THE SAN DIEGO COUNTY FLOODPLAIN MANAGEMENT PROGRAM

Joseph C. Hill
San Diego County, California

A. Jean Brown
State of California

Introduction

San Diego is one of the most rapidly growing areas in the United States. With virtually all the major rivers and streams in a natural (unchannelized) condition, a good flood plain management system is essential to prevent extensive construction of houses and other structures in floodway areas. The need for flood plain management was recognized more than 20 years ago. The California Department of Water Resources (DWR) provided the initial basis for flood plain management through their publication "San Diego County Flood Hazard Investigation, Bulletin 112, 1964" and related flood plain maps.

Several major private projects used Bulletin 112 as a basis for constructing golf courses in flood plains adjoining club houses, homes and other structures elevated above the 100-year flood level. Examples include: Carleton Hills Country Club on the San Diego River, Whispering Palms Country Club in the San Dieguito River and Pauma Valley Country Club in the San Luis Rey River.

San Diego County Flood Plain Program

In 1970, the County Board of Supervisors initiated a Flood Plain Mapping and Management Program which now includes the following elements.

Detailed Flood Plain/Flooding Maps

Some of the first flood plain floodway maps were developed by the State of California DWR for the Upper San Diego River. This is the most critical reach of river in terms of existing flood problems and regulation of development. The maps were published as part of the Upper San Diego River Flood Control Investigation, Bulletin 182, February 1976. This publication recommended Flood Plain Management as the most effective flood control option for the river. Part of the flood plain management program includes emergency procedures during flood periods. The DWR publication, "Stage-Discharge Relationships and Areas of Potential Inundation for Upper San Diego River (including a portion of San Vicente Creek) and Lower San Dieguito River, April 1976," provided detailed information to aid in emergency flood operations. The basis came from flood plain mapping material.

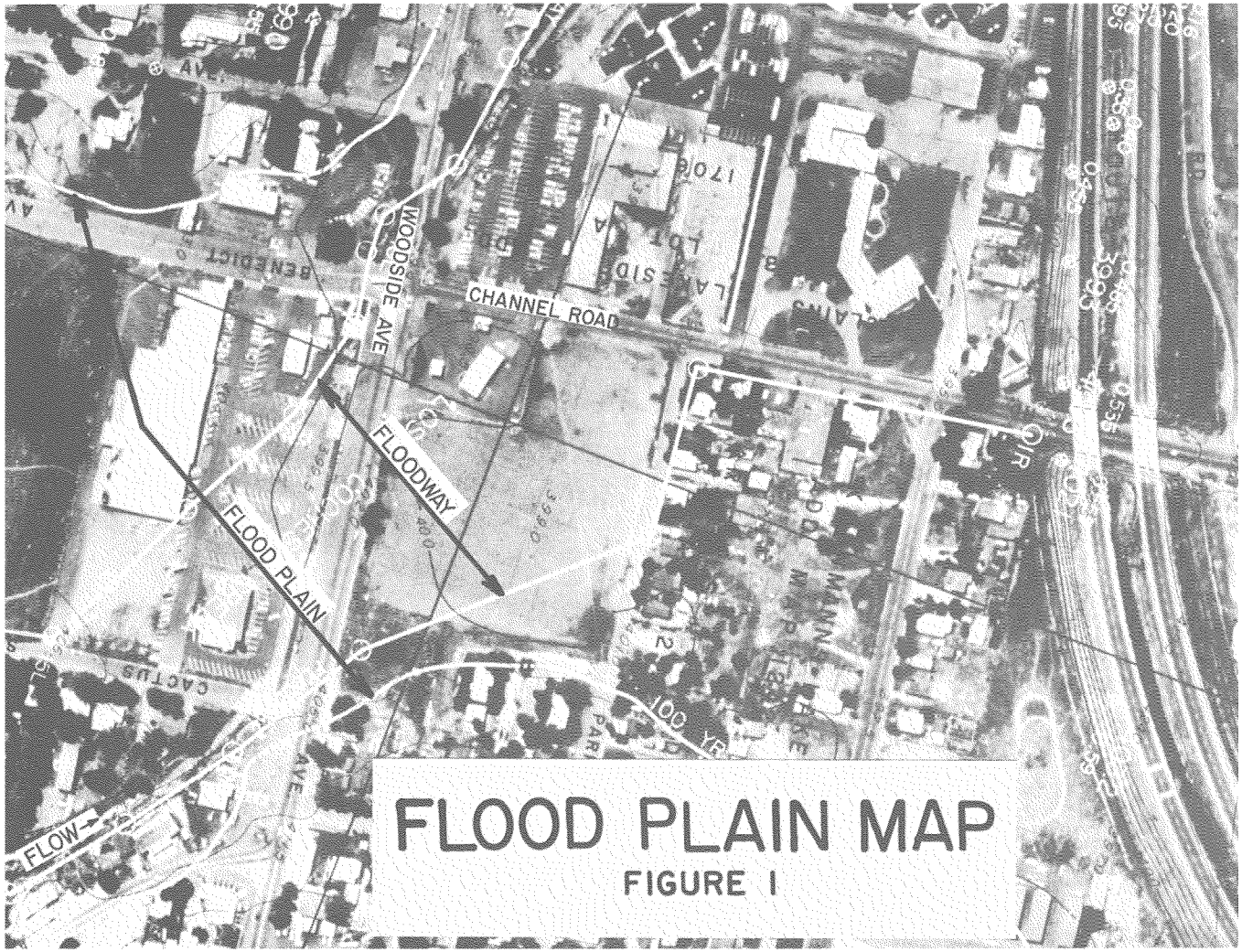
Criteria used in San Diego flood plain studies is given below:

