESSIONS

1. Identification and Classification of Alluvial Fans
   Moderator: James R. Morris
   Speakers: Marie Pearthree
   Phil Pearthree
   James DeGrood/Donald Brooks

2. Modeling and Mapping Unique Hazard Areas
(Alluvial Fans and Erodible Channels)
Moderator: Scott Schlund
Speakers: Joseph Hill
Peter F. Lagasse
Joseph Hill/Gordon Lutes

3. Managing and Modeling with Limited Rainfall Data
Moderator: Bruce Beach
Speakers: Mark Forest
Timothy Sutko
George Sabol/Joe Rumann

Salon 'A'

Noon to 1:30 p.m. LUNCH
Speaker: Jerry Foster, ISO, Introduction by Frank Thomas, FIA
Subject: Community Rating System

Imperial "2"

1:30 to 3:15 p.m. BREAKOUT SESSIONS

1. Case Studies
Moderator: Mary Fran Myers
Speakers: Ken Lewis
Gordon Lutes
Joseph Coombs
Phil Pearthree

Salon B

2. Management Tools
Moderator: Doug Toy
Speakers: David Keefer
Eve Gruntfest
Joseph Hill

3. Debris Generation
Moderator: Kebba Buckley
Speakers: Scott Williams
James D. Schall
Edward R. Miflin

4. Mass Movement Modeling
(Mud Flows and Landslides)
Moderator: David B. Burris
Speakers: John Liou
Stephen D. Ellen

3:15 to 3:30 p.m. BREAK

3:30 to 4:45 p.m.	Plenary Session, Panel of Officials of Developing Areas Addressing Floodplain Management in the Year 2000 and Beyond Moderator: James R. Morris, Arizona Panelists: Sidney Smith, Davis County, UT Bill DeGroot, Denver Dan Sagramoso, Maricopa County

FRIDAY, OCTOBER 21

8:00 to 9:30 a.m.	Plenary Session, Panel Discussion on Data Needs for Managing Unique Hazard Areas of the Arid West Moderator: Ott Chatupron Panelists: Leslie A. Bond Brian Reich Thomas Zickus
9:30 to 9:45 a.m.	BREAK
9:45 to 10:30 a.m.	How Did We Get Here and Where Do We Want To Go From Here? Moderator: Dan Lawrence Speakers: William M. Brown III, USGS Robert MacArthur, USACOE
10:30 to 12:00 N	LEGAL ISSUES PANEL Moderator: Curt Chandler Panelists: James E. Slosson Robert MacArthur John Helm
12:00 to 12:30 p.m.	WRAPUP SUMMARY Frank H. Thomas, Assistant Administrator Federal Insurance Administration

Thursday: 10:15 a.m.
Session #1

CRITERIA FOR DETERMINING ACTIVE AND INACTIVE ALLUVIAL FANS IN THE SOUTHWEST

Marie S. Pearthree, Cella Barr Associates, Tucson
Philip A. Pearthree, Arizona Geological Survey

Alluvial fans in the southwestern United States present uniique flooding problems to the regulatory and engineering communities. The term "alluvial fan" has commonly been applied to piedmonts that extend outward from mountain fronts. Except in specific areas of the southwest where mountain fronts are tectonically active, desert piedmonts are composed of areas that are subject to alluvial fan erosional and depositional processes ("active fans") and areas that are subject primarily to local overbank and shallow sheet flooding ("inactive fans"). Recognition of these different environments is crucial for evaluating flood hazards on desert piedmonts for development or flood insurance purposes.

Stochastic models such as the Federal Emergency Management Agency (FEMA) alluvial fan model should be applied only to potentially active fan areas. Preparation of Flood Insurance Rate Maps for alluvial fans in Arizona has shown a need to apply soils information, topography, and preliminary channel hydraulics to delineate areas subject to active fan processes. Areas containing soils with significant accumulations of clay and calcium carbonate have generally been inactive for more than 10,000 years and should not be modeled as active fans. Locations at which flow has the potential to break out of natural channels, determined using simple hydraulic methods, should be utilized in conjunction with the soils information to determine apex locations for active fans. From these locations, depths and velocities of alluvial fan flooding can be estimated in the downstream direction using a stochastic model.

Thursday: 10:15 a.m
Session: 1

A PHYSICALLY BASED CLASSIFICATION SYSTEM FOR ALLUVIAL FANS AND FAN MANAGEMENT

by
Donald L. Brooks and James R. DeGrood, P.E.

Pima County of Transportation
and
Flood Control District

A major problem confronting floodplain managers and flood control planners is the variety of morphological and geological features subject to flooding and proper selection of management alternatives appropriate to these features. Because the physiography of flood prone areas is dynamically related to the types of flood processes occurring in those areas, management must be tailored to their distinct hydraulic characteristics. Therefore, the key to effective management decision making for regulating these features is the ability to characterize and classify them according to their morphology and flood processes. Such a classification system would thus allow logical selection of management alternatives based on geomorphology and anticipated flooding behavior

The authors propose a classification matrix for alluvial fans and related features based on readily available information such as aerial photography, topography, and visual survey. The matrix allows descriptive typing of morphological flood hazard areas with a systematic selection of management or mitigation strategies. Easy diagnosis of flooding behaviors associated with distinct land areas then allows more rapid and better selection of management solutions. It is hoped that the use of such a system will facilitate rational planning and design for development, flood control and land management.

Thursday: 10:15 a.m.
Session: #2

FLOODPLAIN MANAGEMENT WITH HIGHLY UNSTABLE STREAM BEDS

Joseph C. Hill, Karl Mohr, FEMA

In 1973 the stream bed in Moosa Canyon was flat as a pancake. The canyon bottom consists of a deep alluvial sediment with a diameter of about .1 millimeter. The four mile long canyon had a mapped floodplain that was 500 to 1000 feet wide with a average depth of about five feet.

During the next 10 years flood flows eroded incised channels 15 to 20 feet deep and 50 to 200 feet wide in the upper portion of the canyon. The lower part of the canyon experienced sedimentation, with the whole bottom increasing about four feet in elevation. In some places, the 1983 ground was higher than the original computed floodplain elevation.

The typical HEC-2 analysis can not be used as a floodplain management tool in this situation. FEMA and the County of San Diego agreed that a special Erosion and Sedimentation Hazard designation be placed on County floodplain maps. Any development proposed within this area would be subject to special criteria and detailed engineering studies. The Federal Insurance Rate Map will show the area as an unnumbered A Zone.

Thursday: 10:15 a.m
Session: #2

ALLUVIAL FAN MANAGEMENT - MAPS, REGULATION AND PLANNING

Joseph C. Hill, David R. Dawdy
and
Godon Lutes

San Diego County is preparing a flood management plan for the desert community of Borrego Springs. The plan is based of a Federal Emergency Management Agency (FEMA) alluvial fan study. In addition, criteria forland development regulation and flood control structural facilities are being included. The County has retained Mr. David Dawdy as a consultant on fan analysis and Boyle Engineering Cooperation as flood control consultants. The following items are discussed:

- Alluvial fan analysis, mapping and application criteria.
- A special designation "Fan Terminus Alluvial Wash" for the downstream end of a fan is defined with a HEC-2 analysis.
- The County flood plain management ordinance includes specifice language for regulation of alluvial fans. Additional criteria for regulation has been developed.

A flood management plan is also being developed under contract to Boyle Engineering. The plan will include the option of structural facilities such as dikes and channels where non-structural methods are not adequate. Methods of financing will be included.

Thursday: 10:15 a.m.
Session: #2

DELINEATION OF A FLOODING AND EROSION BUFFER FOR A SOUTHWESTERN ARROYO

By Peter F. Lagasse,
James D. Schall

Resource Consultants, Inc.,

ABSTRACT: A procedure is outlined for establishing a flooding and erosion buffer zone along an arroyo. The approach is applicable in general to ephemeral stream systems ofthe Southwest, while the hydrologically based definition of erosion and flood risk is applicable specifically in an urban setting. The risk analysis recognizes both the short-term impacts of flooding and erosion and the cumulative impacts of erosion over the long term. The procedure is based on an understanding of the basic physical processes of an arroyo system and integrates simple qualitative concepts with quantitative analysis of the vertical dynamics of the arroyo bed. Trends in vertical instability such as aggradation and degradation are then extended in the horizontal dimension to provide estimates of lateral erosion and channel migration potential. Application of the procedure to Calabacillas Arroyo northwest of Albuquerque, New Mexico, demonstrates reasonable results considering the documented dynamic behavior of ephemeral stream channels in the Southwest. The procedure answers a current need for engineering analysis techniques to support management and control of arroyos in an urban setting.

Thursday: 10:15 a.m.
Session: #3

VARIATION IN SHORT AND LONG DURATION, 100 YEAR, PRECIPITATION TOTALS IN THE VICINITY OF THE EASTERN FACE OF THE SIERRA NEVADA RANGE.

Mark E. Forest, Senior Hydrologist, Nimbus Engineers

Rainfall-runoff modeling requires the use of representative rainfall totals, intensities and distributions. The primary source of such information is usually NOAA Atlas 2 combined with a 6 or 24 hour dimensionless temporal rainfall distribution such as the SCS Type I and II. Many engineers have recognized that the SCS Type II distribution produces conservative results in many geographical areas, but due to lack of a superior alternative, the Type II is often used.

This paper explores the difference in 100 year, short and long duration precipitation totals for the geographical area that includes the central Sierra Nevada Range and the area on the leeward side of that mountain range. A close comparison of rainfall intensity-duration-frequency information generated for this area, indicates that there is very little variation in 100 year, 5 to 15 minute depths, but large variation in long duration depths (24 hours to 10 days) with increase in elevation or orientation of exposure. This fact suggests serious difficulties with the use of a dimensionless distribution for rainfall-runoff modeling, since the use of such a distribution assumes that both the short and long duration totals and intensities can be increased by the same ratio.

Thursday: 10:15 a.m.
Session: #3

FLOOD ANALYSIS CRITERIA FOR THE ARID WEST: Part 1 - Rainfall Data

Timothy E. Sutko, Joe M. Rumann, George V. Sabol

Rainfall data is needed for the development of design rainfall criteria for use in hydrometerological flood analyses. This rainfall criteria is often required as part of the rules and regulations of agencies that are responsible for the management of floodplains or construction of flood control and drainage facilities. Often these agencies adopt the published results of previously performed rainfall data analyses, such as contained in NOAA Atlas 2, for its rainfall criteria because of the availability and general acceptance of this information. For the arid west this information may not provide the best practical rainfall criteria because of the limited data that was available at the time of analysis. Additional rainfall data has become available since the publication of these information sources.

The limitations of these published rainfall analyses for the arid west are discussed, and some discrepencies between the results of these information sources and recent data analyses are presented. The data requirements and the needs for up-to-date rainfall data analyses are presented in regard to rainfall depth-duration-frequency, rainfall time distributions, and depth-area reduction factors.

Thursday: 10:15 a.m.
Session: #3

FLOOD ANALYSIS CRITERIA FOR THE ARID WEST: Part 2 - Unit-hydrograph Data

George V. Sabol, Joe M. Rumann, Timothy E. Sutko

Unit-hydrographs are used in most hydrometeorological flood analyses throughout the United States and in the arid west. In many areas of the United States there is adequate rainfall-runoff data to develop site-specific or regional unit-hydrographs for use in a flood analysis; however, appropriate unit-hydrographs or adequate rainfall-runoff data for unit-hydrograph development are seldom available in the arid west. Synthetic unit-hydrographs are usually used for flood analyses in the arid west and numerous synthetic hydrograph procedures are available; however, the applicability of these procedures for use in the arid west is questionable.

Recently, two studies were conducted for the Flood Control District of Maricopa County for the purpose of selecting or developing synthetic unit-hydrograph procedures for use in Maricopa County, Arizona. A study was conducted to compile S-graphs, a form of unit-hydrograph, from the southwest and to select S-graphs for use in the various physiographic land forms in Maricopa County. A second study was conducted to collect rainfall-runoff data from the southwest and to analyze this data to develop a synthetic hydrograph procedure for arid lands. Rainfall-runoff data was compiled from the Walnut Gulch Experimental Watershed in Tombstone, Arizona, the Tucson Experimental Watersheds, urban hydrology programs in Denver and Albuquerque, and Wyoming studies.

The result and conclusions of these data studies, and recommendations for additional data collection programs will be presented.

Thursday: 10:15 a.m.
Session: #4

INCORPORATING THE EFFECTS OF ATTENUATION AND INFILTRATION INTO FLOOD RISK ANALYSIS ON ALLUVIAL FANS

Edward R. Miflin

One of the assumptions of the methodology developed by Dawdy and adopted by the Federal Emergency Management Agency for determining flood risks on alluvial fans is the peak discharge of a flood event is constant throughout the flow path. Therefore, the methodology does not account for losses to the peak flow that result from infiltration of floodwaters into the alluvial fan and attenuation of the flood wave. This paper investigates a method to incorporate the consideration of losses to the peak flow into the methodology. A simple example that considers losses to the peak flow to be proportional to the distance that the flood has traversed the alluvial fan is discussed.

Thursday: 10:15 a.m.
Session: #4

USE OF THE U.S.G.S. DIFFUSION HYDRODYNAMIC MODEL ON ALLUVIAL FLOOD PLAINS

Theodore V. Hromadka II and Johannes J. DeVries

The Diffusion Hydrodynamic Model or DHM, recently published by the United States Geological Survey (U.S.G.S) provides a computer model which can be used on alluvial fans to predict floodplains. The model is easy to use, and involves only the need for a personal computer. In this paper, the 100-year floodplain for a major river overflow in the City of Garden Grove, California, is considered. The DHM is used to develop the floodplain for a wide variety of assumptions. The DHM is demonstrated to be a useful tool in floodplain evaluations which involve converging/diverging flows such as occur in desert flows on alluvial fans.

Thursday: 1:30 p.m.
Session: #1

KINGMAN AREA MASTER DRAINAGE PLAN

By K.V. Lewis
Boyle Engineering Corporation

The City of Kingman and surrounding environs located on an alluvial fan have developed without full consideration to the drainage needs of the area. This has resulted in public inconvenience and flood damage to both public and private property. To guide future development and mitigate flooding in existing areas, City of Kingman and Mohave County officials identified the need for a comprehensive Master Drainage Plan.

The greater Kingman study area is 72 square miles in extent and includes 65 miles of proposed open channels. The contributing drainage basin is 180 square miles. Alternative drainage improvements were discussed with City/County officials early in the study with non-viable alternatives discarded. This allowed the consultant to concentrate his efforts on the preferred solution.

The study showed that the most effective means of mitigating the effects of stormwater flooding is to establish drainage corridors and construct channel improvements. A major diversion channel paralleling the AT&SF Railroad track will significantly reduce flows through the developed section of town.

A unique feature of this project was the cooperation of interested parties. Very early in the study, when the diversion channel was conceived, an agreement in principle for its construction was obtained from the AT&SF Railroad, the City of Kingman and Mohave County. Within days after submittal of the final plan, construction began on a new bridge under the railroad at the outlet of the diversion channel.

Thursday: 1:30 p.m.
Session: #1

CITIZEN GROWTH CONTROL and ENVIRONMENTAL PROTECTION BALLOT INITIATIVES - EFFECT ON PLANNING AND REGULATION IN FLOODPLAINS

Joseph C. Hill, Chantal Saipe, County of San Diego

The perception by some citizens in San Diego of uncontrolled growth and environmental degradation has resulted in an initiative on the November 1988 ballot. The initiative would limit the number of building permits that can be issued annually and greatly restrict development in sensitive lands (floodplains, wetlands, areas with riparian habitat, steep slopes, etc.) if passed by the voters.

The County Board of Supervisors is also proposing to place a Measure on the November Ballot. The Measure is being developed by a committee chaired by Supervisor Golding (Fifth District). The committee includes representatives of environmental organizations and the construction industry. The objective is to provide the voters with a more workable set of criteria that will meet the objectives of managed growth and environmental protection. The environmental aspects for the proposed Measure are planned to be put into effect in August, 1988 (by adopting an ordinance) if the Board of Supervisors can agree on appropriate criteria.

This paper describes the floodplain aspects of the sensitive lands Measure. Included are the criteria for floodplain regulation and environmental constraints applied to projects in the floodplain. Implementation is primarily through the planning process by requiring a Sensitive Lands Permit for projects. Changes in community plans and other planning processes will also be described.

Thursday: 1:30 p.m.
Session: #1

FLOOD MANAGEMENT MASTER PLANNING FOR ALLUVIAL FANS, A CASE STUDY OF BORREGO VALLEY, SAN DIEGO COUNTY, CA

Gordon Lutes, Joseph Hill, John Hathaway

Borrego Valley is a desert resort/agricultural community in the northeast corner of San Diego County, California about 40 airline miles south of Palm Springs and 60 airline miles northeast of San Diego. Recently this region has experienced increasing popularity as a year-round recreation center and development has accelerated. Anza Borrego Desert State Park in Borrego Valley receives more than 1 million visitors per year. Residents range from 2,000 to 20,000 with the season. Most of the Borrego Valley is subject to violent flash floods which, in light of the growing population and increased building activity, pose a serious threat to both life and property.

The control of desert flash floods presents problems entirely different from riverine areas. The mountainous canyons above Borrego Valley are subject to summer thunderstorms of brief duration and extreme intensity. A storm of this type rained 6.45 inches in 7 hours at nearby Indio, California in September 1939. Tropical storms in 1976 and 1977 damaged areas of Borrego Valley. The canyons leading out of the mountains above Borrego Valley are sparsely vegetated and very steep, with overburden largely composed of low porosity igneous and metamorphic rock.

The topography, vegetation, geology and intense rainfall combine to produce large quantities of runoff and debris moving at dangerously high velocities. When this flow reaches the valley floor, debris deposition forms large alluvial fans or cones. During severe storms, the streams spread over these cones in an unpredictable pattern of watercourses. The result is a flash flood which can strike nearly any portion of the valley with destructive, even fatal results. Most of the existing development in Borrego Valley is on or near these alluvial fans, as the valley floor was geographically formed by these debris flows over long periods of time.

In 1988 the Federal Emergency Management Agency (FEMA) produced maps showing contours of predicted flood depth and velocity for the alluvial fans. This paper discusses the procedure and criteria used to develop the Flood Management Master Plan for the Borrego Valley. The Plan looks at protecting existing and future development. Methods of financing, phasing of improvements, structural alternatives, non-structural alternatives, and design criteria are discussed in the paper. This paper should be very helpful to other Arid West communities trying to manage and regulate development on alluvial fans.

Thursday: 1:30 p.m.
Session: #2

REAL-TIME LANDSLIDE WARNING DURING HEAVY RAINFALL

DAVID K. KEEFER, RAYMOND C. WILSON, ROBERT K. MARK, EARL E. BRABB, WILLIAM M. BROWN III, STEPHEN D. ELLEN, EDWIN L. HARP, GERALD F. WIECZOREK, CHRISTOPHER S. ALGER,* ROBERT S. ZATKIN+

U.S. GEOLOGICAL SURVEY

A real-time system for issuing warnings of landslides during major storms is being developed for the San Francisco Bay region, California. The system is based on empirical and theoretical relations between rainfall and landslide initiation, geologic determination of areas susceptible to landslides, real-time monitoring of a regional network of telemetering rain gages, and National Weather Service precipitation forecasts. This system was used to to issue warnings during the storms of 12 to 21 February 1986, which produced 800 millimeters of rainfall in the region. Although analysis after the storms suggests that modifications and additional developments are needed, the system successfully predicted the times of major land slide events. It could be used as a prototype for systems in other landslide-prone regions.

THURSDAY: 1:30 p.m.
Session: #2

ALERT
A MATURING FLOOD EVALUATION SYSTEM FOR REMODELING AND MAPPING REAL TIME FLOOD CONDITIONS

By Robert J. C. Burnash

All attempts to mitigate flood damages are based on trying to accomplish that which is politically possible. In many circumstances, the difficulties associated with political realities can leave a substantial void in providing adequate protection to flood prone communities. The economic value of infrequently flooded land or the lack of adequate historical data can compound the political problems associated with obtaining appropriate zoning limitations. Under such circumstances, and many others, including those where flood protection is based on the proper operation of flood control projects, real time flood evaluation systems can provide vital information to guide emergency response activities. Alert, a maturing real time system is developing a growing capability to guide the emergency response system which is the final bastion of flood preparedness.

The automated data collection and analysis characteristics of the maturing Alert technology provide a unique potential for extending the flood protection umbrella in a politically acceptable, environmentally unobtrusive manner which can maximize the protection of life with a lower economic cost than any other alternative.

THURSDAY: 1:30 p.m.
Session #2

FLASH FLOOD HAZARD MITIGATION: A COMPREHENSIVE ASSESSMENT

Eve Gruntfest, University of Colorado

An assessment of national vulnerability to flash floods is underway. The effort pursues three key recommendations which emerged from the 1986 Symposium "What We Have Learned Since the Big Thompson Flood" and from research to date. They are 1) an understanding of the geographic distribution of the flash flood hazard, 2) an appreciation of how effective flash flood warning systems have been and can be expected to be, and 3) a set of illustrative case studies to be used by local officials in communities vulnerable to flash flood problems. The research project will synthesize and consolidate information from the many disciplines involved in flood hazard research to develop, based on the available data, an assessment of the unique distinctions of flash floods.

