FLOOD INSURANCE STUDY

VOLUME 1 OF 3

VENTURA COUNTY, CALIFORNIA
AND INCORPORATED AREAS

Community Name	Community Number
CAMARILLO, CITY OF	065020
FILLMORE, CITY OF	060415
MOORPARK, CITY OF	060712
OJAI, CITY OF	060416
OXNARD, CITY OF	060417
PORT HUENEME, CITY OF	065051
SAN BUENAVENTURA, CITY OF	060419
SANTA PAULA, CITY OF	060420
SIMI VALLEY, CITY OF	060421
THOUSAND OAKS, CITY OF	060422
VENTURA COUNTY (UNINCORPORATED AREAS)	060413

REVISED

PRELIMINARY

10/18/2013

REVISED
Month Day, Year

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
06111CV001B

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

Initial Countywide FIS Effective Date: January 20, 2010

First Revised Countywide FIS Date: Month Day, Year

TABLE OF CONTENTS

VOLUME 1

Page

1.0 INTRODUCTION 1

1.1 Purpose of Study 1
1.2 Authority and Acknowledgments 1
1.3 Coordination 5

2.0 AREA STUDIED 6

2.1 Scope of Study 6
2.2 Community Description 11
2.3 Principal Flood Problems 13
2.4 Flood Protection Measures 25

3.0 ENGINEERING METHODS 33

3.1 Hydrologic Analyses 34
3.1.1 Methods for Flooding Sources with New or Revised Analyses in Current Study 34
3.1.2 Methods for Flooding Sources Incorporated from Previous Studies 34
3.2 Hydraulic Analyses 57
3.2.1 Methods for Flooding Sources with New or Revised Analyses in Current Study 59
3.2.2 Methods for Flooding Sources Incorporated from Previous Studies 59
3.3 Vertical Datum 73

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS 74

4.1 Floodplain Boundaries 75
4.2 Floodways 77

5.0 INSURANCE APPLICATIONS 111

6.0 FLOOD INSURANCE RATE MAP 112

7.0 OTHER STUDIES 113

8.0 LOCATION OF DATA 113

9.0 BIBLIOGRAPHY AND REFERENCES 116

10.0 REVISION DESCRIPTIONS 120

10.1 First Revision (Revised Month Day, Year) 121

TABLE OF CONTENTS - VOLUME 1 (continued)

Page

FIGURES

Figure 1. Floodway Schematic 82

TABLES

Table 1: Initial and Final CCO Meetings 5
Table 2: Flooding Sources Studied by Detailed Methods 7
Table 3: Flooding Sources Studied by Approximate Methods 7
Table 4: Letters of Map Change 8
Table 5: Summary of Discharges 40
Table 6: Summary of Elevations 55
Table 7: Manning's "n" Values 58
Table 8: Floodway Data 83
Table 9: List of Levees 102
Table 10: Community Map History 114

TABLE OF CONTENTS - VOLUME 2

EXHIBITS

Exhibit 1 – Flood Profiles

Adams Canyon	Panel	01P
Arroyo Santa Rosa	Panels	02P-07P
Arroyo Santa Rosa Tributary	Panels	08P-09P
Beardsley Wash	Panel	10P-12P
Bell Canyon Creek	Panels	13P-15P
Brown Barranca	Panel	16P
Bus Canyon Drain	Panels	17P-19P
Bus Canyon Drain Tributary	Panel	20P
Calleguas Creek - Arroyo Las Posas - Arroyo Simi	Panels	21P-53P
Camarillo Hills Drain	Panels	54P-56P
Conejo Creek	Panels	57P-63P
Coyote Creek	Panels	64P-66P
Dry Canyon Drain	Panels	67P-68P

TABLE OF CONTENTS - VOLUME 2 (continued)

EXHIBITS (continued)

Exhibit 1 – Flood Profiles (continued)

Erringer Drain	Panels	69P-71P
Fagan Canyon	Panels	72P-73P
Fox Canyon Storm Drain	Panels	74P-78P
Happy Valley Drain	Panels	79P-80
Happy Valley Drain South	Panels	81P-82P
Harmon Barranca	Panelss	83P-84P
Lang Creek	Panels	85P-86P
Las Llajas Canyon Channel	Panels	87P-91P

TABLE OF CONTENTS - VOLUME 3

EXHIBITS (continued)

Las Posas Estates Drain	Panels	92P-93P
Miramonte Drain	Panel	94P
North Simi Drain	Panels	95P-100P
Peach Hill Wash	Panel	101P
Piru Creek	Panels	102P-103P
Pole Creek	Panels	104P-106P
Reeves Creek	Panels	107P-110P
Rincon Creek	Panel	111P
San Antonio Creek	Panels	112P-120P
Santa Clara River	Panels	121P-136P
Santa Clara River Breakout	Panels	137P-138P
Santa Paula Creek	Panels	139P-141P
Sespe Creek	Panels	142P-145P
South Branch Arroyo Conejo	Panels	146P-149P
Stewart Canyon Creek	Panels	150P-154P
Tapo Canyon Channel	Panels	155P-157P
Thacher Creek	Panels	158P-167P
Thousand Oaks North Drain	Panels	168P-169P
Ventura River	Panels	170P-187P
Ventura River without Levee	Panel	188P
Walnut Creek Drain/Gabbart Canyon Creek	Panels	189P-192P

Exhibit 2 – Flood Insurance Rate Map Index (Published Separately)
Flood Insurance Rate Maps (Published Separately)

FLOOD INSURANCE STUDY

VENTURA COUNTY, CALIFORNIA, AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in, or revises and updates previous FIS reports or Flood Insurance Rate Maps (FIRMs) for, the geographic area of Ventura County, including the Cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, San Buenaventura, Santa Paula, Simi Valley, Thousand Oaks, and the unincorporated areas of Ventura County (hereinafter referred to collectively as Ventura County).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Ventura County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP) and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

The Digital Flood Insurance Rate Map (DFIRM) and FIS Report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and geographic information standards and is provided in a digital format so that it can be incorporated into a local Geographic Information System and be accessed more easily by the community.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This revision was completed for FEMA to incorporate a Physical Map Revision (PMR). Hydrology and hydraulic analyses for this revision were completed February 2011.

Prior to this revision, a countywide FIS was prepared and issued in preliminary status. That FIS report included the unincorporated areas of, and incorporated communities within, Ventura County in a countywide format. Information on the authority and

acknowledgments for each jurisdiction included in the countywide FIS, as compiled from their previously printed FIS reports, is shown below.

Camarillo, City of:	The hydrologic and hydraulic analyses from the FIS report dated September 29, 1986, were performed by PRC Toups, for FEMA, under Contract No. H-4032. That study was completed in May 1983.
Fillmore, City of:	The hydrologic and hydraulic analyses from the FIS report dated April 1978 were performed by Harris-Toups Associates, for the Federal Insurance Administration (FIA), under Contract No. H-4032. That work was completed in June 1977.
Moorpark, City of	The hydraulic analyses from the FIS report dated September 29, 1986, were performed by PRC Toups, Inc., for FEMA, under Contract No. H-4032. The hydraulic analysis was completed in July 1983.
Ojai, City of	The hydrologic and hydraulic analyses from the FIS report dated April 1978 were performed by Harris-Toups Associates, for the FIA, under Contract No. H-4032. That work was completed in July 1977.
Oxnard, City of	The hydrologic and hydraulic analyses from the original FIS report were performed by the U.S. Army Corps of Engineers (USACE), for FEMA, under Inter-Agency Agreement Nos. IAA-H-1974 and IAA-H-16-75, Project Order Nos. 13 and 17, respectively. The hydraulic analyses for that study were completed in March 1977. In coastal areas, the hydrologic analyses for that study were performed by Dames & Moore, for FEMA, under Contract No. C-0970. That work was completed in 1984. The study was revised in 1984 to incorporate data used to prepare the FIS for Ventura County, California (FEMA, Unpublished). Hydrologic and hydraulic analyses for that study were performed by PRC Toups for FEMA under Contract No. H-4032, and were completed in July 1983.
San Buenaventura, City of	The hydraulic analyses from the September 29, 1986, FIS report were performed by PRC Toups, for FEMA, under Contract No. H-4032. The study was completed in May 1983.

	In coastal areas, the hydrologic analyses from the September 29, 1986, FIS were performed by Dames & Moore, for FEMA, under Contract No. C-0970.
Santa Paula, City of	The hydrologic and hydraulic analyses from the original FIS report were performed by the USACE, Los Angeles District, for FEMA, under Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 13, Amendment No. 1. That study was completed in May 1978. Hydrologic and hydraulic analyses for the Santa Clara River and Santa Paula Creek were revised by PRC Toups in 1984. The revised hydraulic analysis for the September 3, 1997, FIS was prepared by the USACE as part of a General Reevaluation Report dated March 1995.
Simi Valley, City of:	The hydrologic and hydraulic analyses from the original FIS report were performed by Aqua Resources Incorporated, for FEMA, under Contract No. EMW-89-C-2844. That study was completed in July 1990. The hydrologic and hydraulic analyses from the FIS dated September 3, 1997, for Hummingbird and White Oak Creeks were performed by Ensign and Buckley Consulting Engineers, for FEMA, under Contract No. EMW-90-C-9133. This work was completed in March 1993. The hydrologic and hydraulic analyses from the FIS dated September 3, 1997, for Arroyo Simi, Bus Canyon Drain, Bus Canyon Drain Tributary, Dry Canyon Tributary, Erringer Drain, Las Llajas Canyon Channel, North Simi Drain, and Tapo Canyon Channel were performed by Schaaf & Wheeler, for FEMA, under Contract No. 92-C4042. This work was completed in June 1995.
Thousand Oaks, City of	The hydrologic and hydraulic analyses from the FIS report dated March 1978 were performed by the U.S. Department of Agriculture, Soil Conservation Service, for FEMA, under Inter- Agency Agreement No. IAA-H-16-72, Project Order No. 7. That work was completed in January 1976.
Ventura County (Unincorporated Areas)	The hydrologic and hydraulic analyses from the original FIS report were performed by PRC Toups, for FEMA, under Contract No. H-4032. The hydraulic analyses for that study were completed in July 1983. Additional

hydraulic analyses for riverine areas were performed by Dames & Moore, for FEMA, under Contract No. C-0970. In coastal areas, the hydrologic analyses for that study were performed by Dames & Moore, for FEMA, under Contract No. C-0970.

The hydrologic and hydraulic analyses from the 1990 restudy were prepared by DMA Consulting Engineers, Inc., for FEMA under Contract No. EMW-86-C-2227. The work was completed in January 1988.

The hydrologic and hydraulic analyses for Calleguas Creek, Conejo Creek, Walnut Canyon Drain, Peach Hill Wash, Somis Drain, Camarillo Hills Drain, Santa Rosa Tributary, Arroyo Santa Rosa, Lang Creek, and Thousand Oaks North Drain were performed by Nolte Associates, Inc., for FEMA, under Contract No. EMS-2000-CO-0057 Order No. T005 and completed in September 2004. Ventura County served as a Cooperating Technical Partner (CTP) for the first countywide study. Ventura County, with support from the USACE, was responsible for the development of digital base maps and digital topography for the study reaches.

The hydrologic and hydraulic analyses in the City of Camarillo for Calleguas Creek, Camarillo Hills Drain, Crestview Drain, Edgemore Drain, Mission Drain, Ponderosa Drain, Somis Drain, Somis Drain Tributary, and West Camarillo Hills Tributary were performed by Kasraie Consulting for the City of Camarillo and completed in October 2008. The data was reviewed for technical accuracy by Michael Baker Jr. under contract with FEMA as the National Service Provider. Ventura County Watershed Protection District was responsible for the LiDAR elevations flown in 2005 and used as topography for the study reaches.

The hydrologic and hydraulic analyses for Arroyo Santa Rosa, Arroyo Santa Rosa Tributary, and Peach Hill Wash were initially performed by Nolte Associates, Inc., for FEMA, under Contract No. EMS-2000-CO-0057 Order No. T005 and completed in September 2004. Ventura County Watershed Protection District further revised the hydraulic analyses in May 2008. Ventura County, with support from the USACE, was responsible for the development of digital base maps and digital topography for the study reaches.

The hydrologic analysis for the Calleguas Creek Watershed was performed by Ventura County Watershed Protection District and is included in the report entitled "Calleguas Creek Watershed Hydrology Study," March 2003. The hydraulic analysis for that study was performed by Nolte Associates, Inc.

On selected FIRM panels, planimetric base map information was provided in digital format. These files were compiled at scales of 1:12,000. Additional information was derived from U.S. Geological Survey (USGS) Digital Line Graphs. Additional information may have been derived from other sources. Users of this FIRM should be aware that minor adjustments may have been made to specific base map features.

The coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM), North American Datum of 1983 (NAD 83) GRS80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

Consultation Coordination Officer's (CCO) meetings may be held for each jurisdiction in this countywide FIS. An initial Consultation Coordination Officer (CCO) meeting (also occasionally referred to as the Scoping meeting) is held with representatives of the communities, FEMA, and the study contractors to explain the nature and purpose of the FIS and to identify the streams to be studied by detailed methods. A final CCO (often referred to as the Preliminary DFIRM Community Coordination, or PDCC, meeting) is held with representatives of the communities, FEMA, and the study contractors to review the results of the study.

For this revision of the countywide FIS, the initial CCO meeting was held on April 29, 2010, and attended by a District Representative and District Chief of Staff for Congress, representatives of FEMA, the USACE, BakerAECOM, LLC, and community officials.

The final CCO meeting was held on ____ to review and accept the results of this revised countywide FIS. Those who attended this meeting included the contractor, FEMA, and representatives of the communities. All problems raised at that meeting have been addressed in this revision of the countywide FIS.

The dates of the initial and final CCO meetings held for the communities within the boundaries of Ventura County are shown in Table 1, “Initial and Final CCO Meetings.”

Table 1: Initial and Final CCO Meetings

Community Name	For FIS Dated	Initial CCO Date	Final CCO Date
Camarillo, City of	September 29, 1986	December 14, 1977 July 29, 2004	December 15, 1982 September 21, 2005 November 5, 2008
Fillmore, City of	April 1978	May 3, 1977 July 29, 2004	September 16, 1977 September 21, 2005
Moorpark, City of	September 29, 1986	August 15, 1984 July 29, 2004	December 12, 1984 September 21, 2005
Ojai, City of	April 1978	May 3, 1977 July 29, 2004	September 16, 1977 September 21, 2005

Oxnard, City of	March 1, 1979 October 15, 1985	November 22, 1974 * July 29, 2004	January 25, 1978 * September 21, 2005
San Buenaventura, City of	September 29, 1986 August 19, 1987	December 14, 1977 * July 29, 2004	December 15, 1982 * September 21, 2005
Santa Paula, City of	April 15, 1980 September 3, 1997	* * July 29, 2004	February 27, 1978 * September 21, 2005
Simi Valley, City of	September 27, 1991 September 3, 1997	July 7, 1988 * July 29, 2004	December 4, 1990 * September 21, 2005
Thousand Oaks, City of	March 19, 1978 January 3, 1983	* * July 29, 2004	June 29, 1977 * September 21, 2005 January 11, 2008
Ventura County (Unincorporated Areas)	October 31, 1985 January 4, 1989 September 28, 1990 September 3, 1997	December 14, 1977 * January 9, 1986 * July 29, 2004	December 18, 1982 * November 24, 1987 * September 21, 2005 January 11, 2008
Ventura County and Incorporated Areas	January 20, 2010	April 29, 2010	*

*Date not available

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Ventura County, California, including the incorporated communities listed in Section 1.1.

The scope and methods of this study were proposed to, and agreed upon, by FEMA and Ventura County. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction. The flooding sources studied by detailed methods are presented in

For this revision, a total of 6.75 additional stream miles were restudied. 2.81 miles on Camarillo Hills Drain, 0.62 miles on Edgemore Drain, 0.96 miles on Mission Drain, 0.56 miles on Ponderosa Drain, 1.10 miles on Somis Drain, and 0.70 miles on West Camarillo Hills Tributary were studied using detailed methods.

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

Table 2: Flooding Sources Studied by Detailed Methods

Adams Canyon
Arroyo Conejo
Arroyo Santa Rosa
Arroyo Santa Rosa Overflow
Arroyo Santa Rosa Tributary
Arroyo Simi
Arroyo Simi Overflow North of SPRR
Arundell Barranca
Barlow Barranca
Beardsley Wash
Bell Canyon Creek
Brown Barranca
Bus Canyon Drain
Bus Canyon Drain Tributary
Calleguas Creek - Arroyo Las Posas - Arroyo Simi
Camarillo Hills Drain
Conejo Creek
Coyote Creek
Doris Avenue Drain
Dry Canyon Drain
Edgemore Drain
El Rio Drain
Erringer Drain
Fagan Canyon
Fox Canyon Storm Drain
Franklin Barranca Gabbert Canyon Creek- Walnut Canyon Drain
Happy Valley Drain
Happy Valley Drain South
Harmon Barranca
Hummingbird Creek
J Street Drain
Lang Creek
Las Llajas Canyon Channel
Las Posas Estates Drain
Mills Road Drain
Mira Monte Drain
Mission Drain
North Drain Creek
North Simi Drain
Oxnard Industrial Drain
Pacific Ocean
Peach Hill Wash
Piru Creek
Pole Creek
Ponderosa Drain
Reeves Creek
Rice Avenue Drain
Rincon Creek
San Antonio Creek
Santa Clara Drain
Santa Clara Diversion
Santa Clara River
Santa Clara River Breakout
Santa Paula Creek
Santa Rosa Tributary
Sespe Creek
Somis Drain
South Branch Arroyo Conejo
Stewart Canyon Creek/ Stewart Canyon Storm Channel
Tapo Canyon Channel
Telephone Road Drain
Thacher Creek
Thousand Oaks North Drain
Tributary to South Branch Arroyo Conejo
West Camarillo Hills Tributary
Ventura River
West Wooley Drain
White Oak Creek
White Oak Creek Overflow

All or portions of the flooding sources listed in Table 3, "Flooding Sources Studied by Approximate Methods," were studied by approximate methods.

Table 3: Flooding Sources Studied by Approximate Methods

Alamos Canyon
Arroyo Simi
Arundell Barranca
Brea Canyon
Bus Canyon
Dent Avenue Drain
Dry Canyon
Erringer Road Drain
Gabbert Canyon Creek
Happy Valley Drain
Las Llajas Canyon
Moon Ditch
North Drain
North Simi Drain
Runkle Canyon
Stanley Avenue Drain
Stuart Canyon Storm Drain
Sycamore Canyon
Tapo Canyon
Walnut Canyon Creek
West Fifth Street Drain
White Oak Creek

This FIS also incorporates the determination of letters issued by FEMA resulting in Letters of Map changes (Letters of Map Revision [LOMR], Letter of Map Revision –

based on Fill [LOMR-F], and Letter of Map Amendment [LOMA]) as shown in Table 4, "Letters of Map Change."

Table 4: Letters of Map Change

Community	Flooding Source(s)/Project Identifier	Date Issued	Type
City of Camarillo		June 22, 1993	LOMR
City of Camarillo	Tract 5409, Lots 7-20 & 27-36	March 4, 2005	LOMR-F
City of Fillmore	Greystone Homes, Tract 5099	May 8, 2002	LOMR
City of Fillmore	Greystone Homes, Tract 5099	August 16, 2002	LOMR
City of Fillmore	Southeast Study Area of Santa Clara River at City of Fillmore	November 7, 2003	LOMR
City of Moorpark		December 28, 1994	LOMR
City of Moorpark	Happy Camp Canyon	December 14, 1998	LOMR
City of Port Hueneme		May 25, 1988	LOMR
City of San Buenaventura	Brown Barranca from Telegraph Road to State Highway 126	July 26, 1999	LOMR
City of Santa Paula	Santa Paula Creek Flood Control Project — Zone A99	May 22, 2001	LOMR
City of Santa Paula	Fagan West Overflow	October 31, 2007	LOMR
City of Simi Valley		May 17, 1993	LOMR
City of Simi Valley		March 10, 1994	LOMR
City of Simi Valley		April 28, 1995	LOMR
City of Simi Valley		January 23, 1996	LOMR
City of Simi Valley	PD-S-794	May 26, 1999	LOMR
City of Simi Valley	Tract 5140	February 9, 2001	LOMR
City of Simi Valley	Tract 4923	February 20, 2001	LOMR
City of Simi Valley	The Meadows Project Floodwall	November 26, 2001	LOMR
City of Simi Valley	Arroyo Simi from Railroad to Stow Street	November 6, 2002	LOMR
City of Simi Valley	Tract 5164 — Parker Ranch Project	December 19, 2002	LOMR
City of Camarillo		January 30, 2003	LOMR
City of Simi Valley	Tract 4622 (Lots 1-12) and Tract 4677 (Lots 1-9)	November 18, 2003	LOMR

Table 4: Letters of Map Change (continued)

Community	Flooding Source(s)/Project Identifier	Date Issued	Type
City of Simi Valley	North Simi Valley Drain Detention Basin	April 9, 2004	LOMR
City of Simi Valley	Simi Valley Shopping Center, Building N-2, 1920 Los Angeles Avenue, Simi Valley	November 10, 2005	LOMR
City of Simi Valley	Royal Avenue Bridge	January 20, 2005	LOMR
City of Simi Valley	United States Post Office, City of Simi Valley	June 28, 2007	LOMR
City of Simi Valley	Tract 5473	January 24, 2008	LOMR
City of Thousand Oaks	Tracts 5094, 5095, 5096, Dos Vientos Ranch	December 12, 2000	LOMR
City of Thousand Oaks	Tracts 5072 & 5074, Dos Vientos Ranch	August 31, 2000	LOMR
City of Thousand Oaks	South Branch Arroyo Conejo-Upper Reach	May 9, 2005	LOMR
City of Thousand Oaks	Dos Vientos Ranch Tract 5080	May 29, 2003	LOMR
Ventura County	Santa Cruz River, Freeman Diversion Improvement Project	January 21, 1992	LOMR
Ventura County	Las Posas Estates Drain - Central Avenue to Ponderosa Drive	April 13, 1993	LOMR
Ventura County		June 22, 1993	LOMR
Ventura County		August 3, 1994	LOMR
Ventura County		December 28, 1994	LOMR
Ventura County	Tract 4290	August 6, 1996	LOMR
Ventura County	Medea Creek	February 12, 1998	LOMR
Ventura County	Brown Barranca from Telegraph Road to State Highway 126	July 26, 1999	LOMR
Ventura County	Santa Paula Creek Flood Control Project - Zone A99	May 22, 2001	LOMR
Ventura County	Portions of Cup 4375 & Tracts 4191, 4408, 4590, 4779, and 4934	October 19, 2001	LOMR
Ventura County	Dos Vientos Ranch-Tract 4963	February 7, 2002	LOMR
Ventura County	Greystone Homes, Tract 5099	May 8, 2002	LOMR
Ventura County	Nyeland Acres	August 14, 2002	LOMR
Ventura County	Greystone Homes, Tract 5099	August 16, 2002	LOMR

Table 4: Letters of Map Change (continued)

Community	Flooding Source(s)/Project Identifier	Date Issued	Type
Ventura County	Ventura River Levee	February 6, 2003	LOMR
Ventura County	Camp Comfort Floodway Revision	April 5, 2003	LOMR
Ventura County	Santa Clara River at City of Fillmore	November 7, 2003	LOMR
Ventura County	Bunn Property	April 30, 2007	LOMR
Ventura County	Fagan West Overflow	October 31, 2007	LOMR
Ventura County	Conejo Creek	June 13, 2011	LOMR
Ventura County	Camarillo Hills Drain	July 19, 2011	LOMR

The following technical data were submitted for the September 3, 1997, revision of Santa Paula Creek:

- "Santa Paula Creek General Reevaluation Report," including the Mai Report and Appendices A, B, C, and D, prepared by the USACE, Los Angeles District, dated March 1995.

- Topographic maps entitled "Revisions to Flood Insurance Rate Map," prepared by the USACE, Los Angeles District, dated January 18, 1996.

The results of the restudy of Arroyo Simi, Bus Canyon Drain, Bus Canyon Drain Tributary, Dry Canyon Drain, Erringer Drain, Las Llajas Canyon Channel, North Simi Drain, and Tapo Canyon Channel are presented in the reports entitled "Technical Support Data Notebook for City of Simi Valley, California," dated November 16, 1993, and January 20, 1995, and "Revisions to the Ventura County, City of Simi Valley, CA, Flood Insurance Study, Technical Support Data Notebook," dated June 1995, all prepared by Schaaf & Wheeler.

A hydrologic analysis for the Calleguas Creek Watershed was performed by Ventura County Watershed Protection District and is included in the report entitled "Calleguas Creek Watershed Hydrology Study," March 2003. The hydraulic analysis for the study was performed by Nolte Associates, Inc.

A hydrologic analysis for the Santa Clara River Watershed was performed by Ventura County Watershed Protection District and is included in the report entitled "Santa Clara River 2006 Hydrology Update," December 2006. The hydraulic analysis for the study was performed by Nolte Associates, Inc.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

All or portions of numerous flooding sources in the county were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Ventura County.

2.2 Community Description

Ventura County is located in the south coastal area of southern California. The county covers 1,843 square miles, making it 26th in size among California's 58 counties. It is bounded on the west by Santa Barbara County, on the north by Kern County, and on the east by Los Angeles County. The coastal boundary is approximately 42 miles in length, with almost one-half located within unincorporated county areas.

U.S. Highway 101 (Ventura Freeway) passes through the southern part of Ventura County and connects the county with Santa Barbara County and the City and County of San Francisco to the north and Los Angeles and San Diego Counties to the south. State Highway 126 traverses the Santa Clara River Valley and connects the shipping port at the City of Port Hueneme and industrial and manufacturing activities on the coastal plain with U.S. Interstate 5 and the California Central Valley. State Highway 1 (Pacific Coast Highway) joins the Ventura Freeway between the Cities of Oxnard and San Buenaventura and connects the county with the coastal area south of Ventura County.

According to the 2000 Census, the population of Ventura County was 753,197. The 2010 Census reported a population of 823,318, a 9.3% change from 2000.

The climate of Ventura County is extremely diverse. In general, the county enjoys a mild, Mediterranean type climate with dry, warm summers and wet, cool winters. The average annual temperature is near 60 degrees Fahrenheit (°F) at low elevations near the coast, dropping into the 50s over most of the northern two-thirds of the county and to less than 45°F at high elevations in the mountains. The range of extreme temperatures is from more than 100°F in the interior to only 70°F to 80°F in the coastal valleys. Absolute high temperatures have reached more than 100°F along the coast and at high elevations and have climbed to 110°F and higher at intermediate elevations in the interior. Lows have on occasion dropped slightly below freezing near the coast. Readings in the middle 20s have been reported from the interior portions of the coastal valleys, dropping to well below 0°F in the mountains of the northern portion. Temperatures during a single day have ranged from a high of 96°F to a low of 34°F. Since 1961, freezing temperatures have occurred in Lockwood Valley at least once in each of the 12 months (Environmental Science Services Administration, 1969).

The average annual rainfall in the county ranges from less than 8 inches in the Cuyama Valley in northwestern Ventura County to 38 inches in the Ventura River watershed west of the City of Ojai. Along the coast near the Cities of Oxnard and San Buenaventura and in the Cities of Simi Valley and Thousand Oaks, the average annual rainfall is approximately 14 inches. Annual rainfall totals vary considerably from year to year, ranging from approximately one-third of the normal amount to more than twice the normal. The average annual precipitation at San Guillermo Mountain is approximately 35 inches (Ventura County Public Works Agency, 1976). Generally, the rainfall season extends from November through April with approximately 95 percent of the annual rainfall occurring during that time. Most of the county receives measurable precipitation 30 to 40 days per year.

Snow seldom falls along the immediate coast and is an infrequent occurrence over most of the coastal valleys. Over the mountains snow occurs every winter, and at higher

elevations the annual snowfall amounts to more than 20 inches. At these high levels, snow may occur in any month from November through April and has occasionally been reported in October and May. Over most of the county, snow melts soon after it falls; however, on the higher peaks and along protected northern slopes, it may persist for 2 or 3 months.

Topography of the county is characterized by rugged mountainous terrain in the northern portion and lower mountains and alluvial valleys in the central and southern portions. Much of the southern one-third of Ventura County consists of rolling valleys and is below 1,000 feet in elevation. The central and northern two- thirds of the county are above 2,500 feet, with some of this area above 5,000 feet. The highest elevation in Ventura County is located on the summit of Mt. Pinos which has an elevation of 8,831 feet. Over 90 percent of the northern two-thirds of Ventura County are situated in the Lost Padres National Forest.

No large, well-defined mountain ranges exist within Ventura County. Instead, the area is a complex of discontinuous ranges with local names. Major mountain ranges in the county and their highest elevations are: Mt. Pinos (8,831 feet); Frazier Mountain (8,026 feet); Alamo Mountain (7,371 feet); San Guillermo Mountain (6,569 feet); Pine Mountain (7,510 feet); and the Topatopa Mountains (6,704 feet).