- Orthophoto base maps (200 feet/inch scale). These maps have a picture quality which helps locate flood plain and floodway lines.
- Digitized cross sections. The accuracy of digitized points is better than one foot. Up to 99 can be used per cross section to provide a sufficient basis for development regulation.
- Floodways have specific boundaries. The floodway can be tied to the California coordinate system and property lines.

Examples of flood plain maps and plotted cross sections are given in Figures I and II.

Even with flood plain studies, which have much better quality than the FEMA studies, considerable opposition from property owners was experienced in the implementation of flood plain maps for zoning land development purpose.

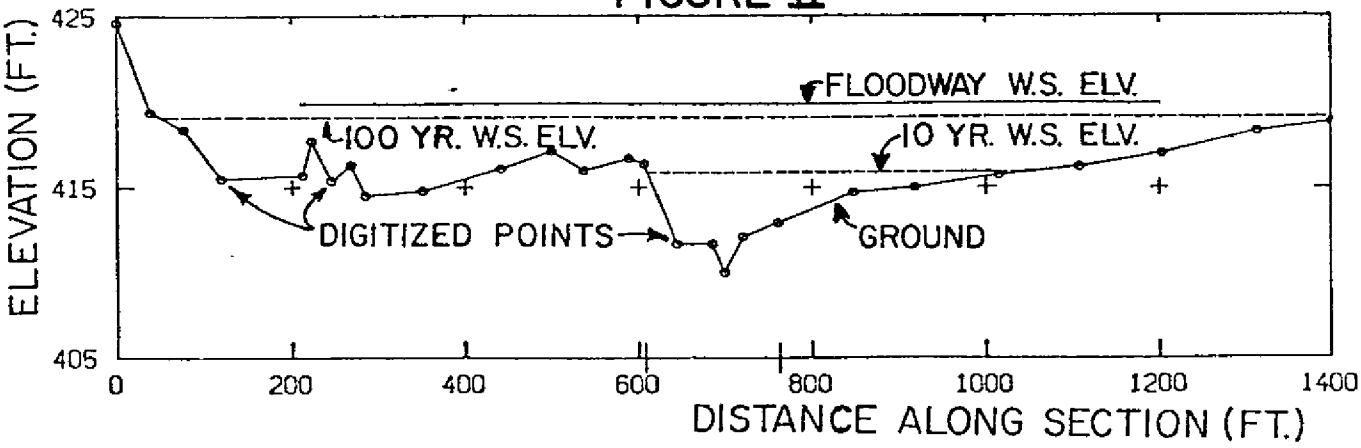
County flood plain mapping and planning program began prior to implementation of the National Flood Insurance Program (NFIP). As Federal funds became available, the two programs were coordinated so that criteria and flood plain studies are compatible. The programs were also coordinated with the cities.



FLOOD PLAIN MAP

FIGURE 1

TYPICAL CROSS SECTION
FIGURE II



The following table provides a list of organizations that have participated in producing detailed flood plain studies that are currently used for planning and regulation of development.

State of California, Dept. of Water Resources*	20 miles
Corps of Engineers*	90 miles
County of San Diego	160 miles
Total	270 miles

*The County provided orthophoto base maps, digitized cross-sections and plotting of flood plain lines for all the detailed flood plain studies.

Cost Effectiveness

Use of flood plain maps to prevent construction of houses and other structures in flood plains avoids the need for construction of flood control channels. The table below provides the cost of flood plain mapping for comparison with the cost of three channel projects that are currently being planned or under construction in San Diego.