At the conclusion of the project, a monograph will be produced that will assess the flash flood hazard in the United States. The final document will include a discussion of flash floods as distinguished from other types of floods with particular emphasis on the distinction between flash flooding in the western versus the eastern United States and the impact on small versus large communities, an assessment of how many people die annually in the United States as a result of flash floods, a map showing the geographic distribution of flash flood prone communities, an analysis of alternative mitigation strategies and a ranking and discussion of flash flood research priorities.

A casebook consisting of detailed examples of community success stories will be compiled and made available to communities that exhibit an interest in implementing flood loss reduction programs. The casebook will include a discussion of the role of warning systems in a successful flood loss reduction program. It will provide an examination of the benefits of warning systems for communities subject to flash flooding as distinct from communities subject to other types of flooding, an assessment of the record on warning systems demonstrating what can reasonably be expected in terms of saving lives and property, and corollary benefits that can be anticipated by communities opting to implement warning systems as part of their flood hazard mitigation strategy. The casebook will also include a directory of experts from a wide variety of disciplines, levels of government, and types of communities who are willing to share their expertise in any area of flood plain management.

Thursday: 1:30 p.m.
Session: #3

APPLICABILITY OF SEVERAL COMMON METHODS OF DEBRIS ESTIMATION

By James D. Schall, Peter F. Lagasse

ABSTRACT

Construction of debris basins has been a common method of sediment control on alluvial fans in urbanizing areas of the Southwest. Design of debris basins requires accurate estimation of potential debris loading. In southern California, the Tatum method and the Los Angeles County Flood Control District procedures have been widely used to estimate debris production rates. These methods were empirically developed based on debris basin data from sites located in Los Angeles county. Most of the data utilized were from watersheds along the southerly aspect of the San Gabriel Mountains, which represents some of the greatest relief and slope in the area. To evaluate the applicability of these procedures to other local areas, specifically to the northeast aspect of the Santa Ana Mountains, a study of the geology, soils, precipitation, vegetation and physiographic factors of the two areas was completed. Additionally, results from the Tatum and Los Angeles County procedures were compared with other techniques for estimating debris production to arrive at the best estimate of potential loading to three proposed debris basins.

Thursday: 1:30 p.m.
Session: #3

THE DISCRETE DEBRIS-MUD FLOW RISK ANALYSIS METHOD

by
Scott R. Williams and Others
Davis County Flood Control, Utah

Generic debris-flow modeling approaches, applied by FEMA and others, provide some usable information with a minimum of site-specific input. More quantitative data relative to particular flood plains is demanded by local governments for justify budgeting of limited public funds for hazard mitigation or restriction of downstream development. Specific channel and watershed conditions will have a tremendous effect on a drainage basin's response to a particular climatic event or series of events. One canyon may be armored against scour whereas another is loaded with channel fill and choked with fallen trees. The watershed may be in excellent vegetative condition or denuded by fire or over grazing. Detached landslides may or may not exist in critical areas where they can be influenced by quantifiable events.

The discrete Debris-Mud Flow Risk Analysis Method attempts to provide the statistical information for effective public policy decisions through individual analysis of canyon conditions and potential response as well as downstream effects. Not only are critical climatic event probabilities assigned, but potential for watershed deterioration (fire, etc.) are included in the final statistical model.

Thursday: 1:30 p.m.
Session: #3

A POLICY STATEMENT FOR T-YEAR DEBRIS PRODUCTION ESTIMATION

Theodore V. Hromadka II

The County of San Bernardino has recently concluded development of a Debris-Production estimation technique. The approach results in T-year return frequency annual debris-production estimates, and includes the effects of fire on the catchment. The technique was developed by use of over 200 catchments which have been monitored for debris flows. The resulting procedure is a set of regression equations, each equation providing a specific T-year return frequency estimate. Although the equations are calibrated for a particular region, the methodology can be used in other localities.

Thursday: 1:30 p.m.
Session: #4

AUTOMATED MODELING OF DEBRIS-FLOW HAZARD USING DIGITAL EVALUATION MODELS

STEPHEN D. ELLEN
and
ROBERT K. MARK

U.S. GEOLOGICAL SURVEY, MENLO PARK, CALIFORNIA

Debris flows that develop from soil slips on hillslopes can be modeled in large part from topographic form as depicted by digital elevation models (DEMS). In the San Francisco Bay region, soil-slip sources of debris flows typically occupy concavities (hollows) with gradients steeper than 26°, so that a combination of slope gradient and cross-slope curvature measured from DEMs can be used to define likely sources. Debris-flow paths downslope from the sources can be delineated using a computer program that searches out downslope direction in a DEM. Distance of flow along these paths can be modeled in different ways using gradients and distances calculated from the DEM; critical gradients for scour, transport, and deposition can be identified, or lag-rate models can be applied to predict where volume of each potential flow decreases to zero. Once the extent of each potential flow is modeled, the relative hazard from all potential flows can be obtained from an automated count of the number of potential flow paths that cross each map cell.

Calibration of this model for a particular area requires determination of the topographic settings and potential volumes of local debris-flow sources, as well as the local travel-distance behavior of debris flows.

Thursday: 1:30 p.m.
Session: #4

MUD FLOOD and MUD FLOW MAPPING in DAVIS COUNTY, UTAH

John Liou

Abstract

Rapid snowmelt and heavy rains triggered the landslides, mud flow and mud flood in Davis County, Utah and other communities along the Wasatch front and Wasatch plateau areas in the spring, 1983 and 1984. With a population of approximately two million people, the areas sustained extensive direct damages in excess of 250 million dollars from landslides, mud flow, and mud flood. As the results of these events, many agencies including local, state, and Federal government, increased the efforts of mud flow research which includes the better techniques of estimating the quantity of debris in the source areas, the theoretical bases of the transport dynamics or hydraulics of mud flow along the canyon valley and in the canyon mouth, and mud flow hazard area mapping techniques in the alluvial fans A sound theory based and duplicable mud flow model was developed through the joint effort of the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers and applied this model to define the mud flow hazard areas in Davis County, Utah. This paper will describe the physical characteristics of mud, the dynamics or hydraulics of mud flow in one-dimensional flow region and in two-dimensional flow region and also describe the detailed processes to prepare the model input data or information from the examples of mud flow in Davis County, Utah. The current FEMA Alluvial Fan Mapping Methodology can be used to define the mud flood hazard areas in the study.

PROGRAM PARTICIPANTS

Virginia Bax-Valentine is the Chief Engineer/General Manager for the Clark County Regional Flood Control District. She received a B.S. in civil engineering from the University of Idaho and currently is a registered PE in the states of Nevada and Utah. After graduation she worked as a consulting engineer on a variety of civil engineering projects involving flood control, water resources and wastewater treatment and collection systems. She is currently vice-president of the Nevada Society of Professional Engineers and is past-president of the local chapter of ASCE; she is a member of the UNLV Engineering Advisor Council, Water Pollution Control Federation and ASFPM. She is the first Chief Engineer/General Manager of the regional flood control district, providing for the first time a comprehensive regional master plan for flood control and a permanent source of funding approved by the five incorporated entities and Clark County, Nevada.

Leslie A. Bond is a consulting hydrologist with his office in Arivaca, Arizona. He graduated from the University of Arizona in 1972 with a B.S. in hydrology and received a Masters in public administration from Arizona State University in 1983. He was the first hydrologist hired by the Flood Control District of Maricopa County, Arizona, where, from 1974 to 1979, he developed floodplain management regulations, drainage requirements for subdivisions, and performed and supervised various other hydrologic investigations. In 1976 Mr. Bond became a flood warning hydrologist for the State of Arizona. From then until 1986 he worked in flood warning and floodplain management, including five years as the State Coordinator for the National Flood Insurance Program. As a consultant since 1987, Mr. Bond has worked on a variety of projects, including floodplain delineations, model floodplain management ordinances, flood damage mitigation and an evaluation of the federal, state and local floodplain management activities in the State of Tennessee. He is currently working for L.R. Johnston Associates on an assessment of the nation's floodplains and for French and Associates to develop community rating procedures for flood insurance. He is also producing an evaluation of this conference and editing the conference proceedings.

William M. Brown III is a Physical Scientist with the Branch of Geologic Risk Assessment of the U.S. Geological Survey in Menlo Park, California. He is also an Associate Member of the Association of State Floodplain Managers and a member of the Arid Regions Committee. He has worked on a variety of hydrologic and geologic problems throughout the American West for the past 21 years, and is currently working on the general inter-relations of geologic hazards and public policy. He is an experienced instructor in the field of hydrogeological hazards, and receives many regional, national and international assignments for this expertise.

Bill DeGroot received his BSCE in 1969 and MSCE in 1974, both from South Dakota School of Mines and Technology. After graduation, and prior to obtaining his MS degree, Bill spent approximately a year with Shell Oil Company as a field engineer at a refinery in California. He also spent two years as an officer in the Army Corps of Engineers, including a tour of duty in Viet Nam. Bill joined the Urban Drainage and Flood Control District in 1974 as Chief of the Flood Plain Management Program, a position he still holds. He has been active in the American Society of Civil Engineers, American Public Works Association and the Association of State Floodplain Managers. He is a trustee of the Foundation for Colorado State Parks and a former vice-chair of the South Platte River Greenway Foundation.

Stephen D. Ellen received his Ph.D. in Geology from Stanford University in 1971 and joined the U.S. Geological Survey in 1972. His work has included the mechanics of geologic folding; description of hillside materials in the San Francisco Bay region; geologic mapping in northern California; development of a method for mapping landslide susceptibility based on terrain form; debris-flow hazard evaluation in the San Francisco Bay Region, Utah, and Oahu; development of methods for determining susceptibility of soil to debris flow; and development of techniques for automated mapping of debris-flow hazard using digital elevation models (DEMs).

Mark E. Forest received a B.S. in hydrology from the University of Arizona and is noe a registered P.E. in the State of Nevada. He is currently employed by Nimbus Engineers in Reno as a project manager. His projects have included flood insurance studies, watershed master plans, flood control studies, watershed and watercourse modeling and drainage design. He has also held water related positions with the State of Arizona and Pima County Department of Transportation and Flood Control District.

Eve Gruntfest, Associate Professor, Department of Geography, University of Colorado, Colorado Springs. She has been working on flash flood mitigation since the 1976 Big Thompson Flood in Colorado She is the author of the Manitou Springs Flood Hazard Mitigation Plan and in 1986 she organized the Symposium "What We Have Learned Since the Big Thompson Flood". Currently Dr. Gruntfest is the principal investigator of a National Science Foundation funded project: Flash Floods: A Comprehensive Assessment.

John Helm received a law degree from Arizona State University. He's a former member of the Land and Natural Resources Division, Appelate Section, Department of Justice, Washington, D.C. He is now in private practice in Tempe, Arizona with the firm of Helm and Kyle, specializing in water and construction related problems. He is special counsel to Maricopa County, Arizona on water problems. He is the general counsel for the Arizona Floodplain Management Association (AFMA) and has been active with ASFPM since 1985. He was instrumental in the formation of the Arid West Committee.

James R. Hogg is the Civil Engineer in charge of the Floodplain Management Section of the Kern County Department of Planning and Development Services with 13 years experience in floodplain management and flood control activities. His sections' responsibilities include flood hazard area delineations, review of land divisions and developments for conformance with floodplain regulations and drainage standards, providing site specific flood hazard information for building permits, developing and administering floodplain regulations, and providing public information on flood hazard issues. He is a member of the American Society of Civil Engineers and ASFPM.

Theodore V. Hromadka II received a B.A. and an M.A. in applied mathematics from California State University, Fullerton; and an M.S. Ph.D. in civil engineering as well as a Ph.D. in mathematics from the University of California, Irvine. He is a registered P.E. in the State of California and is currently Director of Water Resources Engineering, Williamson and Schmid, Irvine, California. Dr. Hromadka has been involved for over 12 years in civil engineering and academic research. His engineering experience includes the completion of numerous water-resource investigations. Major projects include the development of master plans of flood control for watersheds, preparation of county hydrologic procedures and hydrology manuals and development of computer systems for hydrologic analyses and hydraulic design. Dr. Hromadka's research work has spanned the disciplines of ground water and surface water hydrology. He has developoed micro-computer software for hydrologic analyses and hydraulic design which is widely used by the engineering community. He is an associate professor of applied mathematics and director of the computational mechanics program at California State University, Fullerton. He is also director of the Computational Hydrology Institute, Irvine, and has been a lecturer of applied mathematics and engineering at CSU and University of California, Irvine. He has published more than 150 refereed technical journal and full-conference papers, twelve governmental reports, eleven books, five public-domain governmental computer programs and more than 400 professional engineering reports involving flood control, water supply, ground water flow, sedimentation, hydrology and hydraulics.

David K. Keefer is a Geologist and Research Group Leader with the U.S. Geological Survey (USGS) in Menlo Park, California. He received B.S. and M.S. degrees in geology from Stanford University in 1971, an M.S. degree in civil engineering from the Univeristy of Illinois, Urbana, in 1973, and a Ph.D. in applied earth sciences from Stanford in 1977. His Ph.D. research concerned the mechanics of initiation and movement of earth flows. Dr. Keefer joined the USGS in 1974 and currently supervises the landslide research group based in Menlo Park. After receiving his Ph.D., he conducted research on seismically-triggered landslides. His studies include post-earthquake investigations of landslides in 13 earthquakes in the United States, Japan, and Argentina; analysis

of a worldwide data base on landslides caused by historical earthquakes; and work on probabilistic models for preducting the areal extent of landslides in earthquakes. Most recently, Dr. Keefer has been working on relations between rainfall and landslide initiation and on development of a method for issuing public landslide warnings in real time during severe rainstorms. The team of researchers he leads made the first successful regional landslide prediction in the United States in February, 1986. Dr. Keefer is the author or coauthor of more than 60 articles and reports on landslides, on other slope processes, and on other topics including tunneling and archaeological geology.

Art Krueger received a B.S. and a M.S. in Civil Engineering from the University of Southern California. He worked for five years for the City of Los Angeles designing flood control projects for Los Angeles County. He has been with the Riverside County Flood Control District for the past 17 years and is currently in charge of the floodplain management section.

Peter F. Lagasse received a B.S. in Civil Engineering from the U.S. Military Academy, West Point, New York in 1960, a M.S. in Coastal Engineering from the University of California, Berkley in 1966 and a Ph.D. in Civil Engineering from Colorado State University in 1975. Prior to joining Resource Consultants, Inc., in 1984, Dr. Lagasse had 20 years of engineering experience with the Corps of Engineers and academic assignments at the U.S. Military Academy, West Point, New York. He also had four years experience with a water resources consulting firm as Vice President for Engineering and Environmental Services where he was responsible for erosion, sedimentation, and geomorphic studies, river engineering and stabilization projects, research and development projects, and litigation support services. His experience over the last twelve years has been concentrated in the area of assessing the impact of engineering development on the hydraulics and morphology of river systems. Areas of investigation include response to dredging, impacts of gravel mining response to dam construction and stability of bridge crossings.

Charles L. Laird has been employed by San Bernardino County since 1960. He is a registered Civil Engineer in the State of California since 1973 and a graduate of the University of Redlands (1979). In 1982 he was appointed to the position of Assistant Director of the Department of Transportation and Flood Control and is generally responsible for Planning, Engineering and Administration activities. In recent years he has been most active in coordinating land development and developing transportation and drainage fee programs. Other positions include serving as Chief of the Flood Control District Planning and Water Resources Divisions from 1974 through 1978 and Chief of Solid Waste Management Planning Division from 1978 through 1982.

Andrew S. Lee is a Senior Engineer at California Department of Water Resources. He is in charge of the new Flood Loss Reduction Section and administers California's floodplain management program and the National Flood Insurance Program. Mr. Lee began his career with the department as a part-time engineering aid while studying at the University of California at Davis where he earned his B.S. degree with a concentration in Water Resources Engineering. His full-time employment with the department began with planning and project formulation studies for a water facility in the Sacramento-San Joaquin Delta. Over the years Andy supervised the Delta Facilities Planning Program and the Recreation Planning and Implementation for the Delta, the Instream Water Use Program; and just prior to taking on the new Flood Loss Reduction Section, he was Chief of Surface and Groundwater Data Section in the department's Central District. He was program manager for the Central District's Water Quantity and Quality Measurements Program.

Robert C. MacArthur, Ph.D., P.E. is the Principal Engineer for the firm of MacArthur Engineering Associates in San Luis Obispo. He is a registered P.E. in California, Colorado, Nevada, Wyoming and Hawaii (pending). He received his B.S., M.S. and Ph.D. at the University of California, Davis and received a one-year research fellowship grant in oceanographic engineering at the University of Delaware. He has had national and international experience in planning, developing and coordinating applied research, teaching and engineering analyses dealing with problems in water resources development and management, environmental engineering, water quality assessment and enhancement, river mechanics, estuarial hydrodynamics, sedimentation engineering, water supply, irrigation, land use methods, and modeling of hydrological and other engineering systems. He is the co-author of two books and author or co-author of approximately 100 publications and reports in the fields of hydraulics, hydrology, sediment engineering, land reclamation, special hazards analyses, and estuarine and coastal hydrodynamics. He is currently employed by the U.S. Army Corps of Engineerss Hydrologic Engineering Center in Davis, California for the purpose of completing some research and reporting in the area of river and floodplain hydraulics.

James R. Morris, P.E. is Chief of the Flood Management Section at the Arizona Department of Water Resources. Mr. Morris is a graduate of Ohio State University with a B.S. and M.S. in Civil Engineering. He has been involved in floodplain management in Ohio and Arizona for the past 10 years.

Brian M. Reich, Adjunct Professor of Hydrology and Water Resources, as a Professional Engineer, is attuned to needed surface water hydrology improvements. The past four years, he has consulted on surface water and rainfall input, which is a critical factor in today's computer models used in determining flood-peak attenuation. During the previous decade he worked as floodplain manager for city and county agencies. He developed two University of Arizona courses on urban stormwater computations and

management. Before settling in Arizona, he spent eight years establishing a large hydrology research and teaching program at Pennsylvania State University. His prime interests are rainfall/intensity/distributions and flood prediction.

Joe Rumann is currently a hydrologist at Maricopa County Flood Control District, supervising the Special Projects Branch of the Hydrology Division. He is responsible for the District's flood alert system. He received his B.S. from Northern Arizona University and is currently working toward a masters in hydrology at the University of Arizona.

George Sabol is presently a consulting engineer out of Denver. He is currently working for the Flood Control District of Maricopa County and the Arizona Department of Transportation in the preparation of hydrology design manuals.

Daniel E. Sagramoso is the Chief Engineer and General Manager of the Flood Control District of Maricopa County, Arizona. He was involved for many years in the planning, design and construction of projects, including flood control structures, as an officer in the United States Army Corps of Engineers. Upon completion of active military duty, he moved back to the Phoenix area in August, 1977 and joined the Flood Control District staff. He served as Deputy Chief Engineer of the District until March, 1982, when he was promoted to Chief Engineer and General Manager. Mr. Sagramoso is a Registered Professional Engineer in Arizona and Missouri and has the degrees of Bachelor of Science in Engineering from the University of Missouri and Master of Science in Engineering from Arizona State University.

James D. Schall received a B.S. in Interdisciplinary Engineering from Purdue University in 1976, a M.S. in Civil Engineering in 1979 and a Ph.D. in Civil Engineering in 1983, both from Colorado State University. He is registered in Colorado and California. His expertise is in hydraulics, erosion and sedimentation. At Resource Consultants, Inc., he has been involved with reservoir analyses, channel design projects and evaluation of channel stability. These projects have required evaluation of sediment transport rates, aggradation/degradation, local scour, reservoir sedimentation, revetment design, computer modeling, preparation of plan and profile drawings, and cost estimation. Prior to joining Resource Consultants, Inc., Dr. Schall worked in southern California and was involved with hydrologic analyses/hydraulic design for various urban developments. Prior to this Dr. Schall worked for a water resource firm where he participated in a variety of projects throughout the United States involving fluvial system analysis and responses. Indicative of his riverine water resource experience is his participation as primary author on the "Design Manual for Engineering Analysis of Fluvial Systems" prepared under funding from the Arizona Department of Water Resources.

Dr. James E. Slosson received his Ph.D. in Geology at the University of Southern California in 1958 after receiving his M.S. degree in 1950 and his B.S. in 1949 from the University of Southern California. He is a registered geologist in California, Arizona, Idaho, Delaware, Georgia, Oregon and North Carolina as well as a certified engineering geologist and registered geophysicist in California. He was a professor of geology for over thirty-four years and has been a lecturer and visiting professor at many colleges and universities including Harvard, University of Southern California, UCLA and Caltech. He served as State Geologist for California and Chief of the California Division of Mines and Geology in the mid 1970s. He has served on the California Seismic Safety Commission and the Board of Registration for Geologists and Geophysicists as well as many other state and local governmental advisory boards dealing with all phases of geology. He is currently a member of the National Research Council Committee on Ground Failure Hazards and the FEMA/Colorado Department of Public Safety Advisors Committee for Landslide Hazard Mitigation. He serves as a coordinator for the ASCE/OES Disaster Preparedness Committee. He is presently Chief Engineering Geologist for his own consulting firm involved in forensic geology, data interpretation, hazard mitigation and prevention, soil erosion abatement, hydrogeology, seismic studies and engineering geology. He holds memberships in some fifteen professional organizations including AAPG, AIPG, ASCE,AEG, EERI, AND GSA. He has authored over ninety papers and articles, chiefly on the topic of natural/geologic hazards and the consequences.