Most of Ventura County is situated within three major watersheds: the Santa Clara River, the Ventura River, and Calleguas Creek. The largest watershed is the Santa Clara River Basin which originates in Los Angeles County. It has a drainage area at the Ventura-Los Angeles County line of 644 square miles. Total drainage area at the Pacific Ocean is 1,605 square miles. This watershed is approximately 80 miles in length and averages approximately 25 miles in width. Approximately one-half of the Santa Clara River watershed is located in Ventura County and one-half is in Los Angeles County, with small portions in Kern and Santa Barbara Counties. The watershed headwaters are at Pacifico Mountains in Los Angeles County with a total fall from its headwaters to the ocean of 6,367 feet. Major tributaries of the Santa Clara River within Ventura County are Piru Creek, Sespe Creek, Santa Paula Creek, and Hopper Creek.

Calleguas Creek drains most of the southeastern part of Ventura County including the Cities of Thousand Oaks, Simi Valley, and Camarillo. The total drainage area of Calleguas Creek is 325 square miles. This is an elongated watershed with a maximum length of approximately 30 miles and a maximum width of approximately 14 miles. Its headwaters are in the Santa Susana Mountains. The watershed area is located in Ventura County except for a 4.5-square-mile area in Los Angeles County. From its headwaters to Hitch Boulevard, downstream from Moorpark, Calleguas Creek is locally known as Arroyo Simi; from Hitch Boulevard to Seminary Road, near Somis, it is locally known as Arroyo Las Posas. Major tributaries of Calleguas Creek are Conejo Creek and Revolon Slough.

Most of the Ventura River watershed is contained within Ventura County. It originates on the south slopes of Pine Mountain northwest of the City of Ojai and flows into the Pacific Ocean through the western part of the City of San Buenaventura. The total drainage area is 226 square miles. Its watershed extends approximately 21 miles north from the Pacific Ocean and has an average width of 11 miles. The drainage area is fan-shaped. The main

stream of the river originates at the junction of the North Fork of Matilija Creek and Matilija Creek and flows approximately 15.6 miles to the ocean. Major tributaries to the Ventura River are San Antonio Creek and Matilija Creek.

2.3 Principal Flood Problems

Ventura County

Three types of storms produce precipitation in the Ventura County area: general winter storms, local thunderstorms, and summer tropical storms. The general winter storms, uniformly characterized by heavy and prolonged precipitation over a large area, usually occur during the period from November through April. These storms originate over the Pacific Ocean and move eastward over the area. Local thunderstorms can occur at any time, but usually they cover comparatively small areas. These storms are especially prevalent in the northern mountains during middle and late summer. Summer tropical storms, though infrequent, have occurred in southern California. These storms are of relatively large size and normally originate in the tropics and enter the area from a southeast or a southwest direction. These storms may occur in the summer or early fall.

The largest recorded flood along the Santa Clara River occurred on January 25, 1969. The maximum discharge was 165,000 cubic feet per second (cfs), which is approximately equivalent to a 2-percent-annual-chance flood at Montalvo. The January flood was followed by the second largest recorded flood along the Santa Clara River on February 25, 1969. The peak discharge of the February flood was 152,000 cfs. Damage from the Santa Clara River during the 1969 floods totaled more than $23 million, which included damage to private property as well as roads, bridges, railroads, and flood control and sanitation facilities. Major highway bridges partially destroyed or damaged were the Willard Bridge over the Santa Clara River in Santa Paula and the State Highway 118 Bridge crossing the river at Saticoy. Numerous railroad bridges were destroyed or damaged by floodflows. State Highway 126 was damaged at various locations, and the USACE levee near Saticoy was severely damaged. Twelve lives were lost by drowning as a result of the January flood. In the City of San Buenaventura, the river overtopped its banks to the north and flooded agricultural land, severely damaging a golf course, the Ventura Marina, and the sewage treatment plant. Total damage to the marina and sewage treatment plant was estimated to be $4 million (Ventura County Flood Control District, September 1969).

Tributaries to the Santa Clara River also experienced considerable damage during these storms. The City of Santa Paula was seriously threatened on two occasions by Santa Paula Creek, requiring the evacuation of over 6,000 persons. The State Highway 150 Bridge over Santa Paula Creek was destroyed in addition to the railroad bridge over Sespe Creek. Both the Old Telegraph Road and State Highway 126 bridges over Sespe Creek in Fillmore were damaged. Damage was also reported to flood control improvements in Franklin-Wasson Barranca, Warring Canyon Creek, and Oxnard West Drain. Temporary repairs completed following the January flood were almost entirely destroyed by the February flood (Ventura County Flood Control District, 1969).

Other recent floods on the Santa Clara River occurred in 1938, January 1969, February 1969, 1978, 1983, and 1992. The 1938 flood was the largest recorded flood on the Santa Clara River prior to the 1969 floods. This flood had an estimated peak flow of 120,000 cfs and a recurrence interval, based on current runoff conditions, of approximately 20 years. It destroyed three spans of the State Highway 118 Bridge at Saticoy and washed out the Harbor Boulevard Bridge. The City of Fillmore was isolated by bridge failures cutting off highway travel in all directions. The flood severely disrupted electric, gas, telegraph, and telephone service. Many ranches experienced heavy damage to orchards located in the path of the flood. No other reliable estimates of flood damage are available for this flood event.

The 1943 flood caused severe damage to agricultural land, crops, and railroad tracks and bridges. In the City of Fillmore, it washed out the north approach to the Bardsdale Bridge. The west approach to the railroad bridge over Sespe Creek was washed out, and the west approach to the highway bridge over Sespe Creek was damaged. The estimated peak discharge on the Santa Clara River at Montalvo was 80,000 cfs, which is equivalent to a 13-year (7.9-percent-annual-chance) flood event based on current runoff conditions.

The 1952 flood caused an estimated peak discharge on the Santa Clara River at Montalvo of between 40,000 and 50,000 cfs, which is approximately a 8-year (13-percent-annual-chance) event based on current runoff conditions. It was responsible for severe erosion damage to properties along the river.

The March 1978 flood on the Santa Clara River at Montalvo had a peak discharge of 102,200 cfs, which is approximately a 15-year (5.9-percent-annual-chance) event based on current runoff conditions. The flood caused severe damage to roads, bridges, and agricultural land throughout the watershed. Sespe Creek in the City of Fillmore overtopped its banks to the east and severely damaged the western portion of the city.

The largest recorded flood on the Ventura River occurred in February 1978. The peak discharge reached 63,600 cfs at the gauging station just downstream from the confluence with Coyote Creek. This is equivalent to a recurrence interval of approximately 70 years. Other major floods on the Ventura River and their estimated recurrence interval based on current runoff conditions are as follows:

Date	Peak Discharge (cfs)	Recurrence Interval
February 1978	63,600	70 Years
January 1969	58,000	60 Years
February 1992	45,800	45 Years
January 1995	43,700	40 Years
January 2005	41,000	30 Years
February 1969	40,000	30 Years
March 1938	39,200	25 Years

The 1938 flood caused an estimated $1.3 million in damage to homes, businesses, agricultural land, transportation facilities, and utilities in the Ventura River area. In the City of San Buenaventura, residents were evacuated from their homes as floodwaters flowed through the west end of the city. Live Oak Acres was also heavily damaged along with the Foster Park diversion works and oil field equipment north of the City of San Buenaventura.

The 1943 flood threatened the west end of the City of San Buenaventura. The flows did not, however, overtop the channel banks and evacuation was not required. People were evacuated from their homes in Live Oak Acres, and rail and highway traffic were disrupted when landslides and washouts blocked transportation arteries.

Flood damage was estimated in excess of $16 million in the Ventura River watershed during the January and February 1969 floods. Major watercourses throughout the watershed were severely eroded or aggraded, depending on streambed slopes. Debris and boulders carried by flood flows from the mountains surrounding the Ojai Valley resulted in reduced channel capacities and bank overflow through orchards and residential areas.

The 1978 flood caused extensive damage to roads, bridges, sewer systems, agricultural property, and flood-control facilities in the upper Ventura River watershed. Traffic was disrupted by extensive road damage that occurred throughout the basin. Flood channels filled with debris and changed their course. Damage to residential property was especially severe in Casitas Springs, Live Oak Acres, and Hawthorne Acres.

Rainfall throughout the Calleguas Creek watershed is generally quite low and extremely variable, making the identification of the maximum flood of record extremely difficult. The largest flood of record in the City of Simi Valley occurred on February 16, 1980, and had a peak discharge of 9,310 cfs at the Madera Road Bridge from a drainage area of 71 square miles.

The maximum flood of record at the City of Moorpark occurred in March 1983, and had a peak discharge of 10,800 cfs. The major floods that have occurred at the two gages are as follows:

Date	Peak Discharge (cfs) City of Moorpark, Arroyo Simi	Peak Discharge (cfs) City of Simi Valley, Arroyo Simi
1983	10,800	10,700
1980	*	9,310
1992	*	9,140
1978	8,600	7,730
1998	*	6,610

Date	Peak Discharge (cfs) City of Moorpark, Arroyo Simi	Peak Discharge (cfs) City of Simi Valley, Arroyo Simi
1995	*	6,450
1969	6,500	6,330

*Data not available

Downstream of the Cities of Moorpark and Simi Valley along Calleguas Creek, in the vicinity of the California State University Channel Islands (CSUCI), the largest recorded flood occurred on March 1, 1983, with a peak discharge of 25,900 cfs. Other peak events that have occurred at this gage are as follows:

Date	Peak Discharge (cfs)	Recurrence Interval
March 1, 1983	25,900	30 Years
February 16, 1980	25,300	25 Years
February 6, 1998	21,600	20 Years
January 9, 2005	19,700	15 Years
March 4, 1978	18,700	15 Years
February 25, 1969	16,340	10 Years

Flood damage in the Calleguas Creek watershed is generally less than in other areas in the county and consists primarily of erosion and sedimentation to agricultural land, residential and business developments, transportation facilities, and channel improvements. Damage during the February 1980 flood totaled approximately $9 million. The damage occurred primarily at the Point Mugu Naval Air Missile Test Grounds, which was directly in line of the floodwaters that had breached the Calleguas Creek levees. In addition, approximately 1,500 acres of farmland were covered by floodwaters.

The Ventura County coastline is exposed to winter storms generated in the North Pacific Ocean and to summer storms generated in the South Pacific Ocean. Normally, the coastline is sheltered by Point Conception from ocean swells generated by the northern storms. On rare occasions when the storm track migrates far enough south, the county is exposed to those swells. Under these conditions, breakers of 6 to 10 feet have been observed, frequently causing damage to inadequately protected structures and facilities located along the shoreline. Areas particularly susceptible to severe wave action, erosion, and flooding include Sea Cliff Colony, Rincon Point Beach, Faria Beach Bank, Faria Beach Colony, Solimar Beach Colony, Oxnard Shores, Silver Strand Beach, and several sections of U.S. Highway 101 from Rincon Point to Emma Wood State Park (USACE, 1980).

A brief description of several significant storms provides historic information to which coastal flood hazards and the projected flood depths can be compared (State of

California, 1980; Daily Free Press, 1907; Ventura County Star Free Press, 1939; USACE, 1978; Steve Howe, 1978).

December 9, 1907

Four hundred feet or more of the Ventura County wharf was carried out to sea by high turbulent waves. Shortly after noon, the waves, concurrent with a high tide, lifted the deck of the wharf and deposited the deck and piles into the ocean. The entire deck was destroyed except for one pile indicating where the wharf had been. Later, the wreckage was washed onshore and the beach below Ash Street was strewn with lumber. The entire loss was difficult to estimate. Besides the loss to the structure itself, there was a loss of oil pipes and loading fixtures, a derrick engine, and lumber.

December 24, 25, and 26, 1939

The Ventura County coastline and particularly the Point Mugu-Hueneme Harbor area bore the brunt of a terrific storm which swept down the southland coast on December 24th. Twenty-four people were reported drowned when a fishing boat capsized. Several boats and pleasure craft were wrecked or sunk. The 60 mph gales which swept up the Pacific Ocean off Mexico destroyed the Point Mugu fishing pier, ripped out a 300-foot section of the Hueneme pier, and produced costly holes and gouges in the entrance channel of Port Hueneme.

December 1969

High waves stemming from intense storms in the Aleutian Islands hit the Ventura County shoreline from December 4 to 7. The swell was measured at 20 feet. From December 13 to 16 another set of waves damaged the beachfront road at Silver Strand Beach. A final set of waves hit the county shoreline on December 19th. Shorefront homes were damaged, and Mandalay Beach Road in Oxnard Shores was flooded. Total damage was estimated at hundreds of thousands of dollars.

The channel capacity of Rincon Creek is affected by the dense growth of trees and bushes in the main channel and overbank areas. Installation of the bridge culvert crossing U.S. Highway 101 and the Southern Pacific Railroad further obstructs the floodflow. During the 1969 storms, several near-bank residential houses along the reach downstream of the culvert were threatened by the floods, and one house near the ocean was badly damaged.

Winter 1977-1978

A combination of high astronomical tides, strong onshore winds, and high storm waves resulted in significant coastal flooding in Ventura County. Storm wave damage to private property in Ventura County exceeded $300,000. The major impact areas were Mussel Shoal, Faria Beach Colony, and Oxnard Shores. In Faria Beach Colony alone, over 25 beachfront homes suffered broken windows,

flooded interiors, and damaged or destroyed seawalls, bulkheads, stairs, patios, and decks.

Approximately $135,000 was required to restore state beaches and facilities damaged by storm waves. For example, at Emma Wood State Park, the beach and recreational vehicle parking area was eroded, the concrete base of a lifeguard tower was washed away, and the road into the park was destroyed.

Other damages resulting from high waves occurred at various points along the county coastline. Sections of old U.S. Highway 101 were damaged when protective rock was removed and debris deposited on the highway by wave action. The Ventura Marina was also damaged by wave action. Armor rock was badly displaced along parts of the marina breakwater, navigation lights were damaged, and a concrete walk was destroyed, requiring repairs amounting to between $200,000 and $300,000.

City of Camarillo

The Ventura County Watershed Protection District (VCWPD) maintains a stream gauging station (No. 806) on Calleguas Creek above U.S. Highway 101 (Ventura Freeway). The largest recorded flood on Calleguas Creek occurred on March 1, 1983. The peak discharge reached 17,200 cfs at the U.S. Highway 101 gauging station; this discharge is equivalent to a recurrence interval of approximately 30 years. Other peak events and estimated recurrence intervals that have occurred at this gage are as follows:

Date	Peak Discharge (cfs)	Approximate Recurrence Interval
March 1, 1983	17,200	30 Years
February 16, 1980	13,400	15 Years
February 12, 1992	12,560	15 Years
February 25, 1969	11,820	15 Years
March 4, 1978	9,970	10 Years

Unofficial records derived from statements by local residents indicate that large floods occurred in 1862, 1884, 1889, 1914, and 1916; the 1862 and 1884 floods were likely the largest of these unrecorded flows.

Previous studies of Calleguas Creek and its unimproved tributaries show water velocities from 1 to 12 feet per second (0.7 to 8.2 mph). Velocities greater than 3 feet per second (2.0 mph) in water deeper than 3 feet are considered hazardous.

Flood damage in the Calleguas Creek watershed generally consists of erosion and sedimentation to agricultural land, residential and business developments, transportation facilities, and channel improvements. However, in March 1983, flood flows broke through the leveed banks of Calleguas Creek in the lower reach below U.S. Highway 101

and caused an estimated $21.5 million in damage to agricultural properties. The City of Camarillo estimate of damage was $160,000. Damage during the February 1980 flood totaled approximately $9 million. This occurred primarily at the Point Mugu Naval Air Station, which was directly in the line of the floodwaters that had breached the Calleguas Creek levees. In addition, approximately 1,500 acres of farmland were covered by floodwaters.

The VCWPD also maintains a stream gauging station (No. 800) on Conejo Creek above U.S. Highway 101. The largest recorded flood on Conejo Creek also occurred on March 1, 1983. The peak discharge reached 13,300 cfs at the U.S. Highway 101 gauging station; this discharge is equivalent to a recurrence interval of approximately 20 years. Other peak events and estimated recurrence intervals that have occurred at this gage are as follows

Date	Peak Discharge (cfs)	Approximate Recurrence Interval
March 1, 1983	13,300	20 Years
February 16, 1980	11,800	15 Years
February 11, 1992	9,950	10 Years
March 4, 1978	9,830	10 Years
February 24, 1998	9,820	10 Years

Flood damage in the Conejo Creek watershed generally consists of erosion and sedimentation. In March 1983, estimated damage was approximately $1 million, with approximately 75 percent of that amount estimated for debris and silt removal to restore the creek capacity. Flood flows on Conejo Creek add to damages occurring from Calleguas Creek flood flows below the confluence of the two creeks.

City of Fillmore

The types of storms that occur in the Santa Clara River basin are general winter storms, thunderstorms, and tropical storms. General winter storms, characterized by high-intensity rainfall, combined with the effects of impervious soil types, sparse vegetation and steep gradients, result in high debris potential. The major obstructions restricting the flow are the bridges where debris might collect, causing backwater, overflow into overbank areas, or destruction of the bridge.

Damaging floods on the Santa Clara River and Sespe Creek in the vicinity of the City of Fillmore are known to have occurred as early as 1862. A large flood was experienced in 1914. Major recorded floods affecting the City of Fillmore area also occurred in 1938, 1943, 1969, 1978, 1983, 1992, 1995, 1998, 2005, and 2006. The largest natural flood of record on Sespe Creek occurred in January 2005, and the largest natural flood of record on Santa Clara River occurred in January 1969.

The following are the floods of record for both the Santa Clara River and Sespe Creek at the City of Fillmore:

Date	Discharges (cubic feet per second) Sespe Creek	Santa Clara River
January 2005	85,300	32,000
February 1978	73,000	22,800
January 1995	65,000	17,100
February 1998	62,500	*
January 1969	60,000	68,000
March 1938	56,000	24,000
March 1983	56,000	30,600
April 2006	44,600	*
February 1969	45,000	62,500
January 1943	44,000	*

*Discharges not recorded

The St. Francis Dam failure in March 1928 created the largest flood known to have occurred on the Santa Clara River. The dam was located in the San Francisquito Canyon in Los Angeles County; however, most of the damage occurred in Ventura County. Approximately 385 people were killed, 1,250 homes were destroyed, and all of the orchards on the Santa Clara River floodplain were washed away. The flood that resulted from the dam failure is classified as manmade; consequently, it is not considered representative of the type and severity of future natural floods.

The January 1969 flood had a recurrence interval of approximately 15 years on Sespe Creek and approximately 45 years on Santa Clara River. Sespe Creek was diverted from its normal course and inundated its east overbank all the way to a north-south line adjacent to A Street, damaging the Southern Pacific Railroad Bridge. The Santa Clara River inundated approximately 3,000 acres of orchards.

The February 1969 flood interrupted transportation on all sides of the city and caused more damage due to the still-saturated soils from the previous flood. This flood had a recurrence interval of approximately 10 years on Sespe Creek and approximately 35 years on Santa Clara River. Sespe Creek broke through its east bank again, and the Santa Clara River damaged the City of Fillmore sewage treatment plant and washed away 90 acres of orchards. Pole Creek was clogged with debris and broke out of its bank at the railroad bridge.

The largest flood of record for Sespe Creek occurred in January 2005. This flood had a recurrence interval of about 30 years on Sespe Creek and 15 years on Santa Clara River.

During floods along the Santa Clara River, the riverbanks are subject to erosion, and the river is subject to the formation of sandbars. These factors have had a significant effect in changing the river channel cross sections during large floods.

Sespe Creek is the largest tributary to the Santa Clara River within the study area. The creek leaves the canyon area and, at a point approximately 1 mile north of the City of Fillmore (3 miles northeast of the Santa Clara River confluence), the present streambed alignment turns southwest, and the streambed splits into two major flowlines that widen, meander, and are not well defined. During severe storms, the flow is usually not contained within the streambed through this turn to the southwest. The water overtops the southeasterly bank and flows directly south through the western part of the City of Fillmore into the Santa Clara River. Excessive debris, in the form of brush, soil, and rock (including large boulders), is carried along with the flood.

Pole Creek is a smaller tributary to Santa Clara River and has been improved by the VCWPD. This creek had a serious debris problem during the 1969 flood, when the channel filled up to the banks with debris.

City of Moorpark

Rainfall throughout the Arroyo Simi watershed is generally quite low and extremely variable, making identification of the maximum flood of record extremely difficult. The maximum flood of record on Arroyo Simi at the City of Moorpark occurred in March 1983 and had a peak discharge of 10,800 cfs. Other major floods occurred in 1969, with a peak discharge of 6,500 cfs, in 1970 with a peak discharge of 6,820 cfs, and in 1978 with a peak discharge of 8,600 cfs.

Flood damage in the Arroyo Simi watershed is generally lower than in other areas in the county. It consists primarily of erosion of and/or sedimentation to agricultural land, residential and business developments, transportation facilities, and channel improvements.

City of Ojai

The major watercourse through the City of Ojai is San Antonio Creek. Damaging floods along San Antonio Creek and its tributaries in the vicinity of the City of Ojai are reported to have occurred as early as 1862. Floods of sufficient magnitude to cause extensive damage occurred in 1862, 1867, 1884, 1911, 1914, 1938, and 1943. Major floods recorded along San Antonio Creek (those having a peak discharge of more than 3,500 cfs at the gauging station north of Casitas Springs) occurred in 1952, 1958, 1965, 1966, and 1969. The flood of January 25, 1969, had the largest recorded peak discharge (16,200 cfs).

Records of river stage and discharge in the San Antonio Creek basin have been maintained since the USGS began observations in 1949 with a gage presently located at the downstream side of the State Highway 33 Bridge, 0.9 mile north of Casitas Springs. Recorded peak flows at this gage for major floods in San Antonio Creek are shown below in order of magnitude:

Date	Peak Flows (cfs)	Approximate Recurrence Interval
January 2005	24,000	40 Years
January 1969	16,200	20 Years
January 1995	14,400	20 Years
February 1978	13,900	14 Years
February 1998	13,100	14 Years
February 1969	11,500	10 Years

Flooding is aggravated by several factors, such as inadequate channel cross sections, culverts at roadways, poor flow line alignment, excessive debris, and some encroachment of development.

The principal danger of flooding along the Fox Canyon Storm Drain is due to the inadequate inlet under Daly Road that could become clogged from debris generated upstream of Daly Road.

City of Oxnard

The coastal plain near the City of Oxnard is flat, with a slope to the ocean of approximately 10 to 20 feet per mile. The flat topography is a major factor in determining the flood hazards in the area and results in large areas of shallow flooding when the capacity of the existing flood control improvements is exceeded. Because of the relatively small drainage areas and the existing grade to the ocean, this shallow flooding reaches depths of 1 foot or greater only in areas where the topography and planimetric features join to restrict the flow. The significant shallow flooding areas occur on Beardsley Wash, El Rio Drain, Santa Clara Drain, Oxnard Industrial Drain, and Oxnard West Drain. Beardsley Wash, El Rio Drain, and Santa Clara Drain cause extensive shallow flooding upstream of U.S. Highway 101. Oxnard Industrial Drain causes shallow flooding at the intersection of Oxnard Boulevard (State Highway 1) and Date Street. Oxnard West Drain causes shallow flooding at the north side of the intersection of West Wooley Road and Ventura Avenue. The Southern Pacific Railroad roadway acts as a regulating control and creates a ponding area upstream of the railroad on Rice Avenue Drain. El Rio Drain creates a ponding area at the crossing of Ventura Road and the Southern Pacific Railroad. The most recent and maximum flood of record occurred in January 1969. This event caused a peak discharge of 165,000 cfs on the Santa Clara River and was considered a 2-percent-annual-chance event.

City of San Buenaventura

Future 1-percent-annual-chance flooding from the Ventura River will occur in an area west of the Ojai Freeway (State Highway 33) between Shell Road and Canada de San Joaquin, a small tributary just south of Shell Road. Flooding is caused by a constriction in the river at the Shell Road Bridge that forces water to the east under the Ojai Freeway

and then south. The 1-percent-annual-chance breakout is contained at Canada de San Joaquin by a stoplog dike. This dike has been certified by the VCWPD. The dike is not sufficient, though, to contain the 0.2-percent-annual-chance breakout, which will continue flowing southerly through the western part of the city.

In other portions of the study area, flooding consists of ponding and sheetflow during the less frequent flood events, caused primarily by manmade obstructions to flow in the channels. Overflow for the 0.2-percent-annual-chance event on Arundell Barranca at U.S. Highway 101 flows westerly to Barlow Barranca. Barlow Barranca has insufficient capacity at U.S. Highway 101 for both the land 0.2-percent-annual-chance floods; therefore, excess runoff flows westerly to the Mills Road Drain, which also has insufficient capacity at U.S. Highway 101. Overflow runoff continues westerly to Channel Drive, where it flows over the Southern Pacific Railroad tracks and returns to Arundell Barranca.

The Moon Ditch culverts under U.S. Highway 101 cannot convey the 1-percent-annual-chance flood discharge and the excess flows southeasterly along Ventura Boulevard and either returns at the Southern Pacific Railroad crossing or continues southeasterly to the Santa Clara River.

Peak flows in excess of the 2-percent-annual-chance flood in Brown Barranca above Blackburn Road overtop the eastern bank and flow southeasterly, where they pond along with excess flow from Franklin Barranca. During extreme events, the flows overtop the Santa Paula Freeway (State Highway 126). The 0.2- percent annual chance flood overtops the road crossings of Telegraph, Henderson, and Darling Roads, but the flows return to the channel downstream.

In Franklin Barranca, discharge in excess of the 1-percent-annual-chance event breaks out at Darling Road, and the sheetflow continues to the Santa Clara River through Saticoy.

City of Santa Paula

Santa Paula Creek, which flows south along the eastern corporate limits of the City of Santa Paula and into the Santa Clara River, has the greatest flood potential. The city has experienced inundation from both Santa Paula Creek and the Santa Clara River. The worst floods occurred in 1914 and 1938. In both floods, a large portion of the city was inundated.

City of Simi Valley

Low-lying areas adjacent to the Arroyo Simi and its tributaries are subject to periodic flooding. Significant floods occurred in 1978, 1980, 1983, and 1992. The highest discharge recorded within the City of Simi Valley was 10,570 cfs on March 1, 1983, at the Madera Bridge (County of Ventura, 1983). A flood peak of this magnitude has approximately a 3-percent chance of recurrence each year, a 30-year flood (County of Ventura, 1983).

Devastating floods struck Southern California during the periods of January 18-26 and February 20-26, 1969 (USACE, 1969). In Ventura County, the floods were the greatest recorded to that date. The January flood was a result of the highest monthly precipitation total ever recorded in Ventura County at that time. The February flood was a result of intense rainfall similar in magnitude to the rainfall that caused the record breaking flood of January 23-27. The damages from the February flood were by far the greatest in the history of Ventura County and were largely due to the reduced channel capacities resulting from debris and sediment deposition of earlier floods.

The January and February flood flows on the Arroyo Simi were mostly contained in the stream channel of the reach extending from Sinaloa Road to Tapo Street. Damages due to erosion, primarily affected grade stabilizers and rock revetments along the channel.

A debris-laden flow from an unnamed canyon tributary to Tapo Canyon threatened the destruction of three homes in the tributary. Flood flows from the North Simi Drain, a tributary of Arroyo Simi, deposited large quantities of sediment in an orange grove and on Cochran Street—a major thoroughfare in the City of Simi Valley. Flood flows on the Sycamore Canyon Creek overtopped the stream banks in the upstream reach and damaged a county golf course and Madera Road—another major thoroughfare.

In the Calleguas Creek watershed, which includes the City of Simi Valley, the highest peak flows ever recorded occurred on March 1, 1983. The peak flows near the mouth of Calleguas Creek reached the 3-percent-annual-chance flood level. In the center of Simi Valley, extensive overtopping of stabilizers widened the channel to twice its normal size. Peak flows lasted four hours. The sustained high velocity, debris-laden water tore at channel linings, undercut stabilizers and threatened adjacent homes (County of Ventura, 1983).

Sinaloa Dam in the Sycamore Canyon drainage became saturated and showed signs of sloughing. About 1,400 people living in 500 homes located below the dam were evacuated by the City of Simi Valley (County of Ventura, 1983).

City of Thousand Oaks

Portions of the South Branch Arroyo Conejo Channel are concrete-lined; and some portions are improved earth with dikes, with a slope range between 0.13 foot to 2.2 feet per 100 feet. The unlined portion of the channel is inadequate in size to convey the 1-percent-annual-chance frequency peak discharge, resulting in flooding.

Flooding due to the 1-percent-annual-chance frequency event is limited to the downstream portion of Lang Creek and the area between Wilbur Road to just north and east of Gainsborough Road.

Portions of Arroyo Conejo are enclosed in a conduit and other portions flow as open channels. The closed conduit is designed to carry the 5-percent-annual-chance frequency peak discharge with freeboard. The capacity of the conduit was checked at several places to ascertain whether it would carry the 1-percent-annual-chance peak discharge, and this was confirmed. However, flooding would occur at the 0.2-percent-annual-chance frequency event. Flow is restricted by inlet conditions at Hillcrest Drive and Westlake

Boulevard, where overland flow originates. Flows would then be in a southerly direction down Siena Drive towards the Ventura Freeway, then northwesterly and somewhat parallel to Ventura Freeway, and finally reentering the Arroyo Conejo conduit in the vicinity of Oakwood Drive. Average depth of flooding would be 0.5 foot for the 0.2-percent annual chance frequency event.