Cost of Flood Plain Mapping Study	= $10,000/mile
Channel Costs:	
Los Coches Creek $7,000,000/2 miles	= $3,500,000/mile
Telegraph Canyon Creek $5,400,000/1-1/2 miles	= $3,600,000/mile
Sweetwater River $30,000,000/2 miles	= $15,000,000/mile

The cost of constructing channels is 350 to 1,500 times more than flood plain management in these examples. The three creeks and rivers listed above have flood plain/floodway maps which are used to prevent additional construction that would be damaged by a 100-year flood. However, so many houses and other structures are in the identified flood plain that channel construction is the only option available.

Basis for Flood Control Design

Proposed development in flood plains is aided by a flood plain study. Most of the information needed for design of bridges, channels and other structures is available, and the extent of potential flooding is defined. It is standard practice in San Diego County to use flood plain studies as a basis for design.

The most common type of development in flood plains is construction in the fringe area. This can be accomplished easily with practically no additional flood control engineering.

National Flood Insurance Program

The County of San Diego (unincorporated area) entered the Emergency Phase of the National Flood Insurance Program (NFIP) in 1971. Ordinances have been adjusted so they are in conformance with NFIP criteria. The County (unincorporated area) entered the Regular Phase of the NFIP in 1984.

Planning

The flood plain maps provide a basis for future planning and have been incorporated into the County General and Community Plan maps. They are also used in the zoning process by the County.

Community plans can specify special conditions relative to flood plains to reflect the desires of the citizens. Some communities elect to leave flood plains natural. Others use the flood plain maps, cross-sections, etc., as a basis for channel design.

Environmental Considerations

The County General Plan recommends that floodways be left in a natural condition unless existing structures are present, making channels desirable for safety

reasons. This approach is similar to that expressed by the Federal Government through Executive Orders 11988 and 11990.

Erosion and Sedimentation Considerations

In some locations, river beds are subject to extreme change during flood conditions. Lateral erosion during flooding can move a river several hundred feet outside the bank of a floodplain that has been defined with clearwater analytical methods. Sedimentation can raise a river bed--and the floodplain level--many feet above and beyond the clearwater floodplain. River lengths affected by major erosion and/or sedimentation is 10% to 20% in San Diego. While the percentage of river lengths is not great, the effect on property is. There are documented cases in which floods of 10-year and 50-year recurrence intervals have damaged structures and property outside existing floodplain boundaries.

A publication by the State of California, DWR has been helpful in evaluation problems. "Erosion and Sedimentation in San Diego County Watersheds" provided a basis for determining sediment yields from watersheds quantifying the increase in flood flows resulting from urbanization of a watershed and anticipating erosion and sedimentation in the San Diego River. This report predicted that major floods would put the 1,000 foot long Highway 67 bridge over the San Diego River in danger of failure. The 1978 and 1980 floods eroded the riverbed to the extent that the State replaced the entire bridge with a new structure.

Howard Chang, professor at San Diego State University and consultant, has developed procedures for evaluation of erosion and sedimentation in rivers. Several papers have been published in the American Society of Civil Engineers, Hydraulics Journal.

Summary and Conclusion

Rapid growth in an area with natural flood plains, such as San Diego, requires a comprehensive flood plain management program. Otherwise, houses and other structures will be constructed in unidentified flood plains, with danger to life and damage to structures as the inevitable floods occur in the area. Structural protection of houses and other buildings that are built in flood plains can be

expected to be 300 to 1,500 times more expensive than the cost of managing the flood plain.

Over 250 miles of flood plains have been mapped and are used for regulation of development in San Diego. The flood plain areas are identified in community planning maps. Environmental aspects of natural flood plains are incorporated in planning activities. The San Diego Program received an Outstanding Civil Engineering Achievement Award from the San Diego Section of the American Society of Civil Engineers in 1982.

The State of California, DWR was instrumental in initially identifying and providing the basis for directing development away from major flood plains. A coordinated effort between the State, federal and local government has provided an essential flood plain management program for San Diego.

References

State of California, Department of Water Resources

1964 San Diego County Flood Hazard Investigation, Bulletin No. 112

1976 Upper San Diego River Flood Control Investigation, Bulletin No. 182

1976 Stage-Discharge Relationships and Areas of Potential Inundation for Upper San Diego River (Including a Portion of San Vicente Creek) and Lower San Dieguito River in San Diego County

1977 Erosion and Sedimentation in San Diego County Watersheds