Sidney W. Smith graduated with a Bachelor of Science degree from Utah State University in 1966. He is a licensed land surveyor and a licensed professional engineer for the state of Utah and has been licensed in Idaho, Wyoming and California. He is presently Director of the Davis County Public Works Department. Before entering the public sector, Mr. Smith was a consulting engineer to governments, the mining industry, and commercial, industrial and residential land developers. Efforts were primarily concentrated in the areas of storm drainage, geotechnical and site engineering as well as project management.

Frank H. Thomas is Assistant Administrator in the Office of Loss Reduction for FEMA's FEderal Insurance Administration. Mr.Thomas is responsible for the development, administration, and coordination of FIA's overall floodplain management policy and implementing procedures among the federal agencies as well as state and local governments. Included in these activities are the Community Assistance Program, Community Compliance Program, Unified National Program for Floodplain Management, E.O. 11988 and Section 1362 (Flood Damaged Property Acquisition). Mr. Thomas currently chairs the Federal Interagency Floodplain Management Task Force. Prior to joining the FIA, Mr. Thomas was Acting Director of the U.S.Water Resources Council.

NOTES FOR ARID WEST CONFERENCE PARTICIPANTS
ON
ISSUE PAPERS FOR THE NATIONAL ASSESSMENT

Last year, the Federal Interagency Task Force on Floodplain Management contracted with L. R. Johnston Associates to assess the nation's floodplains and the programs and activities which affect them. The Task Foce, chaired by the Federal Emergency Management Agency, is made up of the Federal agencies which have activities in floodplains.

During the first year of the contract, L. R. Johnston Associates produced a comprehensive description of the nation's floodplains and the programs at all levels of government which affect them. This document is currently under review by the Task Force and others. It will be available in a draft form within a few months.

During the current year, L. R. Johnston Associates is to evaluate the programs and activities which affect the floodplains. One of the methods being used to accomplish this evaluation is the development of issue papers based upon the the first year's work. These issue papers are being distributed to persons and organizations who have interest or knowlege of the individual issues for comment.

These issue papers are intended to make positive statements, supported by the data collected during the first year. They may appear to be biased or in error. If so, persons who can provide opposing or supporting data are encouraged to submit it, in writing, so that appropriate corrections may be made.

Leslie A. Bond Associates is a major subcontractor to L. R. Johnston Associates for this contract. Mr. Bond's primary areas of work within the assessment are arid west issues and technical areas such as hydrology, hydraulics and climatology. He is representing L. R. Johnston Associates at this conference to obtain input on the three issue papers of specific interest to the participants.

If you have time to review these issue papers during the conference, please contact Mr. Bond and give him your impressions. You may also contact him after the conference by phone or letter. If you have concerns with the statements, or if you have data which supports or refutes them, please send written comments to him at:

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ISSUE PAPER FOR ARID AND SEMIARID LANDS:
THE IMPACT OF POPULATION GROWTH ON
FLOODPLAIN MANAGEMENT IN ARID AND SEMIARID LANDS

I. STATEMENT OF THE ISSUE: Population in the arid and semiarid lands of the United States is increasing rapidly, and this growth is projected to continue to do so for at least the next 20 years. The large majority of these new residents will want single-family homes or mobile homes, both of which require large areas for development. In most growing cities and metropolitan areas in the arid regions, the land most available for development is that in and adjacent to floodplains, on alluvial fans, and in areas subject to landslides.

Annual and short term precipitation variability are high in these areas. There are greater differences in frequent and infrequent storms. As a result of this high variability in precipitation and the varied geography of the western part of the country, streamflow is also more highly variable than in more humid regions. Also, most new residents, including many of the state and local government employees who draft and administer regulations and the elected officials who adopt them, do not fully understand this variability.

Because much of the arid and semiarid region of the United States is younger from a geologic standpoint, and because it is relatively dry, slopes are generally steeper and sediment transport is generally higher during a flood of a given size. These factors lead to a less stable geomorphology and more rapid geomorphologic change. Sedimentation and scour rates may change suddenly and dramatically in response to changes in the watersheds above. Landforms which do not exist in other parts of the country do not respond to management practices developed elsewhere.

Many of the natural values in arid and semiarid regions are concentrated in the riparian areas of their floodplains. These areas are often very fragile relative to mans' ability to cause change. They are particularly sensitive to changes in riverine hydrology and sediment transport, both of which may be changed by urbanization or other development.

The combination of these factors will lead to greatly increased flood damages to new and existing development if new management techniques are not developed and employed immediately. Similarly, rare, diverse riparian habitat may be permanently damaged or destroyed by current development policies.

II. HYPOTHESIS: WITH THE HIGH VARIABILITY IN METEOROLOGIC AND HYDROLOGIC PHENOMENON AND A FASTER RATE OF GEOMORPHOLOGIC PROCESSES, THE ONGOING AND PROJECTED POPULATION GROWTH IN MANY ARID AND SEMIARID PARTS OF THE UNITED STATES WILL LEAD TO RAPID INCREASES IN FLOOD DAMAGES AND CONTINUED RAPID DETERIORATION OF FLOODPLAIN NATURAL VALUES THROUGHOUT THESE AREAS.

III. SUPPORT FOR THE ISSUE. Note: Arid and semiarid regions are defined by the World Meteorological Organization (WMO) according to a combination of mean annual rainfall and temperature. In the United States, most areas west of the 110th west longitude line are either arid or semiarid. Most arid lands in the United States are in Arizona, California, Nevada, New Mexico, Texas and Utah. Most of the rest of these states, as well as most of Colorado, Idaho, Montana, Nebraska, North Dakota, Oklahoma, Oregon,

South Dakota, Washington and Wyoming are classified semiarid.

III.A. POPULATION GROWTH. Most of the information on population growth is from the Joint Center for Housing Studies of the Massachusetts Institute of Technology and Harvard University, in The Demand for Housing and Home Financing into the 21st Century, National Association of Realtors, Washington, DC, September 1987. This report does not make projections on a state-by state basis, so it is not possible to get an accurate projection for the arid and semiarid regions. However, all of the arid lands are in states in the west and south, as are almost all of semiarid regions. Locations of the western states according to the breakdown used for the projections are:

Midwest: Kansas, Montana, Nebraska, North Dakota and South Dakota.
Northeast: None
South: Oklahoma and Texas.
West: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming.

III.A.1. POPULATION AND HOUSING. Although the annual population growth rate for the 1980's is expected to be about one per cent, housing activity will be driven by shifts in the population's age shifts. A significant factor in the increased demand for new housing is the growth of "non-traditional" households, including singles and one-parent households. A household is defined as a group of people occupying a housing unit, and the percentage of non-traditional households increased from 21.5% in 1950 to 41.7% of the total households in the United States in 1985. As the Baby Boom population ages toward the end of the century, non-traditional households are projected to increase to almost 50% of the total, and they will form up to 75% of the new households between 1985 and 2000.

One telling projection is that there will be between 11.6 and 13.5 million new households between 1985 and 1995, and between 17 and 19 million new households by the year 2000. These projections indicate that the vast majority of new housing (81%) will be located in metropolitan areas, and that the areas of highest growth will be the south and the west. It should also be noted that over 84% of the new households are expected to want single family residences or mobile homes, housing types which generally require the most land.

They also indicate that almost 90% of these new housing units will be in the south and the west, producing average annual growth rates in those regions on the order of 2% for the 15-year period.

III.A.2. INDUSTRY AND COMMERCE. Projections for employment in the major industries, based on data available in 1982, show a continuing relative increase in construction, communications, finance and related fields, and services, while there is a relative decrease in agriculture, manufacturing, transportation, work in private households and government (Bureau of the Census, 1985).

In recent years, the western states have been successful in attracting "clean" industry, and construction, finance, services and communications can be expected to follow the move of households and population to the west and the south.

If it is assumed that there will be no major changess in development and construction practices, there will be an ongoing increase in small, medium and large shopping centers, generally sprawling, with large parking areas. There will also be continuing construction of sprawling "clean" industrial parks, along with some large single industries and some redevelopment of downtown areas with high-rise buildings. As in housing, these new uses will be relatively land-intense developments, although with an even more disruptive effect on urban drainage.

III.A.3. PROBABLE LOCATION OF NEW DEVELOPMENT. The geology of most of the arid regions consists of rocky mountains and valleys filled with deep alluvium. These valley fills include all of the areas where erosion and sedimentation are greatest, such as alluvial fans, meandering streams and landslide areas. They also contain virtually all of the surface and groundwater supplies for the large urban areas in the west.

Because of the expense of constructing foundations, sewer systems, transportation systems and the other urban infrastructure, most existing development in the arid regions is on these alluvial deposits. There is no reason to believe that this practice will change in the near future.

III.B. VARIABILITY IN METEOROLOGIC AND HYDROLOGIC PHENOMENA.

III.B.1. VARIABILITY IN METEOROLOGIC PHENOMENON. An examination of the Statewide Average Climate History (1883-1982) (Karl, et. al., 1983) shows that the ratio of standard deviation to mean annual precipitation is greater in the arid states than in the wetter states. When the states are divided into the divisions by the National Weather Service, the higher variability of annual precipitation in the more arid regions is even more apparent (National Oceanographic and Atmospheric Administration, 1981). In Idaho, for example, the the statewide average precipitation is 18.9 inches with a standard deviation of 2.69 inches, for a ratio of 14.2%. However, in the Panhandle Division, where rainfall is 27.4 inches, the ratio is 15.5%, while in the NE Valleys Division, where the rainfall is 9.0 inches, the ratio is 23.3%.

III.B.2. VARIABILITY IN HYDROLOGIC PHENOMENON. The U.S. Geological Survey has performed "regional regression analyses" for many areas of the country. This process analyzes the peak flow data from gaged streams, compared with a number of parameters which are expected to influence peak flows, such as drainage area, slope and precipitation. The regression analysis produces a formula which "predicts" peak flows for ungaged areas. This analysis also produces a "standard error of estimate" (SEE), given in log units, which indicates the accuracy of the equations. A larger SEE indicates a less accurate prediction.

In the discussion of the regression analysis for Arizona streams, it is stated that "Much of the error [in the analysis] can be attributed to the extreme time and spacial variability of the annual peak discharges in Arizona; the varaibility of the annual peak discharges in Arizona is greater than that in most other states" (Roeske, 1978). In fact, the SEEs for Arizona are about twice those for Illinois (Curtis, 1977) and Indiana (Glatfelter, 1984).

III.C. GEOMORPHOLOGIC PROCESSES. The arid regions and some of the semiarid regions of the United States are largely characterized by steep mountain ranges composed mostly of bedrock, with valleys filled with alluvium. Due to the

overall steepness of the terrain and the infrequent rainfall to carry out the processes of erosion os the rock and transportation of the sediment to the oceans, these alluvial fills are quite active in sedimentation and erosion.

III.C.1. RATE OF GEOMORPHOLOGIC CHANGE. Because of the generally greater slopes, the relative youth of the mountains and the variability of rainfall, the rate of geomorphologic change in the arid and semi-arid regions is greater. Gravity causes faster runoff from the slopes. Higher flood velocities carry more sediment and larger particles. The development of alluvial fans, the coarse sediments in the alluvial valleys, and the extent of landslide-prone areas in the west all point to these differences.

III.C.2. STABILITY OF GEOLOGIC FEATURES. As a result of the fast rate of geomorphologic changes, many landforms in the arid and semi-arid regoins of the country are unstable. The relatively rapid aggradation and degradation of stream channels causes much of this instability. Degradation of a river channel, which may be brought on by a variety of causes, migrates upstream and into tributaries. Degradation also leads to channel meander when the stream attempts to reach a new equilibrium between slope and sediment load. Changes in surface cover, highly variable rainfall and channel cutting at the bottom of slopes increase the incidence of landslides.

IV.A. IMPACT OF THESE FACTORS ON FUTURE FLOOD DAMAGES. The combination of rapid population growth, highly variable rainfall and runoff characteristics and rapid geomorphologic changes point toward greatly increased flood damages throughout the arid and semi-arid west in the future. These damages will result from:

1. lack of data to properly evaluate the flood hazards;
2. development standards which do not properly identify the nature of the flood hazards; and
3. changes in the natural runoff patterns and geomorphologic processes.

In the case of lack of data, estimated flood peaks are too low half the time, resulting in under-estimation of flood elevations. Development standards which do not include recognition of the geomorphologic processes in the watersheds and in the channels will not protect new development fron all of the hazards associated with flooding in these regions. Changes in the runoff patterns will increase flood peaks, resulting in increased damages to both new and existing development. Changes in the sediment transport process will result in either greater scout and entrenchment of streams, or aggradation in channels, increasing flood heights. Either will generally cause increased damages to development.

IV.B. IMPACT OF THESE FACTORS ON NATURAL VALUES. Increased population affects natural floodplain values in two principal ways: development along the floodplains is almost always detrimental to the fragile environment; and changes in hydrologic and geomorphologic processes change the environment.

Even casual use of many floodplain areas in arid regions is destructive to native flora and fauna. Similarly, seemingly minor changes in land use within the watersheds and floodplains, including activities which change sediment transport and runoff patterns, or the lowering of the watertable, have drastic impacts on floodplain natural values.

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ISSUE PAPER FOR ARID AND SEMIARID LANDS:
THE IMPACT OF LAND-USE POLICIES AND PRACTICES FOR
PUBLIC AND PRIVATE LANDS ON DOWNSTREAM FLOODPLAIN MANAGEMENT

I. STATEMENT OF THE ISSUE: Aside from the effects of urbanization, it has been observed that rural land-use policies and practices in arid and semiarid lands have sometimes dramatic impacts on local flood hydrologic and geomorphologic processes. These policies and practices have a long-term impact on floodplain management in terms of both flood damages and natural values in downstream floodplains.

Because the land forms, flora and fauna are determined by the availability of water, the factors which determine storm runoff are closely interconnected and are extremely responsive to changes in their relative balance. Since the arrival of the first Europeans 450 years ago, mans' activities have caused dramatic changes in these relationships, with resulting changes in the floodplains and the floods. Our increasing ability to change the watersheds and floodplains increases our uncertainty about future floods.

Storm runoff occurs when the rate of precipitation at the soil surface exceeds the rate at which water infiltrates into the soil. Any change which increases the portion of rain which reaches the soil, such as the removal of vegetation, increases the volume of runoff. Any change which decreases the rate of infiltration, such as compaction of the soil or paving the surface with impervious material, also increases the volume of runoff.

Even if the volume of runoff is not increased, changes in the rate of runoff will generally increase flood peaks. The rate of runoff is increased by reducing the roughness of the surface and by straightening and deepening channels. When the rate of runoff is increased, water accumulates at downstream points more quickly, increasing flood peaks and the capacity for erosion.

In arid and semiarid areas, many of mans' activities do or may affect flood runoff. Destruction of the native grazing herds, predator control, introduction of cattle, sheep and other range animals, mining, the construction of rail and highway systems, urban development, surface water diversion, groundwater extraction, the construction of dams and channelization are examples of the wide variety of these activities.

Because of the general scarcity of water throughout these regions, floodplains are frequently the most prolific and diverse locations of plants and animals. Disturbance of the water supply to these areas causes profound changes which may be, for practical purposes, permanent. Similarly, changes in the balance of sedimentation and scour may destroy fragile floodplain ecosystems.

II. HYPOTHESIS: THE IMPACTS OF LAND USE POLICIES AND PRACTICES FOR LARGE AREAS OF PUBLIC AND PRIVATE LANDS ARE NOT INCLUDED IN CURRENT FLOODPLAIN MANAGEMENT POLICIES AND PRACTICES. BECAUSE THESE POLICIES AND PRACTICES AFFECT DOWNSTREAM FLOOD HYDROLOGY, FLOODPLAIN GEOMORPHOLOGY AND NATURAL FLOODPLAIN VALUES, THE MANAGEMENT OF FUTURE FLOOD DAMAGES AND THE PROTECTION OF NATURAL VALUES IN THESE DOWNSTREAM FLOODPLAINS IS NOT POSSIBLE.

III. SUPPORT FOR THE ISSUE.

III.A. UPSTREAM ACTIVITIES AFFECT FLOOD HYDROLOGY AND SEDIMENT PRODUCTION.

As elsewhere, development of floodplain lands in arid and semi-arid regions increases flood damages. In smaller floods, there is damage to public facilities, and in very large floods, there is damage to properly designed structures. There is also the potential for damages which result from increased flood peaks caused by upstream development. Damages in arid and semi-arid regions will be greater from a given flood due to sediment and velocities. Finally, flood damages may be higher in these areas because of scour, sedimentation and meander.

The extraction of groundwater for urban and agricultural uses has lowered the water table in many western streams so that streams which once supported year-round riparian growth no longer do so. The loss of this vegetation can cause dramatic changes in the hydraulic characteristics of a floodplain, including channel entrenchment, changes in meander characteristics and changes in the infiltration rate of flood water.

A study of the history of Central City, CO is exemplary of the impact of mining activities in the west. The discovery of gold in 1859 led to a population of 15,000 within fifteen months. Within three years, the dense aspen and conifer forest was totally harvested over a 25 square mile area. The loss of vegetation caused trenching of valley fills of as mush as 21 feet. When the gold ran out, the area was gradually abandoned, and the population decreased to about 1400 by 1920. Natural reforestation has begun on the north slopes of the watershed, but only covered a small portion by 1974. The entrenched channels remain (Graf, 1979).

The production of feed for cattle and grazing constitute the largest single use of water and land in the western United States. In the upper Colorado River Basin, 90 per cent of the water used is for agriculture, and 88 percent of the irrigated land is used to grow livestock feed. Of the 65 million acres in the upper basin, 47 million acres, or 72 per cent, is used for grazing. In the lower Colorado River Basin, 85 per cent of the water is used for agriculture, and almost half of the irrigated land is used for feed crops. Of the 99 million acres in the lower basin, 82 million acres, or 83 per cent, are rangeland or pasture (Fradkin, 1984).

A draft report on desertification (human-induced barrenness of the land) in the United States says that "Grazing does not cause desertification in itself. It is only when the carrying capacity of the land is exceeded by grazing, whether by livestock, wildlife, or feral animals actually grazing on the land, that overgrazing and desertification can occur". Furthermore, "When the upper reaches of a river basin lose their vegetation... the risk of floods downstream increases several-fold" (Sabadell, 1980).

Most researchers agree that grazing (or overgrazing) has done great damage to watersheds and riparian zones, although many propose management schemes to reduce such damage. The impacts of livestock include soil compaction, denudation of watershed areas, removal of riparian vegetation and the mechanical breakdown of streambanks. These impacts lead to increased soil erosion (and increased sediment loads and turbidity in streams), decreased nutrient load in

streams and lowering of watertables, among other things. Management practices suggested to alleviate these problems center on timing the grazing to avoid times of the year when the most damage is done (Rauzi and Hanson, 1966), (Kauffman and Krueger, 1984), (Marlow and Pogacnik, 1985), (Bryant, 1985).

The steep areas of the west have some of the world's most unstable soils. Root systems of plants substantially increase the stability of soils through several mechanisms, and removal of plants lowers the stability. Studies have shown that after a forest is clear-cut or burned, the biomass of roots declines due to decay of the roots. If the forest slope is marginally stable, landslide frequency often increases after trees are removed. After 12 years, the growth of brush re-establishes most of the soil strength, but if the brush is removed to promote conifer growth, the strength will again decline rapidly (Ziemer, 1981).

III.A.2. UPSTREAM ACTIVITIES AFFECT NATURAL FLOODPLAIN VALUES.

Lowering of the water table in arid and semi-arid regions causes a drastic and often permanent degradation of natural floodplain values. In many areas, a high water table is the only source of water for riparian vegetation. Perm anent pools and springs may be the only local sources of water for native animals. The pumping of groundwater, construction of agricultural drains and channelization, both intentional and incidental to other activities, may lower the water table and change entire ecosystems.

Irrigation can lead to increased salinity in soils and waterlogged soils, either of which can lead to the destruction of agricultural productivity. It is estimated that 25% of the irrigated land in the west is affected by these problems to such an extent that crop yields are reduced. Data are not available on the amount of waterlogged and salinized lands in floodplains (Sabadell, 1980).

Soil salinity is a natural condition. Various salts are contained in the rocks from which soil is made, and rainfall dissolves these salts and carries them through the river systems of the world. In arid regions, however, salt concentrations are higher because the runoff over geologic time has not flushed them to the oceans as thoroughly as in more humid climates (Chow, 1964). The control of runoff for irrigation in the west in itself increases the concentration of salts. Evaporation from western lake and ponds ranges from 70 inches per year at Lake Mead to 120 inches per year in an evaporation pan which would be more representative of small bodies of water. The removal of this pure water increases the concentration of salts (Chow, 1964).