2.4 Flood Protection Measures

Ventura County

Structural flood protection measures in Ventura County include levees, retarding basins, dams, groin fields, rock revetments and the channelization of many watercourses which provide partial or complete protection from 1-percent-annual-chance floods.

The Santa Clara River has levees on its south bank intermittently from a point 14,000 feet above its mouth to a point approximately 50,000 feet above the mouth. At all locations, under a Provisionally Accredited Levee agreement, the levee either meets or exceeds the FEMA policy and, as such, is shown as provisionally providing protection against the 1-percent-annual-chance flood until such time that the provisional accreditation can be verified or it expires.

The Ventura River is contained on its east bank by a levee extending from its mouth upstream approximately 13,000 feet. This levee also exceeds all freeboard requirements and thus provides protection against the 1-percent-annual-chance flood.

The Ventura River has another levee on its east bank located in the area between 35,000 and 41,000 feet above the mouth. An initial hydraulic analysis of the river showed that the levee did not meet the minimum freeboard requirements. As a result, the river was reanalyzed under the assumption that the levee did not exist. The FIRM and Flood Boundary and Floodway Map (FBFM) reflect this second analysis. Calleguas Creek has levees on both banks within the area just upstream of the Point Mugu U.S. Naval Air Missile Test Grounds. These levees do not meet the minimum freeboard requirements and therefore were not considered in the hydraulic analysis. Cross sections were based upon the entire width of the floodplain with the recently improved Revolon Slough used as the west bank. As such, Revolon Slough is a secondary levee for Calleguas Creek and was analyzed under the levee policy criteria. All freeboard requirements were met or exceeded by the levee in the upper portion of the stream. Through the area where Revolon Slough parallels Calleguas Creek, however, the minimum 3.0 feet of freeboard was not maintained. As a result, the east bank of Revolon Slough with levees was removed and the area was reanalyzed using a combined flow of both channels. This also resulted in less than 3.0 feet of freeboard on the west bank levee; it too was removed. The breakout over the Revolon Slough levee is shown on the FIRM. Just above the Point Mugu U.S. Naval Air Missile Test Grounds the entire flow ponds behind State Highway 1. The length of road in which the water can weir across was significantly reduced recently by the construction of a floodwall by the U.S. Navy around a portion of their facilities.

Farther upstream on Calleguas Creek, near the City of Moorpark, the VCWPD has constructed a levee on the west bank in the area between approximately 111,500 and

113,800 feet above the mouth. This levee does not meet the minimum freeboard requirements and was not considered in the hydraulic analysis.

Approximately 2 miles upstream from the VCWPD levee, a private levee has been built on the north bank of Calleguas Creek. Because this is a privately owned levee, it cannot be considered in the hydraulic analysis due to the ownership maintenance requirements stated in the levee policy. Although the levee itself was not considered, the fill placed behind the levee appears to be placed in the floodplain to elevate the property above the BFE. As pre-fill topography is not available and neither is fill compaction data, the fill is assumed to wash away in a flood when the levee is removed. The floodplain is extended to the road, based on topographic data obtained from LiDAR mass-points provided by Ventura County.

The USACE has constructed a levee on the east bank of Sespe Creek. This levee, under a Provisionally Accredited Levee agreement, provisionally meets the minimum requirements and is shown as providing provisional protection against the 1-percent-annual-chance flood until such time that the provisional accreditation can be verified or it expires.

The VCWPD, along with Federal and other local agencies, constructed a number of flood protection and flood control facilities on channels throughout Ventura County. In addition, the State of California, the VCWPD, and various local water districts have constructed storage reservoirs on tributaries to the Ventura and Santa Clara Rivers and Calleguas Creek that have a major impact on peak flood flows.

In the Calleguas Creek watershed, the VCWPD has constructed numerous concrete-lined channels along tributaries to Calleguas and Conejo Creeks in the urban areas of Santa Susana and Newbury Park and the Cities of Camarillo, Moorpark, Simi Valley, and Thousand Oaks. Much of this work has been accomplished through a $32 million bond program approved in May 1967. The U.S. Soil Conservation Service (SCS), in cooperation with the Simi Valley and Calleguas Soil Conservation Districts and the VCWPD, has constructed channel improvements consisting of earth-bottoms, with concrete stabilizers, and rock-revetted side slopes on Calleguas Creek. These improvements are located in the Cities of Simi Valley, Moorpark, and in the vicinity of the City of Camarillo. In addition, the SCS, together with the VCWPD, has fully improved the Revolon Slough from U.S. Highway 101 downstream to its confluence with Calleguas Creek. The improvements are based upon a design flow which is in excess of the 1-percent-annual-chance discharge.

Since 1934, four major dams have been constructed on tributaries to the Santa Clara River. These dams, their locations, drainage areas, and dates of completion are listed in the following tabulation (PRC Toups, 1978):

Name of Dam	Location	Drainage Area (square miles)	Completion Date
Casitas	Coyote Creek	40	1959
Bouquet	Bouquet Canyon	14	1934
Matilija	Matilija Creek	55	1948
Santa Felicia	Piru Creek	422	1955
Pyramid	Piru Creek	293	1971
Castaic	Castaic Creek	154	1972

Pyramid Dam was constructed upstream of Santa Felicia Dam and it controls 293 square miles of the 422-square-mile watershed above Santa Felicia Dam. Since 1948, major dams have been constructed on two tributaries to the Ventura River. Matilija Dam was constructed on Matilija Creek approximately 16.2 miles upstream from the mouth. Although the dam controls approximately 55 square miles, its original storage capacity of 7,000 acre-feet is now less than 2,000 acre- feet because of sediment deposition and a project to lower the crest in 1965. Casitas Dam is located on Coyote Creek approximately 7 miles upstream from the mouth. With a storage capacity of approximately 250,000 acre-feet, it effectively controls runoff from an area of approximately 40 square miles. Casitas Dam filled for the first time in 1978 and has spilled minor amounts on various occasions since that time.

Channel improvements throughout the study area are listed below by the general type and degree of improvement. The rivers and streams that are listed more than once have significant reaches of different types of channel improvements along the reach studied. The following streams have portions of their channels, which are concrete-lined, with capacities equal to or greater than the 1-percent-annual-chance flood:

Stewart Canyon Creek
Happy Valley Drain
Real Canyon Wash
Revolon Slough
Arroyo Santa Rosa Tributary

The following watercourses have re-vetted levees designed to contain the 1-percent-annual-chance or greater flood:

Santa Clara River
Conejo Creek
Sespe Creek
Ventura River
Calleguas Creek

The following watercourses are stable, graded or natural channels that contain the 1-percent-annual-chance or greater flood:

Ventura River
San Antonio Creek
Coyote Creek
Santa Clara River
Calleguas Creek
Arroyo Santa Rosa
Conejo Creek
Bell Canyon Creek
Happy Valley Drain South
Santa Paula Creek (upstream of the City of Santa Paula)

The following are improved channels or natural watercourses that contain 10- percent annual chance or greater floods but that have inadequate capacities for containing the 1-percent-annual-chance flood:

San Antonio Creek	Santa Paula Creek
Sespe Creek	

The following are improved channels or natural watercourses that contain 10-percent-annual-chance or greater floods but that have inadequate capacities for containing the 1-percent-annual- chance flood:

Ventura River	Conejo Creek
San Antonio Creek	Sunset Hills Drain
McNell Creek	Arroyo Santa Rosa Tributary
Thacher Creek	Las Posas Estates Drain
Reeves Creek	Pleasant Valley Road Drain
Happy Valley Drain	Happy Valley Drain South
Miramonte Drain	Santa Clara Ditch
Live Oak Creek	Calleguas Creek
Santa Clara River	South Branch Arroyo Conejo
Sespe Creek	Gabbert Canyon Creek
Santa Paula Creek	Orcutt Canyon Creek
Peach Hills Wash	Waning Canyon Wash
Walnut Canyon Creek	Piru Creek
Arroyo Santa Rosa	

Debris basins have been constructed in the following tributary channels to reduce the downstream transport of debris:

Stewart Canyon Creek	Gabbert Canyon Creek
Real Canyon Wash	Las Posas Estates Drain
Waning Canyon Wash	

The VCWPD has jurisdiction over the bed and banks of these watercourses. Upon request, the VCWPD will furnish technical advice regarding flood hazards to proposed developments adjacent to any channel under its jurisdiction.

Major structural modifications have been made along the 42-mile coastline of Ventura County. Over 25 miles of seawalls and revetments have been constructed to halt erosion and to absorb the impact of wave forces. In addition, 11 groins, 3 breakwaters, and 7 jetties have been constructed to serve a number of purposes including flood protection (Martha J. Shaw, 1980; USACE, 1971).

Rock revetment has been constructed adjacent to State Highway 1 in the Rincon and Point Mugu areas, along the entrance road leading into Emma Wood State Beach, seaward from the homes at Seacliff Beach Colony, and seaward from the camping sites at

Hobson Park. Repairs were made on the old highway revetment from Hobson Park down coast to Emma Wood State Beach, which was damaged by the winter storms of 1977-1978. Immediately down coast from the south jetty at the City of Port Hueneme, the U.S. Navy has constructed a massive rock seawall to protect its property from flooding. Also, at the Point Mugu U.S. Naval Air Missile Test Grounds, a groin field and rock revetments have been constructed by the U.S. Navy to protect the military and recreational facilities (USACE, 1980).

Private Citizens along Oxnard Shores have attempted various shore protection devices to protect their homes, with varying degrees of success (USACE, 1980).

The City of Oxnard now requires new construction along the coastline to have higher flood elevations and to be built on piles (USACE, 1980).

The only major countywide nonstructural flood protection measure is the Public Warning System for severe weather conditions and tsunamis, operated by the U.S. Environmental Science Services Administration in cooperation with various State, county, and local officials (Diane Pierzinski, 1981). This system can provide some measure of flood protection by alerting the coastal residents to take necessary precautions in the event of a tsunami or major storm.

No Federal flood-control facilities exist on Rincon Creek. However, local interests have provided drainage and improvement projects that may reduce flood damages within the study area. After the 1969 storms, Rincon Creek was pilot- channeled from the ocean up to approximately 2,000 feet beyond the junction of Rincon Creek and Casitas Creek under the cooperation of Santa Barbara and Ventura Counties.

City of Camarillo

One stream within Camarillo has levees that protect a portion of the overbank area. On the southern end of the north bank of Conejo Creek, a levee is adjacent to the Leisure Village development. The freeboard requirement for this levee is 3.5 feet at the upper end of the levee, tapering down to 3 feet at the lower end. Another levee is located on the northern bank of the northern end of Conejo Creek, adjacent to the Leisure Village development. Following an initial hydraulic analysis of the channel, it was determined that both levees did not meet the freeboard requirements. As a result, flood hazards were reanalyzed under the assumption that the levees did not exist. Elevations of flood water entering the Leisure Village development from the northern end of Conejo Creek are not controlled directly by elevations on the adjacent reach of Conejo Creek. This shallow flooding was analyzed by approximate methods; therefore, no elevations or depths are presented on the maps.

Numerous channel improvements have also been made within the City of Camarillo. The entire length of Somis Drain is a reinforced-concrete trapezoidal channel. The Lewis Road Drain has been partially improved with reaches of reinforced-concrete trapezoidal channels and a reach of 48-inch reinforced-concrete pipe. The pipe is only capable of carrying the 10-percent-annual-chance flood. A facility along Lewis Road will have 1-percent-annual-chance flood-carrying capacity when complete; however, the facility will not be functional until the second unit of the project is completed. When completed, all

1-percent-annual-chance flooding will be contained. It is not known when the second unit will be installed; therefore, its effects are not included in the Countywide FIS study. Camarillo Hills Drain is a reinforced-concrete channel from its lower crossing of Las Posas Road to the upstream limit of detailed study. The channel has also been improved from its confluence with Revolon Slough to a point approximately 2,000 feet upstream. Mission Hills Drain has also been improved. It is a reinforced-concrete-lined trapezoidal channel from its confluence with Camarillo Hills Drain to approximately 2,025 feet upstream of Rocklyn Street. West Camarillo Hills Drain is a reinforced-concrete trapezoidal channel from its confluence with Camarillo Hills Drain upstream to Las Posas Road. Edgemore Drain is a reinforced-concrete channel from its confluence with Camarillo Hills Drain upstream to Las Posas Road; upstream of Las Posas Road, the drain is a natural channel. Crestview Drain has been improved with reinforced-concrete pipe in the upper section and a reinforced-concrete box conduit in the lower section. Las Posas Estates Drain is a reinforced-concrete trapezoidal channel from the U.S. Highway 101 crossing upstream to Central Avenue. Ponderosa Drain has been improved from its confluence with Camarillo Hills Drain to its upstream study limit. This section is a combination of both a reinforced-concrete trapezoidal channel and a length of reinforced-concrete box.

City of Fillmore

Levees have been erected at many places along Sespe Creek and Santa Clara River, but they are not stabilized and have been either washed out or overtopped by the past floods.

City of Moorpark

The VCWPD has constructed a levee on the west bank of Arroyo Simi between New Los Angeles Avenue and a point north of the Southern Pacific Railroad. This levee does not meet the FEMA requirements under CFR 44 65.10 and, as such, is shown as not providing protection against the 1-percent-annual-chance flood. Gabbert Canyon/Walnut Canyon Creek is a concrete-lined channel.

City of Ojai

A debris basin has been built at the mouth of Stewart Canyon Storm Channel that contains and regulates the outflow for both the 1- and 0.2-percent-annual-chance floods.

Below the basin, the USACE has built a reinforced-concrete channel and box to contain the 1- and 0.2-percent-annual-chance floods. This improvement extends from the spillway of the debris basin to approximately 200 feet downstream of the Southern Pacific Railroad crossing.

A reinforced-concrete channel has been built by the VCWPD from Grand Avenue to approximately 250 feet downstream of the Southern Pacific Railroad crossing. This channel, with existing freeboard, has the capacity to carry the 1-percent-annual-chance flood through this reach. The district has also installed a 72-inch cast-inplace pipe from Grand Avenue upstream to the Daly Road crossing. The lack of inlet control at this point results in shallow flooding that flows southward from the crossing. This pipe could carry

the 1-percent-annual-chance discharge for Fox Canyon at Daly Road, but lacks sufficient capacity to accommodate additional tributary inflow as it proceeds downstream.

There are several secondary drain improvements in the City of Ojai. These were designed for local drainage and do not have significant capacity when considering the impact of major floods.

The USACE has constructed a debris basin and channel to control a standard project design flood from Stewart Canyon Creek; therefore, all flood hazards along the Stewart Canyon Creek have been eliminated above the downstream end of the channel improvement.

City of Oxnard

Several flood control improvements in the City of Oxnard consist of concrete- lined channels designed by the VCWPD for a 2-percent-annual-chance frequency flood based on ultimate development of the drainage area. The improvement with the greatest impact in relieving potential flood damage to the city is the levee designed and built to contain the standard project flood (approximately a 300-year frequency flood) along the southerly bank of the Santa Clara River, which generally follows the City of Oxnard corporate limits. It should be noted that levee requirements for freeboard and maintenance have become more stringent since this levee was designed and built.

Watercourses in that study vary in type and degree of channel improvement. Doris Avenue, El Rio Drain, J Street Drain, Oxnard Industrial Drain (south of Oxnard Boulevard), Rice Avenue Drain, and West Wooley Drain have concrete-lined channels with conveyance capacity designed to be equal to or greater than the 1- percent annual chance floodflow. Some of these conveyance capacities have since been shown to be incorrect and are currently being re-studied.

City of San Buenaventura

In 1948, the USACE completed a levee along the eastern bank of the Ventura River extending approximately 2.6 miles upstream from its mouth at the Pacific Ocean. The levee provides flood protection in this reach of channel from floods up to and including the 1-percent-annual-chance flood.

Following the 1969 flood, the USACE constructed a levee parallel to Harbor Boulevard from the Santa Clara River north to the vicinity of Olivas Park Drive. It was designed to protect the Ventura Marina and the sewage treatment plant from all floods up to and including the 0.2-percent-annual-chance flood. The areas surrounding the levee, however, have since been filled in to the point that the levee is no longer in evidence. The elevations of the Olivas Park Golf Course have also been raised using sediment deposited in the marina during the 1969 flood (VCWPD, Personal Correspondence). The city has also encouraged the construction of a rubble embankment to further protect the golf course from floodflows. The embankment is not engineered, however, and may not withstand erosive velocities associated with a major flood in the river. Agricultural land along the northern bank of the Santa Clara River between U.S. Highway 101 and Harbor

Boulevard and the two city golf courses are still considered to be subject to severe flooding during the 1- and 0.2-percent-annual-chance floods.

The two streams in the City of San Buenaventura that have levees protecting portions of their overbank areas are the Ventura and Santa Clara Rivers. In both instances, the levees meet or exceed all requirements set forth in the FEMA policy and are shown as providing protection from the 1-percent-annual-chance flood.

The VCWPD has been active in the construction of channel improvements for all remaining channels in the study area. Telephone Road Drain, from its confluence with Arundell Barranca to the upstream limit of detailed study, has been improved to contain the 1-percent-annual-chance flood for development conditions at the time of that study.

Arundell Barranca has been improved from East Main Street to its outlet at the Ventura Marina. From the marina upstream to Harbor Boulevard, the channel is a rectangular, reinforced-concrete section with a 25-foot bottom width and 10-foot depth. From Harbor Boulevard to Mills Road, the rectangular concrete channel has a 20-foot bottom width and 6.5-foot depth. The final reach, from Mills Road to Main Street, has a 20-foot bottom width and 8-foot depth.

Brown Barranca is a natural earthen channel from its confluence with the Santa Clara River upstream to Henderson Road. From Henderson Road to Blackburn Road, the channel is made of concrete. The final reach, from Blackburn Road to approximately 500 feet upstream of Telegraph Avenue, is also a natural channel.

Franklin Barranca, from its confluence with the Santa Clara River to its confluence with Wasson Barranca, is a trapezoidal, reinforced-concrete channel. From the Santa Clara River to the Southern Pacific Railroad crossing, the channel has a 12-foot bottom width and a 5.5- to 6-foot depth. From the railroad to Wasson Barranca, the channel has a 14-foot bottom width and a 5- to 5.25-foot depth. Side slopes are 1.5 to 1. From Wasson Barranca upstream to Santa Paula Freeway (State Highway 126), the channel is a rectangular, reinforced-concrete channel with a 16-foot bottom width and 5-foot depth.

With the exception of road crossings and a short reach of reinforced-concrete box just below Telegraph Road, Harmon Barranca, throughout the detailed study reach, is a natural earthen channel with an average 20-foot bottom width and depth ranging from 7 to 35 feet.

Moon Ditch is a trapezoidal, reinforced-concrete-lined channel from the Santa Clara River to the U.S. Highway 101 crossing. The bottom width of the channel is 20 feet, the depth is 7.5 feet, and the side slopes are 1 to 1.

City of Santa Paula

No flood protection measures are in effect within the City of Santa Paula.

City of Simi Valley

In 1959, the VCWPD determined that improvements to Calleguas Creek and its tributaries were necessary because of urban development in the area. They adopted a 10-

year comprehensive plan for flood control and conservation of waters flowing in the principle storm water collecting conduits comprising the drainage network of Ventura County. The 10-year plan and subsequent additions included more than 12 projects within the City of Simi Valley. Those projects consisted of trapezoidal earth channels with rip-rap slope projections along the Arroyo Simi and reinforced concrete open channel along the tributaries of the Arroyo Simi. The design capacities of these projects were typically for 25- (4- percent annual chance) to 2-percent-annual-chance floods.

City of Thousand Oaks

The channel of the South Branch Arroyo Conejo is concrete lined from Ventu Park Road to the Ventura Freeway Culvert, with an average channel slope of 0.4 foot per 100 feet. From the Ventura Freeway Culvert to a point near Michael and Virginia Drives, the channel is improved earth with dikes, having an average slope of 0.13 foot per 100 feet of length. Portions of the South Branch Arroyo Conejo, between the corporate limits near Jenny Drive and Briar Road, are concrete lined, with channel slope variances of 0.25 foot to 2.2 feet per 100 feet.

Portions of Lang Creek, between its confluence with Arroyo Conejo and El Monte Drive, are concrete lined or contained in underground conduits. Recent channel improvements in the city have reduced the flooding problems. These improved channels include a segment of Lang Creek upstream of the El Monte Drive Culvert, a segment of Arroyo Conejo between Moorpark Road and Conejo Boulevard, and a downstream segment of South Branch Arroyo Conejo between Reno Road and approximately 200 feet upstream of Briar Road.

Arroyo Conejo is contained in an underground conduit between its confluence with North Drain and Greenwich Drive. Except for short segments of open channel, Arroyo Conejo, between the Moorpark Freeway and Hillcrest Drive, is a closed conduit.

Most of North Drain Creek has improved concrete lined channels and closed conduits.

North Fork Arroyo Conejo has an improved channel, with little or no floodplain. Below the improved channel, the channel is deeply incised and presents no flooding problem.

The flow in Potrero Valley Creek is controlled by two dams, Lake Sherwood and Lake Eleanor; and no flooding has occurred in this area since their construction.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of

experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge frequency relationships for each flooding source studied by detailed methods affecting the community.

3.1.1 Methods for Flooding Sources with New or Revised Analyses in Current Study

The hydrology for the revised study was retained from the effective analysis. The original 100 year event hydrograph data was applied using inflow nodes in a 1D/2D hydraulic model in the flood route modeling software FLO-2D. The resultant peak flow discharges for Camarillo Hills Drain, Edgemore Drain, Mission Drain, Ponderosa Drain, Somis Drain, and West Camarillo Hills Tributary are summarized in Table 5.

3.1.2 Methods for Flooding Sources Incorporated from Previous Studies

This section describes the methodology used in previous studies of flooding sources incorporated into this FIS that were not revised for this revised countywide study.

<u>Pre-countywide Analyses</u>

Hydrologic analyses were carried out to establish peak discharge frequency relationships for each flooding source studied by detailed methods affecting the community.

For each community within Ventura County that had a previously printed FIS report, the hydrologic analyses described in those reports have been compiled and are summarized below.

Peak discharges for the following streams were obtained from hydrology reports prepared by the USACE for use in Floodplain Information, Flood Insurance, and Special Flood Hazard Area Studies, or flood protection design projects (USACE, April 1973; USACE, 1970; USACE, March 1973; USACE, 1978; USACE, February 1977; USACE, August 1977):

Calleguas Creek	Santa Paula Creek
Conejo Creek	Sespe Creek
Reeves Creek	Stewart Canyon Creek
Revolon Slough	Thacher Creek
San Antonio Creek	Ventura River
Santa Clara River	

Peak discharges for the streams in Ventura County were computed by the study contractor using the USACE HEC-1 Flood Hydro-graph Package computer program (USACE, January 1973) unless otherwise noted. The program was used in conjunction with 2-percent-annual-chance rainfall intensities developed by the VCWPD to compute 2-percent-annual-chance peak flow rates. Base maps used in the hydrologic analysis consisted of USGS 7.5-minute series topographic maps (U.S. Department of the Interior, 1943, 1949, 1950, 1951, et cetera). However, many areas of Ventura County have experienced dynamic growth since the mapping revision; therefore, it was considered necessary to update the base maps in the field to ensure that developed areas used in that study conform to present conditions. Effective impervious percentages were assigned to each developed area using Figure 2 in the USGS report *Digital Simulation of the Effects of Urbanization on Runoff in the Upper Santa Ana Valley, California* (U.S. Department of the Interior, 1974).

Peak discharge-drainage area relationships are shown in Table 5. The discharges presented have been reviewed by the VCWPD, the USACE, Los Angeles District office, the Cities of Camarillo, Fillmore, and San Buenaventura.

Using the 2-percent-annual-chance flow as a base, discharges for the 10- and 1-percent annual chance recurrence intervals were then computed using ratios established from regionalized equations developed by the USGS and described in *Magnitude and Frequency of Floods in California_* (U.S. Department of the Interior, 1977). Discharges for the 0.2-percent-annual-chance event were estimated using a 0.2-percent/1-percent-annual-chance peak flow ratio developed from frequency tables for nearby long-term stream gauging stations computed by the USACE and the VCWPD. The frequency tables were computed using techniques outlined in U.S. Water Resources Council Bulletin No, 17, “Guidelines for Determining Flood Flow Frequency" (U.S. Water Resources Council, 1976).

Coastal flood hazard areas subject to inundation by the Pacific Ocean were determined on the basis of water-surface elevations established from regression relations defined by Thomas (FEMA, 1984). These regression relations were defined as a practical method for establishing inundation elevations at any site along the southern California mainland coast. They were defined through analysis of water-surface elevations established for 125 locations in a complex and comprehensive model study by Tetra Tech, Inc. (Tetra Tech, Inc., 1982). The regression relations establish wave run-up and wave setup elevations having 0.1, 0.01, and 0.002 chances of occurring in any year and are sometimes referred to as the 10-, 1-, and 0.2-percent-annual-chance flood events, respectively.

Wave run-up elevations were used to determine flood hazard areas for sites along the open coast that are subject to direct assault by deep-water waves. Run-up elevations vary with location and local beach slope and were computed at 0.5-mile intervals, or more frequently in areas where the beach profile changes significantly over short distances. Areas with ground elevations 3.0 feet or more below the 1-percent-annual-chance wave run-up elevation are subject to velocity hazard.

Wave setup elevations determined from the regression equations on the basis of location along the coast were used to identify flood hazard areas along bays, coves, and areas sheltered from direct action of deep-water waves.

Peak discharges for Calleguas and Conejo Creeks were taken from a hydrology report prepared by the USACE for use in a special flood hazard study of that area (USACE, January 1977).

An unpublished report (U.S. Department of the Army, 1973) prepared by the USACE in 1973 was utilized for the peak discharges for the Santa Clara River and Pole Creek. The original hydrologic study (USACE, 1973) used in preparation of the USACE's Flood Plain Information report provided peak discharges for the hydraulic analysis of Sespe Creek.

Peak discharges for Arroyo Simi were originally obtained from a hydrology report prepared by the USACE for use in a special flood hazard study (USACE, August 1977).

Peak discharges for San Antonio and Thacher Creeks were taken from a hydrology report prepared by the USACE (U.S. Department of the Army, 1973).

Peak discharges for the remaining streams studied were computed using the USACE HEC-1 Flood Hydrograph computer program (USACE, 1973). The program was set up to provide a Standard Project Flood discharge based on input parameters, as described in the USACE *Generalized Standard Project Rainflood Criteria* (USACE, 1967). A discharge-frequency curve developed by the USACE (USACE, March 1973) for North Fork Matilija Creek was used in reducing the standard project flood discharges to the discharges for the 10-, 2-, 1-, and 0.2-percent annual chance flood.

Standard Project Flood peak discharges were computed for each stream utilizing the USACE HEC-1 flood hydrograph computer program (USACE, 1973). The storm selected as critical for the study area is a high-intensity, 3-hour thunderstorm taken from a USACE report (USACE, 1967). The reservoir routing capability of the HEC-1 program was used where significant storage occurred. This was encountered on the El Rio Drain where a freeway embankment creates a considerable amount of ponding. The Rice Avenue Drain is intersected by a railway embankment that also causes ponding.

The only useful stream-gauging station within the study area is located on the Honda Barranca, a tributary to Beardsley Wash.

This USGS gage provided 19 years of record. This gage is generally representative of the steep, rural drainage area that is characteristic of the entire Beardsley Wash Basin. The remaining streams within the study region are in an urbanized area with relatively flat slopes. The Orange County Flood Control District's Westminster stream gage, located approximately 30 miles south of Los Angeles, was found to be in a similar hydrologic setting. This gage is considered

representative of these study streams and was utilized in the study. The Westminster gage provided 18 years of record.

Values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges at the gages were obtained from a log-Pearson Type III distribution of annual peak flow data (U.S. Water Resources Council, 1976). The Honda Barranca gage records contained several years of unusually low peaks, and the Beard adjustment for abnormally dry years was used (USACE, 1962). An adjustment to the annual flows from the Westminster gage was made to account for differences in imperviousness between the stream gage drainage area and the study area.

The Standard Project Flood was computed at the Honda Barranca stream gage. The 19 years of record at the Honda Barranca gage were plotted graphically using the Beard plotting positions (USACE, 1962). Because the five lowest values were observed to be unusually low, the Beard method to adjust for abnormally low years was used to calculate the Standard Project Flood at the gage and then plot the exceedence interval.

A comparison of the discharges computed by the log-Pearson stream gage analysis (U.S. Water Resources Council, 1976) of the Standard Project Flood indicated that the Standard Project Flood computed at the Honda Barranca gage has a recurrence interval of 500 years. Ratios of the 10-, 2-, and 1-percent-annual-chance frequency flows to the Standard Project Flood flow were taken from the discharge-frequency curves of the two stream gages and used to compute the selected frequency flows at the locations where the Standard Project Flood had been calculated.

Peak discharges for the Santa Clara River were taken from a hydrology report prepared by the USACE for use in conducting Flood Plain Information and Flood Insurance Studies (USACE, April 1973). Flow rates for the Ventura River were obtained from a similar USACE hydrology report (USACE, December 1970).