Spreading water on the soil for irrigation causes even greater concentration. The vast majority of water used for irrigation either evaporates from the surface or from the soil, or is transpired by the crops, leaving the salts. These salts accumulate rapidly, requiring additional water to flush them to a stream or drainage system. One irrigation project of only 60,000 acres in southwest Arizona increased the salinity of Colorado River water reaching Mexico from 750 ppm to 1500 ppm in a few years. International agreements on water quality caused the United States to build a channel to keep the brine from this project separate from the Colorado River, and to build a desalinization plant to remove the salts. Water from the Upper Colorado Basin had 250 ppm salts prior to irrigation. By 1972, that had increased to 606 ppm, and is

projected to rise to 800 ppm by the year 2000 (Worster, 1985).

In the San Joaquin Valley of central California, agricultural drainage was directed into the Kesterson National Wildlife Refuge, where it concentrated selenium to such an extent that birds were unable to nest successfully. After just three years of drainage, rangers were shooting noise makers to scare birds away from the refuge to save them. It has been suggested that the soils contaminated by this drainage be collected and isolated as a hazardous waste site. This drain, which was intended to pass through the refuge to discharge into the San Francisco Bay, has been stopped for environmental reasons. It is estimated that one million acres of the San Joaquin Valley will be lost to agriculture in the next 100 years without the drain (Worster, 1985).

Saltcedar (Tamarix chinensis Lour) has spread rapidly in streams throughout the arid and semiarid regions of the United Sates since about 1930. Among other characteristics, saltcedar affects flood flows by increasing channel and floodplain roughness, increasing the stability of floodplain sediments and changing the channel width, depth, sinuosity, gradient, and even channel location. An examination of the results of clearing of saltcedars from a reach of the Gila River in southeastern Arizona shows that flood elevations during large floods can be changed by a foot or more, while channel characteristics changed dramatically. Velocities doubled, channel roughness was reduced about 180%, and channel depth increased about 70% (Burkham, 1976).

Saltcedar has become the single dominant species of vegetation in many river reaches previously characterized by variety and perpetual succession. It is apparently capable of replacing native riparian vegetation and maintaining its hold on invaded areas indefinitely. Although not present in the a study reach of the Gila river in 1914, saltcedar increased in area of domination from about 150 acres in 1937 to about 1000 acres in 1964. It occupied roughly 1,000,000 acres in western floodplains in 1965.

Despite its natural values, there has been a dramatic loss of riparian habitat in the arid and semi-arid regions of the United States. Reports of 98% reduction in the Sacramento River Valley (CA), 90% in the Lower Colorado River Valley and similar losses in other areas demonstrate how much has been lost. In the Missouri River Valley in South Dakota and Montana, 55% of 1510 river miles has been converted from river to reservoir by federal water development projects (Hoar and Erwin, 1985). It is estimated that 96% of 2.4 million acres of riparian forest in Missouri which existed when the earliest European settlers arrived has been removed. Similar figures probably apply to western states where now less than 0.5% of the land area is in native riparian habitat (Johnson, 1978).

There are a variety of causes for the tremendous reduction in riparian habitat in the arid and semiarid regions of the country. Many riparian species (both native and exotic) transpire huge amounts of water, so systematic removal has been seen as a way to conserve water. Some species are resistant to erosion, so as they thrive, they contribute to channel meander, serving as a major contributor to the geomorphologic equilibrium of the river system. The construction of dams has reduced riparian habitat both by flooding it out and by changing the downstream hydrology in ways which are detrimental. Major stands of riparian forests have been destroyed for lumber and fuel. Water tables have been lowered by pumping causing the loss of phreatophytes. Erosion

has caused damage. Large areas have been cleared for agricultural uses. Increased salinity of water in streams resulting from irrigation of farm lands has also damaged or destroyed riparian habitat.

III.B.I. IMPACTS OF WATERSHED USES ON FLOOD DAMAGES.

Many activities in watersheds above developed floodplains can change the hydrology of flood peaks, flood volumes and sediment loads, leading to increases in flood damages to developed areas. Generally, the floodplain management programs instituted to protect development have no control and little knowledge of these watershed uses. In the arid and semi-arid regions of the country, these effects may be especially important. Even though large portions of the watersheds in many states are in public ownership, there are no comprehensive efforts to determine and control the impacts of upstream land use on downstream development. This situation leads to the potential increase of flood damages to existing and future development.

III.B.2. IMPACTS OF WATERSHED USES ON NATURAL VALUES.

The floodplains of the west are of extreme importance to a wide variety of plants and animals. Precisely because of the scarcity of water, the varied habitat in the narrow band between water and desert supports some of the most diverse communities of birds and mammals in the world (Johnson and Lowe, 1985). Lowering of water tables, degradation of water quality, changes in the sediment transport equilibrium and changes in flood peaks and velocities all have an impact on natural floodplain values. As is the case in flood damage reduction, floodplain management programs to protect or enhance natural values have little or no knowledge of or influence over upstream land uses which may counter their efforts.

Also, the lack of a coordinated policy to preserve riparian areas has already led to the destruction of the vast majority of such areas. Even though restoration of native riparian habitat is impossible in much of the arid and semi-arid west, there is no comprehensive effort to protect what is left.

The loss of native riparian vegetation and the lack of a comprehensive effort to understand and control the impacts of watershed uses will lead to further deterioration of floodplain natural values throughout the western United States.

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ISSUE PAPER FOR ARID AND SEMIARID LANDS:
THE DECLINE OF HYDROMETEOROLOGICAL DATA COLLECTION
IS DETRIMENTAL TO FLOODPLAIN MANAGEMENT.

I. STATEMENT OF THE ISSUE. Floodplain management, including both damage reduction measures and the protection of natural values, is highly dependent on current and historic knowledge of precipitation and runoff. Structural flood control, floodplain land use management, stormwater management and other elements of flood loss reduction are dependent upon either an historic record of flooding or a synthesis of flood hydrology based upon historic precipitation data. Reservoir operation, range management, fisheries management and flood warning and response are dependent upon more immediate rainfall and runoff data.

In the arid and semiarid regions of the country, there are fewer raingages and those gages have shorter records than in more humid parts of the country. Also, the number of NWS raingages has decreased dramatically within the last decade. As with raingages, the density of USGS streamgages is lower in this area, and ther number of gages has declined in recent years. There is no area-wide system for the collection of sediment data needed to evaluate many of the floodplain geomorphological processes which affect both flood damages and natural values.

In all aspects of analysis and forecasting, the parameters determining the hydrology are assumed to be constant. That is, it is assumed that climate, runoff characteristics, channels hydraulics and similar factors which affect surface water hydrology remain constant over time. If this assumption cannot be met, additional data are required to determine the impact of changes on the hydrology.

II. HYPOTHESIS: AN INADEQUATE HISTORIC RECORD OF PRECIPITATION AND RUNOFF IN THE WEST, COMBINED WITH AN ONGOING DECLINE IN THE DATA COLLECTION EFFORT, ARE REDUCING THE ABILITY OF PLANNERS TO ACCURATELY DETERMINE THE LOCATION AND NATURE OF FUTURE FLOODPLAINS. THIS IS LIKELY TO INCREASE FUTURE FLOOD DAMAGES AND DECREASE NATURAL FLOODPLAIN VALUES.

III. SUPPORT FOR THE STATEMENT.

III.A. NEED FOR DATA IN FLOODPLAIN MANAGEMENT.

III.A.1 FLOOD HYDROLOGY. Several aspects of floodplain management in the United States are based on historic records in meteorology and hydrology. Some sort of rainfall and streamflow (or stream level) records have been maintained in a few places since European settlement. These records have been used to determine average annual flood elevations and other river parameters. In the last 50 years or so, systematic river records have been used to determine probablistic flood characteristics for infrequent floods for purposes of flood control, water conservation and land use management in floodplains.

As a result of the assumptions inherent in statistical hydrology, the following statements are true:

1. Flood estimates are more accurate (fewer assumptions are made) at gaged sites on a stream.

2. Longer records are more likely to represent the possible range of floods at a gaged site.

3. If rainfall/runoff analysis is used, long records at closely spaced raingages will provide better results.

4. If precipitation patterns or runoff characteristics have changed or will change in the future, the deterministic methods currently used will not accurately predict future streamflows or stream elevations.

It is therefore obvious that more streamgages and raingages, with longer periods of historic record, will improve the accuracy of future flood estimates. Furthermore, if climate or watershed conditions have changed or are changing, additional data are essential to anticipating changes in future floods.

III.A.2. WATER CONSERVATION, RANGE MANAGEMENT AND MANAGEMENT OF RIPARIAN HABITAT. Data requirements for water conservation, range management, management of riparian habitat and other related aspects of floodplain management require both a reasonably good historic record for long term planning and current or seasonal data for management. Water quality data are also needed for management of natural values in floodplains.

III.A.3. FLOOD WARNING. Flood warning in the western United States is generally needed on smaller streams with short times between the onset of precipitation and the occurrence of flooding. Therefore, most flood warning uses rainfall/runoff analysis, with streamgages for verification during the flood and calibration of the model after a flood. Flood warning therefore requires relatively dense networks of telemetered precipitation data. Most existing flood warning systems in the west are operated and maintained by local governments with assistance from state and federal agencies. Few if any of these gages are maintained to the standards required by the NWS for historic data. There are no plans to improve the quality of these data, nor to ensure that future flood warning systems will be operated to provide technically adequate data.

III.B. HISTORY OF DATA COLLECTION IN ARID AND SEMIARID REGIONS.

III.B.1. HYDROLOGIC DATA.

III.B.1.a. STREAMFLOW DATA. The Nation's streamflow records are primarily collected and archived by the United States Geological Survey (USGS). In many cases, other federal agencies, state and local agencies and others cooperate with the USGS in this data collection. Since it established its first streamgage in 1889, the streamgage network of the USGS increased through 1980, and has declined since then.

The total number of continuous and partial-record streamgages in the United States with data archived by the USGS declined from 16,697 in 1980 (Gilbert and Buchanan, 1982) to 13,217 in 1985 (Condes de la Torre, 1985), a decline of 21% in five years. In the 17 western states, excluding Alaska and Hawaii, the 6,559 stations operated in 1980 (Gilbert and Buchanan, 1982) declined to 5,346 by 1985 (Condes de la Torre, 1985), a similar 20% drop.

The vast majority of the streamgages in the United States are operated by the USGS. In 1984, for example, the USGS operated 7,002, or 93% of the 7,492 daily record stations. With a very few exceptions, the streamgages operated by the USGS are a cooperative effort. That is, a local sponsor pays for part of the operation of each station. For this reason, the addition or removal of a streamgage from the network is generally decided by the local sponsor, so that there is no overall consistency to this aspect of data collection. It is subject, in large part, to budget problems and political decisions made by the thousands of local cooperating agencies.

Runoff from small watersheds is important for many purposes, including highway drainage design and urban drainage analysis, and runoff from them cannot be accurately extrapolated from data for larger watersheds because the runoff processes and storms are different for small watersheds. Of 846,000 tributaries in the United States with drainage areas between one and two square miles, fewer than 60 were gaged (Riech, 1987).

III.B.1.b. SEDIMENT DATA. Particularly in the arid and semi-arid regions of the country, sediment data are important to floodplain management. In the 17 western states excluding Alaska and Hawaii, there were 914 sediment gages operated by the USGS. This included only 19 sediment stations in Arizona, Nevada and Utah (Gilbert and Buchanan, 1982). By 1985, these 17 states had 619 sediment gages, a decrease of 32% in 5 years. There were some dramatic shifts in the distribution of these gages: the number of stations in Arizona, Nevada and Utah increased from 19 to 58, while the number in Texas decreased from 169 to 42 (Condes de la Torre, 1985).

III.B.1.c. WATER QUALITY DATA. Data collection on surface water quality, a factor in the preservation of natural values, has similarly declined in recent years. In 1980, there were 9414 continuous record and long-term stations operated by the USGS (Gilbert and Buchanan, 1982). Five years later, this number had dropped to 4166 stations, (Condes de la Torre, 1985), a decrease of 56%.

III.B.2. METEOROLOGIC DATA. The primary agency for the collection and archiving of precipitation data is the National Weather Service (NWS). Data from gages not operated by the NWS or some other agency recognized as competent by the NWS is of little value for hydrologic analyses.

Twenty-five years ago, the U.S. Weather Bureau, now the NWS, planned for one precipitation gage per 625 square miles for climatological purposes, of which they had about 80%. For hydrologic purposes, one gage was recommended for every 100 square miles, and for thunderstorm analysis and flood warning, one gage every square mile (Chow, 1964). By comparison, the almost universally used "Precipitation-Frequency Atlas of the Western United States" published by the NWS in 1973, used data from only 38 recording raingages, a density of only one gage per 3100 square miles. The NWS operates only 29 such gages in Arizona today. There are fewer than 40 NWS recording raingages in Utah and Nevada (Reich, 1988).

III.B.3. CLIMATOLOGIC DATA. Climate records in the United States are very new, although there are efforts to extend them back in time. One such study used tree rings to estimate the variability of annual rainfall in central California. It concludes that while there have not been any long-term changes in mean annual precipitation over the past 400 years, there have been wide

swings in the variability of precipitation over 20 to 30 year periods. In particular, the period 1920 to 1965 had low variability and low precipitation. Although many floodplain management concerns are not affected by annual precipitation, it is noted that, "Most of the population growth and dam construction have occurred since the last period of high variability. An increase in variability , and the associated increase in the uncertainty of water availability, could put serious strains on the water impoundment and delivery systems in the area, especially if there is continued growth in population and water demand" (Michaelsen, Haston and Davis, 1987).

III.C. ANTICIPATED IMPACTS OF AN INADEQUATE DATA BASE ON FLOODPLAIN MANAGEMENT.

III.C.1. FLOOD DAMAGES. Since the vast majority of streams in the arid and semiarid west have never been gaged, floodplain management for flood damage reduction necessarily relies heavily upon regional analyses and rainfall/runoff analyses. Where regional analyses have been developed, the error estimates are so large as to make them of no practical value. Similarly, the scarcity of precipitation data of a quality suitable for rainfall/runoff analyses make their results questionable. Finally, there is a great deal of evidence to suggest that watershed and channel changes are changing so that any analysis based on historic data of any kind may not be an adequate basis for many aspects of floodplain management, including land use management in floodplains, planning for structural flood control, floodplain construction, stormwater management and flood warning.

Problems in the estimation of flood peaks are readily apparent in the present combination of methods (and the assumptions they are based on) and available data.

A measure of the problems in estimating flood peaks is the uncertainty in the final results, expressed in terms of confidence limits. The quantity of flow for a given recurrence interval in a particular analysis is the best estimate of that flow. The confidence limits tell us how good that estimate is.

An example is cited to demonstrate the magnitude of the error potential in hydrologic methods. In Arizona, multiple regression techniques were applied to data from 221 streamgages and their watersheds to find the hydrologic parameters which best describe (predict) flows for various recurrence intervals. Regression equations were developed for the 2, 5, 10, 25, 50, 100 and 500 year floods on ungaged watersheds (Roeske, 1978). The Standard Error of Estimate (SEE) for 100 year flood peaks in the six regions in Arizona range from 45% to 91%. That means that the gaged data for only 68% of the gages in one of the regions fall within 91% of the value computed by the equation. The ungaged streams to which the method is to be applied cannot be expected to be any more accurate. A 100 year flood estimate of 10,000 cfs implies only a 68% probability that the "true" 100 year flood is between 900 cfs and 19,100 cfs. This analysis estimates that 16% of all streams which have an estimated 100 year flood peak of 10,000 cfs have an actual 100 year peak greater than 19,100 cfs.

In the arid and some semiarid areas of the country, the effects of sediment transport and changes in runoff characteristics due to watershed use have all but overshadowed all efforts at floodplain management. In stream reaches where the channel changes during a flood event or between events, flood elevations

cannot generally predicted accurately without including a sediment analysis or other sophisticated technique to estimate the impact of these changes on flood elevations. In a channel estimated to have a capacity of about 40,000 cfs at Tucson (AZ), scour during a flood of 52,700 cfs lowered the channel bottom enough that overbank flooding did not occur. A 1980 flood in the Gila River downstream from Phoenix (AZ) deposited over ten feet of sediment in the main channel, causing the 100-year flood discharge to flood the 500-year floodplain as it was calculated using an assumption of a stable bed.

Climate change, whether a change in temperature or precipitation, may have dramatic effects on floods and natural values in floodplains. In the hottest arid regions of the nation, a temperature increase of only 2 degrees C would result in zero runoff from from 16" of annual precipitation (Revelle and Waggoner, 1983).

Uncertainties in the rainfall data also come into play. In a recent study in Clark County (Las Vegas), NV, storm depths from the NOAA Atlas, the standard source of such data throughout the nation, were determined to be 44% low for 100-year storms with less than three hour duration (Paulson and Bax, 1986).

Current and seasonal data are also used for short-term runoff forecasts for water supply. These data are also used to predict seasonal range conditions. Both inflow to reservoirs and range condition in upstream watersheds may be of great importance to floodplain managers.

For floodplain management, it is generally assumed that climate is constant, that is, the conditions which have been observed and recorded in recent history will persist. Recent advances in certain scientific fields, including dendrochronology and flood paleontology have provided evidence that climate is not so stable. Climatic change would have a significant impact on flooding and floodplain management. In fact, a recent study was forecasts increased atmospheric carbon dioxide, which would lead to temperature increases and decreased precipitation in the United States (Weller et.al., 1983), (Waggoner, 1983), (Revelle and Waggoner, 1983), (Revelle, 1983).

All of these uncertainties point to an inability to manage floodplain development for the purpose of damage reduction. Where there are large errors in the estimates of flood peaks, development may be grossly overbuilt or subject to frequent flooding. Where there is uncertainty about future hydrology or changes in the stream channels, floodplains cannot be properly delineated. Most of these uncertainties can only be reduced by an increased number of data collection points and/or longer records.

III.C.2. ANTICIPATED IMPACTS ON MANAGEMENT OF NATURAL VALUES.

Because water is generally the limiting factor in the maintenance of natural floodplain values in arid areas, any changes in precipitation or runoff are critical to these values. To the extent that the groundwater and surface water hydrology cannot be accurately forecast, managers of fisheries, riparian habitats and other natural floodplain characteristics will be limited in their ability to protect them. These limitations can be reduced by an increased number of data collection points and/or longer records.

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Some Important Legal Decisions

by

Gay Havens and James E. Slosson

Archer v City of Los Angeles (1941) 19 Cal. 2d 19

Lower Bologna Creek (Marina Del Rey) upstream development increased flow, velocity, & peak; lower area agricultural land (in 1940) flooded.

Findings

- "common enemy doctrine" which permits landowners to divert floodwater
- downstream owner has no right of redress for injury to land caused by improvements made in the watercourse by an upstream owner to protect upstream land even though the channel is inadequate to accommodate the increased flow of water resulting from improvements
- straightening, widening or deepening a channel to improve drainage does not entail diversion
- gathering surface waters which flow in no defined channel and discharging them into the stream that is their natural means of drainage even though stream is inadequate to accommodate increased flow is permissible for upstream owner to do

Albers v County of Los Angeles (1965) 62 Cal. 2d 250

The 102 property owners in the area now known as the Portuguese Bend Landslide contended, among other things, that the County of Los Angeles caused the landslide by the construction of an extension to Crenshaw Blvd. (specifically by the addition of fill at the head of the landslide)

Findings

- the immediate and proximate cause of the landslide was the road building activity of the County on Crenshaw Boulevard
- County is therefore liable for damages

Keys v Romley (1966), 64 Cal. 2d 396

The facts in this case involved surface waters (rather than a natural watercourse) and an upper landowner changing the natural system of drainage

Findings

- rule in California has been that the upper landowner is entitled to discharge surface waters from his land as the water naturally flows, but is liable for damage caused by discharge in an unnatural manner, i.e. each owner's duty was to leave the natural flow of surface water undisturbed

- modified the above rule by adding a requirement of reasonableness holding that:
  - no party (upper or lower) may act arbitrarily and unreasonably
  - everyone must take reasonable care in using his property to avoid injury to adjacent property through the flow of surface waters
  - failure to exercise reasonable care may result in liability by an upper to a lower landowner
  - it is duty of any person threatened with injury to his property by the flow of surface waters to take reasonable precautions to avoid or reduce any actual or potential injury.
  - if action of both upper and lower landowners are reasonable and necessary, then the injury must be borne by the upper landowner who changes a natural system of drainage

Rowland v Christian (1968) 69 Cal. 2d, 108

Action for damages for personal injuries caused by a defective fixture in an apartment occupied by defendant

Findings

- it is a question of fact whether a landowner has acted reasonably, to be resolved in each case by considering all circumstances including such factors as the gravity and foreseeability of the harm, the utility of the conduct, and the purpose or motive with which the landowner acted

Holtz v Superior Court (1970) 3 Cal. 3d 296, 306-307

Plaintiff's property was allegedly damaged by the excavation and construction work by defendant City and County of San Francisco for underground rapid transit system.

Findings

- whether foreseeable or not, physical injury to real property proximately caused by a public improvement as deliberately designed and constructed is compensable

- Archer v City of Los Angeles should not be read to eliminate a reasonableness requirement on the construction of upstream improvements

- the "privilege" to erect flood control measures recognized by the Archer exception is not necessarily an "absolute privilege", but in many instances is only a "conditional" one

- when a public agency is engaged in such "privileged activity" as the construction of barriers to protect against flood waters, it must act reasonably and non-negligently.

Sheffet v County of Los Angeles (1970) 3 Cal. App 3d 720

A new subdivision was created above an older section in Pasadena. The storm drain design in the new subdivision caused the already developed homes below to become flooded when they had never experienced flooding before.

Findings

- imposes inverse condemnation liability on a public entity which has approved and accepted, for a public purpose, work performed by a subdivider or private owner of property

Blau v City of Los Angeles (1973) 32 C.A. 3d 77

Plaintiffs sued City of Los Angeles to recover for damage caused by landslide, alleging that faulty construction of streets by original owner and alter dedicated to City contributed to landslide

Findings

- recognizes concurrent causes: if there is more than one substantial factor or cause of damage, each important causal element may produce legal liability notwithstanding the contribution of others
- when public entity approves and accepts a public improvement constructed by a private party, the public entity and not the private party is liable for damages

Ducey v Argo Sales and State of California (1979) 25 Cal. 3d, 707

State was held liable for damages in an accident resulting from its failure to correct a dangerous condition (no median barrier) on public highway (Nimitz Freeway in S.F. Bay Area)

Findings

- state was held negligent in not constructing median barrier and such negligence was the proximate cause of injuries
- rejected contention that barrier was too costly to construct
- failed to take corrective action (mitigation) after informed and/or "put on notice" of hazard.

Hill v People ex rel. Dept. of Transportation (1979) 91 Cal. App 3d 142

Suit was brought against State by motorist who was injured when her vehicle was struck by a tractor-trailor's oversized load, for which CalTrans had issued a transport permit and prescribed a permissible route. One overpass on the prescribed route was too low, the load struck the overpass and fell to the highway and struck defendant's vehicle.

Findings

- immunity for liability by governmental agency for injury caused by issuance of a permit DOES NOT apply if the issuance of an approval creates a dangerous condition on the government's own property

First Evangelical Lutheran Church v Los Angeles County (1980)
Superior Court of California, Los Angeles County No. C 273 634 and U.S. Supreme Court (1978)

A high intensity storm in 1978 preceded the summer before by a brush fire resulted in a massive debris flow and flood which inundated the community of Hidden Springs (a church camp) located in the San Gabriel Mountains north of Los Angeles. All of the community structures, which were located within the boundaries of the 50-year flood event, were lost as well as were the lives of thirteen people. Plaintiffs in the Superior Court Case (No C 273 634) argued that the County should have constructed a debris basin to prevent the flood. Later, and after the Superior Court had dismissed the County, the church (plaintiffs) applied for a permit to reconstruct at the same location; however a change in zoning by Los Angeles County related to floodplains prohibited reconstruction in the area. Plaintiffs argued that the change in zoning after the disaster was a taking of property. This (the later) case ended up in the U.S. Supreme Court.

Findings by the Los Angeles Superior Court

- Los Angeles County was held not liable for damages based upon the following facts:

  - because the brush fire had completely denuded most of the watershed, the debris production exceeded 400,000 cubic yards of sediments, and a dam for such debris would have been of such a magnitude as to require approval by the State Division of Safety of Dams. Time for analysis, design, approval, and construction exceeded the time between fire and flood

  - the debris basin would have had to be built upon the land of the U.S. Forest Service

  - the structures were located in a designated 50-year flood plain

  - the people were warned of the imminent peril by the L.A. Sheriff, but they did not leave

Findings by the U.S. Supreme Court

- ruled only on the issue of the remedies available to the Church IF the zoning regulations were a taking

- reversed the California court decision and held that IF the regulations were unconstitutional as a taking, L.A. County would be responsible for temporary damages

- remanded the case to the California courts to determine on facts whether a taking of property had occurred.

see synopsis by John Kusler, attached

Sprecher v Adamson Companies (1981) 30 C3d, 358, 178 CR 783

Uphill landowner's (Adamson's) Property in Malibu contained an active natural landslide which he knew about but which both parties agreed had not been aggravated or caused by any action of Adamson. In March 1978, heavy rain triggered a major slide which damaged Sprecher's home

Findings

- reversed the common law rule that a landowner has no duty to remedy a natural condition of land in order to prevent harm to adjoining landowners
- applies general tort principles that everyone is responsible for injury or damage caused by negligence
- the distinction between artificial and natural condition should be rejected when implying duty of reasonable care
- duty to exercise due care can arise out of possession alone
- appellate court agreed with the Superior Court
- State Supreme Court reversed appellate Court and returned case to lower court (Superior Court) for rehearing
- later the Superior Court rehearing the case dismissed Adamson because the plaintiffs had acted to prevent Adamson from mitigating the landslide prior to failure (in 1960's)

Linvill v Perello (1987) 189 Cal. App 3d 195

Plaintiffs (downstream owners) sued for personal injuries and property damages allegedly caused when defendants (upstream owners) constructed a levee on defendant's property which diverted the direction in which floodwaters flowed.

Findings

- rejects a rule from Archer v. City of Los Angeles that upstream flood control improvements are not subject to the principles of ordinary negligence
- a property owner must act reasonably under all circumstances when building barriers to protect his property from damage by floodwaters
- everyone is responsible for an injury caused by his want of ordinary care or skill in the management of property
- an upstream landowner has no absolute right to protect his land from floodwaters by constructing structures which increase the downstream flow of water into its natural watercourse, but is instead governed by ordinary principles of negligence and reasonableness
- overrules Archer

Ektelon v City of San Diego (1988) California Court of Appeal, Fourth Appellate District, Division One D002575

Several commercial property owners and renters sued an upstream developer and the City of San Diego for flood damages

Findings

- an upstream landowner has no absolute right to protect his land from floodwaters by constructing flood control structures which increase the downstream flow of water into its natural watercourse, but is instead governed by the ordinary principles of negligence
- local government must consider downstream consequences and take action to prevent damage
- if upstream owner modifies stream, he must consider downstream consequences
- sent case back to trial court to be reheard without using Archer

"Food for thought" item

Jail sentences of up to five years and restitution for $17 million have been ordered by a judge in Trento, Italy as a settlement of a dam collapse that killed 269 people in 1985. The court convicted 10 men of manslaughter because they were responsible for operating or conducting periodic safety checks on the earthen dam.

(from U.S. Water News, Oct. 1988)

SUPREME COURT DECISION ON TAKING: TAKE A CLOSER LOOK

This article was prepared for the Association by Jon Kusler, Attorney At Law.

THE "TAKING ISSUE" AND FIRST EVANGELICAL LUTHERAN CHURCH VS. LOS ANGELES COUNTY

With considerable excitement but little understanding of the technical issues, newspapers across the country announced on the morning of June 10th a U.S. Supreme Court decision - First Evangelical Lutheran Church vs. Los Angeles County. Unfortunately, a number of lawyers who had not even read the case described it to papers as a landmark decision of the most ominous proportions, adding to public misunderstanding and confusion.

What did the case hold? What did it change? What actions should wetland and floodplain managers take in light of the case?

THE CASE

In 1978 a severe flood in Los Angeles County destroyed an outdoor recreation camp for handicapped children owned by First Lutheran Church. Shortly thereafter, LA County adopted interim floodplain regulations prohibiting reconstruction and new construction in the area. The Church sued the County based on several theories with the principal claim that the regulation was a taking of property. First Lutheran also claimed the flooding had been caused, in part, by cloud-seeding by the County.

The single issue in the case which was appealed to the U.S. Supreme Court was very narrow and had to do with the legal remedies available to First Lutheran Church IF the regulations were a taking. *THE CASE NEVER WENT TO TRIAL ON THE FACTS AND THE VALIDITY OF THE FLOODPLAIN REGULATIONS WAS NEVER DETERMINED BY THE LOWER COURTS OR THE SUPREME COURT.* The lower California court held that, as a matter of law based upon earlier California cases, the church could not possibly recover damages for a temporary taking. IF the regulations were a taking, the only remedy for the landowner was to have the desired permit issued or the regulations changed. This narrow ruling with regard to potential remedies was affirmed by California courts and appealed to the Supreme Court.

The U.S. Supreme Court, faced with this hypothetical taking, reversed the California court and held that IF the regulations were unconstitutional as a taking, LA County would be responsible for TEMPORARY DAMAGES. The Court did not consider how those damages would be measured.

The Court remanded the case to the California courts to determine on the facts whether a taking of property had occurred.

SIGNIFICANCE OF THE CASE

Although it is important, the case is not the landmark decision "for which the developers have been waiting". It is a highly technical case addressing a single, narrow issue - available remedies for a taking. It is also a highly complicated case which raises more questions than it answers. The confusing majority opinion written by Chief Justice Rehnquist is dissected in a scathing dissent by Justice Stevens which describes the case as a "loose cannon" likely to result in a great deal of "unproductive litigation". The confusing nature of the decision and the many unanswered questions detract substantially from its precedent value.

What did the Court say in the case? The Court:

- DID NOT HOLD THAT THE LAND USE REGULATIONS IN QUESTION WERE A TAKING. As noted by Chief Justice Rehnquist in the majority decision, "We have accordingly no occasion to decide whether the ordinance at issue actually denied appellant all use of its property or whether the county might avoid the conclusion that a compensable taking had occurred by establishing that the denial of all use was insulated as a part of the State's authority to enact a safety regulation."
- DID NOT HOLD THAT ANY OTHER SPECIFIC LAND USE REGULATIONS ARE A TAKING.
- DID NOT FORMULATE A NEW TEST FOR TAKING. There is not much discussion of the test for taking, but Justice Rehnquist emphasizes the denial of "all use of property" test for taking which has been cited by the U.S. Supreme Court, and other courts in recent years.
- DID NOT OVERRULE ANY EARLIER CASES OF THE SUPREME COURT. The case, therefore, must be read in conjunction with earlier cases. As recently as March 9, 1987, the Court in Keystone Bituminous Coal Association vs. DeBenedictis held that a highly restrictive Pennsylvania subsidence statute and regulations which prohibited the extraction of coal which could cause subsidence in certain circumstances were NOT A TAKING OF PROPERTY. On December 4, 1985, the Court unanimously held, in U.S. vs. Riverside Bayview Homes, that Section 404 wetland regulations were not, on their

Cont. next page

face, a taking of property, nor that just being subject to regulations is a taking.

In these and other cases the Court has steadfastly held that:

- regulations adopted for a valid public purpose may substantially reduce land values without a taking;
- impact of regulations on an entire property must be evaluated in determining whether a taking has occurred;
- public safety and the prevention of nuisances is a paramount concern of government and no landowner has a property right to threaten public safety or cause nuisances;
- regulations are, in general, a taking only if they deny "all use" or all "economic use" of an entire property including "investment backed expectations".

Although the First Lutheran Church case deals exclusively with remedies, SHOULD A TAKING OCCUR, it is significant in some respects. The case:

- MAY CREATE POLITICAL PROBLEMS, not for what it says but for what uninformed developers, legislators, and the general public think it says;
- RAISES THE POSSIBILITY THE REGULATORY AGENCIES MAY HAVE TO PAY TEMPORARY DAMAGES FOR CERTAIN HIGHLY RESTRICTIVE REGULATIONS THAT ARE ULTIMATELY HELD TO BE A TAKING. But the Court leaves an array of unanswered questions here.

WHAT ACTIONS SHOULD WETLAND AND FLOODPLAIN MANAGERS TAKE IN LIGHT OF THE CASE?

First, stay calm. View the case for what it is and is not. Remain confident that soundly conceived floodplain and wetland regulations will continue to be sustained at all levels. There have been hundreds of state and federal court decisions holding floodplain and wetland regulations valid over a period of years and only a few invalidating regulations as applied to particular property. These are undisturbed by this decision. It is almost certain that even the extreme regulations involved in this case will be sustained once they are tried on the facts.

Second, ask any landowner or lawyer citing this case if they have actually read the opinion. If they claim that it holds wetland or floodplain regulations in general, or even the ones in this case, unconstitutional, it is likely they have not read the case.

Third, if you as a regulatory agency wish to minimize any change of "taking", emphasize performance standards in your wetland and floodplain regulations.

Fourth, take the normal precautions to avoid a "taking" which many of you have been using for years, particularly when land values are high and impacts on the landowner are particularly severe.

1) Provide a variance or "special permit" procedure in regulations, since such provisions are very rarely held to be a taking on their face and they provide the regulatory agency with an opportunity to deal with extreme hardships.

2) Emphasize health and safety considerations, prevention of water pollution and prevention of nuisances in your regulations and in your written findings for individual permit denials. Regulatory actions tied to these objectives have not been held a taking.

3) Tie in your regulations with national or statewide programs such as the Federal Flood Insurance Program. Courts have been particularly willing to sustain such regulations.

4) Apply large lot zoning (e.g., 2-10 acres) to floodplain or wetland areas where appropriate or possible because courts have held that regulations which permit some reasonable use on an entire property do not take property.

5) Document with particular care the need for the regulations and the reasons for your permit denials in urban or other settings where land values are very high.

6) Encourage preapplication meetings by permittees so that mutually acceptable project designs can be formulated.

7) Apply your regulations in a consistent and equitable manner. Maximize the opportunity for notice and public hearing.

8) If you adopt a moratorium, do so for a fixed period and make sure the reasons are clear and legitimate.

9) Coordinate regulatory, tax and public works policies to insure that the fiscal burden on landowners for community services is consistent with permitted uses.

10) Apply, in extreme circumstances, transferrable development rights to help relieve the burden on landowners.

11) Use acquisition rather than regulation where active public use is needed for land or a single landowner or group of landowners must bear disproportionate burdens for the public good.

From a legal perspective, not much has changed. Be reasonable! Be confident!

A more extensive analysis with case sight prepared by Kusler is available through the ASFPM Executive Office.

O'Hara et al v. Los Angeles County Flood Control District (1941) 19 Cal. 2d 61

Flood control district replaced low permeable dikes that bordered a river with improvements that were constructed for flood control. These improvements increased the velocity of water in the river and obstructed drainage of surface waters into the river. Plaintiff's land was flooded during a rainstorm by surface waters which were prevented by the improvements from draining into the river and by water in the river bursting through the banks.

Findings

- Lower riparian owner has no redress from injury to his land caused by improvements in the stream when there has been no diversion of water out of its natural channel
- Private landowner may not obstruct flow of surface waters that naturally drain across his property from adjoining land
- A governmental agency in constructing public improvements may validly exercise its police power (eminent domain) to obstruct flow of surface waters not running in a natural channel without making compensation for resulting damages

Shaeffer v. State of California (1972) 22 Cal. App. 3d 1017

Plaintiffs sued State to recover for alleged flood damages during construction of a flood control project in Yuba County

Findings

- if flood control improvements do not subject a landowner to any additional flooding than would have occurred without the improvement, State incurs no liability

Pagliotti v. Acquistapace (1966) 64 Cal. 2d 873

Upper-ground owner (plaintiff) in Santa Barbara built apartment units and a parking area on previously unimproved land. The parking area was bounded by a 6" berm which channeled surface waters across lower ground owner's property through a defined swale. The surface waters were necessarily increased by the improvements and instead of spreading fan wise across lower property as in the past, now flowed in a concentrated manner. Lower property owner (defendant) constructed a berm (small dam)to block water from flowing onto defendant thus blocking flow and causing water to back up onto plaintiff's property.

Findings

- Upper ground owner had no alternative method of disposing of surface waters except across lower owner's property
- defendant enjoined from blocking flow
- Plaintiff was allowed to build (and pay for) ditch across lower owner's property and to maintain it
- Action by plaintiff was reasonable

Helix Land Co., Inc. v. City of San Diego (1978) 82 Cal. App. 3D 932

Helix owned land in the Tia Juana River Valley adjacent to the Mexican border. The U.S. and Mexico entered into a treaty to build a flood control channel along the river. Along with the construction of the flood control improvements, the City of San Diego enacted new zoning ordinances for lands within the flood plain. Helix alleges that the zoning ordinances were a property-taking device rather than a regulation of the use of land.

Findings

- Mere reduction in market value as a result of zoning change does not result in inverse condemnation
- Zoning was required by the Federal Flood Plain zoning requirements and was not done arbitrarily by the City.

The Law in California

[1–3] The rights and liabilities of adjoining landowners in California with respect to the flow of surface waters, have generally been determined by the rule of civil law, *aqua currit et debet currere ut currere solebat.*[6] The civil law rule was first adopted by the Supreme Court of California in 1873 (Ogburn v. Connor (1873) 46 Cal. 346), and has been generally recognized as the prevailing law of surface waters in the state ever since. (See, e.g., Archer v. City of Los Angeles (1941) 19 Cal.2d 19, 27, 119 P.2d 1; LeBrun v. Richards (1930) 210 Cal. 308, 313–314, 291 P. 825, 72 A.L.R. 336; Heier v. Krull (1911) 160 Cal. 441, 444, 117 P. 530; Los Angeles Cemetery Ass'n v. City of Los Angeles (1894) 103 Cal. 461, 466–467, 37 P. 375; McDaniel v. Cummings (1890) 83 Cal. 515, 519, 23 P. 795, 8 L.R.A. 575; Voight v. Southern Pac. Co. (1961) 194 Cal.App.2d Supp. 907, 909–910, 15 Cal.Rptr. 59; Gonella v. City of Merced (1957) 153 Cal.App.2d 44, 51, 314 P.2d 124; Andrew Jergens Co. v. City of Los Angeles (1951) 103 Cal.App. 2d 232, 235, 229 P.2d 475.) Under our civil law rule the owner of an upper, or dominant, estate is entitled to discharge surface water from his land as the water naturally flows. As a coroliary to this, the upper owner is liable for any damage he causes to adjacent property by the discharge of water in an unnatural manner. In essence, each property owner's duty is to leave the natural flow of surface water undisturbed.

6. "Water runs and ought to run as it is accustomed to run." For discussion of the early English origin of this phrase, see Wiel, Waters: American Law and French Authority (1919) supra, 33 Harvard Law Review 133, 144.

GOALS AND OBJECTIVES

OF

ARID REGIONS COMMITTEE

Terri Miller, Arizona, Chair

PURPOSE: **Improve flood hazard management techniques within arid regions.**

Goal 1. **Strengthen subcommittee goals and objectives and participation.**

1.1 Develop specific goals and objectives for each subcommittee.

1.2 Coordinate activities with other subcommittees.

1.3 Provide periodic updates for Arid West Newsletter.

Goal 2. **Develop lines of communication between researching data collection agencies and local floodplain administrators.**

2.1 Identify research projects to address problems associated with western flood hazard areas.

2.2 Inform research institutions and appropriate federal agencies of the research needs.

2.3 Identify data needs of local floodplain administrators.

2.4 List source of data collected by various agencies.

2.5 Develop catalog and resource center for information collection.

Goal 3. **Develop interim methodologies and guidelines for management of western flood hazard areas.**

3.1 Review existing models, mapping procedures and local regulations for effectiveness and applicability.

3.2 Identify advantages and disadvantages of existing procedures and regulations.

3.3 Add collected information to resource center.

Goal 4. **Organize and conduct technical meetings for information exchange.**

4.1 Organize a conference for Fall of 1988.

4.2 Organize a meeting of the subcommittee chairs.

Goal 5. **Develop bibliography by topic of unique hazards in the west.**

5.1 Collect published and unpublished information on management of unique hazards.

5.2 Categorize documents by hazard consistent with subcommittee designations.

5.3 Publish catalog of information available from resource center.

Goal 6. **Develop proposed standards for adoption and promulgation by the ASFPM.**

6.1 Develop standards for each subcommittee.

6.2 Review and recommendation by committee.

Goal 7. **Assist FEMA in the publication of a handbook on standards for development in unique hazard areas, in a format which can be updated periodically.**

DEVELOPMENT STANDARDS SUBCOMMITTEE

DEFINITIONS

Distributary Flow: A distributary flow area is characterized by flows emulating from a single source which often split and develop independent branches with independent floodplains that may join, re-split and then rejoin in many combinations as the flows continue downslope; may have large areas of sheet flow and high sedimentation rates.

Subgroups of Distributary Flow Areas

1. New - characteristics include gully and rill formations that are non-stable and extremely shallow. New areas would be subjected to sheet flow and the distributary flow patterns would be constantly shifting even during relatively low flow events.

2. Young - characteristics include more definition in location of distributary flow channels although major shifting can still occur during medium heavy flow events.

3. Old - characteristics include stable channel locations, well incised and subject to changes only in massive flow events. Still retains distributary patterns but ridges are not as susceptible to sheet flooding.

Mass Movement of Materials: An area of mass movement of materials is characteristically a non-riverine system where flows contain enough solids so flows cease to act as water but where water is still the primary means of transport. Mass movement areas are typically found where slopes are greater than 5%. Flow events of mass movements of material are precipitation initiated.