Flood discharges for the Santa Clara River and Santa Paula Creek were obtained from hydrology reports prepared by the USACE for use in floodplain information, flood insurance, and special flood hazard studies (USACE, April 1973; USACE, February 1977).

Part of the hydrologic analyses for Fagan and Adams Canyons, and breakout flows from Santa Paula Creek, involved evaluation of several hydrologic methods (USACE, December 3, 1969; USACE, August 1972; USACE, March 1972; USACE, April 1977). The peak discharges on Fagan Canyon were reduced from previously generated values (USACE, April 1977) to account for a change in drainage area size. For Adams Canyon, the peak discharges were determined using the unit hydrograph method. The record from the USGS stream gage listed as Santa Paula Creek near the City of Santa Paula was used along with historical flood information dating back to 1914 in order to develop the discharge-frequency relationship for Santa Paula Creek. This relationship was developed using log- Pearson Type III analyses (U.S. Water Resources Council, 1976).

These data were used to determine breakout flows from Santa Paula Creek shown as Profile Base Line Numbers 1, 2, and 3 along the streams.

For the main stem of Arroyo Simi below its confluence with Tapo Canyon and Runkle Canyon, a HEC-1 model developed by the Los Angeles District, USACE, for their 1987 Calleguas Creek Hydrology Report (USACE, 1987) was used. The model utilized a general storm of uniform precipitation over the entire 321 square mile Calleguas Creek watershed of which the Arroyo Simi sub-basin constituted 13 percent of the area.

For the upper reaches of Arroyo Simi and its tributaries within the City of Simi Valley, values were taken from VCWPD Modified Rational Method (Ventura County, 1985) computer output and adjusted for precipitation depth-area relation of the tributary area. This model better reflected the effects of local intense storms of the same recurrence interval on the smaller tributary areas. The two models produced similar results for the middle reaches of Arroyo Simi.

The peak discharge data for the 2-percent-annual-chance frequency flood event and the isohyetal map of mean annual precipitation were supplied by the VDWPD. Their hydrologic data were based on the U.S. Soil Conservation Service design hydrograph method (U.S. Department of Agriculture, 1971). An analysis was made to determine the relationship between the desired 10-, 1-, and 0.2- percent annual chance frequency events to the available 2-percent-annual-chance frequency event. The design hydrograph method, Soil Conservation Service Revolon-Beardsley hydrologic data, and stream gage analyses were considered in determining this relationship.

Revised Analyses for the First Countywide FIS

A regional flood frequency analysis was performed for Rincon Creek to determine the peak flood discharges of selected recurrence frequencies. The analysis was based on log-Pearson type III flood frequency distribution. To determine the distribution parameters for the ungaged Rincon Creek, six nearby coastal streams including Carpinteria, Atascadero, San Jose, Gaviota, Jalama Creeks, and Los Laureles Canyon were selected to establish the regional equations. Gage statistics including mean and standard deviation for the above six streams were computed using Bulletin 17B guidelines (U.S. Department of the Interior, 1982). The procedures used included adjusting the statistics of stations having discharges identified as low outliers. A regional skew coefficient of -0.2 was used (USACE, 1985). The calculated mean annual peak discharge versus drainage area and the calculated standard deviation versus drainage area were plotted and the least-square regression equations were derived for mean annual peak discharge and standard deviations. Using the derived equations, mean and standard deviations for Rincon Creek were calculated to be 2.7378 and 0.5852, respectively. The calculated peak flood discharges for selected recurrence frequencies are located in the Summary of Discharges table (Table 5).

Due to insufficient capacity of the culvert under U.S. Highway 101 and the Southern Pacific Railroad, channel breakout along Rincon Creek will occur at the

upstream culvert entrance during a 1-percent-annual-chance flood event. The breakout flow will travel in the form of sheet low through the highway underpass and return to the creek downstream of the culvert. The peak discharges for the 1-percent annual chance flood shown in the Summary of Discharges table (Table 5) have been adjusted to account for the breakout and return of floodwater. The breakout discharge was determined to be 1,820 cfs.

Analyses for the First Countywide FIS

Peak discharge values for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods were obtained from the report entitled "Calleguas Creek Watershed Hydrology Study" dated March 2003. The flow events are treated independently and in locations where two reaches combine the larger discharges are used. Peak discharges were determined in the countywide FIS study by use of the Ventura County Modified Rational Method (VCRAT) version 2.2-computer program

A summary of peak discharge-drainage area relationships for all streams studied by detailed methods is shown in Table 5, "Summary of Discharges."

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods for the flooding sources studied by detailed methods and are summarized in Table 6, "Summary of Elevations."

Table 5: Summary of Discharges

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
ADAMS CANYON					
At Telegraph Road	8.40	1,200	3,100	4,200	7,400
ALAMOS CANYON					
At Southern Pacific Railroad	6.00	*	*	3,800	*
ARROYO LAS POSAS					
Upstream of confluence of Peach Hill Wash	117.40	8,260	17,120	22,090	36,520
Downstream of confluence of Long Canyon Creek	143.35	9,390	19,460	25,100	41,500
ARROYO SANTA ROSA					
Upstream of confluence With Arroyo Conejo	14.35	1,970	3,770	4,740	7,510
At confluence of Tributary to Arroyo Santa Rosa	13.04	1,980	3,800	4,770	7,570
At East Las Poras Road	8.33	1,861	3,561	4,473	7,099
At Santa Rosa Road	8.61	1,770	2,610	2,830	3,650
Downstream of Duval Road	9.29	1,750	2,580	2,790	3,580
ARROYO SIMI					
Downstream of confluence with Happy Camp Canyon Creek	113.20	8,300	17,200	22,190	36,670
Downstream of Alamos Canyon	88.70	5,670	13,060	17,460	31,200
Downstream of Brea Canyon	80.20	5,570	12,820	17,140	30,530

*Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
ARROYO SIMI (CONTINUED)					
Downstream of North Simi Canyon	69.50	5,600	12,890	17,240	30,810
Upstream of Bus Canyon Drain	61.50	5,110	11,950	15,900	28,580
Upstream of Tapo Canyon Channel	32.30	4,440	10,220	13,670	24,420
Downstream of Meier Canyon	30.90	4,460	10,270	13,730	24,540
Upstream of Las Llajas Canyon Channel	10.40	2,410	5,540	7,400	13,230
Upstream of White Oak Canyon	2.70	1,000	2,300	3,080	5,500
ARUNDELL BARRANCA					
At U.S. Highway 101	9.24	1,360	4,420	6,200	11,500
BARLOW BARRANCA					
At U.S. Highway 101	2.13	380	1,250	1,700	3,200
BEARDSLEY WASH					
At Ventura Freeway	15.00	2,100[1]	4,600[1]	6,200[1]	11,000[1]
Upstream of Wright Road	14.00	2,300	5,000	6,800	12,000
BELL CANYON CREEK					
Upstream of Ventura/Los Angeles County boundary (approximately 1,860 feet downstream of East Bell Canyon Road)	5.13	700	2,340	3,300	6,200

[1] Decrease due to overbank losses upstream

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
BELL CANYON CREEK (CONTINUED)					
Upstream of elevation 1,128 feet (approximately 2150 feet downstream of North Buckskin Road)	3.32	490	1,650	2,300	4,300
BREA CANYON					
At confluence with Arroyo Simi	2.10	*	*	1,250	*
BROWN BARRANCA					
At confluence with Santa Clara River	3.49	600	1,930	2,660	5,000
Upstream of Telegraph Road	1.81	325	1,050	1,450	2,700
BUS CANYON DRAIN					
At confluence with Arroyo Simi	5.10	*	*	3,050	*
Above confluence of Bus Canyon Drain Tributary	3.70	*	*	2,800	*
BUS CANYON DRAIN TRIBUTARY					
At First Street	1.10	*	*	1,300	*
At Fitzgerald Road	0.80	*	*	1,050	*
CALLEGUAS CREEK					
At Highway 1	262.00	12,230	28,140	37,630	67,240
Downstream of confluence of Conejo Creek	248.30	16,000	30,610	38,460	61,030

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
CALLEGUAS CREEK (CONTINUED)					
Upstream of Conejo Creek & Lewis Drain	168.70	10,390	21,520	27,770	45,900
At Seminary Road	164.90	10,350	21,450	27,680	45,760
CAMARILLO HILLS DRAIN					
Upstream of confluence with Revolon Slough	8.1	1,720	3,564	3,564	7,620
Upstream of confluence of Las Posas Estates Drain[1]	7.5	1,670	3,336	3,336	7,440
Downstream of confluence of Crestview Drain	5.55	1780	3,640	4,790	7,920
At Ventura Freeway	*	*	*	3,220	*
At Lantana Street	*	*	*	2,226	*
At Dunnigan Street	*	*	*	842	*
Downstream of Ponderosa Drive	*	*	*	737	*
CONEJO CREEK					
At confluence with Calleguas Creek	77.60	9,300	17,800	22,300	35,500
At Highway 101 bridge	71.90	9,560	18,300	22,000	36,500
Downstream of confluence of Arroyo Conejo	60.00	9,660	18,500	23,200	36,900
COYOTE CREEK					
Upstream of Confluence with Ventura River	41.30	500	1,450	2,500	3,450
Downstream of Casitas Dam	38.70	100	300	2,100	3,040

* Data not available

[1]Decrease due to Bajo Aqua timing of hydrograph attenuation

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
DORIS AVENUE DRAIN					
At Patterson Road	0.40	50	150	250	750
DRY CANYON DRAIN					
At Heywood Street	3.70	*	*	3,350	*
At Southern Pacific Railroad	2.90	*	*	2,400	*
At Highway 118/Simi Valley Freeway	2.20	*	*	1,750	*
EDGEMORE DRAIN					
Downstream of Getman Street	*	*	*	451	*
Downstream of Aileen Street	*	*	*	366	*
EL RIO DRAIN					
At Confluence with Santa Clara River	1.70	90	220	300	800
At Vineyard Avenue	1.60	90	190	250	800
Downstream of Ventura Freeway	1.40	90	160	200	760
Upstream of Ventura Freeway	0.87	170	450	580	1,100
Downstream of Walnut Drive	0.26	70	170	220	400
ERRINGER DRAIN					
Upstream of confluence with Arroyo Simi	1.40	*	*	1,420	*
At Arcane Street	1.30	*	*	1,410	*
At Fitzgerald Street	1.20	*	*	1,410	*
FAGAN CANYON					
At the Southern Pacific Railroad tracks	3.40	800	2,100	2,800	5,200

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
FOX CANYON STORM DRAIN					
At confluence with Steward Canyon	2.30	1,400	2,300	2,800	4,000
FRANKLIN BARRANCA					
At confluence with Santa Clara River	4.96	700	2,380	3,350	6,200
Upstream of Santa Paula Freeway	1.47	250	820	1,140	2,100
HAPPY VALLEY DRAIN					
Upstream of diversion with Happy Valley Drain South	1.22	275	840	1,140	1,950
Upstream of El Roblar Drive	0.42	110	350	480	810
HAPPY VALLEY DRAIN SOUTH					
At Cruzero Street	0.59	130	240	360	510
HARMON BARRANCA					
At confluence with Santa Clara River	5.28	700	2,320	3,270	6,100
Upstream of Telephone Road	4.59	610	2,070	2,900	5,400
HUMMINGBIRD CREEK					
At Alscot Avenue	1.90	*	*	1,790	*
At Kyehner Drive	1.80	*	*	1,570	*
At Freeway	1.60	*	*	1,480	*
J STREET DRAIN					
At mouth	1.90	200	550	900	3,000
At Pleasant Valley Road	1.70	200	500	850	2,900

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
J STREET DRAIN (CONTINUED)					
At Bard Road	1.50	150	450	750	2,450
At Redwood Street	0.90	100	300	450	1,500
LANG CREEK					
Upstream of confluence of Arroyo Conejo	6.80	1,390	2,670	3,350	5,320
Downstream of Wilbur Road	6.00	1,390	2,610	3,280	5,210
LAS LLAJAS CANYON CHANNEL					
At Industrial Street	12.50	*	*	2,800	*
LAS POSAS ESTATES DRAIN					
Upstream of confluence with Camarillo Hills Drive	2.50	380	1,240	1,710	3,200
Northeast of Central Avenue at elevation 103 feet	1.88	310	980	1,360	2,600
MILLS ROAD DRAIN					
At U.S. Highway 101	1.30	240	790	1,100	2,000
MIRAMONTE DRAIN					
Upstream of Ventura River	1.51	360	1,050	1,420	2,420
Upstream of confluence of Happy Valley Drain South	0.79	200	600	810	1,390
Upstream of Loma Drive	0.32	90	290	390	670

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
MISSION DRAIN					
Downstream of Glenbrook Avenue	*	*	*	570	*
Downstream of Coe Street	*	*	*	666	*
NORTH SIMI DRAIN					
At confluence with Arroyo Simi	2.20	*	*	1,952	*
At First Street	1.80	*	*	1,610	*
At Simi Valley Freeway	1.40	*	*	789	*
OXNARD INDUSTRIAL DRAIN					
At mouth	8.90	500	1,400	2,100	7,600
Above confluence of Rice Avenue Drain	3.40	250	600	950	3,400
At East Wooley Road	1.90	150	400	650	2,300
OXNARD WEST DRAIN					
At Edison Company Water Canal	4.90	400	1,050	1,750	5,850
At Channel Islands Boulevard	3.50	300	800	1,300	4,400
At West Hemlock Street	3.20	300	750	1,250	4,100
At Wooley Road	2.80	250	620	1,050	3,450
At West Fifth Street	2.20	200	500	800	2,650
PEACH HILL WASH					
Upstream of confluence with Calleguas Creek/Arroyo Las Posas/Arroyo Simi	3.95	700	1,450	1,870	3,090
Upstream of Home Acres Drive	2.60	470	970	1,250	2,060

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
PEACH HILL WASH (CONTINUED)					
Downstream of confluence of Small Dam/Debris Basin Dike	1.13	530	1100	1,420	2,350
Upstream of Peach Hill Road	0.43	240	500	650	1,080
PIRU CREEK					
At confluence with Santa Clara River	441	2,500	33,000	41,000	60,000
POLE CREEK					
At confluence with Santa Clara River	7.80	2,000	4,500	5,700	10,000
PONDEROSA DRAIN					
Downstream of Mobil Avenue	*	*	*	308	*
REEVES CREEK					
At confluence with Thacher Creek	4.70	1,500	3,500	4,400	6,100
At mouth of canyon	2.30	900	2,100	2,600	3,600
REVOLON SLOUGH					
Downstream of Camarillo Hills Drive	38.70	2,500	7,100	10,000	20,000
At Highway 101	30.00	2,200	6,200	8,700	16,500
RICE AVENUE DRAIN					
At Rose Avenue	4.40	230	600	900	3,050
At Etting Road	4.10	200	550	800	2,600

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
RICE AVENUE DRAIN (CONTINUED)					
At Ventura County limits south of Wooley Road	2.20	50	110	150	1,500
At downstream crossing of Southern Pacific Railroad	1.90	30	45	50	1,500
Approximately 500 feet upstream Southern Pacific Railroad crossing	1.30	110	300	500	1,650
RINCON CREEK					
At confluence with Pacific Ocean	14.60	2,990	7,530	10,320	*
At U.S. Highway 101 culvert	14.60	2,990	7,530	8,500	*
Upstream of U.S. Highway 101 culvert	14.60	2,990	7,530	10,320	*
RUNKLE CANYON					
At confluence with Arroyo Simi	2.80	*	*	1,400	*
At Fitzgerald Road	2.40	*	*	1,200	*
SAN ANTONIO CREEK					
At confluence with Ventura River	51.20	7,000	15,700	19,900	30,000
Downstream of confluence of Lion Creek	46.70	6,400	14,400	18,200	27,400
Upstream of confluence of Lion Creek	34.00	5,200	11,700	14,800	22,300
Downstream of confluence of Stewart Canyon	31.50	4,900	11,000	14,000	21,000
Upstream of confluence of Stewart Canyon	26.00	4,200	9,500	12,000	18,000

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
SAN ANTONIO CREEK (CONTINUED)					
Downstream of confluence of Thacher Creek	24.90	4,200	9,600	12,000	18,000
Upstream of confluence of Thacher Creek	15.00	2,500	5,600	7,000	11,000
Upstream of confluence of McNell Creek	12.10	2,500	5,600	7,00	11,000
Downstream of confluence of Gridley Canyon	9.70	2,100	4,700	5,800	9,200
SANTA CLARA DITCH					
Upstream of Nyeland Sump	9.26	920	3,120	4,430	8,200
Upstream of Central Avenue	6.65	750	2,530	3,580	6,600
SANTA CLARA RIVER					
At mouth	1,625	41,000	116,000	161,000	270,000
At Willard Bridge	1,534	41,000	116,000	161,000	270,000
Upstream of confluence of Santa Paula Creek	1,505	40,000	113,000	157,000	265,000
Downstream of confluence of Sespe Creek	1,500	40,000	113,000	157,000	265,000
Upstream of confluence of Sespe Creek	1,182	23,000	66,000	92,000	160,000
Downstream of confluence of Hopper Creek	1,174	40,000	113,000	157,000	265,000

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
SANTA CLARA RIVER (CONTINUED)					
Downstream of confluence of Piru Creek	1,100	40,000	113,000	157,000	265,000
At Ventura County/Los Angeles County boundary	644	15,000	43,000	60,000	104,000
SANTA CLARA RIVER BREAKOUT					
At mouth at Pacific Ocean	*	*	28,000	73,000	182,000
SANTA PAULA CREEK					
Downstream of confluence with Mud Creek (north of the City of Santa Paula)	42	7,300	19,000	28,000	51,000
At stream gauging station	40	6,800	18,000	26,000	48,000
SESPE CREEK					
Approximately 4,000 feet downstream of Highway 126	263	33,000	72,000	92,000	145,000
Approximately 5,000 feet upstream of Southern Pacific Railroad	259	29,000	62,000	80,000	131,000
SOMIS DRAIN					
At Corby Avenue	*	*	*	582	*
At Shepherd Drive	*	*	*	952	*
SOUTH BRANCH ARROYO CONEJO					
Upstream of Ventura Freeway	10.72	1,470	4,850	6,800	12,800
Upstream of Jenny Drive Extension	7.46	1,210	4,000	5,700	10,700

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
STEWART CANYON					
Upstream of confluence with San Antonio Creek	5.00	1,400	3,800	5,500	7,900
STEWART CANYON STORM CHANNEL					
At confluence with San Antonio Creek	5.00	2,400	4,600	5,500	7,900
Upstream of confluence with Fox Canyon	2.60	980	2,200	2,700	3,900
SYCAMORE CANYON					
Below detention dam	*	*	*	184	*
TAPO CANYON CHANNEL					
At confluence with Arroyo Simi	20.70	*	*	8,500	*
At Tapo Canyon Road	17.80	*	*	8,500	*
TELEPHONE ROAD DRAIN					
At confluence with Arundel' Barranca	2.02	430	1,290	1,760	3,300
Upstream of U.S. Highway 101	1.68	375	1,110	1,500	2,800
THACHER CREEK					
At confluence with San Antonio Creek	10.60	2,300	5,400	6,800	9,500
Downstream of confluence of Reeves Creek	8.70	2,200	5,200	7,600	9,200
Upstream of confluence of Reeves Creek	3.70	1,100	2,500	3,200	4,500
At mouth of canyon	3.30	1,300	3,000	3,800	5,300

* Data not available

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
THOUSAND OAKS NORTH DRAIN					
Upstream of confluence of Arroyo Conejo	1.26	780	1,490	1,870	2,970
At State Highway 23	1.13	740	1,420	1,780	2,830
At La Jolla Drive	0.90	630	1,210	1,530	2,420
TRIBUTARY TO ARROYO SANTA ROSA					
Upstream of confluence with Arroyo Santa Rosa	3.75	950	2,590	3,700	6,720
At Vista Arroyo Drive	1.73	550	1060	1330	2110
VENTURA RIVER					
At Pacific Ocean	226	34,000	67,000	78,000	103,000
At Shell Chemical Plant	222	34,000	66,000	77,000	102,000
At Casitas Vista Road	184	30,000	58,000	68,000	90,000
At Casitas Springs	143	29,000	55,000	65,000	86,000
At Baldwin Road	81	16,000	31,000	36,000	48,000
Downstream of confluence of North Fork Matilija Creek	70.40	15,000	30,000	34,500	46,000
Upstream of confluence of North Fork Matilija Creek	54.30	12,000	23,500	27,500	36,500
WALNUT CANYON DRAIN					
At Walnut Canyon Road	0.61	310	640	820	1,360

Table 5: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
WEST CAMARILLO HILLS TRIBUTARY					
At Euclid Avenue	*	*	*	820	*
WEST WOOLEY DRAIN					
At West Hemlock Street	0.80	100	300	450	1,550
At Ventura Railway crossing	0.20	25	70	100	390
WHITE OAK CREEK					
At confluence with Arroyo Simi	4.20	*	*	3,470	*
At confluence of Hummingbird Creek	3.70	*	*	2,670	*
At freeway	1.50	*	*	960	*

* Data not available

Table 6: Summary of Elevations

Flooding Source	Wave Run-up[1] Elevation (feet NGVD)*		
	10-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
PACIFIC OCEAN			
At mouth of Rincon Creek	9.6	11.5	13.7
At Ocean Avenue	10.3	12.8	15.1
At GP Pier	11.9	15.5	18.0
At Mobil Pier	10.2	12.6	14.9
At mouth of Madranio Canyon Creek	9.4	11.2	13.3
At mouth of Padre Juan Canyon Creek	10.3	12.8	15.0
Approximately 100 feet south of intersection of Padre Juan Canyon Road and Pacific Coast Highway	9.6	11.6	13.8
Approximately 50 feet south of Pacific Coast Highway at a point 2,500 feet east of its easternmost intersection with Solimar Beach Road	10.7	13.4	15.8
Approximately 200 feet south of the Southern Pacific Railroad at a point 8,000 feet west of its crossing of the Ventura River	10.3	12.6	15.0
Approximately 150 feet south of the Southern Pacific Railroad at a point 5,000 feet west of its crossing of the Ventura River	10.9	13.7	16.1
Approximately 400 feet west of the Southern Pacific Railroad at a point 3,400 feet west of its crossing of the Ventura River/At Ventura River	9.7	11.5	13.9
At a point 2,000 feet north of the Channel Islands Harbor Outlet/ At mouth of Santa Clara River	10.3	12.7	15.0
At Channel Islands Harbor	7.4[2]	8.1[2]	9.3[2]
At a point 2,000 feet south of the Channel Islands Harbor Outlet	13.2	15.9	17.3
At Point Mugu	19.2	27.5	31.3

[1] Average elevations given; elevation may vary in area cited

[2] Wave setup elevation

Table 6: Summary of Elevations (continued)

Flooding Source	Wave Run-up[1] Elevation (feet NGVD)*		
	10-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
PACIFIC OCEAN (CONTINUED)			
Approximately 75 feet south of Pacific Coast Highway at the point where it is 3,000 feet west of its crossing of La Jolla Canyon Creek	13.8	18.4	21.4
Approximately 300 feet southwest of the Pacific Coast Highway crossing of La Jolla Canyon Creek	12.1	15.5	18.3
At the mouth of La Jolla Canyon Creek	10.6	13.1	15.6
Approximately 100 feet southwest of Pacific Coast Highway at the point where it is 2,000 feet west of its crossing of Big Sycamore Canyon Creek	12.1	15.5	18.2
Approximately 300 feet west of the mouth of Big Sycamore Canyon Creek	16.2	22.4	25.8
At the mouth of Big Sycamore Canyon Creek	10.6	13.0	15.5
Approximately 100 feet south of Pacific Coast Highway at the point where it is 3,000 feet east of its crossing of the Big Sycamore Canyon Creek	16.2	22.4	25.8
Approximately 50 feet south of Pacific Coast Highway at the point where it is 4,500 feet east of its crossing of Big Sycamore Canyon Creek	13.1	17.2	20.1
Approximately 200 feet south of Pacific Coast Highway at the point where it is 3,500 feet west of its crossing of Deep Canyon Creek	11.6	14.7	17.4
Approximately 200 feet south of Pacific Coast Highway at the point where it is 1,000 feet west of its crossing of Deep Canyon Creek	12.0	15.4	18.1
At the mouth of Deep Canyon Creek	11.6	14.7	17.4
Approximately 300 feet south of the intersection of Pacific Coast Highway and Yerba Buena Road	11.1	13.9	16.5

[1] Average elevations given; elevation may vary in area cited

Table 6: Summary of Elevations (continued)

Flooding Source	Wave Run-up[1] Elevation (feet NGVD)*		
	10-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
PACIFIC OCEAN (CONTINUED)			
Approximately 600 feet south of the intersection of Pacific Coast Highway and South Beach Club Way	11.4	14.4	17.0
Approximately 400 feet south of Pacific Coast Highway at the point where it is 2,500 feet east of its intersection with South Beach Club Way	11.2	14.0	16.6
At Ormond Beach	10.5	12.8	15.3
Approximately 900 feet south of intersection of Figueroa Street and East Harbor Boulevard	12.1	15.7	18.3
Approximately 1,000 feet southwest of intersection of South Seaward Avenue and Pierpont Boulevard	9.7	11.5	13.9
At Ventura Marina	7.4[2]	8.1[2]	9.3[2]

[1] Average elevations given; elevation may vary in area cited
[2] Wave setup elevation

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

Roughness coefficients (Manning's “n”) were chosen by engineering judgment and based on field observation of the channel and floodplain areas Table 7, “Manning’s ‘n’ Values,” contains the channel and overbank "n" values for the streams studied by detailed methods.

Table 7: Manning's "n" Values

Flooding Source	Channel "n"	Overbank "n"
Adams Canyon	0.060	*
Arundell Barranca	0.015	0.030
Arroyo Simi	0.015-0.120	*
Barlow Barranca	0.024	*
Brown Barranca	0.015-0.030	0.050
Calleguas Creek	0.030-0.035	0.040-0.090
Camarillo Hills Drain	0.030-0.060	0.030-0.040
Conejo Creek	0.025-0.030	0.15
Edgemore Drain	0.030-0.036	0.035-0.221
Fagan Canyon	0.014	0.035
Fox Canyon Storm Drain	0.015-0.035	0.020-0.060
Franklin Barranca	0.015	0.030-0.100
Harmon Barranca	0.040	0.070
Las Posas Estates Drain	0.015-0.050	0.040-0.070
Mills Road Drain	0.015	*
Mission Drain	0.03-0.043	0.035-0.221
Pole Creek	0.015-0.040	0.040-0.070
Rincon Creek	0.012-0.125	0.060-0.150
San Antonio Creek	0.032-0.036	0.030-0.043
Santa Clara River	0.025-0.030	0.040-0.070
Santa Paula Creek	0.035	*
Sespe Creek	0.060	0.070
Somis Drain	0.03-0.045	0.035-0.221
Stewart Canyon Storm Channel	0.015-0.040	0.040
Telephone Road Drain	0.015	*
Thacher Creek	0.030-0.035	0.020-0.035
Ventura River	0.025-0.040	0.040-0.050
West Camarillo Hills Tributary	0.030-0.039	0.035-0.221

* Data not available

Elevation reference marks (ERMs) used in this study, and their descriptions, are shown on the FIRM. ERMs shown on the FIRM represent those used during the preparation of this and previous FISs. The elevations associated with each ERM were obtained and/or developed during FIS production to establish vertical control for determination of flood elevations and floodplain boundaries shown on the FIRM. Users should be aware that these ERM elevations may have changed since the publication of this FIS. To obtain up-to- date elevation information on National Geodetic Survey (NGS) ERMs shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

3.2.1 Methods for Flooding Sources with New or Revised Analyses in Current Study

Water surface elevations for the floodplain boundaries for the revised study were determined using FLO-2D, a two-dimensional flood routing model. Topographic information for the model was generated from Light Detection and Ranging (LiDAR) point data, which were used to develop a 10-ft grid system in FLO-2D. The channel system in the model was established by referring to topographic data and aerial photography.

Bridges and culverts were measured through field survey and stage-discharge rating tables were developed from design charts available in Hydraulic Design of Highway Culvert (FHWA, September 2001).

The channel system was developed using as-built drawings of the canals and effective cross-seciton data from HEC-RAS models.

6.75 additional stream miles were restudied. 2.81 miles on Camarillo Hills Drain, 0.62 miles on Edgemore Drain, 0.96 miles on Mission Drain, 0.56 miles on Ponderosa Drain, 1.10 miles on Somis Drain, and 0.70 miles on West Camarillo Hills Tributary were studied using detailed methods. This restudy affects Ventura County (Unincorporated Areas) and the City of Camarillo.

Flood profiles were not developed for these streams.

3.2.2 Methods for Flooding Sources Incorporated from Previous Studies

<u>Precountywide Analyses</u>

Each incorporated community within, and the unincorporated areas of, Ventura County, has a previously printed FIS report. The hydraulic analyses described in those reports have been compiled and are summarized below.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (USACE, 1972) and hand calculations. At selected locations, primarily at crossings (bridges), hand calculations were made to supplement the analysis.