Subgroups of Mass Movement of Material Areas:

1. Fine grained - characteristically where the majority of the flow mass is composed of silts, clays and fine grained sands.

2. Sands and gravels - characteristically where the majority of the flow mass is composed of coarse-grained sands and gravels.

3. Cobbles and boulders - characteristically where the majority of the flow mass is composed of cobbles and boulders.

Unstable Channels: An unstable channel area is characteristically a riverine system subject to vertical and horizontal movement through scour and deposition. Low flows in the system may exhibit large horizontal movements within a meander belt or terrace. The system may consist of many channels with only one floodplain (braided).

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Definitions of Flash Floods

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Do We Need a Definition?

Schwartz and Dingle (1980): NWS in 1979 defined a flash flood as "a flood which follows the causative event (such as excessive precipitation, dam failure, ice-jam breakup) within a few hours." Glossary of Meteorology in 1959 defined a flash flood as "A flood that rises and falls quite rapidly with little or no advance warning, usually as a result of intense rainfall over a relatively small area." Schwartz and Dingle contend that of the more than 1000 significant flash floods, all have met the NWS definition but few the Glossary's - most common are synoptically produced floods which have very different characteristics than the rarer disastrous floods. "Treatment of all floods in an identical manner takes away from the truly significant ones, i.e. the effect of the true flash flood warnings are diminished." (p.254) Still there are preparedness problems for the more common not-so-flash floods. They suggest a new category: the hybrid flood. "...all floods are not alike. The difference in types of floods is so great that singular preparedness, forecast guidelines, and warning procedures for them cannot adequately encompass all of them." (p.258)

"We have to standardize classes of floods in term of their potential impact. Broad terms, such as flash flooding, urban flooding, small-stream flooding, drainage flooding, and river flooding, need to be standardized to facilitate community response as well as hazard assessment." (U.S. Department of Commerce, 1978, p. 37)

1. Short Time/High Velocity (too much water, too little time)

- "<u>Flash flood</u> is a flood that occurs in a short time (minutes to hours) after the causative event." (Hydrology Subcommittee of the Federal Interagency Advisory Committee on Water Data, 1985, p. 87)

- "A flash flood is a local hydrometeorological phenomenon, which allows short lead time for warnings." (Georgakakos, 1986, p. 1236)

- "A flood which follows within a few hours of heavy or excessive rainfall, dam or levee failure, or a sudden release of water impounded by an ice jam." (U.S. Department of Commerce, 1980, p. 3; U.S. Department of Commerce, 1987, p. 4)

- "A flood that crests in a short length of time and is often characterized by high velocity flow. It is often the result of heavy rainfall in a localized area." (Federal Emergency Management Agency, 1986c, p. 216)

- "A flood that reaches its peak flow in a short length of time (hours or minutes) after the storm or other event causing it. Often characterized by high velocity flow." (Federal Emergency Management Agency, 1986b, p. 162; U.S. Army Corps of Engineers, 1984, p. 11)

- "...a flood that follows the causative event (this might be excessive rains, a dam failure, etc.) within a few hours. The rise in runoff and stream levels is spectacular and produces hydrograph traces that reflect an extreme jump in discharge volume." (Congress of the United States, 1980, p. ix; National Science Foundation, 1980, p. 248)

- "The United Nations' World Meteorological Organization (WMO) (1981, p. 1) defines a flash flood as 'a flood of short duration with a relatively high peak discharge.'" (Cahail, 1987, p.2)

- "Flash floods are distinguished from general flooding by the very rapid runoff of water following heavy rains." (Kircher, et al., 1987, p. 118)

- "...a flash flood takes place when this large volume of rainwater quickly leaves the watershed of a river or stream as runoff....Flash floods result when large volumes of rainwater are deposited in such short periods of time that the ground cannot absorb the water." (Bomar, 1983, pp. 63-64)

2. Specific Time Limits

<u>Six Hours</u>

- "In the United States, the National Weather Service has adopted a more general definition of a flash flood as a flood that follows the causative event within a few hours. For operational purposes, floods occurring within six hours of the causative event are considered flash floods (U.S. Department of Commerce, 1982, p. 4-3)." (Cahail, 1987, p. 2)

- "For prediction and warning purposes, floods are classified by NWS into two types: those that develop and crest over a period of approximately six hours or more, and those that crest more quickly. The former are referred to in this section as 'floods', and the latter as 'flash floods.'" (White, 1975, p. 11)

Twelve Hours

- "...the definition of a 'flash flood' varies considerably from region to region in the U.S. Suffice it to say, a flash flood is a flood that occurs in a short period of time. Flash floods can occur in minutes or hours following torrential rains, a sudden breech of a dam or a collapse of a levee. For the sake of discussion in this paper, a flash flood is a flood which occurs within 12 hours of the causative event." (Barrett, 1983, p.9)

- "...the NWS working definition of a flash flood (heavy rainfall within a 12-hour period that leads to the issuance of a flash flood warning)." (French, 1983, p.585)

- "There is no sharp distinction between floods and flash floods. Operationally, flash floods are floods that are short fused and require the issuance of warnings by the local warning and forecast offices rather than the regional River Forecast Centers (RFC)(NOAA, 1981a)....For the purposes of this work and in accordance with the operational definition, the time interval of 12 hours (see also Barrett, 1983) will be adopted as the upper bound of the time interval between the time of occurrence of the causative event and the time of occurrence of the flash flood at a certain location....

The adoption of the time interval of 12 hours to distinguish flash floods from ordinary river floods leads to the incorporation of the so-called 'hybrid' floods (Schwartz and Dingle, 1980) under the flash flood umbrella. The hybrid floods are a cross between the true flash floods, with the celebrated 'wall of water' moving downstream, and the main stem floods of large rivers. In most cases, a true flash flood upstream will precede a hybrid flood at a location farther down the river....

The proximity of several cities to headwater mountainous areas and the short hydrologic response time of the developed, near impervious, urban terrain, necessitates the inclusion of urban flooding within the realm of flash flooding." (Georgakakos, 1986, p. 1233)

3. Raging Torrents/Walls of Water

- "Others are flash floods - the result of heavy precipitation - raging torrents that rip through river beds and surge over their banks sweeping everything before then...No stages can be forecast in flash floods." (Federal Emergency Management Agency, 1986a, p. 2-1)

- "At the other end of the spectrum [from slow rise river floods] are the highly localized cloud burst floods which may come roaring out of a canyon in a breaking wave of water many feet high, churning together mud, rocks and debris, moving boulders and trees, and destroying manmade structures in their paths, for example the Big Thompson flood of 1976." (National Science Foundation, 1980, p. 14)

- "Other floods are sudden, resulting from heavy localized rainfall. These flash floods are raging torrents which rip through river beds, urban streets, coastal sections, and mountain canyons after heavy rains, and sweep everything before them." (U.S. Department of Commerce, 1981)

- "Flash flooding involves an extremely fast rise in water surface elevation and abnormally high water velocity, often creating a 'wall' of water and debris moving down the channel and floodplain. Flash floods usually result from some combination of intense precipitation, steep slopes, a small drainage basin, and a high proportion of impervious ground surfaces. They often occur in small streams that are normally shallow or dry and can cause extensive damage...." (Federal Emergency Management Agency, 1985, p. 9)

4. Environmental Influences

- "Flash Flooding occurs in all fifty states. Steeply sloping valleys in mountainous areas are the most common setting, but flash flooding can also occur in urban areas. Urban flooding is an increasingly serious problem due to the removal of vegetation, placement of debris in channels, construction of culverts and bridges which constrict flood flows, paving and other replacement of ground cover by impermeable surfaces which increase runoff, and construction of drainage systems which increase the speed of runoff." (Federal Emergency Management Agency, 1987, p G-2)

- "Due to the mountainous topography and high intensity rainfall [characteristic of arid regions], flood velocities are often high and flooding occurs suddenly. Rapid (flash flooding) causes loss of life as well as increased property losses since automobiles, materials, and other goods often cannot be removed as flooding begins." (Kusler, 1986, p. 3)

<u>Mountainous Terrain</u>

- "...flash floods which are an explosive development that presents a particularly difficult problem in mountainous terrain." (Changnon, 1983, p. 25)

- "Flash floods are due to the fast runoff of water from heavy rains in a relatively short time, and runoff is accelerated in mountainous and narrow valley terrain." (French, 1983, p. 584)

Urban Events

- "The other type of riverine flooding occurs in upstream areas and poorly drained flat lands. These are due to intense rainstorms. Their effects are intensified when they occur over an urban area where impervious surfaces produce rapid runoff or channel capacity is reduced. Urban areas also enhance precipitation, particularly in heavier rainfall rates, bringing additional flooding to urban and suburban areas, as well as rural areas beyond the city." (Changnon, 1983, p. 9)

- "Perhaps the most common misconception is that flash floods are largely rural events where a 'wall of water' comes roaring out of mountainous terrain; killing local residents and unsuspecting campers....While such floods are significant, they do not portray the true nature of the flash flood problem. On a day-to-day basis, the flash floods at Kansas City, Missouri and Austin, Texas are much more representative of the urban nature of the hazard." (Mooney, 1983, p. 128)

- "Catastrophic damages along relatively minor watercourses result from the lethal combination of two well-documented phenomena. First, small watersheds respond more dramatically than larger ones to changes in land use (i.e., urbanization) in terms of rapidity and volume of flood runoff. Sewering, paving, and the building over the natural land surfaces cause a small stream that drains only a few square miles to become perceptively more flashy and dangerous, while a larger stream with a watershed of several hundreds or thousands of square miles is scarcely affected by such land use changes." (Platt, 1987, pp. 5-6)

Case Studies

Based on specific past flash flood events, the accumulated flash flood definitions will be assessed. In each case the events will be analyzed to evaluate the applicability of the different definitions to that event.

Criteria for Case Study Selection

There were four criteria for choosing the flash flood events:

1. We wanted recent flash flood events. We limited our selection to events that have occurred since 1970.

2. We wanted a geographic distribution from throughout the United States. Not only did we want to include events from both the eastern and western U.S., but we searched for events occurring in the areas represented by the different meterological classification categories as discussed by Maddox, et al. (1979) and Hirschboeck (1987).

3. Because we had decided to include dam breaks in our definition of flash floods, we made sure to include at least one event involving a dam break in our selection.

4. We based our selection on three available lists which consisted of catastrophic flash flood events as defined by different criteria. (1) The first, taken from French, et al.'s 1983 article "Mortality from Flash Floods: A Review of National Weather Service Reports, 1969-81," is a list of flash floods occurring between 1969 and 1981 which were investigated by a National Weather Service survey team. The NWS sends a survey team whenever a weather related disaster involves 30 or more deaths or more than $100 million in property damage. (2) The second list, taken from Baker and Costa's 1987 paper "Flood Power," is based on USGS data and records the largest floods ever documented for a given size drainage area and other large floods in different physiographic areas of the United States. (3) The final list, taken from Hirschboeck's 1987 paper "Catastrophic flooding and atmospheric anomalies," is based on her selection of catastrophic flood peaks from catalogs of maximum floodflows. She compiled her list based on basin size and geographic distribution and excluded events due to dam breaks, snowmelt or ice jams.

We attempted to choose events which fulfilled our other criteria and were included on as many of the above lists as possible. However, we deviated from the events appearing on the three lists in order to include some of the most recent flash floods in the United States.

Possible Flash Flood Event Case Studies

	Location (Flood List*)	Date	Deaths	Circumstances
1.	Johnstown, PA (1,2,3)	7/20/77	76	11" of rain
2.	Harrisburg, PA (1,3)	6/24/72	118	19" of rain associated with Hurricane Agnes
3.	Buffalo Creek, WV (1,2)	2/26/72	139	4" in 2 days dam break
4	Cheat and South Branch Potomac Rivers, WV	11/3-5/85		10" in 3 days
5.	Tulsa, OK	5/27/84	14	14" in 6 hours
6.	Austin, TX (1)	May 1981	13	10" in 4 hours
7.	Big Thompson, CO (1,2,3)	7/31/76	135	12" in 4.5 hours
8.	Bronco Creek, AZ (2,3)	8/18/71		
9.	El Dorado Canyon, NV (1,2,3)	9/14/74	9	7" in .5 hours
10.	Los Angeles, CA (1)	Feb 1978	20	6.2" in 12 hours followed by dam break

*The lists referred to are taken from the following publications and are discussed on the preceding page:

1. French, J., et al. 1983. "Mortality from Flash Floods: A Review of National Weather Service Reports, 1969-81," Public Health Reports, Vol. 98, No. 6, Nov-Dec, pp. 584-588.
2. Baker, V. and J. Costa. 1987. "Flood power," Catastrophic Flooding, L.Mayer and D. Nash, Editors, Boston: Allen & Unwin, pp. 1-21.
3. Hirschboeck, K. 1897. "Catastrophic flooding and atmospheric anomalies," Catastrophic Flooding, L.Mayer and D. Nash, Editors, Boston: Allen & Unwin, pp. 23-55.

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ANNUAL REPORT FOR THE YEAR 1987-88

Association of State Floodplain Managers, Inc.

ASSOCIATION OF STATE FLOODPLAIN MANAGERS, INC.

1987-88 ANNUAL SUMMARY REPORT

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SUMMARY REPORT

1987 - 1988

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This Summary Report is a compendium of reports submitted to the Board of Directors and membership covering the July 1987 through June 1988 fiscal year. It overviews some of the past year's activities and accomplishments of the Association.

The major documents herein are the reports on progress toward achieving the goals and objectives established at the beginning of the year. The Board of Directors adopted goals and objectives to focus the efforts of the Executive Board. Each committee adopted goals and objectives for its year's work, which were approved by the Board of Directors.

As the reports indicated, 1987 - 1988 was a year of significant accomplishments...by the committees and the Executive Board. Members can be proud of your Association and of the effort many of you put forth in any way, whether you helped a committee, assisted with the conference, wrote a report or provided information and advice. Members should feel free to suggest ideas for future goals and objectives. By focusing on member needs, we will remain a strong and viable Association. This report also contains an outline of yearly calendar events as well as a summary of our coordination with other groups.

Readers should also review the 1988 Membership Directory. It outlines next year's goals and objectives as well as providing a list of all members. Additionally, it contains the Association's policy on floodplain management in the nation. This and other information is available from:

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1987-88 ANNUAL REPORT FROM THE EXECUTIVE BOARD

Information Exchange

The Association's Office continues to receive requests for technical assistance from state and local officials as well as federal offices and the private sector. We attempt to refer local people and citizens to the appropriate government office nearest them to handle problems and concerns directly. We provide model legislation, ordinances, or handbooks to individuals as well as other national associations seeking that information.

The Association's Newsletter, "News & Views", continues to be published every other month to an increased circulation. It is mailed to over 600 professionals in the United States, Canada, England, Australia, New Zealand and Central America. The newsletter has a high "re-read" factor, where each copy is circulated among a number of people. This provides extensive coverage on the issues concerning Association members and others in the industry. We continue to encourage everyone, particularly state and local officials to submit articles on any interesting approaches or projects of Flood Hazard Management and Mitigation. The newsletter is produced with funds from the membership. Any information for inclusion can be submitted to the Editor, Diane Watson, at the Executive Office address in Madison.

In addition to News & Views, the Association started a new publication during the past year, "The Insider", directed toward members only. It is published in the months when News & Views is not produced. This publication provides last minute information on programs and membership news to all Association members. The past year was a trial. The Board, representing members' interest in its continuation, put it in the budget again for FY'88-89.

Publications are in greater demand all of the time. The Association has a list of 19 publications and brochures available for sale. The price is low, aimed at covering production cost, with some provided at no cost. Demand has increased to the point of two to three requests per week. Proceedings from our annual conferences and the Western States' High Risk Conference are also in demand. The summary of the Stormwater Management workshop held in Tulsa, Oklahoma last April will be available this fall.

During the past year, the Association has had two technical publications available, which have been in significant demand. A number of other technical publications are in the offing and some have been put out for peer review by the Publications Committee. We are in the process of compiling a major paper on legal issues which we hope to have out in early 1989.

The 1988 Membership Directory was given a major facelift this year. In addition to the usual lists of members, publications, awards, activities, etc., it contains the Association's and Committees' Goals and Objectives for FY'88-89, the recently approved ASFPM Floodplain Management Policy Statement, description of the new Flood Hazard Fellowship Fund, Member Benefits and Organizational Charts, and more. It has become a handy, concise resource for Association information.

The Publications Committee is working on a report which will be somewhat similar to the "Biennial Report" published in 1985. It will be titled "State and Local Floodplain Management: 1988-89". Jackie Monday is working on it, and will be requesting information to update the states' assessment survey conducted in the fall of 1987.

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Liaison with Other Organizations

During the past year, the Association entered a cooperating status arrangement with the National Governor's Association. We have a similar cooperating status with the Council of State Governments. Numerous other groups maintain contact with us and cooperate with us in ventures relating to national and technical issues, including the Coastal States Organization, the Association of State Dam Safety Officials, the Association of State Wetland Managers, the National Coordinating Council on Emergency Management, the National Emergency Management Association, the National Association of Urban Floodplain Management Agencies, and others. In addition, liaison is maintained with numerous federal agencies. The Association participates on the Federal Interagency Floodplain Management Task Force, which has representatives from all of the federal agencies involved in flood hazard issues. We have participated in a number of their seminars, including the recent one on greenways as well as seminars on floodproofing and other issues.

We continue to work with the Hazard Center in Boulder and serve on their advisory committee. We work with the National Science Foundation and serve on a number of their advisory groups for research proposals and projects. We are represented on the Flood Insurance Producers National Committee and the Corps of Engineers' Floodproofing Committee.

State Associations and Chapters

A number of states have state associations that are operating within their boundaries. Both Illinois and Arizona have state associations which are chapters of ASFPM. A new association was formed in April 1988 in Michigan and there has been a state association in Louisiana for several years. In May 1988, there was an organizational meeting for a state association in Texas. The Vice-Chair is also working with Minnesota on forming a state association. We continue to provide services and information to those groups whenever possible. The chapters are represented on the Board by a Chapter Director.

Membership Status

The Association has over 850 members as of June 1988. Membership reflects a significant increase from last year and includes 22 corporate members, 32 agency members, approximately 300 individual members (two-thirds are associate members, the rest are state and international), and about 500 chapter members. We represent a significant share of the state and local floodplain managers in the nation and have an excellent representation of federal agency people among our members. During the past year, the membership benefits have been clarified by the Board of Directors and a chart depicting member benefits was included in the 1988 Membership Directory.

Internal Matters

Administrative Council Initiated - In June of 1987, the Board approved the concept of creating an Administrative Council to serve for the Board of Directors and to assist the Chair in the administration of the Association. The purpose of this Council is to:

1) formulate and draft proposed policy to present to the Board for action,
2) function as a working group to collect information and "boil down issues,"
3) oversee committee activity to ensure that needs are being met.

The Council consists of the Chair (Dante Accurti), Executive Director (Larry Larson), three Issue Coordinators (Mark Riebau, Bob Cox, Bill Trakimas) and two Members-at-large (French Wetmore, Lotwick Reese).

Flood Hazard Fellowship Fund - The ASFPM Flood Hazard Fellowship Fund was established by the Board of Directors in May of 1988 to provide awards to recognize and encourage individual achievement in the profession of flood hazard management. The Fund was established in the spirit of advancement of the field of floodplain management as practiced by Dr. Gilbert White, the initial contributor to the Fund. The Fund will be administered by a Board of Trustees (Jean Brown, Rebecca Hughes, Bill Lesser). A booklet on the Operating Procedures and application process is available on request from the Executive Office.

Financial Affairs - A task force was formed at Board direction to centralize the Association's accounting system. The existing system of switching the accounts and CPA with every change of Treasurer, as well as the increasing complexity of the financial affairs, was getting too cumbersome and time-consuming for voluntary commitment. An accountant/bookkeeping service was hired in Madison to keep the books under the direction of the Treasurer and Executive Director. The bylaws were amended to conclude the Treasurer's term at the end of the fiscal year rather than at the conference when new officers are generally installed.

Non-profit Status - Last winter, the Executive Office began working on application to the IRS for Recognition of Exemption [from Federal Income Tax] under Section 501(c)(3) of the Internal Revenue Code. We are currently recognized as non-profit under Section 501(c)(4), but that status does not allow donations (i.e. to the Flood Hazard Fellowship Fund) to be deductible under individual's contributions line item. We have indications that significant donations would follow such approval. In addition, this status would exempt us from paying sales tax and other taxes which could save us a significant amount of money over the year, most notably on conference expenses. We seem to be nearing the end of this lengthy and complex process, and hope to have a positive ruling in October.

State Award Renamed - The State Award for Excellence in Flood Hazard Management which is given by the Association every year was named after Tom Lee on behalf of efforts by Jim Wright. Tom Lee is posthumously considered a pioneer in state floodplain management programs. The award is now known as the Tom Lee State Award for Excellence in Flood Hazard Management.

Conferences

In addition to our annual conference in Nashville, the Association cosponsored a Stormwater Management Workshop with the City of Tulsa, OK, in April and is a cooperating party on the National Wetland Symposium in Oakland, CA, in June. We also participated in numerous other conferences throughout the year. The ASFPM Conference Guidelines and Procedures Manual, a 60-page document, was completed and put into use this year, as were guidelines for submitting a regional/issue proposal to the ASFPM for sponsorship. A three-year planning cycle was established for planning the ASFPM annual conferences.

Arid Regions Conference - The Arid Regions Conference, to be held October 19-21, 1988 in Las Vegas, and co-sponsored by the Arizona Floodplain Management Association, is moving along on schedule. The Call for Papers went out in June, with the brochure mailed in August. Terri Miller, Arid Regions Committee Chair, is coordinating on behalf of the Association.

Stormwater Management Conference with EPA - At the Board meeting following the Nashville conference, the Board discussed and approved cooperating with EPA on a conference on stormwater management issues. Originally slated for fall, it now will probably be in mid-February in Colorado Springs. Stan Williams, ASFPM Stormwater Management Committee Chair, is working with Eve Gruntfest with the University of Colorado and Brad Miller from the Denver office of EPA. Jon Kusler will also work on developing the agenda. Expected turnout is about 200.

Contracts

Western States High Risk Areas - This contract with the Corps of Engineers involved conducting a seminar in Las Vegas in 1986 on alluvial fans, mudflows, mud floods, meandering streams, flash floods and fluctuating lakes. The proceedings for that symposium are now available on our Publications List. In addition to the papers from the symposium, the Proceedings include recommendations on issues critical to mapping and managing these high risk areas. Jon Kusler was the symposium leader and produced and edited the Proceedings.

Status of Floodplain Management Activities in the Nation - The Association was a subcontractor to Larry R. Johnston & Associates, who has the primary contract with the Floodplain Management Task Force to describe floodplain management status in federal, state, local and private sectors in the nation. The Association's efforts were concentrated on the status of state and local activities and programs. Our report was completed and furnished to LRJ Associates.

Community Rating System - The Association completed Phase I of a contract with FEMA to recommend which activities should get credit to reduce the premium costs for flood insurance. This would apply in communities having good floodplain management activities which help reduce flood losses. All flood insurance policy holders in that community would probably get a premium break on their flood insurance rates. The contract, led by French Wetmore, has now entered Phase II, and the Association's role is to provide technical advisors to accompany the field survey teams as they evaluate the measurability of various community activities in order to give credit on policy premiums.

National Resource Center - Approximately $30,000 has been committed to this project. With options still pending, the final arrangements will hopefully be made in 1988 so creation of this essential reference site can be initiated.

Literature Search on Risk Analysis - The Corps of Engineers' Hydrologic Engineering Center has a contract with Jim Owen to do a literature search on publications that convey risk assessment to individuals and communities and that deal with showing people how to undertake certain flood prevention measures. The Association will assist in obtaining the publications from the states and forward them to the Corps Office in Davis, California.

Washington Liaison

The Association has a continuing arrangement with the Council of State Governments in Washington, D.C. to provide legislative tracking to keep us informed of key dates and schedules in Congress. Legislation we have been working on during the past year includes:

* support of re-authorizing the NFIP (the program now expires on September 30, 1989) in the oversight hearings conducted by the House Subcommttee;
* flood insurance for erosion areas (Jones-Upton Amendment to the Housing Act) which was passed and is now law;
* support of the amendments to the Disaster Relief Act of 1974, which would create several new post-disaster mitigation funding programs;
* FEMA budget in which we addressed the rate increases for flood insurance and increased funding for Section 1362;
* support for continuing hazard mitigation assistance and other key issues in the FEMA budget;
* support on continued funding for river basin and floodplain management activities of the SCS; and
* support of re-programming the Corps of Engineers FY'87 funds to assist in the Corps' floodplain management.

1987-88 GOALS AND OBJECTIVES PROGRESS REPORT

GOAL 1 Improve national floodplain management and programs by:

1.1 Ensure sufficient funding for the federal mapping effort and Committee report to the Board.

PROGRESS: This is an on-going activity. In this time of shrinking federal budgets, states have been advised to keep FIA adequately informed about mapping needs/problems that they are experiencing so that FIA can request adequate financial resources to meet state needs. FIA budget requests for mapping are currently stable.

1.2 Seek to improve federal mitigation statutes.

PROGRESS: Progress is being made. The House passed the Disaster Relief Act which includes the Association's requests on mitigation funding. The SBA authorization to allow disaster loans to be used for mitigation activities is being considered in the House and supported by the Association. We are also supporting increased funding for Section 1362 in the FEMA budget.

1.3 Support and improve the Community Assistance Program (CAP).

PROGRESS: Underway. We gathered input and worked to fine tune the program in an attempt to make it more useful for participating states and their communities.

1.4 Support the adoption and implementation of a community rating Committee system.

PROGRESS: Completed. The CRS concept was adopted by FIA, and an implementation system is being developed with assistance from the Association.

1.5 Plan and schedule a stormwater management conference.

PROGRESS: Completed. A workshop was held in Tulsa, Oklahoma in April, another is planned for late winter 1989.

1.6 Plan and schedule an arid regions conference.

PROGRESS: Completed. A conference has been planned and scheduled for October 19-21, 1988 in Las Vegas.

1.7 Complete development of and adopt an ASFPM national floodplain management policy statement.

PROGRESS: The ASFPM component to a national policy statement was prepared and circulated to the membership and was adopted by the Board in Nashville.

1.8 Complete a proposal for, seek funding, and implement a national resource center.

PROGRESS: Stalled. Some sources we are hopeful of funding at the federal level have been slow in developing.

GOAL 2 Improve service to Association members through these administrative efforts:

2.1 Develop procedures to standardize conference planning and Committee execution.

PROGRESS: Completed. A conference manual and related material has been developed and adopted.

2.2 Develop outline for and determine the work and funding needed to complete an Association biennial report.

PROGRESS: Completed. Next year's objective is to complete this report and distribute it at the end of this year.

2.3 Develop a proposal and adopt procedures for the best use of Gilbert White's donation.

PROGRESS: Completed. In April, the Board approved the establishment of the "Flood Hazard Fellowship Fund". A Board of Trustees was appointed to accept applications and award the Fellowship.

2.4 Provide additional information to Association members beyond the bi-monthly News & Views.

PROGRESS: Completed. An additional newsletter, The Insider, was developed and is now sent to members in odd months.

2.5 Promote state associations.

PROGRESS: This is an on-going objective. This year has seen success in Michigan, which has formed an association. An organizational meeting was held in Texas in May and discussion continues in California.

2.6 Develop and implement a federal legislative tracking Liaison system.

PROGRESS: Completed. The Executive Director and CSG staff have developed and refined such a system. The ASFPM person responsible for a given bill is provided copies of the updates.

2.7 After one year's implementation, evaluate the Administrative Council and its actions.

PROGRESS: Underway. The AdCo provides a very useful working group to analyze details of complex issues; a necessity for the continuous operation of the ASFPM.

2.8 Pursue international exchange.

PROGRESS: This is an on-going activity. A proposal is being refined soliciting sponsorship to finance:

1) a newsletter,
2) an international directory, and
3) a professional exchange program.

COMMITTEE REPORTS

ARID WEST COMMITTEE

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GOAL 1 Strengthen subcommittee participation and their goals and objectives.

1.1 Develop specific goals and objectives for each subcommittee.

1.2 Develop questionnaires relative to each subcommittee's goals and objectives.

1.3 Summarize responses and develop policy paper.

1.4 Coordinate activities with other subcommittees.

1.5 Provide Quarterly updates for Arid West Newsletter.

PROGRESS: Subcommittees, with the exception of the Regulations Subcommittee, have not met since February, 1986. Questionnaires were sent out by at least one subcommittee, but a summary of responses was not received by the chair.

GOAL 2 Develop lines of communication between researching data collection agencies and local floodplain administrators.

2.1 Identify research projects to address problems associated with western flood hazard areas.

2.2 Inform research institutions and appropriate federal agencies of the research needs.

2.3 Identify data needs of local floodplain administrators.

2.4 List source of data collected by various agencies.

PROGRESS: There has been no known progress to date.

GOAL 3 Develop interim methodologies and guidelines for managing western flood hazard areas.

3.1 Review existing models, mapping procedures and local regulations for effectiveness and applicability.

3.2 Identify advantages and disadvantages of existing procedures and regulations.

PROGRESS: Members of the Regulation Subcommittee have been reviewing ordinances and discussing the effectiveness of regulations with various jurisdictions with arid west problems. A publication of suggested wording for various hazards is planned.

GOAL 4 Organize and conduct technical meetings for information exchange.

4.1 Organize a super conference for the Winter or Spring of 1988.

4.2 Organize a meeting for subcommittee chairs.

PROGRESS: An Arid West Conference is planned for October 19 - 21, 1988 at the Aladdin Hotel in Las Vegas. A call for papers will be mailed by the end of May, 1988. Watch *News & Views* and the *Insider* for further information.

GOAL 5 Develop bibliography by topic of unique hazards in the west.

5.1 Collect published and unpublished information on management of unique hazards.

5.2 Categorize documents by hazard consistent with subcommittee designations.

5.3 Publish bibliography.

PROGRESS: A bibliography has been started for alluvial fans.

GOAL 6 Develop proposed standards for adoption and promulgation by ASFPM.

6.1 Development of standards by subcommittee.

6.2 Review and recommendation by committee.

6.3 Action by Association.

PROGRESS: The group representing the states of California, Utah, Arizona, Colorado and Nevada met in Phoenix in March, 1988. Their goal is to formulate criteria for development standards in unique hazards areas of arid regions. At this time it is not clear whether this will be part of the Arid West Committee of ASFPM or a separate group working with FEMA on the development of these standards. This group is now in the process of defining the hazards. An effort will be made to develop standards defensible in a court of law which FEMA will endorse.

COASTAL ISSUES COMMITTEE

Ruth Ehinger
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(609) 292-0060

GOAL 1 Begin background research toward developing an Association position on the feasibility of a nationally acceptable method of applying shoreline erosion rates to coastal construction regulatory setbacks.

1.1 Survey coastal states on their development and use of coastal construction setback lines including methodology, philosophy and effectiveness.

PROGRESS: Surveys conducted by others (John Houlihan, NOAA Office of Ocean and Coastal Resource Management, Coastal States Organization) have been collected and a draft questionnaire has been prepared for discussion at Coastal Committee Meeting.

GOAL 2 Improve Association understanding of sea level rise projections.

2.1 Prepare article for "News & Views" on seal level rise.

PROGRESS: Draft article prepared for submission for next issue.

GOAL 3 Establish and maintain working relationships with other organizations concerned about or affected by coastal floodplain issues.

3.1 Work with other committees on coastal issues.

PROGRESS: Reviewed initial draft of proposed Community Rating System.

3.2 Function as the Association's liaison with the Coastal States Organization, the American Shore & Beach Preservation Association, and NOAA's Office of Ocean and Coastal Resource Management.

1987 - 88 CONFERENCE COMMITTEE

Bob Cox
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GOAL 1 Establish a standing Conference Committee.

PROGRESS: Completed. Bob Cox chaired this committee for FY 1987-88. Mr. Jerry Louthain will chair the committee for FY 88-89.

GOAL 2 Standardize the Planning and Execution of the ASFPM Annual Floodplain Management Conference.

2.1 Establish a 3-year planning cycle for each conference.

PROGRESS: Completed. Nominations have been accepted for the 1990 conference and 2 pre-nominations have been accepted for the 1991 conference.

2.2 Establish guidelines and procedures for the ASFPM annual conference.

PROGRESS: Completed. A 60-page ASFPM Conference Guidelines and Procedures Manual was produced by the Conference Committee and accepted by the Board of Directors.

2.3 Explore the potential for using private consultants to assist with some of the designated conference tasks.

PROGRESS: Not completed at this time.

ADDITIONAL ACTIVITIES:

1. Coordinated the hotel selection for the 1989 Annual Conference in Scottsdale.
2. Coordinated with the Nashville Program Chair in setting up speaking slots for major speakers.
3. Assisted the Executive Director's Office with coordinating the April 88 Stormwater Management Conference in Tulsa.
4. Assisted the Executive Director's Office with coordinating the Fall 88 Arid West Conference.
5. Produced a proposal guidelines section of the ASFPM Conference Manual. This section presents guidelines for submittal of proposals to the ASFPM for regional/issue conferences sponsored by the Association.
6. Organized the Spring 88 Administrative Council meeting in Gulf Shores, Alabama.

FLOODPROOFING/RETROFITTING COMMITTEE

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GOAL 1 Improve the general knowledge in the areas of floodproofing and retrofitting.

1.1 Coordinate the exchange of knowledge and identification of research needs with others via the National Floodproofing Committee and the Interagency Floodproofing Coordination Committee.

PROGRESS: This is an ongoing activity. The F/RC Chairperson is the Association Liaison with Corps of Engineers' National Floodproofing Committee and chairs the Interagency Floodproofing Coordination Committee, composed of members from the Corps of Engineers, FEMA and the Association. Through these various committees, information relating to floodproofing and retrofitting is freely exchanged.

1.2 Publicize new developments in floodproofing and retrofitting through the *"News & Views,"* the *"Insider"* or other means.

PROGRESS: We have assisted the Corp's National Floodproofing Committee in assimilating a comprehensive bibliography of publications dealing with floodproofing (completed 8/88 and distributed to all members). These publications are available through all Corps of Engineers District Offices. As any new developments come to light, the Association membership will be kept informed through our newsletters or director mailings to F/RC members.

1.3 Coordinate floodproofing and retrofitting training with appropriate federal agencies.

PROGRESS: The Floodproofing Coordination Committee is currently assessing the feasibility of developing education and training programs in floodproofing and retrofitting.

1.4 Identify target groups and develop a training and education program for floodproofing and retrofitting in cooperation with the Floodproofing Coordination Committee.

PROGRESS: In conjunction with objective 1.3 above, the Committee is assessing the possibility of developing a 5-year marketing plan for promoting floodproofing and retrofitting activities. Target groups would be identified and training programs developed. One approach being considered is to enhance the knowledge of Corps' staff at the District level. This staff would then pass this training and knowledge on to the local level of government and to private contractors involved in or desiring to become involved in floodproofing and retrofitting construction activities.

FLOOD INSURANCE COMMITTEE

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GOAL 1 Improve the dissemination of flood insurance data to states and communities.

PROGRESS: Committee prepared a status report on types of insurance data summaries currently being published. A questionnaire was prepared and distributed to the states. Approximately 26 states responded. Based on this response, a report was prepared and submitted to the Board of Directors and to FIA. Insurance Committee Chair received the requested historical flood data from FIA in March. FIA has taken our suggestions for developing future reports which will show both WYO and Direct Program totals. Based upon letter from Assistant Administrator, James Taylor, our recommendations have been well received and our future needs met. The Insurance Committee will monitor the progress on future dissemination during 1988.

GOAL 2 Evaluate the effectiveness of FIA's policy on long term lake flooding and Great Lakes erosion.

PROGRESS: Chair has discussed with FIA claim's staff if many claims have been filed under the long term lake flooding policy. The high lake levels of past years seem to have dropped and therefore interest has decreased. As lake levels decrease then this policy which requires continuous flooding for 90 days becomes moot. Committee will continue to monitor this activity with FIA.

Status of FIA's policy on Great Lakes erosion is somewhat different. Policy prior to the passage of the Upton-Jones Amendment to the 1987 Housing and Community Development Act, was that the structure had to suffer direct physical damage from floodwaters or from erosion caused by high lake levels above the anticipated cyclical levels. Under this scenario the number of claims filed and paid were small compared to the properties suffering damage. The reason being that uninsurable parts of the property were damaged (loss of years, seawalls, docks, bluffs, etc.).

The passage of the 1987 Housing and Community Development Act has somewhat changed this position. Under the provisions of the Upton-Jones Amendment, structures declared to be in "imminent threat of collapse due to erosion' could receive relief under the flood policy if the structures are moved prior to the next loss. FIA is currently in the process of developing guidelines for how to determine what is in imminent threat of collapse. Dr. Brian Mrazik, Assistant Administrator, Office of Risk Assessment will be discussing this issue and FIA's short and long range plans for dealing with the erosion issue. The Insurance Committee will monitor the effectiveness of these measures during the next year.

GOAL 3 Continue working with the Flood Insurance Producers National Committee and keep the membership apprised of its activities.

PROGRESS: Chair represents the ASFPM at FIPNC Meetings. Chair attended meetings on November 19, 1987 and March 23-24, 1988. A copy of the meeting notes and appropriate handouts have been forwarded to the Insurance Committee, and ASFPM Officers (Accurti, Cox, Larson).

Chair has involved two members of the FIPNC in the 1988 ASFPM Conference in Nashville. John Mulady, United Services Automobile Association (USAA) is participating as a panelist and will be moderating a concurrent workshop. Bob Ross, Chair of FIPNC, will be our closing speaker.

GOAL 4 Work with FEMA Region VIII in implementing the Flood Insurance Recommendations contained in their report entitled, *"Closed-Basin Lake Flooding."*

PROGRESS: To date nothing has been accomplished on this goal. Chair will be appointing a committee member to look into the feasibility of implementing the identified recommendations in this report.

GOAL 5 Work with FIA on the development of a Community Rating System.

PROGRESS: Chair has been an active member of the CRS Task Force since its commencement in March 1987. Chair has attended every meeting; to date CRS Task Force has met seven times. A summary of the meetings has been written and sent to the Insurance Committee and the ASFPM Officers. Status reports have also been prepared and published in *"New & Views."*

FIA has endorsed the CRS Report prepared by the Task Force in October 1987. Progress is being made in 1988 to field test the criteria developed by the Task Force as part of a Community Rating System. French Wetmore is heading up this effort for the ASFPM. The Committee Chair meanwhile remains as part of FIA's CRS Task Force.

Several other members of the ASFPM have taken part on the CRS Task Force: Dan Accurti, Stan Williams and Ruth Ehinger.

MAPPING AND ENGINEERING STANDARDS COMMITTEE

Mark Riebau
WI DEPT. OF NATURAL RESOURCES
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Madison, WI 53707
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GOAL 1 Seek to improve methods and techniques used to evaluate flooding risk and recommend changes to the methods, procedures and analyses to obtain the best practicable result.

1.1 Prepare a report summarizing the best available methods for evaluating risk for building levees and for evaluating the risk for development behind levees by May, 1988. Subcommittee Chair: Terry Paxton, City of Sacramento, CA (916) 449-1255

PROGRESS: Terry is seeking input from interested members.

1.2 Identify minimum standards for detailed maps and supporting documents. This report should specify what background information should be available to support floodplain and floodway delineation and how it should be organized and stored. Subcommittee Chair: Jim Morris, Arizona Dept. of Water Resources, (602) 255-1566.

PROGRESS: Jim is seeking input from interested members.

1.3 Evaluate means of predicting closed-basin lake flood levels and prepare a report recommending best method by May, 1988. Subcommittee Chair: None

PROGRESS: None

1.4 Review and comment on proposed NFIP rule change to include coastal dunes in the V-Zone (comments to be coordinated with the Coastal Committee) by October 15, 1987. Subcommittee Chair: Anna Zacher, U.S. Army Corps of Engineers, Los Angeles, (213) 894-2028.

PROGRESS: Completed. Comments incorporated in 12/22/87 letter to Rules Docket Clerk.

1.5 Review and comment on proposed NFIP rule change to permit increases greater than one foot in the BFE for dams, bridges, and other encroachments by October 15, 1987. Subcommittee Chair: Mark Riebau.

PROGRESS: Completed. Comments were solicited and incorporated in 12/22/87 letter to Rules Docket Clerk.

1.6 Review and comment on proposed NFIP rule changes to define "maintenance" for altered or relocated water courses by October 15, 1987. Subcommittee Chair: Mark Riebau.

PROGRESS: Completed. Comments were solicited and incorporated in 12/27/87 letter to Rules Docket Clerk.

1.7 Review and comment on proposed NFIP rule change to provide the Administrator (FEMA) the authority to waive fees for conditional map revision where the proposed project would reduce the flood hazard for existing structures by October 15, 1987. Subcommittee Chair: Mark Riebau.

PROGRESS: Completed. Comments were solicited and incorporated in 12/22/87 letter to Rules Docket Clerk.

GOAL 2 Seek to improve maps for floodplain management and FEMA's map revision process.

2.1 Develop recommendations regarding flood hazard designation for lands within floodplains that are naturally above the base flood elevation. Subcommittee Chair: Jim Morris, Arizona Dept. of Water Resources, (602) 255-1566.

PROGRESS: Jim is seeking comments from interested members.

2.2 Develop recommendations for mapping areas and establishing setbacks in areas subject to long-term ocean and Great Lakes coastal erosion by March, 1989. Subcommittee Chair: Christopher P. Jones, Coastal Science & Engineering, Inc., Columbia, SC (803) 799-8949.

PROGRESS: Chris is seeking comments from interested members.

2.3 Provide comments to FEMA on study to evaluate wave run-up on the Great Lakes by October, 1988. Subcommittee Chair: Christopher P. Jones (see 2.2).

PROGRESS: Chris is seeking comments from interested members.