Cross sections for the majority of the hydraulic analyses were taken from topographic maps at a scale of 1:2,400, with contour intervals of 2 and 5 feet (Ventura County Department of Public Works, 1967-1979), At some locations, this mapping was supplemented with 1:6,000 scale mapping, with a contour interval of 20 feet (Ventura County Department of Public Works, Topographic Maps, Scale 1:6,000, Contour Interval 20 feet). These maps were developed by the Ventura County Department of Public Works using photogrammetric methods from photography taken at various times since 1967. In areas where there had been substantial cross-sectional changes due to development not reflected on the existing topographic maps or significant scour and deposition within the study reach, field-surveyed cross sections and improvement plants were used to supplement the mapping. Cross sections for the entire reach of the Santa Clara River, except within the City of Fillmore, were field surveyed in the summer of 1979 at approximately 1,500-foot intervals. Improvement plans supplied by the VCWPD were used in the analysis of all channels improved by them.

Starting water-surface elevations for all streams analyzed using the HEC-2 computer program were determined by normal-depth analysis using the slope/area method, or by using critical depth. For streams flowing into the Pacific Ocean, the starting elevations were based on mean higher high water.

Generally, the distances on the flood profiles correspond to distances measured along the centerline of the designated watercourses. In several areas, however, the meandering nature of the low-flow streambeds necessitated use of distances measured along the centerline of the 1-percent-annual-chance flow paths. On the maps, these flow lines, used to establish the respective profile distances, are delineated and labeled as Profile Base Lines.

No profiles were developed for these sources of sheet flooding because flood elevations plotted along the centerline of the channel have little relevance to the condition of flooding in the overbank area. Sheetflows are unpredictable, determined strictly from local topography, and do not lend themselves to HEC-2 backwater analysis. As such, the depths of all sheet flooding were determined through hand calculations.

Debris potential was considered in the analysis throughout the study area. Current policies of the USACE Hydrologic Engineering Center, VCWPD, and the USACE Los Angeles District Office were evaluated and considered in establishing criteria for that study.

Based on data supplied by the USACE and the experience of the study contractor, criteria were adopted for consideration of the debris potential in the streams studied. The debris potential for each stream is classified as high,

medium, or low, based on historic flood data, an analysis of the characteristics of the drainage area, and a field investigation of the flooding source by hydraulic engineers. On streams with low debris potential, no provision for debris was made in the hydraulic analysis. For stream reaches where the debris potential was determined to be medium, the bridge geometry was altered using the following criteria:

1. At all reinforced-concrete box culverts and bridge crossings where the cross-sectional end area was 100 square feet or less, the pier widths were doubled. Where the crossing consisted of two or more circular pipes, the cross-sectional end area was reduced by 20 percent.
2. At all bridge crossings with cross-sectional end areas between 100 and 250 square feet, 1 foot of width was added to each side of each pier.
3. At all bridges with cross-sectional end areas greater than 250 square feet, 2 feet of width were added to each side of each pier.

For stream reaches where the debris potential was determined to be high, the bridge geometry was adjusted by the same criteria listed above; in addition, peak discharges were bulked by a factor from 1.1 to 1.5, based on an individual analysis of the flooding source.

Alluvial fan methodologies were applied to calculate flow depths and velocities in portions of San Antonio Creek and Thacher Creek (David R. Dawdy, 1979). Alluvial fans are characterized by unstable channel systems due to slope and soil conditions. Consequently flows rarely spread evenly over the surface of an alluvial fan and can be concentrated in an identifiable temporary channel or confined to only portions of the fan surface. The ability to scour and deposit sediment makes flow paths prone to lateral migration and relocation to any portion of the fan during a single runoff event and subsequent events. This erratic, unpredictable behavior subjects all portions of the fan to potential flood hazard, regardless of location. As the fan widens, the probability of flooding at a given depth and velocity at a specific point generally decreases.

Water-surface elevations for approximate-study streams were based on hand calculations or HEC-2 backwater analyses supplemented with hand calculations.

On Somis Drain, which is an improved channel, the HEC-2 program proved impractical; hand calculations using Manning's equation and equilibrium equations (pressure-momentum) were utilized instead.

Cross sections for the majority of the hydraulic analyses in the City of Camarillo were taken from topographic maps at a scale of 1:2,400, with contour intervals of 2 and 5 feet (Ventura County Department of Public Works, 1967-1979). These maps were developed by the Ventura County Department of Public Works using photogrammetric methods from photography taken at various times since 1967. In areas where there had been substantial cross-sectional changes due to development not reflected on the existing topographic maps or significant scour or deposition within the study reach, field-surveyed cross sections and improvement plans were used to supplement the mapping.

A field survey was also conducted on Conejo Creek in December 1979 to determine the current profile of the channel from U.S. Highway 101 to a point approximately 8,600 feet upstream. The surveyed profile was in some instances lower and at other points higher than the 1:2,400-scale mapping indicated. The hydraulic analysis of the channel was based on this surveyed profile. All other topographic data along this reach were obtained from existing topographic mapping (Ventura County Department of Public Works, 1967-1979) and from improvement plans of the adjacent housing development (Woodyard and Associates, 1980).

Starting water-surface elevations for all detailed-study streams within the City of Camarillo except Conejo Creek were determined by the slope-area method; for Conejo Creek, the water-surface elevation at its confluence with Calleguas Creek was used.

Due to the nature of flooding on Somis Drain and Las Posas Estates Drain downstream of Central Avenue, flood profiles were not shown for these areas.

At a number of locations throughout the study area, the channel flow exceeded the banks and caused sheetflow in the overbank areas. Sheetflows are unpredictable, determined strictly from local topography, and do not lend themselves to HEC-2 backwater analysis. As such, the sheetflow depths were determined by hand calculations.

Debris potential in the improved channels was considered light and, at some locations, nonexistent. For example, at Somis Drain and Las Posas Road, the channel consists of two side drains running parallel to the road that merge and cross Las Posas Road via a double box culvert at supercritical slopes. Debris cannot impact the pier because flows enter the box from the sides. As such, the debris potential increased downstream and the piers at Flynn Road were considered wider than their constructed width. Field observations confirmed the collection of debris in this reach.

At no point was it assumed, or field verified, that debris would completely plug culverts in improved channels. An unimproved culvert near Camarillo Drive on West Camarillo Hills Drain, north of the city, is plugged and was considered to remain that way.

Although debris was not considered to be a problem for improved channels, some crossings do present problems, albeit minor ones. These are as follows: the Coe Street crossing of West Camarillo Hills Drain; the Aileen Street crossing of Edgemore Drain; and the Flynn Road, Lewis Road, Stiles Avenue, and Shepherd Drive crossings of Somis Drain. In the channels listed above, the storm flows remain within the channel until reaching bridges that were constructed years after the channel construction. Generally, the flooding resulting from these restrictions is confined to roadways; however, the Coe Street crossing did cause some overland flooding.

Cross sections in the City of Fillmore were determined from topographic maps at a scale of 1:1,200, with a contour interval of 2 feet, furnished by the VCWPD (VCWPD, 1965, et cetera). The contour interval of 5 feet was used for mapping of Sespe Creek north of the Southern Pacific Railroad. In areas where there had been substantial cross-sectional changes due to development not reflected on the existing topographic mapping (Ventura County Flood Control District, 1965, et cetera), improvement plans were used to supplement the mapping. Cross sections are located at close intervals above and below bridges in order to compute the significant backwater effects of these structures. All bridges were surveyed to obtain elevation data and structural geometry.

Water-surface elevations for the Santa Clara River of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (USACE, February 1972). A more detailed summary of hydraulic analysis for several of the flooding sources is discussed below.

Roughness coefficients (Manning's "n") used in the computations were assigned on the basis of field investigations of the flood plain areas and previous studies by the USACE (USACE, April 1973; USACE, 1972) and the Ventura County Flood Control District (Ventura County Flood Control District, 1969).

Based on these data and the study contractor's experience, the following criteria were adopted for consideration of the debris potential in the streams studied. The debris potential for each stream was classified as either high or medium, based on historic data, an analysis of the characteristics of the drainage area, and a field investigation of the flooding source by hydraulic engineers.

For stream reaches where debris potential was determined as medium, the bridge geometry was altered by adding 2 feet on each side of the bridge piers.

For stream reaches where debris potential was determined as high, the bridges encountered did not have piers within the channel. However, a coefficient of 1.5 was used to bulk the peak discharges for the hydraulic analysis of the entire reach.

The debris potential determined for the Santa Clara River and Sespe Creek was medium, while for Pole Creek, the determined debris potential was high.

The drainage area of the Santa Clara River is approximately 1,200 square miles at the City of Fillmore. The hydraulic analysis for the river included review and adoption of existing data plus additional independent analyses.

The flood boundaries presented in USACE Flood Plain Information reports were adopted (USACE, April 1973; USACE, 1972). By using the HEC-2 computer program and modeling effective flow, a 1-percent-annual-chance profile was developed that was consistent with the Intermediate Regional Flood present in the Flood Plain Information report. This model provided an acceptable 1-percent-annual-chance profile with the exception of the backwater effect caused by the

bridge at State Highway 123. Here it was necessary to modify the 1-percent-annual-chance water-surface profile in the Flood Plain Information report to properly reflect the effects of the bridge.

This effective flow model was then utilized to develop the 10-, 2-, and 1-percent-annual-chance profiles for the floodway analysis.

Sespe Creek is the largest tributary to the Santa Clara River and has a drainage area of approximately 260 square miles at the confluence. The major flood hazard to the City of Fillmore from Sespe Creek is the lack of containment as it approaches the northern corporate limits. The natural streambed makes an S-curve as it reaches the mouth of the canyon. The channel cross section does not have the capacity to contain the flood flows, nor are the banks protected from the high- velocity flows which impinge directly on them. This situation results in an extreme hazard to the area of Fillmore west of A Street from the northern corporate limits down to the confluence with the Santa Clara River.

With concurrence from the City of Fillmore, the VCWPD, and FEMA, the ability of the Sespe Creek streambed to carry the flow was analyzed. Also, the hazard in the overbank areas was indicated by acknowledging the potential of an upstream breakout by zoning the east overbank area as an area of shallow flooding with an average depth of 3 feet. Flood elevations in this area were determined by extending elevations computed for Sespe Creek Channel across the area, while maintaining an average depth of 3 feet. The analysis of the existing Sespe Creek Channel was based on several conditions. The starting water-surface elevation was determined using the slope/area method.

The 1-percent-annual-chance profile for Sespe Creek published in the USACE Flood Plain Information Study (USACE, June 1972) was reviewed and adopted. However, the original hydraulic data supporting the USACE Flood Plain Information report was not available, and an effective flow HEC-2 model was developed using the width of the floodplain that included both east and west channels. This model provided a 1-percent-annual-chance profile consistent with the 1-percent-annual-chance profile in the USACE Flood Plain Information report (USACE, June 1972). This was accomplished by using a relatively high Manning's "n" value, representing both development and the width of alluvial material, assuming that certain percentages of each discharge frequency would be contained in the effective flow model. The same 1-percent-annual-chance discharge analyzed for the Flood Plain Information report was used with the effective flow model.

These assumptions gave profiles that were consistent with those published in the Flood Plain Information report by the USACE. Hand calculations were made to obtain water-surface elevations at the three crossings on the east channel of Sespe Creek. The calculations for the Southern Pacific Railroad and Telegraph Road crossing on the west channel indicate a weir-flow condition over the railroad bridge. However, historical data shows that the railroad bridge's approaches will wash out; therefore, the water-surface elevations are plotted on the bridge decks on the profiles.

On Sespe Creek, when there were two flow channels, an analysis was made on both to determine which would have the greater flood elevation. The greater of the elevations are shown on the flood profiles. Stationing, however, is based on the designated stream channel.

Channel cross-section data for Rincon Creek were digitized from the 4-foot contour interval aerial topographic map compiled in the present study (Aerial Topographic Maps, 1987). The geometric and structural data of the culvert crossing U.S. Highway 101 and the Southern Pacific Railroad were obtained from the as-built plans (State of California, 1968) and supplemented with the field survey by the study contractor. Hydraulic analysis also showed that, due to insufficient culvert capacity, floodwater breakout would occur at the upstream entrance of the culvert for the 1-percent-annual-chance flood. The breakout flow will enter Bates Road and travel southward, in the form of sheetflow, through the highway underpass and return to the creek downstream of the culvert. Due to the topography at the south end of the highway underpass, the sheetflow will split into four branches to return to the channel. Present hydraulic analysis therefore considered the effects of return flows downstream of the culvert and the split of discharge to Bates Road (and subsequently, to the highway underpass) at the upstream entrance. Pole Creek, previously unstudied, has two distinct sections due to channel characteristics. The first section runs from the northern corporate limits to the mouth of Pole Creek Canyon. This channel section is unimproved, but well incised in a steep natural canyon. The second section is an improved concrete- lined channel with a rip-rap transition from the natural channel at the mouth of the canyon.

All discharges, with the exception of the 0.2-percent-annual-chance flood, are contained in the natural channel. The 0.2-percent-annual-chance flood breaks out at the mouth of the canyon and was analyzed as a sheet flow problem carrying approximately 10 percent of the total flow. This hazard quickly dissipates as the street system and topography provide adequate relief drainage.

The improved section of Pole Creek extends from the mouth of the canyon to approximately 1,000 feet downstream of State Highway 126. This improved section was analyzed as supercritical flow and found to contain all but the 0.2-percent annual chance flood.

In consideration of the high debris potential, all discharges were bulked by a coefficient of 1.5. All discharges are contained in the channel proper or within 200 feet of it for the upper half of the section. In the vicinity of First Street, the 0.2-percent-annual-chance discharge breaks out towards the west but is contained by the western natural bank. The slope of the channel changes from 2.1 percent upstream of the Southern Pacific Railroad bridge to 0.16 percent downstream, and the 0.2-percent-annual-chance discharge weir-flows move over both the railroad bridge and the bridge at State Highway 126. The concrete lining ends at cross section 2510, and both the 0.2-percent and 1-percent-annual-chance storms overflow the levees onto the Santa Clara River floodplain.

The starting water-surface elevation used in the hydraulic analysis of Pole Creek was determined by the slope/area method.

Downstream of cross section A on Pole Creek, flood elevations in non-channel areas are controlled by flows from the Santa Clara River; therefore, no profile is presented for Pole Creek in this area.

Water-surface elevations for the upstream segment of Fox Canyon Storm Drain, from a point 9,490 feet above Daly Road to the corporate limits were obtained by hand calculations using Manning's equation.

Cross-section data in the City of Ojai were obtained from topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Ventura County Flood Control District and Ventura County Surveying and Mapping Division, 1977). Cross sections in all detailed studies were located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures.

Starting water-surface elevations for San Antonio and Thacher Creeks were taken from the profiles used in the Floodplain Information report (USACE, 1973). For the remaining streams in the City of Ojai, the initial water-surface elevations were determined by normal depth and slope area analyses.

On the Fox Canyon Storm Drain, it is probable that the box culvert under Daly Road will be clogged with debris during a 1-percent-annual-chance flood. It was clogged in 1969 with a peak flow substantially less than a 1-percent-annual-chance flood. The hydraulic analysis shows that, upstream of Daly Road, the 1-percent annual chance flow exceeds the channel capacity. This overflow and the clogging of the culvert under Daly Road result in shallow flooding between Montgomery Street and the Fox Canyon Storm Drain downstream from the culvert. The shallow flooding continues south, through the City of Ojai, until it reenters the channel in the vicinity of the Southern Pacific Railroad crossing.

The area to the east of the channel is also a potential flood hazard area. The area above Aliso Street was not analyzed as part of that study as the drainage area is less than 1.0 square mile. The area below Aliso Street, along with potential overflow from Dron Creek and Crooked Creek (outside the corporate limits) to the northeast, will produce shallow flooding until it can enter the channel.

Water-surface elevations of floods of the selected recurrence intervals were computed use of the USACE HEC-2 step-backwater computer program (USACE, October 1973) for the Santa Clara River and the upstream study reach of Beardsley Wash. This computer program was used on all other streams studied in detail, but was not used to establish base flood elevations on these streams. Base flood elevations on these streams were determined by hand calculations.

The HEC-2 program (USACE, 1973) was used to evaluate the capacities of Lower Beardsley Wash, Oxnard Industrial Drain, Oxnard West Drain, Rice Avenue Drain, and J Street Drain. Once their capacities had been reached, the

HEC-2 model no longer provided adequate flood elevations due to the existing flat topography and resultant shallow flooding. Therefore, no profiles were developed for these streams. El Rio Drain and Doris Avenue Drain have the capacity to contain the 1-percent-annual-chance flood, but are subject to shallow flooding during a 0.2-percent-annual-chance flood.

Elevations of sheetflow and ponding areas were determined by normal-depth calculations in conjunction with topographic maps (Ventura County Flood Control District, 1970; City of Oxnard, 1967, et cetera).

Starting water-surface elevations for the Santa Clara River were taken from a USACE floodplain report (USACE, 1968). Starting water-surface elevations for Oxnard Industrial Drain were determined from Pacific Ocean high tide elevations. For the remainder of the streams studied, starting water-surface elevations were determined by the slope/area method.

Cross sections for the Santa Clara River were field surveyed in the summer of 1979 at approximately 1,500-foot intervals. Improvement plans supplied by the VCWPD were used in the analysis of Telephone Road Drain and Arundell, Brown, Harmon, and Franklin Barrancas. For streams flowing into the Pacific Ocean, the starting elevations were based on mean higher high water.

Most of the channels studied have segments that contain the 1-percent-annual-chance flood discharge. These channel reaches were studied through use of the HEC-2 computer program (USACE, February 1972) to develop a profile for the 10-, 2-, and 1-percent-annual-chance flood frequencies; however, the 0.2-percent-annual-chance flood discharge in most cases would exceed the banks of the channel, becoming sheetflow in the overbanks. Sheetflows are unpredictable, determined strictly from local topography, and do not lend themselves to HEC-2 backwater analysis. As such, the depths of all sheetflow flooding were determined through hand calculations. Sheetflow flooding was found to occur along portions of the Ventura River, Telephone Road Drain, and Arundell, Brown, Franklin, and lower Harmon Barrancas.

Due to the nature of flooding on Arundell, Barlow, and Franklin Barrancas, Mills Road and Telephone Road Drains, Harmon Barranca downstream of the Southern Pacific Railroad crossing, and Brown Barranca downstream of Blackburn Road, flood profiles were not shown for these areas.

Debris potential was determined to be low for Telephone Road Drain, Arundell Barranca, and Franklin Barranca. Debris potential was considered medium for the Santa Clara River, Ventura River, Harmon Barranca, and Brown Barranca below Telegraph Road. Bridge openings and culvert sizes were adjusted in accordance with the criteria discussed above. A high debris potential was determined for Brown Barranca above Telegraph Road, and peak discharges were bulked by a factor of 1.5.

Cross sections for the Santa Clara River in the City of Santa Paula were field surveyed in the summer of 1979 at approximately 1,500-foot intervals. Cross

sections used for the remaining detailed flooding sources in that study were obtained from the VCWPD.

VCWPD provided as-built drawings of Fagan Canyon that were used in the hydraulic analysis. The culvert under Santa Paula Street was assumed to be completely plugged during major floods, based on historical occurrences. Consequently, most of the flood flows were over the street and back into the channel downstream, with the exception of minor flows escaping to the east down Dean Drive. Because of dense vegetative growth between Santa Paula Street and Main Street, the channel and overbanks were assigned "n" values of 0.055 and 0.070, respectively.

The profile for Fagan Canyon illustrates only the water-surface elevation for flows contained within the channel up to the Southern Pacific Railroad tracks; below this point, the profile is only for the flows that enter the concrete ditch.

Santa Paula Creek flows are essentially confined within the channel above the vicinity of Gatewood Lane. At this point, the creek makes a bend, which reduces the velocity and causes debris deposition. Analysis indicates that approximately 25 percent of the 1-percent-annual-chance flood peak discharge breaks out and flows toward Mariposa Drive and Laurel Road. In the vicinity of Hawthorn Street, another breakout occurs and flows east; this is approximately 18 percent of the remaining flow on Santa Paula Creek. However, the most critical breakout was determined to occur in the vicinity of the Oak Mobile Home Estates. Based on historical events, it is estimated that 70 percent of the total remaining floodflow breaks out and flows west toward the city. Additional floodflow breaks out east of the city and flows southeasterly toward the Santa Clara River, affecting the City of Santa Paula as shallow sheetflow.

Santa Paula Creek was studied using normal-depth calculations, historical observations, engineering judgment, and partial use of the HEC-2 computer program (USACE, October 1973). Because of the instability of the channel through this reach, no profile was plotted nor were Flood Hazard Factors determined. The flooding along the channel was designated as Zone A. The extent of flooding along the channel was based on existing planimetric and topographic features.

Analysis of three breakout flows through the City of Santa Paula consists of determination of overland flow depths from flows con-fined to paths following city streets. This was accomplished using topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (USACE, June 1977). These flows are shown on the maps as Profile Base Line Numbers 1, 2, and 3.

Shallow flooding breakout flows from Santa Paula Creek with average depths of 1, 2, and 3 feet were determined using normal—depth computations.

Along the Santa Clara River, the meandering nature of the low-flow streambed necessitated use of distances measured along the centerline of the 1-percent-

annual-chance flow path. On the maps, this flow line, used to establish the respective profile distances, is delineated and labeled as a Profile Base Line.

Flood profiles for the Santa Clara River and Fagan and Adams Canyons are presented for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods. However, flooding from Santa Paula Creek consists largely of breakouts that flow away from the channel, especially in the lower creek reaches, where the existing channel invert is at a higher elevation than the surrounding ground. In addition, during large floods, the invert is raised by debris deposition. Flood profiles are presented for the breakout flows along the roads.

For Profile Base Line Numbers 1 and 3, the 10- and 2-percent-annual-chance floods are not shown on the profiles, because floods of these recurrence intervals are contained in the Santa Paula Creek channel. For Profile Base Line Numbers 2 and 3, the 10-percent-annual-chance floods are not shown on the profiles, because the 10-percent-annual-chance flood is contained in the Santa Paula Creek channel.

Cross-sectional data for the hydraulic analysis of all floodplains and for natural channels in the City of Simi Valley was obtained primarily from 1968 topographical maps (Ventura County, 1968) at a scale of 1:2,400 with 2 foot contours. Cross-sectional data for all engineered channels, drop structures, culverts, and bridges were obtained from design or as-built drawings in the files of the VCWPD. Engineered channels account for approximately 80 percent of all channels studied in detail.

Water-surface elevations for the 1-percent-annual-chance flood in the City of Simi Valley were computed using the USACE HEC-2 water-surface profiles computer program (USACE, February 1985). The starting water-surface elevation for the subcritical backwater analysis of Arroyo Simi was determined using the slope/area method. Starting water-surface elevations for the down water analysis of all tributaries were determined using critical depth. Supercritical analysis was used on all super critically designed, smooth concrete channels constructed by the VCWPD. These facilities were considered to pass the 1-percent-annual-chance flood if the calculated water surface was below the low chord of street crossing box culverts, and was easily contained within the unobstructed right-of-way of the flood control facility.

Where existing culverts on the steep tributary channels were determined to be inadequate, the outflow onto the city streets was determined by culvert-weir analysis. The average depth of the resulting channel-independent sheet flooding was determined by critical or normal depth analysis of relatively unobstructed streets and adjacent yards that intercepted the flows down slope of the outflow. Where sheetflow would be expected to pond the water-surface elevation was based on the estimated inflow and the lowest containing ground elevation between flow-obstructing buildings. Ponding typically occurred in cul-de-sacs and street corners that lacked an unobstructed surface outlet.

Work maps used for the study were 1968 topography maps at a scale of 1:2,400 with a contour interval of 2 foot (Ventura County Public Works Agency, 1968), augmented by 1987 photo maps at a scale of 1:1,200 (City of Simi Valley, 1987) depicting present development.

All hydraulic analyses in the City of Simi Valley assume that the channels and structures will remain effectively free of any debris blockage or sediment depositions during a 1-percent-annual-chance flood event.

Intermittent short-duration overflow surges due to wave action associated with supercritical flow are expected to occur at some tributary culvert entrances deemed adequate in that study.

Local flooding, which is not addressed in that study, may occur at any point within the City of Simi Valley. Users of that study are advised to be aware of local enclosures and obstructions to surface flow, such as may be created by heavy board fences and masonry sound/privacy walls that are commonly found in many subdivisions. Local flooding depths up to 6 feet may occur behind these walls prior to their collapse or overtopping. Based on the foregoing, the following specific areas within the City of Simi Valley were determined to be prone to flood depths greater than one foot during a 1-percent-annual-chance flood event:

On Arroyo Simi, major overbank flooding occurs along the south bank upstream of the Royal Avenue Bridge and follows Corto, Hollister and Fallon Streets before returning to the channel at Sycamore Drive. The 2.5mile-long reach of upper Arroyo Simi channel from the vicinity of Ralston Avenue to the city limits on Smith Road has the most extensive potential flooding identified within the study area. Flood depths up to 6 feet occur behind the Southern Pacific Railroad embankment in the Aurelia Street area. Extensive ponding occurs in the Christine Avenue area between Arroyo Simi and White Oak Creek.

On Dry Canyon, flood flows leave the channel at the Alamo Street culvert and flows southward between Atherwood and Wanda avenues.

On Tapo Canyon initial flooding begins at the Alamo Street culvert and extends south and west to Los Angeles Avenue. Flows averaging up to 3 feet deep follow Lemon Drive, Copperfield, Sequoia, Darby, Cochran, Medina and Galena Streets. Pending occurs on Galena Street, and Hilldale Avenue.

On Las Llajas Canyon, flooding begins at the Cochran Street culvert and flows down Fig Street to pond at Alpine Street.

On White Oak Creek, flood flows are diverted westward at the Simi Valley Freeway, crossing the freeway at Yosemite Avenue and flooding the area northeast of Cochran and Stow Streets.

On Hummingbird Creek, flooding occurs south of the Alscot Avenue culvert.

On Bus Canyon and its eastern tributary flooding begins at the Dakin Avenue culvert. Additional flooding occurs at the First Street culvert with ponding in Village Court, along Royal Avenue and through the junior high school grounds. At the downstream end of Bus Canyon flooding occurs in Sinaloa Villa and along Sinaloa Road, Los Angeles Avenue and Aristotle Street, returning to Arroyo Simi at the Madera Bridge.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the SCS, WSP-IN step-backwater computer program (WSP-IN, December 1971).

From a point approximately 1,700 feet upstream from Moorpark Road upstream, the Arroyo Conejo Channel contains the 1- and 0.2-percent-annual-chance floods. Downstream from this point recent channel improvements have resulted in the reduction of flooding. The upper reaches of Lang Creek from Gainsborough Road upstream to a point 100 feet downstream of El Monte Drive contain the 1- and 0.2-percent-annual-chance floods. Channel improvements upstream of El Monte Drive have eliminated the flooding problems upstream. The flood profile is not shown for the entire segment of Creek upstream from Gainsborough Road.

The basis for this revised hydraulic analysis included a channelization project extending approximately 7,000 feet upstream from the confluence of Arroyo Santa Rosa with Conejo Creek; the deposit of fill and grading improvements in areas south of Santa Rosa Road along Sumac Lane and Arroyo-Santa Rosa Tributary, and north of Santa Rosa Road along East Las Posas Road and Arroyo Santa Rosa Overflow.

Information on the methods used to determine peak discharge-frequency relationships for the streams restudied as part of this countywide FIS is shown below.

This revised hydraulic analysis resulted in changes to the base (1-percent-annual-chance) flood elevations and discharges, and modifications to the floodplain and floodway boundaries along Arroyo Santa Rosa, Arroyo Santa Rosa Tributary, and Arroyo Santa Rosa Overflow. In support of this revision, the following technical data were submitted:

- "As-built" drawings of Plan and Profile of Arroyo Santa Rosa Unit I, prepared by the Ventura County Flood Control District, dated August 1983;
- "As-built" drawings of Grading Plan for Tract No. 3936 along Arroyo Santa Rosa Tributary prepared by Haaland & Associates, Inc., dated May 1987;
- "As-built" drawings of Grading and Drainage Plan for Tract No. 2532 along Arroyo Santa Rosa Overflow, prepared by Conejo Valley Engineering, Inc., dated February 1981;

- "As-built" drawings of Grading Plan for Tract No. 3242 along Arroyo Santa Rosa Overflow prepared by CC&B, Inc., dated December 1981; and
- "As-built" drawings of Bridge Modifications and Channel Improvements for Tract No. 2739 along Arroyo Santa Rosa, prepared by Fred W. Hammer, dated July 1982.

Flood elevations for Rincon Creek were computed using the USACE HEC-2 step- backwater computer program (USACE, February 1972). Starting water-surface elevations were determined assuming critical depth at the downstream section near the mouth. This assumption was validated by examining the HEC-2 computational results.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 7, "Manning's "n" Values."

Analyses for the First Countywide FIS

Aerial photogrammetric techniques were used to develop topographic maps with 2-foot contour intervals. This information was used to develop the hydraulic models for the delineation of the 1- and 0.2-percent-annual-chance floodplains and floodway. Hydraulic analyses were performed using the USACE computer program HEC-RAS Version 3.1, November 2002. Channel roughness coefficients (Manning's "n") used in the hydraulic computations were determined by engineering judgment, field reconnaissance, and by using the tables in *Open Channel Hydraulics* by Ven Te Chow.