2.4 Review current format for revising FIS texts and recommended changes. Subcommittee Chair: None.

PROGRESS: None

2.5 Assist FEMA to identify community to explore the development of a GIS and provide floodplain data in digital format by October, 1987. Subcommittee Chair: Dick Campbell, Greenhorne & O'Mara, Greenbelt, MD, (301) 982-2855.

PROGRESS: Completed. FEMA has selected Pinellas County, Florida, including St. Petersburg and Pinellas Park Water Management District and has initiated a pilot project.

2.6 Identify problems and propose solutions to obtaining original hydrologic and hydraulic model and supporting data necessary to reproduce and update flood profiles by May, 1988. Subcommittee Chair: Karen Kabbes, Illinois DOT, Schaumburg, IL (313) 705-4341.

PROGRESS: Karen has solicited comments in coordination with FEMA's Existing Study Data Package (ESDP) survey.

GOAL 3 Facilitate the exchange of information and further the education of members and interested individuals or groups regarding the development and improvement of study criteria and map production.

3.1 Actively participate in the annual meeting of the ASFPM by sponsoring speakers or displays regarding the changing criteria and mapping techniques.

3.2 Establish point of contact and exchange information with FEMA's Office of Risk Assessment.

3.3 Coordinate with Arid West Committee on issues concerning mapping and engineering standards.

3.4 **Coordinate with Coastal Committee on issues concerning mapping and engineering standards.**

3.5 **Coordinate with Storm Water Management Committee on issues concerning mapping and engineering standards.**

PROGRESS: Ongoing efforts in all of GOAL 3's objectives.

FLOOD MITIGATION COMMITTEE

French Wetmore
Consultant
153 Nanti
Park Forest, IL 60466
(312) 747-5273

GOAL 1 Improve the general knowledge of flood hazard mitigation.

1.1 Coordinate the exchange of knowledge and identification of research needs with others via the Floodproofing Coordination Committee, Wallace Wilson, Michigan, subcommittee chair.

PROGRESS: Transferred to the newly-created Floodproofing Committee.

1.2 Publicize new developments in mitigation via *"News & Views"* and other means.

PROGRESS: The first two papers in the Association's new technical paper series are on mitigation. There have been mitigation articles in every issue of the *"News & Views."* New developments were publicized at the November NFIP Conference and at a special floodproofing workshop on December 7, 1987. Several sessions at the Annual Conference in Nashville will cover related issues such as public information and river basin management.

1.3 Explore post-flood mitigation opportunities and disseminate research findings.

PROGRESS: The Committee is following the findings of the University of New Orleans research and the lessons learned after Illinois flooding. The findings of these projects are the subject of two special sessions at the Nashville conference. The October *"News & Views"* had an article on post-flood work in Michigan.

1.4 Coordinate mitigation training with FEMA.

PROGRESS: No action this year.

GOAL 2 Improve Federal mitigation incentives.

2.1 Support amendments to the Disaster Relief Act which will provide new funding sources for community and individual mitigation activities.

PROGRESS: The House passed amendments to the Disaster Relief Act which include all of the Association's request on funding. The Association has been talking with the Senate Subcommittee responsible for the bill. Because of the fast moving developments of this project, an update will be provided at the Nashville Conference.

2.2 Support changes to the Section 1362 statutory authority which will provide more funding for a variety of building protection measures.

PROGRESS: The Association's position is incorporated in testimony submitted to Congress on FEMA's FY/89 appropriations. Passage of the Jones-Upton provisions provided new funding for protecting buildings before they are damaged by flood related erosion.

2.3 Work with the Insurance Committee to help FIA develop a community rating system that encourages flood loss reduction.

PROGRESS: The Chair of the Mitigation Committee and the Chair of the Insurance Committee are members of the Community Rating Task Force. A draft report on proposed activities to be recognized by the Community Rating System is being circulated to all ASFPM members for review and comment at the Nashville Annual Conference.

2.4 Support FIA's work to use the NFIP to provide financial incentives for retrofitting.

PROGRESS: Transferred to the newly created Floodproofing Committee.

2.5 Support the FEMA Disaster Assistance Office's efforts to allow disaster assistance funds to be used for retrofitting.

PROGRESS: Transferred to the newly created Floodproofing Committee.

GOAL 3 Pursue special mitigation issues.

3.1 Follow up on the closed basin lake flooding report. Mark Matulik, Colorado, subcommittee chair.

PROGRESS: Some of the report's recommendations have been incorporated in the Community Rating System report (see 2.3).

3.2 Promote national efforts to deal with Great Lakes flooding and erosion. Jim Boulton, Michigan, subcommittee chair.

PROGRESS: Transferred to the Coastal Committee.

3.3 Work with the Regulations Committee to obtain changes in the NFIP definition of "substantial improvements."

PROGRESS: This is a priority issue with the Regulations Committee. A special session on substantial improvements is being held at the Nashville Annual Conference.

PUBLICATIONS COMMITTEE

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GOAL 1 Complete printing of Three to Four Technical Reports by April 1, 1988.

PROGRESS: None will be completed by the Nashville conference. Several papers (6) are under consideration; one is through the peer review and will have to be rewritten. Several authors have been contacted; however, they have all expressed a desire to rewrite their individual papers before submitting the paper for peer review. Recently, several additional topics and authors have been suggested which will require follow-up in the next 6-8 months. Solicitation of papers through committee chairs has been largely unsuccessful. We need to explore other strategies for printing papers that will be more successful than soliciting for technical papers directly.

GOAL 2 Publish a Membership Directory by July 1, 1988.

PROGRESS: The 1988 Membership Directory was mailed to all members 8/1/88. This Directory included the current members, Officers and Board, Committee Chairs, the Association's floodplain management policy statement, Association and Committee goals and objectives for 1988-89, and much new information of interest to members. Descriptions of the Federal agencies involved in floodplain management was also included. Four ads were placed, offsetting the production cost by $900 (net).

GOAL 3 Publish a Biennial Report (Floodplain management status report) by December, 1988.

PROGRESS: Jackie Monday has submitted a proposal to produce a report by 12/88 called *"Status of Floodplain Management"* which will include narratives of each state and a few local programs as well as matrices of state activities. All states will be contacted over the next 3 months to provide information to be included in the report.

GOAL 4 Generate Revenues to offset publication costs.

PROGRESS: Technical reports are currently being provided at cost. Advertising in the Membership Directory did reduce the cost of that publication by $900.00. All other publications will be advertised in the Membership Directory to further promote distribution of these publications. Requests for publications average 2-3 per week.

FLOODPLAIN REGULATIONS COMMITTEE

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GOAL 1 Make recommendations for improving and refining the floodplain management criteria of the National Flood Insurance Program.

1.1 Maintain communications with those responsible within the Federal Insurance Administration for making revisions to the criteria.

PROGRESS: Good contact was maintained throughout the year with the Office of Loss Reduction in an effort to monitor upcoming rule changes and to provide committee input.

1.2 Prepare committee recommendations concerning any proposed revisions to the criteria for Board action.

PROGRESS: The Committee prepared recommended positions relative to the suspension of the existing mobile home park rules and, in conjunction with the Mapping and Engineering Committee, to the revision to Section 60.3 proposed in the November 3, 1987 Federal Register.

1.3 Establish a subcommittee to prepare a position paper on the definition of substantial improvement.

PROGRESS: The Committee has been working with the Office of Loss Reduction in their effort to develop both short-term and long-term recommendations for addressing the substantial improvement issue. A questionnaire on the subject is being prepared and distributed in an attempt to obtain input from state and local officials on the issue.

1.4 Continue to identify important regulation issues which the Committee should address during the 1987-88 fiscal year and beyond.

PROGRESS: Some concern was raised about the potential administrative problems which may be caused by regulating travel and park trailers on a site for 180 consecutive days. The Committee responded by submitting an article to *"New & Views"* which outlined a FEMA policy memorandum clarifying the issue.

GOAL 2 Ensure local and state needs are addressed through the Community Assistant Program (CAP).

2.1 Work with Association CAP coordinator to provide input into the development of 1988-89 CAP.

PROGRESS: Committee provided comments to coordinator and culminated effort by discussing the topic during Committee meeting held in conjunction with November NFIP Conference in Bethesda, MD.

2.2 Continue to identify local and state needs which should be considered by CAP eligibility.

PROGRESS: Topic on Committee meeting agenda at Nashville.

GOAL 3 Conduct activities for improving state and local floodplain management regulatory programs.

3.1 Prepare position papers on local floodplain management regulatory programs and on the role states should play in regulating floodplain and coordinating federal and local regulatory programs.

PROGRESS: Some discussion but no substantive progress.

GOAL 4 Develop a better system for obtaining more widespread input on material prepared by the Committee.

PROGRESS: Working on it.

RESEARCH COMMITTEE

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GOAL 1 Publish the ASFPM Priority Research Needs list in an attractive format for use by researchers and research administrators (funders).

PROGRESS: The Committee will meet on May 16 to review and approve a draft brochure for mailing to potential floodplain management researchers. A mailing list of 1,500 researchers who might be interested in undertaking floodplain management research has been assembled. Mailing labels have been secured. Procedures for mailing using a nonprofit organization bulk mail permit have been worked out so that this goal can be achieved at minimum cost.

GOAL 2 Call on key federal agencies in a position to fund studies that address ASFPM priority research needs and solicit their help.

PROGRESS: Committee members have met with officials of the National Science Foundation, Department of the Interior, U.S. Army Corps of Engineers, and University Council on Water Resources Research to discuss floodplain management research needs.

GOAL 3 Prepare brief articles to accompany the ASFPM Priority Research Needs list for newsletter/publications aimed at researchers in various relevant disciplines.

PROGRESS: No action pending approval of Research Needs brochure.

GOAL 4 Prepare a list of research-sponsoring agencies and work with states to identify key agencies they can work with to ensure that important research needs are met.

PROGRESS: A list of potential funding agencies nationally, and in each of the fifty states, has been assembled. Bill Lesser is undertaking a pilot test of our hypothesis that state water resources research centers are a likely target for ASFPM efforts to stimulate research on our priority research needs. Based on that experience in Massachusetts, the Committee will work out a protocol for members to use in approaching funding agencies in their states.

STORMWATER MANAGEMENT COMMITTEE

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SUMMARY: At the 1987 Association meeting in Seattle, Dan Accurti posed two questions: First, what is the definition of Stormwater Management, and secondly, what could the Association do to assist in local stormwater management efforts? During the past year, we have made some progress in answering these questions through the Association's Stormwater Management Committee. Here is an explanation of the progress the Committee has made toward the goals for this year.

GOAL 1 Establish a Stormwater Management Committee.

1.1 Name a Committee Chairperson

1.2 Select committee membership.

PROGRESS: A Committee Chairperson was named after the Seattle conference, and a committee sign-up sheet produced a list of 19 people interested in serving on the Committee. Three-fourths of those joining the Committee were Associate or Corporate Members of the Association. Halfway through the year, a new Committee Roster of eleven members was sent out, of which only three members were holdovers from the first list. Again, only one-fourth of the new member list were from state agencies.

GOAL 2 Prepare an article for *"News & Views."*

PROGRESS: As part of the effort to define stormwater management, an article entitled *"Reconciling Stormwater and Floodplain Management"* was published in the October, 1987 issue of *"News & Views."* Several Association members responded in writing with their thoughts on this subject. Letters were sent to Committee members asking their views on the questions raised in the article. This subject was also discussed at a Committee meeting held on November 15, 1987 in Bethesda, Maryland.

GOAL 3 Provide input to FEMA, and other federal agencies as appropriate, on stormwater management concerns.

PROGRESS: At FEMA's NFIP Biennial Conference in November, 1987, a panel workshop on Urban Drainage/Stormwater Management addressed issues such as where does floodplain management start and stormwater management end.

Some of the solutions to issues raised by the subject of stormwater management were:

A. rate adjustments for B and C zones,
B. mapping adjustments where the community has done the study,
C. encouragement of local management, and
D. recognition in the proposed Community Rating System.

As a follow-up to this session, the Stormwater Committee Chairperson was added to FEMA's Community Rating Task Force to provide comments concerning stormwater management activities that need to be included in the rating system.

GOAL 4 Sponsor a national workshop to discuss and define stormwater management and related issues.

PROGRESS: Representatives from 16 communities with active stormwater management programs (ten of which were stormwater utility organizations) from ten states met in Tulsa, Oklahoma in April, 1988 for a workshop entitled *"Stormwater Management at the Crossroads."* These local stormwater "experts" were joined by Federal and State officials, as well as representatives from 15 private consulting firms, for a two-day session that focused on reviewing and making recommendations on stormwater management activities included in the Community Rating System.

It became clear at this workshop that communities with stormwater management programs use that term to include many diverse activities. The earlier concept of "stormwater management" meaning regulating runoff or limiting discharges from new development, has evolved to include other measures that retain runoff in some locations and accelerate discharges in others. This includes efforts to enhance runoff water quality as well as channel maintenance and erosion control. According to one knowledgeable observer, the term "stormwater management" is emerging as a concept of a coordinated administrative response to managing urban precipitable water resources.

The Tulsa workshop also identified many of the forces influencing stormwater management, including the fact that more and more stormwater programs are being created at the local level of government and that the trend will probably be accelerated by the water quality requirements enforced by the Environmental Protection Agency. One problem faced by these new stormwater management organizations is that there is not an association or group that offers a program tailored to their specific management needs. Many organizations do share interests with stormwater management agencies, such as the American Public Works Association, the American Society of Civil Engineers, the National Association of Urban Flood Management Agencies, the Water Pollution Control Federation, and the Association of State Floodplain Managers; but none of these existing groups addresses the specific needs of this emerging field.

The Association of State Floodplain Managers shares many common concerns with urban stormwater management agencies, but would have to make substantial changes in its organizational structure if it wanted to attract these communities as members. The purpose of the Association would have to be expanded to include the needs of stormwater management, and the stormwater agencies would have to be able to participate fully as voting and office-holding members.

GOAL 5 Develop an ASFPM policy statement regarding stormwater management.

PROGRESS: The primary questions posed by the Chair of the Association for this Committee were to define the term "stormwater management" and to identify what the Association of State Floodplain Managers could do to assist in local stormwater management efforts. Based on the work of the committee to date, the response to those questions would be:

A. The term "stormwater management" should be used by the ASFPM to mean the institutional response of communities to manage stormwater runoff in an urban environment, including efforts to:

- prevent or mitigate the adverse impacts (flooding, erosion, and sedimentation) related to the conveyance of excessive rates and volumes of stormwater runoff,
- improve stormwater quality,

- protect and enhance wetlands, fish and wildlife habitat, and water recreational facilities, and

- promote groundwater recharge.

B. Assist in the growth and development of stormwater management agencies by deciding whether or not to broaden the Association to include stormwater management, or maintain the current Association and provide assistance to stormwater agencies in establishing a new organization that will not only disseminate information, but will also make recommendations concerning public policies affecting management.

GOAL 6 Monitor developments affecting stormwater management and disseminate pertinent information.

PROGRESS: The specific objective of the Tulsa Stormwater Workshop was to identify and consider issues that affect the future of the field of stormwater management. Here is a list of some of the trends and forces that were discussed in Tulsa:

A. while it has been largely a local government effort up to now, stormwater management is being affected more and more by actions at the State and Federal levels,

B. some stormwater programs have now reached maturity, and there is a greater consistency in the development of the financial, maintenance, and regulatory activities of new stormwater programs,

C. funding mechanisms such as the drainage service charge or the utility fee are becoming more widespread,

D. State and Federal involvement in stormwater management will result in defining uniform standards and expectations,

E. successful stormwater management programs are built on a foundation of developing public understanding and support with a strong emphasis on drainage basin or watershed plans,

F. there is a growing relationship between stormwater and the management of floodplains, wetlands, greenways and recreational trails,

G. FEMA's proposed Community Rating System may help to define and focus stormwater activities through recognition of successful programs, and

H. the Environmental Protection Agency's program to regulate stormwater discharges will profoundly affect the field of stormwater management.

The Association's Stormwater Management Committee will continue to monitor these and other developments, and will make this information available to interested members.

CALENDAR OF MAJOR MEETINGS DURING 1987-88

The Association sponsored or had a representative at a number of significant meetings and conferences on Floodplain Management during the last year. Many of them are listed below.

Date	Activity
1987	
June	Corps of Engineers meeting to discuss 800 CFS/1.5 mi2 limit on flood control works
July 9-10	Community Rating Task Force meeting
July 20-23	Natural Hazards Workshop in Boulder, CO
August 26-28	Community Rating Task Force meeting
September 11-13	Administrative Council meeting in Madison, WI
September 15-17	Community Rating Task Force meeting
September 16-18	Hydrology of Wetlands Symposium in Chicago, IL
September 21-23	Association of State Dam Safety Officials Annual Meeting in Columbus, OH
September 23-25	Federal Agency meetings in Washington, D.C.
September 24-25	Arizona Floodplain Management Association meeting
October 19-21	Community Rating Task Force meeting
October 27	Board of Directors Conference Call
November 15-19	National Flood Insurance Program Biennial Conference in Washington, D.C.
November 18	Community Rating Task Force meeting
November 19	Interagency Floodproofing Coordination Committee meeting
December 8	Interagency Floodproofing Coordination Committee meeting
1988	
January 12-14	Community Rating Task Force meeting
January 20-22	FEMA Issues Seminar at EMI
January 21-22	Arizona Floodplain Management Association meeting
January 29	NSF Research-Advisory Committee Meeting on "Coping with Infrastructure Losses" in Washington, D.C.

Date	Activity
1988	
February 24-25	Greenways Workshop sponsored by EPA and the Floodplain Management Task Force in Washington, D.C.
February 29	Board of Directors Conference Call
March 3-6	Administrative Council Meeting in Alabama
March 16-18	Federal Agency meetings in Washington, D.C.
March 29	Board of Directors Conference Call
April 12-13	"Stormwater Management at the Crossroads", an invitational workshop in Tulsa, OK
April 13	Michigan Association of Stormwater and Floodplain Management organizational meeting and Technical Conference in Lansing, MI
April 14	Illinois Association of Stormwater and Floodplain Management annual conference in Naperville, IL
April 25-27	Annual Write Your Own Conference for National Flood Insurance Program in San Diego, CA
April 28	Community Rating Task Force meeting
May 3	Board of Directors Conference Call
May 15-19	"Floodplain Harmony", ASFPM Annual Conference in Nashville, TN
May 20	Interagency Floodproofing Coordination Committee meeting
May 25	Meetings on Disaster Relief Act and Small Business Administration Disaster Loan Program bills, Washington, D.C.
June 9-10	Arizona Floodplain Management Association meeting
June 25-29	Association of State Wetland Managers Symposium in Oakland, CA

ASSOCIATION OF STATE FLOODPLAIN MANAGERS, INC.
P.O. Box 2051 Madison, Wisconsin 53701-2051 (608) 266-1926

RESOLUTION 87-1

ASSOCIATION SUPPORT FOR FEMA'S HAZARD MITIGATION ASSISTANCE PROGRAM

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WHEREAS, floods are the greatest cause of Presidential disaster declarations and the greatest cause of FEMA disaster assistance payments;

WHEREAS, studies have shown that without flood hazard mitigation activities, flood damages and federal disaster payments will increase;

WHEREAS, FEMA's Hazard Mitigation Assistance Program has been shown to be a unique and very productive program to encourage and support new hazard mitigation initiatives at the state and local levels; and

WHEREAS, FEMA is considering eliminating the Hazard Mitigation Assistance Program in spite of its successful track record over a relatively short period of time;

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of this Association that:

1. It is the policy of this Association to support continued funding of the Hazard Mitigation Assistance Program.
2. The Chair will petition the appropriate FEMA officers and request their support for continued funding.
3. The Mitigation Committee is tasked to provide technical information and assistance to FEMA and the Congress on the program's expenses and benefits.

Adopted: November 18, 1987

Transmitted to FEMA 12/11/87

ASSOCIATION OF STATE FLOODPLAIN MANAGERS, INC.
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RESOLUTION 88-1

WHEREAS, the Congress is debating reauthorization of the programs of the Small Business Administration (SBA); and

WHEREAS, the House of Representatives has introduced a bill to improve the SBA disaster loan program; and

WHEREAS, it is the desire of the Association of State Floodplain Managers (ASFPM) to promote opportunities for mitigation efforts that reduce future damages;

NOW, THEREFORE, it is **RESOLVED** that the ASFPM adopts the following position of support on the improvements to the SBA disaster loan program:

1. Expediting and simplifying disbursement of disaster loans is a great need and should be pursued by the SBA.

2. Increasing the amount of unsecured loans from $5,000 to $10,000 will maintain program parity with proposed amendments to the Federal Emergency Management Agency's Individual and Family Grant funding limits and will reduce the administrative burden on disaster victims.

3. Authorization of the loan of an additional 20% to help property owners undertake mitigation measures will result in long-term reduction in the effects of future disasters.

4. That the intent of the mitigation provision is to fund property protection measures and those adjunct projects necessary to maintain the useability of protected buildings.

5. That the Chair of the ASFPM Mitigation Committee will convey this resolution and our concerns to the appropriate Congressional offices.

Adoped, this 16th day of May, 1988.

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