Hydraulic computations for all reaches included modeling bridges and culverts. Field investigations were conducted to verify bridge and culvert dimensions for all reaches. The summary of discharges for the Calleguas Creek Watershed is included in this study. These flows are modified flows from the report entitled "Calleguas Creek Watershed Hydrology Study" dated March 2003. The flows were modified to account for spills that would not return to the channel where they originated.

Many locations along the study reaches have spills that cannot be described by the hydraulic model alone. Some of the assumptions and procedures used to map certain spills along the study reaches are detailed below.

A significant spill for Calleguas Creek occurs downstream of Highway 101 on both the left and right overbanks. Spill calculations were done to determine the flows traveling on the left and right overbanks. The flows for these calculations are from the Lower Calleguas Creek hydraulic model analyzing the flows in the left and right overbanks and the channel for each cross section. A spill model for the left overbank was then created and resulted in a Zone AO (Depth 2') at the start of the spill then transitions to a Zone AO (Depth 1') after crossing Pleasant

Valley Road and continuing down to the confluence with Conejo Creek. The flow used for this spill does not re-enter Calleguas Creek until the confluence with Conejo Creek.

A hydraulic model was created for the right overbank spill. This area is flat and being used as agricultural land so there are not high points to help trap the spill. The nearest high ground was the Revolon Slough to the west. The main flow path of the spill has been mapped as a Zone AE with BFEs. The rest of this flat land has been mapped Zone X designating shallow flooding. Closer to the confluence of Calleguas creek and Revolon Slough, the spill overtops the west side of Revolon Slough. The confluence of Calleguas Creek and Revolon Slough acts as one large channel because the levee in between the two watercourses was not high enough to contain the flows. A hydrograph for Calleguas Creek at the confluence with Revolon Slough was analyzed to determine the flow in the Revolon Slough during the peak discharge of Calleguas Creek. That flow was estimated to be 4,000cfs in the Revolon Slough when Calleguas Creek was at a peak discharge of 37,723cfs. The worst-case scenario was that Calleguas Creek overtops the levee between the creek and Revolon Slough. Failing the levee would lower the water-surface elevations, thus not producing the worst case scenario. Since the levee was overtopped, there was no need to fail the levee. The Lower Calleguas Creek model accounts for the water in Revolon Slough by setting the bottom of the Revolon Slough equal to the water-surface elevations computed for the Revolon Slough. The model was then run to determine the extent of the flooding. The levee along the southeast side of Calleguas Creek was also overtopped.

The concrete channel of the upstream of Highway 23 was not large enough to contain the 1- and 0.2-percent-annual-chance flows. Water spills over Encino Vista Drive and into a small basin east of Highway 23. A spill model was created to determine flooding depths in this area and has been mapped as a Zone X to designate shallow flooding. The water was assumed to slowly return to the Thousand Oaks North Drain via a small inlet at the low point of this small basin.

South Grimes Wash, a tributary of Arroyo Simi, confluences with Arroyo Simi from the north at approximately 1,800 feet downstream of Hitch Boulevard and near the downstream limit of study for Arroyo Simi. The wash was modeled on FLO-2D and extended from the confluence to New Los Angeles Ave, creating approximately a 1,200 ft-long channel reach. South Grimes Wash is a natural channel about 100-ft wide with heavy vegetation on the bottom. A total of five channel cross sections were extracted from the LIDAR topographic map and, after interpolation, a total of nine (9) individual cross sections were assigned to the wash within the FLO-2D model.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of

1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD 88. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities.

Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. The conversion from NGVD 29 to NAVD 88 was determined to be 2.58 feet where an elevation of 0.0 feet NGVD 29 is equal to an elevation of 2.58 feet NAVD 88.

The base flood elevations shown on the FIRM represent whole-foot rounded values. For example, a base flood elevation of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD29 should apply the stated conversion factor(s) to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

For information regarding conversion between the NGVD and NAVD, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988*(Reference 1), visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed or limited detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with contour intervals of 2 and 5 feet (Ventura County Department of Public Works, 1967-1979).

For the streams in this revised study, maximum depths resulting from the FLO-2D model were used. Depths between 0.850’ and 1.499’ were mapped as zone AO1, depths between 1.500’ and 2.499’ were mapped as zone AO2, depths between 2.500’ and 2.999’ were mapped as zone AO3 and all depths above 3.0’ were mapped as zone AE.

Coastal floodplain boundaries were delineated using the wave run-up or wave setup elevations computed at each 0.5-mile interval. Between these points, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with contour intervals of 5, 10, 20, 25, 40, and 50 feet (U.S. Department of the Interior, 1943, et cetera).

For the streams designated "Zone A Contained in Channel," the 1-percent-annual-chance floodplain boundaries are based on channel improvement plans, existing channel alignment, and right-of-way.

For the approximate-study streams, flood boundaries were delineated using topographic maps at a scale of 1:2,400, with contour intervals of 2 and 5 feet (Ventura County Department of Public Works, 1967-1979) and field inspection notes.

Floodplain boundaries in Leisure Village along Conejo Creek were based on as-built plans for Leisure Village at a scale of 1:480 (Woodyard and Associates, 1980).

On Beardsley Wash, the 1- and 0.2-percent-annual-chance floodplain boundaries were delineated using topographic maps at a scale of 1:2,400, with contour intervals of 2 and 5 feet (Ventura County Department of Public Works, 19671979).

For the City of Fillmore, the contour interval of 5 feet was used for the mapping of Sespe Creek north of the Southern Pacific Railroad. All boundaries were established in conjunction with field investigations by hydraulic engineers.

In areas of the City of Fillmore where the flood hazard consists of shallow flooding on alluvial cones, flood boundaries were determined by a combination of extensive field investigation, analysis of the latest topography, normal depth calculations, and historical flooding data.

In areas where effective area modeling was used, and for the Sespe Creek breakout zone, the flood boundaries were determined by extending the water- surface elevation on the overbank until it reaches the natural topography. The flood boundaries for both the Santa

Clara River and Sespe Creek in the City of Fillmore were adopted from the USACE Flood Plain Information, Santa Clara River and Sespe Creek in the vicinity of Fillmore, California (USACE, June 1972).

In the City of Ojai, for Fox Canyon Storm Drain and Stewart Canyon Storm Channel, the boundaries of the 1- and 0.2-percent-annual-chance flood have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Ventura County Flood Control District and Ventura County Surveying and Mapping Division, 1977).

The 1-percent-annual-chance flood boundaries for San Antonio and Thacher Creeks in the City of Ojai were adopted from the Floodplain Information report (USACE, June 1973) after they were field checked for verification. A small change was made to the 1-percent-annual-chance flood boundary near the eastern corporate limits at Soule Park. The topography shows, along with field investigations, that the flow will be a few hundred feet wider than indicated in the Floodplain Information report, because of overflow from the channel upstream and from side inflow from the mountains. The 1-percent-annual-chance flow would be contained in the channel in the study area if it had not exceeded the capacity upstream of the study area. The 0.2-percent-annual-chance flood boundaries were delineated on the topographic maps, as mentioned. The 1- percent annual chance boundaries for the areas studied by approximate methods were based on historical data, VCWPD information (Ventura County Flood Control District, 1969), and engineering judgment.

The boundaries of the 1-percent-annual-chance flood for Rincon Creek were delineated using flood elevations determined at cross sections. Between cross sections, flood boundaries were extrapolated using aerial topographic maps of Rincon Creek near Rincon Point," with a scale of 1:4,800, and contour intervals of 4 feet (Aerial Topographic Maps, 1987). Flood boundary delineation consists of flooding along the main channels and sheetflow flooding on the floodplains.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain.

The floodways presented in this study were developed through a series of procedural steps that included:

1. Evaluation of equal-conveyance reduction from each side of the flood plain
2. Negotiation and coordination with local and regional agencies
3. Review of existing hydraulic data
4. Analysis of existing floodway zoning by the community
5. Analysis of design criteria of existing and proposed structural improvements
6. Analysis of the natural topography and the practicality of access of flood fringe areas

Three distinct types of situations that allow the delineation of a floodway occur in the county. These are broad, well-defined floodplains; well-incised natural channels containing the 1-percent-annual-chance discharge; and fully improved channels of 1-percent-annual-chance capacity.

The first of these situations, a broad, well-defined floodplain, occurs along both the Santa Clara and Ventura Rivers.

The second situation allowing delineation of a floodway is that of well-incised natural channels containing the 1-percent-annual-chance flood discharge. In these areas, the channels are generally deeply incised and nearly rectangular, having steep, vertical banks. Because the 1-percent-annual-chance storm is contained within these channels, any

encroachment would be narrow, require extensive fills, and present problems of access. Consequently, the 1-percent-annual-chance floodplain boundary is the floodway boundary for these streams.

The final situation lending itself to delineation of a floodway is that of a 1-percent-annual-chance design channel. Because the 1-percent-annual-chance discharge is fully contained within the channel banks, they become the boundaries of this already operational floodway.

Bell Canyon Creek is a narrow canyon through a developed residential area. A floodway through this reach would not be applicable. A Floodway Data Table (FDT) was not shown because cross-section stationing did not match cross-section locations on the map.

No floodway was determined for Brown Barranca because of the unpredictability of flow paths and the presence of low-velocity irregular sheetflow, thus, no FDT was shown.

On Camarillo Hills Drain, no floodway was developed upstream of Las Posas Road because the channel is improved and is located primarily along existing roads.

No floodway was determined for Coyote Creek because it is a steeply incised channel with little access.

No floodways were determined for Happy Valley Drain and Happy Valley Drain South because their floodplains are partially developed. Any future development in the floodplains would have to be accompanied by major improvements to the channels.

A floodway was not developed for Las Posas Estates Drain downstream of Central Avenue and Somis Drain because the flood hazard is contained within the channel.

No floodway was determined for the Miramonte Drain due to the already partially developed floodplain.

A floodway was not developed for Reeves Creek due to high velocities, an already partially developed floodplain, and the excessive increase to the 1-percent-annual-chance water surface that would occur if a continuous encroachment were allowed. No FDT was produced for Reeves Creek because cross-section stationing did not match the location of the cross sections on the map.

No floodways were computed for Santa Paula Creek or the South Branch Arroyo Conejo. Santa Paula Creek, through its lower reach, has an unstable flowline which results in large breakouts. The upper reach is primarily through a narrow canyon. As a result, no floodway was developed for the creek. The South Branch Arroyo Conejo is a partially improved channel that passes through fully developed areas of Thousand Oaks. As such, a floodway would not be applicable. No Floodway Data Tables were computed for these streams because the location of cross sections on the maps did not agree with the stationing in the printout.

There are no floodways or FDT entries for the following streams because the flooding problems on these streams consist of sheetflow or shallow flooding, in which case a

floodway is impractical: El Rio Drain, Revolon Slough, Mills Road Drain, Santa Clara Drain, Rice Avenue Drain, and Sunset Hills Drain.

No floodway was computed for Franklin Barranca or Nyland Drain because the 1-percent-annual-chance flood is contained in an improved channel and a floodway would not be applicable; thus, no FDT was shown.

Downstream of U.S. Highway 101 (Ventura Freeway) in the City of Camarillo, floodways could not be determined for Calleguas Creek due to limited existing channelization, unpredictability of flow paths, and the presence of low-velocity, irregular sheetflow.

The floodways in the City of Fillmore have been reviewed with the local and regional agencies responsible for floodplain management. There is agreement conceptually among the agencies with the methodology and resulting designated floodways. Ventura County has adopted an ordinance, FC-18, that specifically details the process by which a final floodway may be designated. The floodways in this report are presented as final floodways to be utilized for land use management upon the completion of the legal process as dictated by County Ordinance FC-18. In all cases, the floodways presented in this report have been evaluated and found to be consistent with current FEMA criteria.

A floodway based on equal conveyance reduction was applied on the whole Santa Clara River, but yielded unacceptable high velocities on the banks of the floodway in some areas. Therefore, the floodway was determined by trial, considering the natural topography and existing land uses and the practicality of access to the flood fringe areas. This analysis provided a floodway acceptable to the community, which met the FIA's criteria for the allowable increase in water-surface elevation. Some areas, such as the sewage treatment plant, have been included in the floodway fringe with the knowledge that velocities are high enough to erode unprotected channel banks. However, in the areas where development now exists, it would be far more practical from the land use control standpoint to require bank protection for further development rather than include these areas in the floodway.

Floodflows on Arundell and Franklin Barrancas, Telephone Road Drain, Harmon Barranca downstream of the Southern Pacific Railroad crossing, and Brown Barranca downstream of Blackburn Road are contained in the channels. Therefore, no floodways were computed in these areas.

No floodway was delineated for Fagan Canyon because of the many uncontrolled breakouts occurring on the canyon below Santa Paula Street. Upstream of Santa Paula Street, no floodway was determined because of complete channel containment of floodflow. Also, no floodway was delineated for Adams Canyon because the flooding is less than 200 feet wide. No floodway was delineated for Santa Paula Creek because it includes all shallow flooding or Zone AE areas for breakouts along streets (Profile Base Line Numbers 1, 2, and 3).

On Fox Canyon Storm Drain, the HEC-2 computer program (USACE, February 1972) was used for the floodway analysis from the confluence with Stewart Canyon Channel to the Southern Pacific Railroad crossing. In most cases, the 1- percent annual chance flood

boundaries were adopted as the floodway; but, in cases where the canyon had sufficient width, the floodway was delineated using the computer program. The 1-percent-annual-chance flood boundary from station 9,490 to station 10,670 was adopted as the floodway boundary, because the flow was contained in the channel.

Harmon Barranca upstream of the Southern Pacific Railroad crossing is a well- incised natural channel that contains the 1-percent-annual-chance flood discharge. The channel is generally deeply incised and nearly rectangular in shape, having steep, vertical banks. Because the 1-percent-annual-chance flood is contained in this channel, any encroachment would be narrow, require extensive fills, and present problems of access. Consequently, the 1-percent-annual-chance floodplain boundary is the floodway boundary for this portion of the stream. No Floodway Data Table was shown because no cross sections were located in unincorporated Ventura County.

On Pole Creek, the 1-percent-annual-chance discharge is contained within the channel; the channel was, therefore, adopted as the floodway.

On San Antonio Creek, the HEC-2 computer program (USACE, February 1972) was used to delineate the floodway boundaries. A series of runs were made to obtain the resulting floodway, which satisfied all applicable criteria.

Floodways were computed for the Santa Clara River, Santa Clara River Breakout, and the upper reach of Beardsley Wash. Floodways are not applicable for areas of shallow flooding; therefore, floodways were not computed for the other flooding sources within the City of Oxnard.

The Santa Clara and Ventura Rivers each have a levee along one bank that prevents encroachment from that side, and both study reaches represent the lowermost end of each river, where peak discharges are maximum and flow velocities are high on the banks of the floodway. The floodway, therefore, was determined by trial, considering the natural topography and existing land uses and the practicality of access to the flood-fringe areas.

Although Sespe Creek in the area under study flows down an active alluvial cone, there are channels along most of the area with substantial capacity. Considering these channels and current plans to construct a levee to contain Sespe Creek flows by the VCWPD, it was felt that a floodway could and should be designated for Sespe Creek. The western boundary is defined by the west bank of the existing west channel. The eastern boundary of this floodway is the proposed alignment of the VCWPD's levee from the crossing at State Highway 126 to the mouth of the canyon. The floodway meets FIA criteria for the increase in water-surface elevations.

On the unimproved reaches of the Stewart Canyon Storm Channel, the 1-percent-annual-chance flood boundaries were adopted as the floodway boundaries in most cases because of a deeply incised channel. The HEC-2 computer analysis (USACE, February 1972) was used to delineate the floodway boundaries in those cases where the canyon widened sufficiently to provide usable areas adjacent to the channel.

On Thacher Creek, the channel banks were adopted as the floodway boundaries, as the existing channel has the capacity to contain the 1-percent-annual-chance flood in the

study reach. However, the floodway fringe is subject to shallow flooding to a depth of 1 to 2 feet, because of the flow breaking out of the channel upstream of the study area. No floodway was computed on Thacher Creek upstream of cross section F because of high velocities and an already partially developed floodplain, and because excessive increases in water-surface elevations of encroachment are permitted.

In some portions of the study of the Calleguas Creek watershed floodways were not determined because of the limited existing channelization, unpredictability of flow paths, and the presence of low velocity irregular sheetflow. Land use along all of the drains is urbanized with houses and/or office buildings on both sides of the drains. Placing a floodway through an urbanized area with the existing houses would be in the proposed floodway does not make sense.

Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 8). The computed floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 8, "Floodway Data." In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the 1-percent-annual-chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

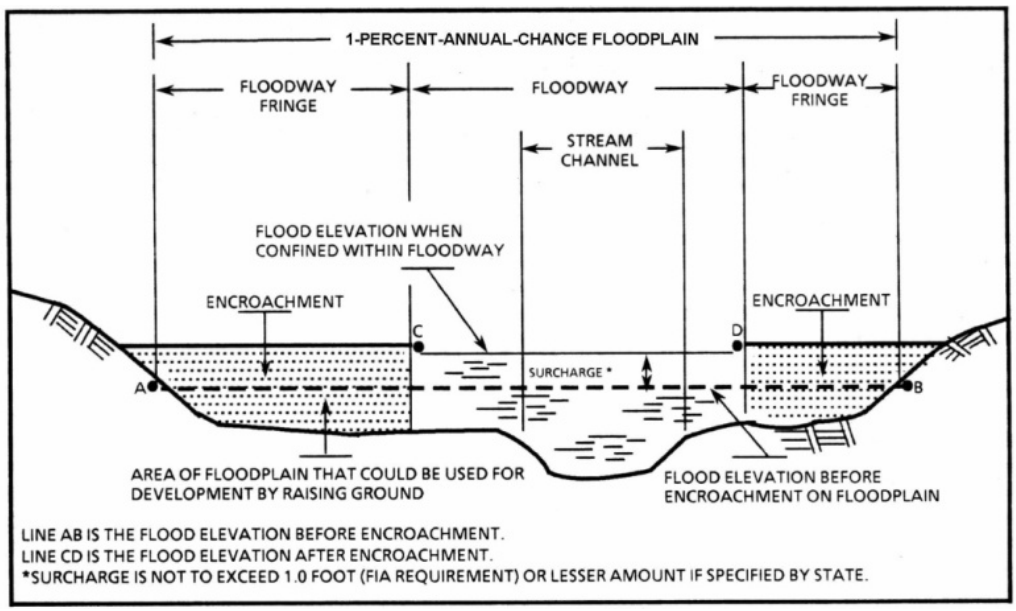

Figure 1. Floodway Schematic

Behind Levee Analyses

On August 22, 2005, FEMA issued "Procedure Memorandum No. 34 — Interim Guidance for Studies Including Levees." The purpose of the memorandum was to help clarify the responsibility of community officials or other parties seeking recognition of a levee by providing information identified during a study/mapping project. Often, documentation regarding levee design, accreditation, and the impacts on flood hazard mapping is outdated or missing altogether. To remedy this, Procedure Memorandum No. 34 provides interim guidance on procedures to minimize delays in near-term studies/mapping projects, to help our mapping partners properly assess how to handle levee mapping issues.

While documentation related to 44 CFR 65.10 is being compiled, the release of a more up-to-date FIRM for other parts of a community or county may be delayed. To minimize the impact of the levee certification process, FEMA issued "Procedure Memorandum No. 43 — Guidelines for Identifying Provisionally Accredited Levees" on March 16, 2007. These guidelines allow issuance of the FIS and FIRM while levee owners or communities compile full documentation required to show compliance with 44 CFR 65.10. The guidelines also explain that a FIRM can be issued while providing the communities and levee owners with a specified timeframe to correct any maintenance deficiencies associated with a levee and to show compliance with 44 CFR 65.10.

FEMA contacted the communities within Ventura County to obtain data required under 44 CFR 65.10 to continue to show the levees as providing protection from the flood that has a 1-percent-annual-chance of being equaled or exceeded in any given year.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Arroyo Santa Rosa								
A	110	1,270	4,650	1.0	233.5	233.5	234.5	1.0
B	1,307	701	2,734	1.8	233.7	233.7	234.7	1.0
C	3,375	269	656	7.3	237.9	237.9	237.9	0.0
D	5,849	44	466	10.2	250.4	250.4	250.4	0.0
E	6,808	20	129	22.0	255.1	255.1	255.1	0.0
F	7,768	36	208	13.7	271.2	271.2	271.2	0.0
G	8,650	27	98	28.8	273.3	273.3	273.4	0.1
H	9,039	46	238	12.9	295.2	295.2	295.3	0.1
I	10,078	53	293	10.5	304.3	304.3	304.5	0.2
J	11,538	22	135	22.6	321.6	321.6	322.0	0.4
K	11,856	39	291	15.4	337.0	337.0	337.3	0.3
L	13,809	57	215	20.9	363.8	363.8	364.2	0.4
M	24,300	136	458	9.0	601.5	601.5	601.5	0.0
N	25,280	780	4,494	0.9	604.0	604.0	604.0	0.0
O	26,470	660	3,277	1.0	604.0	604.0	604.1	0.1
P	28,350	490	1,532	1.8	605.7	605.7	605.8	0.1
Q	30,030	340	405	4.0	612.7	612.7	612.8	0.1
R	31,855	260	274	6.0	624.6	624.6	624.6	0.0
S	33,150	270	680	1.8	643.3	643.3	643.8	0.5

[1]Feet above confluence with Conejo Creek

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

ARROYO SANTA ROSA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Arroyo Santa Rosa Tributary								
A	125[1]	15	250	11.7	258.3	258.3	258.3	0.0
B	1,314[1]	300	580	5.1	263.0	263.0	263.3	0.3
C	2,377[1]	167	412	7.1	270.7	270.7	270.9	0.2
D	4,874[1]	160	349	8.4	290.5	290.5	290.6	0.1
E	5,251[1]	350	613	4.8	293.8	293.8	293.9	0.1
F	5,848[1]	560	544	5.4	296.8	296.8	297.0	0.2
G	6,983[1]	73	123	12.3	304.1	304.1	304.4	0.3
H	7,312[1]	16	89	17.0	307.5	307.5	307.5	0.0
I	7,873[1]	12	51	26.3	312.1	312.1	312.1	0.0
J	9,077[1]	12	51	26.1	336.7	336.7	336.7	1.0
K	9,838[1]	12	52	25.8	352.6	352.6	352.8	0.2
L	10,168[1]	12	55	24.3	359.5	359.5	360.2	0.7
M	10,269[1]	12	47	28.6	362.3	362.3	362.3	0.0
N	10,423[1]	14	41	20.8	365.6	365.6	365.6	0.0
O	10,573[1]	16	86	10.0	373.4	373.4	373.4	0.0
P	10,922[1]	39	92	9.3	378.9	378.9	378.9	0.0
Beardsley Wash								
A	45,400[2]	60	416	14.9	106.3	106.3	106.3	0.0
B	46,300[2]	120	456	13.6	118.2	118.2	118.2	0.0
C	47,300[2]	200	1,230	6.6	150.4	150.4	150.4	0.0
D	48,400[2]	130	966	7.0	151.6	151.6	151.6	0.0

[1]Feet above confluence with Arroyo Santa Rosa
[2]Feet above confluence with Calleguas Creek

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

ARROYO SANTA ROSA TRIBUTARY – BEARDSLEY WASH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Calleguas Creek/ Arroyo Las Posas/ Arroyo Simi								
A – H *								
I	50,544	231	2,634	9.9	149.8	149.8	150.6	0.8
J	54,147	134	1,721	15.6	173.6	173.6	173.6	0.0
K	56,199	536	6,411	4.3	190.3	190.3	190.3	0.0
L	59,895	1,007	5,123	5.4	196.4	196.4	196.4	0.0
M	61,794	410	3,758	7.4	211.4	211.4	211.4	0.0
N	65,392	675	5,376	5.1	234.6	234.6	234.6	0.0
O	66,847	318	2,126	13.0	242.5	242.5	242.5	0.0
P	67,901	353	1,910	14.5	248.4	248.4	248.4	0.0
Q	70,113	371	2,205	12.5	260.5	260.5	260.5	0.0
R	74,041	519	2,997	8.6	280.9	280.9	280.9	0.0
S	77,593	833	3,829	6.6	305.5	305.5	305.5	0.0
T	80,643	484	3,405	7.4	325.4	325.4	325.4	0.0
U	88,341	230	2,372	10.2	377.0	377.0	377.0	0.0
V	90,092	260	2,197	8.7	384.5	384.5	384.5	0.0
W	93,860	144	1,685	11.4	418.6	418.6	418.6	0.0
X	95,831	173	1,250	15.2	433.0	433.0	433.0	0.0
Y	97,526	110	1,304	14.6	445.6	445.6	445.6	0.0
Z	99,696	167	1,772	10.7	457.3	457.3	457.7	0.5
AA	102,734	133	1,145	16.6	483.7	483.7	483.8	0.0
AB	107,078	232	1,459	13.1	512.3	512.3	512.5	0.2
AC	110,715	182	3,130	7.1	541.8	541.8	542.5	0.7
AD	115,040	255	2,725	7.4	555.1	555.1	555.5	0.3
AE	120,336	490	6,785	3.0	588.4	588.4	588.4	0.0
AF	124,146	437	6,995	3.8	603.8	603.8	603.9	0.1
AG	127,543	978	4,548	3.8	615.4	615.4	615.4	0.0

[1]Feet above mouth at Pacific Ocean
*Data not available

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

CALLEGUAS CREEK/ARROYO LAS POSAS/ARROYO SIMI

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Calleguas Creek/ Arroyo Las Posas/ Arroyo Simi (continued)								
AH	131,030	915	5,057	5.2	631.8	631.8	632.4	0.6
AI	131,880	671	3,757	7.1	635.7	635.7	636.7	1.0
AJ	132,000	245	1,749	15.2	637.7	637.7	638.0	0.3
AK	132,380	407	3,595	7.4	642.8	642.8	643.5	0.7
AL	132,930	408	3,769	7.0	644.6	644.6	645.6	1.0
AM	133,355	250	2,058	12.9	645.8	645.8	646.1	0.3
AN	133,705	204	1,641	16.1	649.8	649.8	649.8	0.0
AO	134,030	275	2,874	8.5	654.2	654.2	654.7	0.5
AP	134,980	529	3,047	8.0	657.6	657.6	658.0	0.4
AQ	136,300	484	3,566	6.9	663.4	663.4	664.4	1.0
AR	137,100	250	2,435	10.1	666.9	666.9	667.1	0.2
AS	137,500	250	2,592	9.5	668.7	668.7	669.0	0.3
AT	138,130	250	1,930	12.7	671.6	671.6	671.6	0.0
AU	138,780	299	2,907	8.4	676.8	676.8	677.8	1.0
AV	140,130	208	2,517	9.5	682.5	682.5	682.8	0.3
AW	150,185	200	1,671	11.1	789.1	789.1	789.1	0.0
AX	151,185	132	1,139	16.2	791.6	791.2	791.6	0.4
AY	152,190	137	1,237	13.0	805.4	805.4	802.6	0.0
AZ	153,385	167	1,181	13.6	810.5	810.5	810.5	0.0
BA	154,535	108	1,044	17.7	827.0	827.0	827.0	0.0
BB	155,680	181	1,544	12.0	837.3	837.3	837.3	0.0
BC	156,670	182	1,397	13.2	844.2	844.2	844.2	0.0
BD	157,700	163	1,585	11.7	851.7	851.7	851.7	0.0
BE	158,795	135	1,128	16.4	858.0	858.0	858.0	0.0
BF	159,940	123	893	14.6	867.2	867.2	867.3	0.1

[1]Feet above mouth at Pacific Ocean

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

CALLEGUAS CREEK/ARROYO LAS POSAS/ARROYO SIMI

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Calleguas Creek/ Arroyo Las Posas/ Arroyo Simi (continued)								
BG	160,960	172	1,139	11.4	875.9	875.9	876.4	0.5
BH	161,675	185	939	13.8	881.5	881.5	881.5	0.0
BI	162,390	134	1,203	10.8	888.9	888.9	888.9	0.0
BJ	163,615	300	2,169	6.0	894.8	894.8	895.2	0.4
BK	164,615	135	932	14.0	896.9	896.9	896.9	0.0
BL	165,625	110	1,189	10.9	904.9	904.9	904.9	0.0
BM	166,665	225	2,191	4.5	908.8	908.8	909.0	0.2
BN	167,865	89	639	15.3	915.5	915.5	915.5	0.0
BO	168,960	108	682	14.4	928.9	928.9	928.9	0.0
BP	170,160	93	728	13.5	938.0	938.0	938.0	0.0
BQ	171,325	95	653	15.0	952.2	952.2	952.2	0.0
BR	172,395	95	962	10.2	962.9	962.9	963.1	0.2
BS	173,410	90	869	11.3	966.8	966.8	967.3	0.5
BT	174,395	233	513	20.3	976.2	976.2	976.2	0.0
BU	175,401	110	1,222	6.6	984.1	984.1	984.1	0.0
BV	176,412	137	1,197	6.7	985.8	985.8	985.8	0.0
BW	177,447	56	791	10.1	988.5	988.5	988.5	0.0
BX	178,100	54	578	13.0	988.5	988.5	988.5	0.0
BY	178,483	54	539	13.9	988.5	988.5	988.5	0.0
BZ	179,483	54	407	18.4	989.3	989.3	989.3	0.0
CA	180,351	54	289	26.0	990.5	990.5	990.5	0.0
CB	181,081	142	505	13.9	998.9	998.9	999.2	0.3
CC	181,711	81	739	9.5	1,007.3	1,007.3	1,007.7	0.4
CD	182,612	194	1,240	5.6	1,013.1	1,013.1	1,013.9	0.8
CE	183,331	430	2,192	3.2	1,022.0	1,022.0	1,022.0	0.0

[1]Feet above mouth at Pacific Ocean

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

CALLEGUAS CREEK/ARROYO LAS POSAS/ARROYO SIMI

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Calleguas Creek/ Arroyo Las Posas/ Arroyo Simi (continued)								
CF	183,897	327	2,203	3.2	1,029.9	1,029.9	1,030.9	1.0
CG	186,198	390	1,303	2.6	1,046.0	1,046.0	1,047.0	1.0
CH	187,087	367	2,044	1.6	1,058.1	1,058.1	1,058.6	0.5
CI	187,587	519	1,479	2.3	1,062.3	1,062.3	1,062.8	0.5
CJ	188,377	288	1,243	2.7	1,071.4	1,071.4	1,072.1	0.7
CK	188,740	150	845	4.0	1,076.1	1,076.1	1,076.8	0.7
CL	189,615	183	683	4.9	1,086.9	1,086.9	1,087.4	0.5
CM	189,935	326	748	4.5	1,090.8	1,090.8	1,090.8	0.0
CN	190,245	324	730	4.6	1,096.0	1,096.0	1,096.0	0.0
CO	190,925	47	253	13.3	1,108.5	1,108.5	1,108.5	0.0
CP	191,585	40	302	11.1	1,120.2	1,120.2	1,120.4	0.2

[1]Feet above mouth at Pacific Ocean

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

CALLEGUAS CREEK/ARROYO LAS POSAS/ARROYO SIMI

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Camarillo Hills Drain								
A	2,600	90	778	4.6	57.5	57.5	57.5	0.0
B	3,100	84	675	5.3	57.8	57.8	57.8	0.0
C	4,600	105	740	4.8	59.3	59.3	59.3	0.0
D	5,600	133	830	4.0	60.3	60.3	60.3	0.0
E	7,600	118	512	6.6	63.7	63.7	63.7	0.0
F	11,600	126	621	5.8	75.7	75.7	75.7	0.0
G	14,600	124	574	5.4	83.5	83.5	83.5	0.0
H	16,015	46	238	12.9	87.8	87.8	87.8	0.0

[1] Feet above confluence with Revolon Slough

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

CAMARILLO HILLS DRAIN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Conejo Creek								
A	0	213	2,547	8.8	94.4	94.4	95.4	1.0
B	1,201	413	4,164	5.4	100.1	100.1	100.8	0.7
C	2,488	1,102	7,293	3.1	101.7	101.7	102.3	0.6
D	3,096	1,437	4,833	4.6	102.2	102.2	102.7	0.5
E	3,162	1,449	4,897	4.6	102.4	102.4	102.9	0.5
F	4,536	1,589	5,933	3.8	104.5	104.5	104.7	0.2
G	5,636	1,461	6,405	3.5	105.7	105.7	105.8	0.1
H	6,557	1,180	4,329	5.2	107.1	107.1	107.3	0.2
I	6,643	1,520	4,916	4.6	107.4	107.4	107.5	0.1
J	7,162	1,520	4,916	4.6	107.4	107.4	107.5	0.1
K	8,089	2,410	9,417	2.4	109.3	109.3	109.3	0.0
L	9,974	1,898	4,937	4.7	110.8	110.8	110.8	0.0
M	11,322	1,180	3,994	10.8	113.6	113.6	114.0	0.4
N	12,451	1,526	7,032	8.0	117.1	117.1	117.4	0.3
O	12,770	2,303	12,739	4.3	117.9	117.9	118.2	0.3
P	12,888	1,881	10,591	5.3	117.9	117.9	118.2	0.3
Q	14,580	1,070	8,404	4.2	118.0	118.0	118.8	0.8
R	14,769	323	3,234	7.2	118.7	118.7	118.9	0.2
S	16,729	276	2,974	7.0	120.7	120.7	121.0	0.3
T	17,033	870	6,865	4.4	121.1	121.1	121.8	0.7
U	19,073	561	3,973	6.6	122.1	122.1	122.6	0.5
V	21,501	258	2,474	9.4	126.7	126.7	127.4	0.7
W	25,229	280	3,383	6.8	143.3	143.3	143.3	0.0
X	26,043	635	2,859	8.2	150.2	150.2	150.2	0.0
Y	28,698	204	1,750	7.1	161.5	161.5	161.7	0.2
Z	30,035	157	2,551	8.2	177.3	177.3	177.6	0.3

[1]Feet above Limit of Floodway*

*Limit of Floodway is approximately 160 feet upstream of confluence with Calleguas Creek

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

CONEJO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Conejo Creek (continued)								
AA	30,25	842	4,462	4.7	180.1	180.1	180.2	0.1
AB	33,492	1,230	2,790	7.5	187.4	187.4	187.4	0.0
AC	35,519	1,111	2,547	8.2	193.3	193.3	193.3	0.0
AD	34,631	1,162	2,913	7.1	195.3	195.3	195.3	0.0
AE	36,077	513	2,849	7.3	204.5	204.5	204.7	0.2
AF	36,762	603	2,555	8.1	208.9	208.9	208.9	0.0
AG	37,602	592	2,677	8.7	213.0	213.0	213.4	0.4
AH	38,781	197	1,729	13.4	218.1	218.1	218.2	0.1
AI	39,989	1,272	4,664	5.0	228.3	228.3	228.5	0.2
AJ	40,664	797	2,870	8.1	230.9	230.9	230.9	0.2
AK	41,530	423	2,335	9.7	235.5	235.5	236.4	0.9
AL	42,811	352	2,035	11.1	240.8	240.8	241.3	0.5

[1]Feet above Limit of Floodway*

*Limit of Floodway is approximately 160 feet upstream of confluence with Calleguas Creek

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

CONEJO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Fox Canyon Storm Drain								
A	730[1]	80	265	9.0	688.1	688.1	688.1	0.0
B	1,480[1]	60	250	12.3	699.6	699.6	699.6	0.0
C	2,055[1]	40	140	10.9	706.6	706.6	706.6	0.0
D	10,340[1]	30	60	9.3	885.0	885.0	885.0	0.0
Las Posas Estates Drain								
A	4,810[2]	150	321	5.1	81.6	81.6	82.5	0.9
B	6,370[2]	100	250	6.0	92.8	92.8	92.9	0.1
C	7,250[2]	100	237	6.3	96.3	96.3	96.3	0.0
D	8,000[2]	100	218	6.4	99.4	99.4	99.6	0.2
E	9,440[2]	60	198	6.1	106.3	106.3	107.2	0.9
F	10,400[2]	60	217	4.8	110.1	110.1	110.6	0.5
Peach Hill Wash								
A	250[3]	27	124	15.2	435.4	435.4	435.5	0.1
B	850[3]	58	345	5.5	445.2	445.2	445.8	0.6
C	1,300[3]	29	157	12.0	447.5	447.5	447.6	0.1
D	2,050[3]	30	197	9.6	455.6	455.6	455.6	0.0
E	2,600[3]	12	106	11.8	461.8	461.8	462.6	0.8
F	3,550[3]	121	1,194	2.0	471.7	471.7	471.7	0.0
G	4,300[3]	65	289	8.1	471.7	471.7	471.7	0.0
H	5,600[3]	86	354	6.6	476.9	476.9	476.9	0.0

[1]Feet above confluence with Stewart Canyon Creek
[2]Feet above confluence with Camarillo Hills Drain
[3]Feet above confluence with Calleguas Creek
*Data Not Available

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

FOX CANYON STORM DRAIN – LAS POSAS ESTATES DRAIN - PEACH HILL WASH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Pole Creek								
A	2,510[1]	24	240	36.4	463.2	463.2	463.2	0.0
B	3,150[1]	24	200	41.6	469.2	469.2	469.2	0.0
C	4,600[1]	20	190	45.3	501.7	501.7	501.7	0.0
D	5,500[1]	20	190	45.6	524.4	524.4	524.4	0.0
E	6,100[1]	20	180	46.6	539.4	539.4	539.4	0.0
F	7,450[1]	70	530	16.1	585.2	585.2	585.2	0.0
G	8,030[1]	90	560	15.7	604.4	604.4	604.4	0.0
Piru Creek								
A	3,000[1]	600	4,133	9.9	660.5	660.5	661.5	1.0
B	4,180[1]	763	6,416	6.4	671.1	671.1	671.8	0.7
C	5,000[1]	700	3,740	11.0	674.3	674.3	674.7	0.4
D	6,000[1]	448	3,051	13.4	682.8	682.8	682.8	0.0
E	7,040[1]	285	3,519	11.7	694.4	694.4	694.4	0.0
Rincon Creek								
A	200[2]	433/433[3]	1,977	5.2	15.5	15.5	16.0	0.5
B	450[2]	287/213[3]	1,988	5.2	17.2	17.2	17.8	0.6
C	790[2]	21/0[3]	376	23.3	23.9	23.9	23.9	0.0
D	1,665[2]	21/11[3]	535	15.9	40.4	40.4	40.4	0.0
E	2,165[2]	136/0[3]	1,776	5.8	49.5	49.5	49.5	0.0
F	3,065[2]	133/85[3]	1,296	8.0	67.2	67.2	67.2	0.0
G	3,465[2]	180/82[3]	2,112	4.9	72.6	72.6	73.2	0.6

[1]Feet above confluence with Santa Clara River
[2]Feet above mouth at Pacific Ocean
[3]Width/Width within Ventura County

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

POLE CREEK – PIRU CREEK - RINCON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
San Antonio Creek								
A	1,550	590	2,306	8.6	326.8	326.8	326.8	0.0
B	4,440	219	1,563	12.7	348.2	348.2	348.2	0.0
C	6,230	350	1,934	10.3	368.0	368.0	368.0	0.0
D	7,590	393	1,853	10.7	380.2	380.2	380.3	0.1
E	10,320	420	1,754	11.3	406.2	406.2	406.2	0.0
F	13,090	410	1,777	10.2	437.4	437.4	437.9	0.5
G	16,000	224	1,420	12.8	468.0	468.0	468.0	0.0
H	20,670	124	1,050	17.3	513.2	513.2	513.2	0.0
I	21,790	130	2,132	8.5	530.1	530.1	530.2	0.1
J	25,795	116	1,116	13.3	576.4	576.4	577.1	0.7
K	27,020	176	1,290	10.9	590.5	590.5	590.5	0.0
L	28,000	260	1,028	13.8	600.5	600.5	600.5	0.0
M	29,140	238	2,005	7.0	615.4	615.4	615.4	0.0
N	30,840	372	1,172	11.9	630.0	630.0	630.0	0.0
O	31,890	143	852	14.1	643.0	643.0	643.0	0.0
P	32,850	280	1,032	10.8	654.8	654.8	655.8	1.0
Q	34,350	320	1,148	9.8	678.3	678.3	679.0	0.7
R	36,065	230	1,026	12.0	700.6	700.6	701.4	0.8
S	37,740	150	616	11.4	725.4	725.4	726.1	0.7
T	38,715	170	635	11.0	744.9	744.9	745.3	0.4
U	39,735	105	542	12.9	758.7	758.7	758.7	0.0
V	41,580	100	532	13.1	794.6	794.6	794.6	0.0

[1]Feet above confluence with Ventura River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

SAN ANTONIO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Santa Clara River								
A	1,860	1,895	10,561	8.3	13.7	13.7	13.7	0.0
B	4,000	1,092	6,353	13.9	18.2	18.2	18.5	0.3
C	5,500	4,320	24,269	6.6	23.7	23.7	24.4	0.7
D	7,380	3,701	20,155	8.0	27.1	27.1	28.1	1.0
E	9,700	3,040	20,606	7.8	33.1	33.1	34.1	1.0
F	12,360	1,980	13,456	12.0	41.9	41.9	41.9	0.0
G	15,000	1,150	12,314	13.1	48.2	48.2	48.2	0.0
H	18,000	1,490	14,827	10.9	55.2	55.2	56.2	1.0
I	20,600	1,590	22,576	7.1	64.8	64.8	65.3	0.5
J	23,450	1,683	18,624	8.6	68.5	68.5	68.9	0.4
K	25,600	1,488	10,493	15.3	72.1	72.1	72.1	0.0
L	28,200	1,620	13,499	11.9	80.7	80.7	80.7	0.0
M	31,000	1,430	12,321	13.1	86.2	86.2	86.2	0.0
N	34,000	1,400	13,752	11.7	96.4	96.4	96.8	0.4
O	37,000	1,880	15,625	10.3	100.9	100.9	101.2	0.3
P	40,000	1,500	9,072	17.7	109.4	109.4	109.4	0.0
Q	43,000	1,190	8,612	18.7	117.2	117.2	117.2	0.0
R	45,520	1,700	14,504	11.1	125.2	125.2	125.2	0.0
S	48,500	1,390	10,369	15.5	129.3	129.3	130.0	0.7
T	51,500	1,396	11,808	13.6	143.6	143.6	143.6	0.0
U	54,900	1,123	12,514	12.9	162.1	162.1	162.1	0.0
V	58,870	1,290	8,968	18.0	180.7	180.7	181.1	0.3
W	62,000	1,730	9,832	16.4	189.0	189.0	189.0	0.0
X	65,000	970	14,759	10.9	198.1	198.1	198.2	0.1
Y	68,000	1,020	12,698	12.7	208.2	208.2	208.2	0.0
Z	71,000	1,185	9,283	17.3	219.7	219.7	219.7	0.0

[1]Feet above mouth at Pacific Ocean

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

SANTA CLARA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Santa Clara River (continued)								
AA	73,600	1,486	14,008	11.5	227.6	227.6	227.7	0.1
AB	77,000	1,600	14,567	11.1	242.0	242.0	242.8	0.8
AC	80,100	1,300	11,200	14.4	250.8	250.8	251.1	0.3
AD	83,140	979	9,143	17.6	260.4	260.4	260.4	0.0
AE	87,100	2,420	25,904	6.2	271.9	271.9	272.8	0.9
AF	90,000	2,280	16,985	9.2	281.7	281.7	281.7	0.0
AG	93,000	2,860	14,946	10.5	288.8	288.8	288.8	0.0
AH	97,000	2,510	15,437	10.2	300.4	300.4	300.8	0.4
AI	100,800	2,227	15,948	9.8	308.5	308.5	308.5	0.0
AJ	104,000	2,160	18,465	8.5	322.0	322.0	322.8	0.8
AK	106,900	2,840	12,784	12.3	333.0	333.0	333.1	0.1
AL	109,960	3,380	16,244	9.7	344.0	344.0	344.8	0.8
AM	112,850	3,150	15,842	9.9	354.2	354.2	355.3	1.1
AN	116,160	2,780	16,948	9.3	367.3	367.3	367.4	0.1
AO	119,730	2,120	15,694	10.0	383.3	383.3	384.3	1.0
AP	120,420	2,230	9,210	10.0	384.8	384.8	384.8	0.0
AQ	122,100	1,520	11,007	8.9	392.3	392.3	392.4	0.1
AR	123,950	1,280	13,159	7.5	401.6	401.6	401.6	0.0
AS	125,000	1,450	12,352	7.9	406.1	406.1	406.1	0.0
AT	126,650	1,800	9,922	9.9	414.0	414.0	414.4	0.4
AU	127,600	400	9,001	10.9	418.9	418.9	419.3	0.4
AV	129,080	1,782	13,451	7.3	426.3	426.3	426.3	0.0
AW	130,910	1,920	8,693	11.3	431.8	431.8	432.6	0.8
AX	137,140	2,370	9,942	9.9	464.6	464.6	465.5	0.9
AY	140,070	1,862[2]	8,358	11.7	482.2	482.2	482.5	0.3
AZ	142,660	1,900	10,646	9.2	496.1	496.1	496.3	0.2

[1]Feet above mouth at Pacific Ocean
[2]Floodway width does not include width of high ground area

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

SANTA CLARA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Santa Clara River (continued)								
BA	145,370	1,698	8,018	12.2	511.4	511.4	511.4	0.0
BB	148,050	2,448	12,171	8.1	527.2	527.2	527.5	0.3
BC	150,700	1,770	9,022	10.2	542.4	542.4	542.8	0.4
BD	152,500	1,720	10,296	8.9	553.4	553.4	553.9	0.5
BE	155,400	2,550	13,094	7.0	567.3	567.3	567.3	0.0
BF	158,500	2,640	10,888	8.5	582.5	582.5	583.2	0.7
BG	161,250	2,150	11,851	7.8	599.0	599.0	599.1	0.1
BH	163,550	1,785	9,210	10.0	612.2	612.2	612.2	0.0
BI	165,670	1,950	11,021	8.3	625.5	625.5	625.5	0.0
BJ	168,700	2,160	11,520	8.0	640.0	640.0	640.0	0.0
BK	176,090	2,100	8,096	7.4	681.3	681.3	681.6	0.3
BL	178,650	1,840	7,751	7.7	698.1	698.1	698.1	0.0
BM	181,300	1,165	6,406	9.4	711.9	711.9	712.0	0.1
BN	184,140	525	5,051	11.9	729.9	729.9	729.9	0.0
BO	186,400	675	5,270	11.4	742.6	742.6	742.6	0.0
BP	189,450	1,020	7,006	8.6	758.7	758.7	758.7	0.0
BQ	192,500	1,275	6,442	9.3	774.8	774.8	774.8	0.0
BR	197,880	1,565	8,327	7.2	808.1	808.1	808.1	0.0
BS	203,200	1,575/1,075[2]	7,341	8.2	829.1	829.1	829.1	0.0
Santa Clara River Breakout								
A	1,000	849	6,297	11.6	12.6	12.6	12.6	0.0
B	3,000	1,120	10,674	6.8	17.7	17.7	18.3	0.6
C	5,000	1,700	16,309	4.5	21.2	21.2	21.5	0.3
D	7,130	3,230	15,353	4.8	22.5	22.5	22.9	0.4

[1]Feet above mouth at Pacific Ocean
[2]Width/width within study area

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

SANTA CLARA RIVER – SANTA CLARA RIVER BREAKOUT

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Sespe Creek								
A	9,500[1]	*	11,170	7.2	418.6	418.6	418.6	0.0
B	12,100[1]	*	11,260	7.1	436.7	436.7	436.7	0.0
C	19,800[1]	706	9,002	10.2	504.3	504.3	504.3	0.0
D	22,500[1]	1,000	9,172	10.0	532.7	532.7	532.9	0.2
E	25,200[1]	420	5,426	17.0	559.9	559.9	559.9	0.0
F	28,100[1]	473	5,148	17.9	586.2	586.2	586.3	0.1
G	30,300[1]	282	4,179	22.0	611.4	611.4	611.4	0.0
Stewart Canyon Creek								
A	2,225[2]	105	463	12.2	666.2	666.2	666.2	0.0
B	3,080[2]	64	241	11.3	684.1	684.1	684.1	0.0
C	4,200[2]	52	229	12.2	705.4	705.4	705.4	0.0
Thatcher Creek								
A	350[2]	115	549	12.4	723.5	723.5	723.5	0.0
B	1,650[2]	137	578	11.8	748.7	748.7	748.7	0.0
C	3,190[2]	200	577	10.6	777.7	777.7	777.7	0.0
D	3,620[2]	200	663	9.2	786.5	786.5	786.5	0.0
E	4,700[2]	200	641	9.5	803.0	803.0	803.0	0.0
F	5,590[2]	200	641	9.2	816.7	816.7	816.7	0.0
G	7,208[2]	*	*	*	840.7	*	*	*
H	8,783[2]	*	*	*	869.1	*	*	*

[1]Feet above confluence with Santa Clara River
[2]Feet above confluence with San Antonio Creek
*Data not available

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

SESPE CREEK –STEWART CANYON CREEK – THATCHER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Ventura River								
A	1,540	1,621	11,256	6.9	17.2	17.2	17.2	0.0
B	2,570	1,279	6,557	11.9	20.7	20.7	20.7	0.0
C	3,700	986	8,080	9.7	29.0	29.0	29.1	0.1
D	5,500	608	6,017	13.0	40.7	40.7	41.1	0.4
E	7,500	840	9,209	8.5	49.8	49.8	49.8	0.0
F	9,500	683	4,969	15.7	65.5	65.5	65.5	0.0
G	11,500	1,150	5,657	13.8	78.9	78.9	78.9	0.0
H	13,500	464	4,307	17.6	97.8	97.8	97.8	0.0
I	15,450	450	3,933	19.3	118.1	118.1	118.1	0.0
J	17,224	600	7,978	9.5	134.4	134.4	134.6	0.2
K	19,150	556	4,842	15.8	149.1	149.1	149.1	0.0
L	21,050	335	3,774	20.1	161.2	161.2	161.3	0.1
M	23,250	1,000	6,064	12.2	175.8	175.8	175.8	0.0
N	25,350	465	4,273	16.4	191.1	191.1	191.1	0.0
O	27,600	510	4,379	16.0	206.3	206.3	206.3	0.0
P	29,750	343	3,611	19.4	223.9	223.9	223.9	0.0
Q	32,000	850	9,336	7.5	239.4	239.4	239.4	0.0
R	34,000	689	4,458	14.6	250.3	250.3	250.5	0.2
S	36,000	673	4,639	14.0	266.6	266.6	267.0	0.4
T	38,000	740	4,795	13.6	286.3	286.3	287.3	1.0
U	40,000	800	4,857	13.4	303.8	303.8	304.7	0.9
V	42,000	679	5,110	8.0	322.2	322.2	322.3	0.1
W	44,000	1,550	5,282	7.8	345.4	345.4	345.4	0.0
X	46,000	1,987	5,318	7.7	369.5	369.5	369.5	0.0
Y	48,000	809	4,044	9.9	397.7	397.7	398.5	0.8
Z	51,000	507	3,710	10.8	429.1	429.1	429.1	0.0

[1]Feet above Pacific Ocean

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

VENTURA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Ventura River (continued)								
AA	53,000	974	3,675	10.9	456.7	456.7	456.7	0.0
AB	55,000	1,097	3,625	11.0	482.2	482.2	482.6	0.4
AC	57,000	1,201	3,885	9.8	511.4	511.4	511.4	0.0
AD	59,000	771	3,175	12.0	543.4	543.4	543.4	0.0
AE	61,000	1,509	3,758	10.1	569.5	569.5	570.4	0.9
AF	63,000	1,049	3,607	10.5	599.1	599.1	599.3	0.2
AG	65,000	850	3,210	11.8	626.2	626.2	626.2	0.0
AH	67,000	1,760	3,520	10.8	657.9	657.9	657.9	0.0
AI	69,000	1,833	4,290	8.9	692.4	692.4	692.4	0.0
AJ	71,000	1,350	3,969	9.6	726.8	726.8	727.5	0.7
AK	73,000	935	3,155	11.6	759.2	759.2	759.6	0.4
AL	75,000	313	2,330	15.7	783.3	783.3	783.3	0.0
AM	77,000	428	2,528	13.8	809.8	809.8	809.8	0.0
AN	78,500	570	3,686	9.5	831.2	831.2	831.2	0.0
AO	80,500	480	2,270	15.4	878.0	878.0	878.0	0.0
AP	82,000	239	2,067	16.9	907.0	907.0	907.0	0.0
AQ	84,000	142	1,488	18.5	955.2	955.2	955.2	0.0

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

VENTURA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Ventura River-Without Consideration of Levee								
S	36,000	673	4,639	14.0	266.6	266.6	267.0	0.4
T	38,000	740	4,795	13.6	286.3	286.3	287.3	1.0
U	40,000	800	4,857	13.4	303.8	303.8	304.7	0.9

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

FLOODWAY DATA

VENTURA RIVER-WITHOUT CONSIDERATION OF LEVEE

FEMA understood that it may take time to acquire and/or assemble the documentation necessary to fully comply with 44 CFR 65.10. Therefore, FEMA put forth a process to provide the communities with additional time to submit all the necessary documentation. For a community to avail itself of the additional time, it had to sign an agreement with FEMA. Levees for which such agreements were signed are shown on the final effective FIRM as providing protection from the flood that has a 1-percent-annual-chance of being equaled or exceeded in any given year and labeled as a Provisionally Accredited Levee (PAL). Communities have two years from the date of FEMA's initial coordination to submit to FEMA final accreditation data for all PALs. Following receipt of final accreditation data, FEMA will revise the FIS and FIRM as warranted.

FEMA coordinated with the local communities, USACE, and other organizations to compile a list of levees (see Table 9, "List of Levees") based on information from the FIRM and community provided information.

Table 9: List of Levees

Community	Flooding Source	PAL	Levee Object ID	VCWPD Levee ID
City of Camarillo	Camarillo Hills Drain	No	110	CHD-1
City of Camarillo	Calleguas Creek	Yes	119	CC-3
City of Camarillo	Calleguas Creek	Yes	120	CC-2
City of Fillmore	Sespe Creek	Yes	46	SC-1
City of Fillmore	Pole Creek	No	81	SCR-5
City of Fillmore	Pole Creek	No	82	SCR-5
City of Fillmore	Sespe Creek	No	101	SC-1
City of Fillmore	Santa Paula Creek	No	105	SPC-1
City of Fillmore	Santa Clara River	No	114	SCR-5
City of Moorpark	Calleguas Creek	No	35	NONE
City of Moorpark	South Grimes Canyon Wash	No	39	NONE
City of Moorpark	Arroyo Simi	No	122	AS-2
City of Moorpark	Arroyo Simi	No	123	AS-2
City of Moorpark	Arroyo Simi	No	124	AS-3
City of Moorpark	Arroyo Simi	No	125	AS-3
City of Oxnard/Ventura County Unincorporated Areas)	Santa Clara River	Yes	18	SCR-1
City of Oxnard	Victoria Avenue Drain	No	76	SCR-3

Table 9: List of Levees (continued)

Community	Flooding Source	PAL	Levee Object ID	VCWPD Levee ID
City of Oxnard	Victoria Avenue Drain	No	77	SCR-3
City of Oxnard	El Rio Drain	No	78	ERD-1
City of Oxnard	Santa Clara River	No	86	SCR-3
City of San Buenaventura	Ventura River	No	102	VR-2
City of Santa Paula	Santa Clara River	No	104	SCR-2
City of Santa Paula	Santa Paula Creek	No	113	SPC-1
City of Simi Valley	Arroyo Simi	No	74	NONE
City of Simi Valley	Arroyo Simi	Yes	107	AS-7
City of Simi Valley	Arroyo Simi	Yes	112	AS-7
Ventura County (Unincorporated Areas)	Todd Barranca	No	1	NONE
Ventura County (Unincorporated Areas)	Hidden Valley Wash	No	11	NONE
Ventura County (Unincorporated Areas)	Lake Sherwood	No	12	NONE
Ventura County (Unincorporated Areas)	Conejo Creek	No	14	CON-1
Ventura County (Unincorporated Areas)	Beardsley Wash	No	15	NONE
Ventura County (Unincorporated Areas)	Nyeland Drain/Nyeland Drain Tributary	No	16	NONE
Ventura County (Unincorporated Areas)	Santa Clara River	Yes	18	SCR-1
Ventura County (Unincorporated Areas)	Happy Camp Canyon	No	24	NONE
Ventura County (Unincorporated Areas)	Pacific Ocean	No	27	NONE
Ventura County (Unincorporated Areas)	Tapo Canyon Creek	No	28	NONE
Ventura County (Unincorporated Areas)	Santa Clara River	No	29	NONE
Ventura County (Unincorporated Areas)	Holser Canyon Creek	No	30	NONE

Table 9: List of Levees (continued)

Community	Flooding Source	PAL	Levee Object ID	VCWPD Levee ID
Ventura County (Unincorporated Areas)	Pacific Ocean	No	37	NONE
Ventura County (Unincorporated Areas)	South Grimes Canyon Wash	No	38	NONE
Ventura County (Unincorporated Areas)	Calleguas Creek	No	40	AS-1
Ventura County (Unincorporated Areas)	Ellsworth Barranca	No	52	NONE
Ventura County (Unincorporated Areas)	San Antonio Creek	No	67	NONE
Ventura County (Unincorporated Areas)	Grimes Canyon	No	79	GCW-1
Ventura County (Unincorporated Areas)	Grimes Canyon	No	80	GCW-1
Ventura County (Unincorporated Areas)	Basolo Ditch	No	83	NONE
Ventura County (Unincorporated Areas)	Basolo Ditch	No	84	NONE
Ventura County (Unincorporated Areas)	Piru Creek	No	85	NONE
Ventura County (Unincorporated Areas)	Santa Clara River	No	88	SCR-1
Ventura County (Unincorporated Areas)	Pacific Ocean	No	91	NONE
Ventura County (Unincorporated Areas)	Gabbert Canyon	No	98	NONE
Ventura County (Unincorporated Areas)	Arroyo Santa Rosa	No	109	ASR-2
Ventura County (Unincorporated Areas)	Santa Clara River	No	111	SCR-7
Ventura County (Unincorporated Areas)	Revolon Slough	No	115	RS-1
Ventura County (Unincorporated Areas)	Revolon Slough	No	116	RS-1

Table 9: List of Levees (continued)

Community	Flooding Source	PAL	Levee Object ID	VCWPD Levee ID
Ventura County (Unincorporated Areas)	Revolon Slough	No	117	RS-1
Ventura County (Unincorporated Areas)	Revolon Slough	No	118	RS-1
Ventura County (Unincorporated Areas)	Calleguas Creek	No	121	CC-1
Ventura County (Unincorporated Areas)	Arroyo Simi	No	126	AS-4
Ventura County (Unincorporated Areas)	Calleguas Creek	No	127	CC-1

Approximate analyses of "behind levee" flooding were conducted for all the levees in Table 9 to indicate the extent of the "behind levee" floodplains. The methodology used in these analyses is discussed below.

The structure with inventory ID #1 is located on Todd Barranca. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, an approximate 1-percent-annual-chance flooding was determined based on engineering judgment. The results showed that the flooding was contained in the channel and an approximate Zone A flood hazard boundary was already shown on the land side of the levee in the effective maps. Therefore, no change in the floodplain is recommended in the channel.

The structure with inventory ID #11 is located on Hidden Valley Wash. Based on topographic data obtained from USGS 10m Digital Elevation Model (DEM), there is no depression behind the structure. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #12 is located on Lake Sherwood. Based on topographic data obtained from USGS 10m Digital Elevation Model (DEM), there is no depression behind the structure. Therefore, no change in floodplain is recommended at this location.

The levee with inventory ID #14 is located on Conejo Creek. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. Therefore, no change in floodplain is recommended at this location. Additionally, the FIS states that the effective floodplain in this reach did not consider the levee to be in place.

The structure with inventory ID #15 is located on Beardsley Wash. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood elevations for Beardsley Wash were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #16 is located on Nyeland Drain/Nyeland Drain Tributary. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood elevations for Nyeland Drain were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The levee with inventory ID #18 is located on Santa Clara River. A behind-structure floodplain was obtained based on topographic data obtained from LiDAR mass-points provided by Ventura County and by extending the effective 1-percent-annual-chance base flood elevations for Santa Clara River. However, under a newly issued PAL agreement that extends through December 1, 2009, this floodplain will be shown as a provisionally protected Zone X until such time that the provisional accreditation can be verified or it expires.

The structure with inventory ID #24 is located on Happy Camp Canyon. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood elevations for Happy Camp Canyon were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #27 is located on Pacific Ocean. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the road. Therefore, no change is floodplain is recommended at this location.

The structure with inventory ID #28 is located on Tapo Canyon Creek. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, an approximate 1-percent-annual-chance flooding was determined based on engineering judgment. The results showed that the flooding was contained in the channel and an approximate Zone A flood hazard boundary was already shown on the land side of the levee in the effective maps. Therefore, no change in the floodplain is recommended in the channel.

The structure with inventory ID #29 is located on Santa Clara River. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood elevations for Santa Clara River were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #30 is located on Holser Canyon Creek. Discharges for the stream were calculated using 10m USGS DEMs and USGS regression equations. Using topographic data obtained from LiDAR mass-points provided by Ventura County, and results from approximate hydrologic and hydraulic analysis, a 1-percent-annual-chance flooding was determined.

The structure with inventory ID #35 is located on Arroyo Simi. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood

elevations for Arroyo Simi were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #37 is located on Pacific Ocean. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the road. Therefore, no change is floodplain is recommended at this location.

The structure with inventory ID #38 is located on South Grimes Wash. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, a 1-percent-annual-chance flooding was determined using engineering judgment.

The structure with inventory ID #39 is located on South Grimes Wash. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #40 is located on Calleguas Creek. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood elevations for Calleguas Creek were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The levee with inventory ID #46 is located on Sespe Creek. The structure is part of the ongoing Santa Clara River restudy. The behind-structure floodplain was based on updated hydrologic analysis and LiDAR data provided by Ventura County Watershed Protection District (VCWPD). Under a newly issued PAL agreement that extends through December 1, 2009, this floodplain will be shown as a provisionally protected Zone X until such time that the provisional accreditation can be verified or it expires.

The structure with inventory ID #52 is located on Ellsworth Barranca. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, a 1-percent-annual-chance flooding was determined using engineering judgment.

The levee with inventory ID #53 is located on Ventura River. Based on the FIS and topographic information for LiDAR mass-points provided by Ventura County, the effective shaded zone X to the east of the channel was recommended as the approximate areas of 1-percent-annual-chance flooding.

The structure with inventory ID #67 is located on San Antonio Creek. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood elevations for San Antonio Creek were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #74 is located on Arroyo Simi. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood

elevations for Arroyo Simi were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The structures with inventory ID #76 and 77 are located on Patterson Drain. The structure is part of an ongoing restudy for the Santa Clara River and its' major tributaries. There is no change in floodplain required under FEMA Procedure Memorandums 34 and 43. However, the Santa Clara restudy will recommend flood hazard changes in this area.

The levee with inventory ID #78 is located on El Rio Drain. The structure is part of ongoing Santa Clara River restudy. There is no change in floodplain required under FEMA Procedure Memorandums 34 and 43. However, the Santa Clara restudy will recommend flood hazard changes in this area.

The levee with inventory ID #79 is located on Grimes Canyon. The structure is part of the ongoing Santa Clara River restudy. The behind structure floodplain was based on updated hydrologic analysis and LiDAR data provided by Ventura County Watershed Protection District (VCWPD). No change in floodplain is recommended at this location.

The levee with inventory ID #80 is located on Grimes Canyon. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. No change in floodplain is recommended at this location.

The structure with inventory ID #81 and 82 are located on Pole Creek. The structure is part of the ongoing Santa Clara River restudy. The behind-structure floodplain was based on updated hydrologic analysis and LiDAR data provided by Ventura County Watershed Protection District (VCWPD).

The structure with inventory ID# 83 and 84 are located on Basolo Ditch. The structure is part of the ongoing Santa Clara River restudy. The behind-structure floodplain was based on updated hydrologic analysis and LiDAR data provided by Ventura County Watershed Protection District (VCWPD).

The structure with inventory ID #85 is located on Piru Creek. The structure was utilized in the Santa Clara restudy as a lateral weir. No levee or embankment occurs at this location. No change in floodplain is recommended at this location based on topographic data obtained from LiDAR mass-points provided by Ventura County.

The levee with inventory ID #86 is located on the Santa Clara River. The structure is part of the ongoing Santa Clara River restudy. The behind-structure floodplain was based on updated hydrologic analysis and LiDAR data provided by Ventura County Watershed Protection District (VCWPD).

The structure with inventory ID #88 is located on the Santa Clara River. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #91 is located on the Pacific Ocean. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is

no depression behind the structure. Therefore, no change in floodplain is recommended at this location.

The structure with inventory ID #98 is located on Gabbert Canyon. Based on effective information, the structure was present in the middle of a Zone AO. Therefore, no change in floodplain was recommended at this location.

The Levee with inventory ID #101 is located on Sespe Creek. The structure is part of the ongoing Santa Clara River restudy. The behind-structure floodplain was based on updated hydrologic analysis and LiDAR data provided by Ventura County Watershed Protection District (VCWPD).

The levee with inventory ID #102 is located on Ventura River. The FIS for this community states that the levee was not taken into consideration for hydraulic analysis of this part of the river. Therefore, no change in floodplain was recommended at this location.

The levee and floodwall with inventory ID #103 is located on Ventura River. A behind-structure floodplain was obtained based on topographic data obtained from LiDAR mass-points provided by Ventura County and by extending the effective 1-percent-annual-chance base flood elevations for Ventura River.

The levee with inventory ID #104 is located on Santa Clara River. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, there is no depression behind the structure. The effective 1-percent-annual-chance base flood elevations for Santa Clara River were observed to be lower than the overbanks. Therefore, no change in floodplain is recommended at this location.

The levee with inventory ID #105 is located on Santa Paula Creek. No change in floodplain was recommended at this location as this was part of an A99 zone which implies an area under construction.

The levee with inventory ID #106 is located on Santa Clara River. It appears that fill has been placed at this location to raise the ground above the BFE. No LOMR-F or LOMR was submitted for the fill placed. A behind-structure floodplain was determined based on topographic data obtained from LiDAR mass-points provided by Ventura County.

The levee with inventory ID #107 and 108 are located on Arroyo Simi. A behind-structure floodplain was obtained based on topographic data obtained from LiDAR mass-points provided by Ventura County and by extending the effective 1-percent-annual-chance base flood elevations for Arroyo Simi.

The levee with inventory ID #109 is located on Arroyo Santa Rosa. This levee does not provide protection from the 1-percent-annual-chance floodplain as it is located within the effective AE Zone. However, a change in the behind-structure floodplain was created based on a combination of effective and newly studied data for the Arroyo Santa Rosa at this location.

The levee with inventory ID #111 is located on Santa Clara River. This levee does not provide protection from the 1-percent-annual-chance floodplain as it is located within the effective AE Zone. Therefore, no analysis performed and no change in floodplain recommended at this location.

The levee with inventory ID #112 is located on Arroyo Simi. A behind-structure floodplain was obtained based on topographic data obtained from LiDAR mass- points provided by Ventura County and by extending the effective 1-percent-annual-chance base flood elevations for Arroyo Simi.

The levee with inventory ID #113 is located on Santa Paula Creek. No change in floodplain was recommended at this location as this was part of an A99 zone which implies an area under construction.

The levee with inventory ID #114 is located on Santa Clara River. Based on topographic data obtained from LiDAR mass-points provided by Ventura County, a 1-percent annual chance flooding was determined using engineering judgment.

The levee with inventory ID #115 is located on Revolon Slough. This levee does not provide protection from the 1-percent-annual-chance floodplain. Therefore, no analysis performed and no change in floodplain recommended at this location.

The levee with inventory ID #116, 117 and 118 are located on Revolon Slough. Discharges for the stream were calculated using 10m USGS DEMs and USGS regression equations. Using topographic data obtained from LiDAR mass-points provided by Ventura County, and results from approximate hydrologic and hydraulic analysis, a 1-percent-annual-chance flooding was determined.

The levee with inventory ID #119, 120 and 121 are located on Calleguas Creek. A behind-structure floodplain was obtained based on topographic data obtained from LiDAR mass-points provided by Ventura County and by extending the effective 1-percent-annual-chance base flood elevations for Calleguas Creek.

The levees with inventory ID #122 and 123 are located on Arroyo Simi. The FIS for this community states that the levee was not taken into consideration for hydraulic analysis of this part of the river. Therefore, no analysis was performed, and no change in floodplain was recommended at this location.

The levee with inventory ID #124 is located on Arroyo Simi. This levee does not provide protection from the 1-percent-annual-chance floodplain. Therefore, no analysis performed and no change in floodplain recommended at this location.

The levee with inventory ID #125 is located on Arroyo Simi. Based on effective information, the structure was present in the middle of a Zone AO. Therefore, no change in floodplain was recommended at this location.

The levee with inventory ID #126 is located on Arroyo Simi. Fill appears to be placed in the floodplain to elevate the property above the BFE. As pre-fill topography is not available and neither is fill compaction data, the fill is assumed to wash away in a flood

when the levee is removed. The floodplain is extended to the road, based on topographic data obtained from LiDAR mass-points provided by Ventura County.

The levee with inventory ID #127 is located on Calleguas Creek. The FIS for this community states that the levee was not taken into consideration for hydraulic analysis of this part of the river. Therefore, no analysis was performed, and no change in floodplain was recommended at this location.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Zone AR is an area of special flood hazard formerly protected from the 1-percent-annual-chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1-percent-annual-chance or greater flood event.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of 1-percent-annual-chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and

BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Ventura County. Previously, separate Flood Hazard Boundary Maps and/or FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 10, "Community Map History."

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Ventura County has been compiled into this FIS. Therefore, this FIS report supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this FIS can be obtained by contacting Federal Insurance and Mitigation Division, FEMA, 111 Broadway, Suite 1200, Oakland, California 94607-4052.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Camarillo, City of	September 30, 1972	October 24, 1975	September 29, 1986	September 29, 1986 January 20, 2010
Fillmore, City of	January 23, 1974	December 19, 1975	October 17, 1978	February 1, 1984 January 20, 2010
Moorpark, City of	September 29, 1986	None	September 29, 1986	September 29, 1986 January 20, 2010
Ojai, City of	May 3, 1974	November 28, 1975	October 17, 1978	April 19, 1983 January 20, 2010
Oxnard, City of	August 9, 1974	None	March 1, 1979	October 15, 1985 January 20, 2010
Port Hueneme, City of	July 28, 1972	October 3, 1975	September 24, 1984	January 20, 2010

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
San Buenaventura, City of	May 31, 1974	December 19, 1975	September 29, 1986	August 19, 1987 January 20, 2010
Santa Paula, City of	May 24, 1974	July 25, 1976	April 15, 1980	September 18, 1985 September 3, 1997 January 20, 2010
Simi Valley, City of	May 17, 1974	None	September 27, 1991	September 3, 1997 January 20, 2010
Thousand Oaks, City of	June 7, 1974	None	September 29, 1978	January 3, 1983 January 20, 2010
Ventura County (Unincorporated Areas)	January 31, 1975	October 18, 1977	October 31, 1985	January 5, 1989 September 28, 1990 September 3, 1997 January 20, 2010

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

VENTURA COUNTY, CA AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

Aerial Topographic Maps. (Photography dated February 26, 1987). *Topographic Map,* Rincon Creek near Rincon Point, Scale 1:4,800, Contour Interval 4 feet.

City of Oxnard (Oxnard, California, 1967, 1968), *Topographic Maps,* Scale 1:4,800, Contour Interval 10 feet.

City of Simi Valley. (March 31, 1987). *Photo Maps,* Scale 1:1,200.

County of Ventura, Public Works Agency, Flood Control and Water Resources Department. (October 1983). *Report of 1983 Flood.*

Daily Free Press. (December 9, 1907). *High Seas Wreck Ventura Wharf.*

David R. Dawdy. (1979). "Flood Frequency Estimates on Alluvial Fans," *Journal of the Hydraulics Division ASCE, Proceedings,* Vol. 105, No. HY11.

Environmental Science Services Administration. (September 1969). *The Climate of Ventura County.*

Federal Emergency Management Agency. (Unpublished). *Flood Insurance Study, Ventura County, California (Unincorporated Areas).*

Federal Emergency Management Agency, Federal Insurance Administration. (July 1984). *Coastal Flood Frequency in Southern California.* Donald M. Thomas, Dames & Moore (author).

Kasraie Consulting. (November 30, 2007) *Floodplain Map Revision, City of Camarillo,* California. Prepared for the City of Camarillo.

MAPIX — Mainland, Joint Venture of Airborne 1, Dewberry, Schaaf and Wheeler, TerraPoint, and URS. (May 2008). *Flood Insurance Restudy, Santa Clara River and Tributaries, Ventura County, California.* Prepared for the Federal Emergency Management Agency.

Martha J. Shaw, Scripps Institution of Oceanography. (December 1980). *Artificial Sediment Transport and Structures in Coastal Southern California.*

Nolte Associates, Inc. (September 2004). *Ventura County Flood Insurance Study.* Prepared for the Federal Emergency Management Agency.

Diane Pierzinski. (March 1981). "Tsunamis," *California Geology.*

PRC Toups. (August 1978). *Santa Clara River Diversion Structure Engineering Report.*

State of California, Department of Boating and Waterways. (June 1980). *Summary Report of Man's Impact on the California Coastal Zone.* Dr. Douglas L. Inman (author).

State of California, Transportation Agency. (1968). *As-Built Plans, U.S. Highway 101 Bridge Culvert, Rincon Creek.*

Steve Howe. (December 11, 1978). *Wind Damage Along the California Coast, Winter 1977-78.* California Tomorrow Environmental Intern Program, California Coastal Commission.

Tetra Tech, Inc. (August 31, 2007). *Appeal of Preliminary Flood Insurance Study and Flood Insurance Rate Map (Dated September 16, 2005) in the City of Moorpark, California.* Prepared for the City of Moorpark.

Tetra Tech, Inc. (1982). Report No. TC-3205, *Methodology for Computing Coastal Flood Statistics in Southern California.* Prepared for the Federal Emergency Management Agency.

U.S. Army Corps of Engineers, Los Angeles District. (February 2003). *Calleguas Creek Watershed Feasibility Study, Hydrology Appendix.*

U.S. Army Corps of Engineers, Los Angeles District. (November 1987). *Calleguas Creek Hydrology for Survey Report, Ventura County, California.*

U.S. Army Corps of Engineers, Los Angeles District. (April 1985). *Cameros Creek Debris/Detention Basin, Goleta, California, Reconnaissance Report, Hydrology,* Preliminary.

U.S. Army Corps of Engineers, Los Angeles District. (May 1980). *Ventura County, California: Survey Report for Beach Erosion Control.*

U.S. Army Corps of Engineers, San Francisco and Los Angeles Districts. (1978). *Winter Storm Damage Along the California Coast 1977-1978.* George W. Domurat (author).

U.S. Army Corps of Engineers. (October 1978). *Hydrology for Definite Project Report, Sespe Creek at Fillmore, California.*

U.S. Army Corps of Engineers. (August 1977). *Hydrology for Special Flood Hazard Study, Calleguas Creek and Revolon Slough, Ventura County, California.*

U.S. Army Corps of Engineers. (June 1977). *Topographic Map, Santa Paula Creek, Scale 1:2,400, Contour Interval 2 feet.*

U.S. Army Corps of Engineers. (April 28, 1977). *Regional Flood Frequency Study, Newhall, Saugus and Vicinity, Los Angeles County, Santa Clara River and Tributaries.*

U.S. Army Corps of Engineers. (February 1977). *Hydrology for Flood Insurance Studies, City of Santa Paula, Ventura County, California.*

U.S. Army Corps of Engineers, Hydrologic Engineering Center. (October 1973). *HEC-2 Water-Surface Profiles, Computer Program 723X6-L202A.* Davis, California.

U.S. Army Corps of Engineers, Los Angeles District. (June 1973). *Floodplain Information, San Antonio Creek and Tributaries, Vicinity of Ojai, California.*

U.S. Army Corps of Engineers. (April 1973). *Hydrology for Floodplain Information and Flood Insurance Studies, Santa Clara River and Tributaries, Ventura County, California.*

U.S. Army Corps of Engineers. (March 1973). *Hydrology for Floodplain Information Report, San Antonio and Thacher Creeks, Ventura County, California.*

U.S. Army Corps of Engineers, Hydrologic Engineering Center. (January 1973). *HEC-1 Flood Hydrograph Package, Users Manual.*

U.S. Army Corps of Engineers. (August 4, 1972). *Hydrology for Floodplain Information Studies, Santa Clara River and Tributaries, Ventura County, California.*

U.S. Army Corps of Engineers. (June 1972). *Floodplain Information, Santa Clara River and Sespe Creek, Vicinity of Fillmore, California.*

U.S. Army Corps of Engineers. (March 1972). Design Memorandum No. 4, *Supplementary Design for Santa Paula Creek Channel.*

U.S. Army Corps of Engineers, Hydrologic Engineering Center. (February 1972). *HEC-2 Water-Surface Profiles, Generalized Computer Program, Users Manual.*

U.S. Army Corps of Engineers, Hydrologic Engineering Center. (September 1982*). HEC-2 Water-Surface Profiles.*

U.S. Army Corps of Engineers, Hydrologic Engineering Center. (September 1985). *HEC-2 Water-Surface Profiles, Users Manual.*

U.S. Army Corps of Engineers, South Pacific Division. (August 1971). *National Shoreline Study: California Regional Inventory.*

U.S. Army Corps of Engineers. (June 1971). *Floodplain Information, Ventura River (Including Coyote Creek).*

U.S. Army Corps of Engineers. (December 1970). *Hydrology for Floodplain Information Studies, Ventura River, Ventura County, California.*

U.S. Army Corps of Engineers, Los Angeles District. (1969). *Appendix C: Report on Floods of January and February 1969 in Ventura County.*

U.S. Army Corps of Engineers. (December 3, 1969). *Hydrology for Floodplain Information Studies, Santa Clara River (Vicinity of Santa Paula), Ventura County, California.*

U.S. Army Corps of Engineers. (Ventura County, California, June 1968, revised June 1973). *Floodplain Information, Santa Clara River, Saticoy to Pacific Ocean.*

U.S. Army Corps of Engineers, Los Angeles District. (March 1967). *Generalized Standard Project Rainflood Criteria, Southern California Coastal Streams.* Sacramento, California.

U.S. Army Corps of Engineers. (January 1962). *Statistical Methods in Hydrology.*_Sacramento, California. L. R. Beard (author).

U.S. Department of Agriculture, Soil Conservation Service. (1971). *National Engineering Handbook,* Section 4, Hydrology.

U.S. Department of the Interior, Geological Survey, Hydrology Subcommittee. (March 1982). *Guidelines for Determining Flood Flow Frequency,* Bulletin No. 17B.

U.S. Department of the Interior, Geological Survey. (June 1977). Water-Resources Investigations 77-21, *Magnitude and Frequency of Floods in California.*

U.S. Department of the Interior, Geological Survey. (February 1974). Water-Resources Investigations 41-73, *Digital Simulation of the Effects of Urbanization on Runoff in the Upper Santa Ana Valley, California.*

U.S. Department of the Interior, Geological Survey. (Moorpark, California, 1951, Photorevised 1969, Photoinspected 1974; Simi, California, 1951, Photorevised 1969). *7.5-Minute Series Topographic Maps,* Scale 1:24,000, Contour Intervals 10 and 20 feet.

U.S. Department of the Interior, Geological Survey. (Camarillo, California, 1950, Photorevised 1967; Moorpark, California, 1951, Photorevised 1969, 1974; Newbury Park, California, 1950, Photorevised 1967; Santa Paula, California, 1951, Photorevised 1967). *7.5-Minute Series Topographic Maps,* Scale 1:24,000, Contour Intervals 5, 10, and 20 feet.

U.S. Department of the Interior, Geological Survey. (Oxnard, California, 1949, Photorevised 1967; Saticoy, California, 1951, Photorevised 1967; Ventura, California, 1951, Photorevised 1967). *7.5-Minute Series Topographic Maps,* Scale 1:24,000, Contour Intervals 5 and 20 feet.

U.S. Department of the Interior, Geological Survey. (Apache Canyon, California, 1943; Ballenger Canyon, California, 1943; Black Mountain, California, 1958; Calabasas, California, 1952, Photorevised 1967; Camarillo, California, 1950, Photorevised 1967; Cobblestone Mountain, California, 1958; Cuddy Valley, California, 1943, Photorevised 1973; Cuyama Peak, California, 1943, Photoinspected 1971; Devils Heart Peak, California, 1943; Fillmore, California, 1951, Photorevised 1969; Frazier Mountain, California, 1958, Photorevised 1974; Lebec, California, 1958, Photorevised 1974; Lion Canyon, California, 1943, Photoinspected 1971; Lockwood Valley, California, 1943, Photoinspected 1971; Matilija, California, 1952, Photorevised 1967; McDonald Peak, California, 1958; Moorpark, California, 1951, Photorevised 1969, Photoinspected 1974; Newbury Park, California, 1950, Photorevised 1967; Ojai, California, 1952, Photorevised 1967; Old Man Mountain, California, 1943; Oxnard, California, 1949, Photorevised 1967; Piru, California, 1952, Photorevised 1969; Pitas Point, California, 1950, Photorevised 1967; Point Dume, California, 1950, Photorevised 1981; Point Mugu, California, 1949, Photorevised 1967; Rancho Nuevo, California, 1943; Reyes Peak, California, 1943; San Guillermo, California, 1943, Photoinspected 1971; Santa Paula, California, 1951, Photorevised 1367; Santa Paula Peak, California, 1951, Photorevised 1969; Santa Susana, California, 1951, Photorevised 1969; Santiago Creek, California, 1943; Saticoy, California, 1951, Photorevised 1967; Sawmill Mountain, California, 1943, Photoinspected 1973; Simi, California, 1951, Photorevised 1969; Thousand Oaks, California, 1950, Photorevised 1967; Topatopa Mountains, California, 1943; Trifuno Pass, California, 1949, Photorevised 1967; Val Verde, California, 1952, Photorevised 1969; Ventura, California, 1951, Photorevised 1967; Wheeler Springs, California, 1943; Whitaker Peak, California, 1958, Photorevised 1974; White Ledge Peak, California, 1952, Photorevised 1967). *7.5-Minute Series Topographic Maps*, Scale 1:24,000, Contour Intervals 5, 10, 20, 25, 40, and 50 feet.

U.S. Water Resources Council. (March 1976). *Guidelines for Determining Flood Flow Frequency,* Bulletin No. 17.

Ventura County Department of Public Works, *Topographic Maps,* Scale 1:6,000, Contour Interval 20 feet.

Ventura County Department of Public Works. (1967-1979). *Topographic Maps,* Scale 1:2,400, Contour Intervals 2 and 5 feet.

Ventura County Flood Control District, Personal Correspondence.

Ventura County Flood Control District and Ventura County Surveying and Mapping Division. (Ojai, California, 1977). *Topographic Maps,* Scale 1:2,400, Contour Interval 2 feet.

Ventura County Flood Control District. (Oxnard, California, 1970, revised 1975). *Topographic Maps,* Scale 1:2,400, Contour Intervals 2 or 5 feet.

Ventura County Flood Control District. (September 1969). *The Great Floods of 1969.*

Ventura County Flood Control District. (Fillmore, California, 1965, 1968, and 1971). *Topographic Maps,* Scale 1:1,200, Contour Intervals 2 and 5 feet.

Ventura County Public Works Agency Watershed Protection District. (March 2003). *Calleguas Creek Watershed Hydrology Study.*

Ventura County Public Works Agency Watershed Protection District. (December 2006). *Santa Clara River 2006 Hydrology Update.*

Ventura County, Public Works Agency, Flood Control and Water Resources Department. (Reprinted 1985). *Hydrology Manual.*

Ventura County Public Works Agency. (May 1976). *Biannual Report of Hydrologic Data, 1973-74/1974-75.*

Ventura County Public Works Agency. (Photography of September 17, 1968). *Topographic Maps,* Flood Control District — Zone III — Calleguas Creek Watershed, Scale 1:2,400, Contour Interval 2 feet.

Ventura County Star Free Press. (September 25, 1939, and September 26, 1939). Articles on storm.

Woodyard and Associates. (1980). *As-Built Plans — Leisure Village,* Scale 1:480.

10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original FIS was printed. Future revisions may be made that do not result in the republishing of the FIS report. To assure that the user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data located at:

- City of Camarillo Public Works Department
  601 Carmen Drive
  Camarillo, CA 93010

- Fillmore City Hall
  250 Central Avenue
  Fillmore, CA 93015

- Moorpark City Hall
  799 Moorpark Avenue
  Moorpark, CA 93021-1155

- City of Ojai Public Works Department
  401 South Ventura Street
  Ojai, CA 93024

- City of Oxnard Planning Department
  214 South C Street
  Oxnard, CA 93030

- City of Port Hueneme Public Works Department
  250 North Ventura Road
  Port Hueneme, CA 93041

- San Buenaventura City Hall
  501 Poli Street
  Ventura, CA 93001

- Santa Paula City Hall
  970 East Ventura Street
  Santa Paula, CA 93060

- Simi Valley City Hall
  2929 Tapo Canyon Road
  Simi Valley, CA 93063

- City of Thousand Oaks Public Works Department
  2100 Thousand Oaks Boulevard
  Thousand Oaks, CA 91362

- Ventura County Hall of Administration
  800 South Victoria Avenue
  Ventura, CA 93009-1210

10.1 First Revision (Revised Month Day, Year)

This revision was completed for FEMA to incorporate a Physical Map Revision (PMR). Hydrology and Hydraulic Analyses for this revision were completed February 2011.

The hydrology for the revised study was retained from the effective analysis. The original 100 year event hydrograph data was applied using inflow nodes in a 1D/2D hydraulic model in the flood route modeling software FLO-2D. The resultant peak flow discharges for Camarillo Hills Drain, Edgemore Drain, Mission Drain, Ponderosa Drain, Somis Drain, and West Camarillo Hills Tributary are summarized in Table 5.

Water surface elevations for the floodplain boundaries for the revised study were determined using FLO-2D, a two-dimensional flood routing model. Topographic information for the model was generated from Light Detection and Ranging (LiDAR) point data, which were used to develop a 10-ft grid system in FLO-2D. The channel system in the model was established by referring to topographic data and aerial photography.

Bridges and culverts were measured through field survey and stage-discharge rating tables were developed from design charts available in Hydraulic Design of Highway Culvert (FHWA, September 2001).

The channel system was developed using as-built drawings of the canals and effective cross-section data from HEC-RAS models.

6.75 additional stream miles were restudied. 2.81 miles on Camarillo Hills Drain, 0.62 miles on Edgemore Drain, 0.96 miles on Mission Drain, 0.56 miles on Ponderosa Drain, 1.10 miles on Somis Drain, and 0.70 miles on West Camarillo Hills Tributary were studied using detailed methods. This restudy affects Ventura County (Unincorporated Areas) and the City of Camarillo.