FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 3

ORANGE COUNTY, CALIFORNIA

AND INCORPORATED AREAS

COMMUNITY NAME	NUMBER	COMMUNITY NAME	NUMBER
ALISO VIEJO, CITY OF	060770	LAKE FOREST, CITY OF	060759
ANAHEIM, CITY OF	060213	LOS ALAMITOS, CITY OF	060226
BREA, CITY OF	060214	MISSION VIEJO, CITY OF	060735
BUENA PARK, CITY OF	060215	NEWPORT BEACH, CITY OF	060227
COSTA MESA, CITY OF	060216	ORANGE, CITY OF	060228
CYPRESS, CITY OF	060217	ORANGE COUNTY (UNINCORPORATED AREAS)	060212
DANA POINT, CITY OF	060736	PLACENTIA, CITY OF	060229
FOUNTAIN VALLEY, CITY OF	060218	RANCHO SANTA MARGARITA, CITY OF	060769
FULLERTON, CITY OF	060219	SAN CLEMENTE, CITY OF	060230
GARDEN GROVE, CITY OF	060220	SAN JUAN CAPISTRANO, CITY OF	060231
HUNTINGTON BEACH, CITY OF	065034	SANTA ANA, CITY OF	060232
IRVINE, CITY OF	060222	SEAL BEACH, CITY OF	060233
LA HABRA, CITY OF	060224	STANTON, CITY OF	060234
LA PALMA, CITY OF[1]	060225	TUSTIN, CITY OF	060235
LAGUNA BEACH, CITY OF	060223	VILLA PARK, CITY OF	060236
LAGUNA HILLS, CITY OF	060760	WESTMINSTER, CITY OF	060237
LAGUNA NIGUEL, CITY OF	060764	YORBA LINDA, CITY OF	060238
LAGUNA WOODS, CITY OF	060768		

[1]No Special Flood Hazard Areas Identified

REVISED: REVISED PRELIMINARY

TBD **6/20/2018**

FLOOD INSURANCE STUDY NUMBER
06059CV001C

Version Number 2.3.3.1

FEMA

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FLOOD INSURANCE STUDY REPORT
ORANGE COUNTY, CALIFORNIA

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60.3, *Criteria for Land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as “Post-FIRM” buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) Report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community’s regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Orange County, California.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Aliso Viejo, City of	060770	18070204 18070301	06059C0409J 06059C0426J 06059C0427J 06059C0428J 06059C0429J 06059C0436J 06059C0437J	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Anaheim, City of	060213	18070106 18070201 18070203	06059C0069J 06059C0090J 06059C0109J 06059C0117J 06059C0126J 06059C0127J 06059C0128J 06059C0129J 06059C0131J 06059C0132J 06059C0133J 06059C0134J[1] 06059C0136J 06059C0137J 06059C0141J 06059C0142J 06059C0151J 06059C0152J 06059C0153J 06059C0154J 06059C0156J 06059C0157J 06059C0158J 06059C0159J 06059C0161J 06059C0180J 06059C0185J	
Brea, City of	060214	18070106	06059C0033J 06059C0034J[1] 06059C0041J 06059C0042J 06059C0058J 06059C0059J[1] 06059C0061J 06059C0062J 06059C0063J 06059C0066J	
Buena Park, City of	060215	18070106	06059C0019J 06059C0038J 06059C0106J 06059C0107J[1] 06059C0108J 06059C0109J 06059C0117J 06059C0126J 06059C0128J	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Costa Mesa, City of	060216	18070203 18070204	06059C0254J 06059C0258J 06059C0259J 06059C0262J 06059C0264K 06059C0266J 06059C0267J 06059C0268J[1] 06059C0269K 06059C0278J 06059C0286J	
Cypress, City of	060217	18070106 18070201	06059C0104J 06059C0106J 06059C0108J 06059C0112J 06059C0116J 06059C0117J	
Dana Point, City of	060736	18070301	06059C0501K 06059C0502K 06059C0504K 06059C0506J 06059C0508K 06059C0509K	
Fountain Valley, City of	060218	18070201 18070203	06059C0251J 06059C0252J 06059C0253J 06059C0254J 06059C0256J 06059C0258J 06059C0261J 06059C0262J 06059C0264K	
Fullerton, City of	060219	18070106	06059C0036J 06059C0037J 06059C0038J 06059C0039J 06059C0041J 06059C0042J 06059C0043J 06059C0044J 06059C0061J 06059C0063J 06059C0126J 06059C0127J 06059C0131J 06059C0132J	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Garden Grove, City of	060220	18070106 18070201	06059C0116J 06059C0117J 06059C0118J 06059C0119J 06059C0136J 06059C0137J 06059C0138J 06059C0139J 06059C0141J 06059C0142J 06059C0143J 06059C0144J 06059C0252J	
Huntington Beach, City of	065034	18070201 18070203	06059C0118J 06059C0119J 06059C0227K 06059C0229K 06059C0231K 06059C0232J 06059C0233K 06059C0234J 06059C0241K 06059C0242K 06059C0244K 06059C0251J 06059C0253J 06059C0261J 06059C0262J 06059C0263K 06059C0264K	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Irvine, City of	060222	18070204	06059C0169J 06059C0190J 06059C0278J 06059C0279J 06059C0281J 06059C0282J 06059C0283J 06059C0284J 06059C0286J 06059C0287J 06059C0288K 06059C0289J 06059C0291J 06059C0292J 06059C0293J 06059C0294J 06059C0305J 06059C0308J[1] 06059C0313J 06059C0314J 06059C0315J 06059C0316J 06059C0402J 06059C0406J[1] 06059C0407J 06059C0426J	
La Habra, City of	060224	18070106	06059C0028J 06059C0029J 06059C0033J 06059C0036J 06059C0037J 06059C0041J	
La Palma, City of[2]	060225	18070106	06059C0106J 06059C0107J[1] 06059C0108J	
Laguna Beach, City of	060223	18070301	06059C0407J 06059C0409J 06059C0412K 06059C0416K 06059C0417K 06059C0419K 06059C0426J 06059C0428J 06059C0436J 06059C0438K 06059C0501K	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Laguna Hills, City of	060760	18070204 18070301	06059C0313J 06059C0314J 06059C0426J 06059C0427J 06059C0429J 06059C0431J 06059C0433J 06059C0437J 06059C0441J	
Laguna Niguel, City of	060764	18070301	06059C0429J 06059C0433J 06059C0436J 06059C0437J 06059C0438K 06059C0439J 06059C0441J 06059C0443J 06059C0501K 06059C0502K 06059C0506J	
Laguna Woods, City of	060768	18070204 18070301	06059C0407J 06059C0426J 06059C0427J 06059C0429J	
Lake Forest, City of	060759	18070204 18070301	06059C0308J 06059C0309J 06059C0313J 06059C0314J 06059C0315J 06059C0316J 06059C0317J 06059C0318J 06059C0319J 06059C0328J 06059C0336J 06059C0427J 06059C0431J	
Los Alamitos, City of	060226	18070106	06059C0104J 06059C0112J 06059C0116J	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Mission Viejo, City of	060735	18070301	06059C0317J 06059C0318J 06059C0319J 06059C0336J 06059C0338J 06059C0427J 06059C0431J 06059C0432J 06059C0433J 06059C0434J 06059C0441J 06059C0442J	
Newport Beach, City of	060227	18070203 18070204 18070301	06059C0264K 06059C0267J 06059C0268J[1] 06059C0269K 06059C0286J 06059C0288K 06059C0289J 06059C0377K 06059C0381K 06059C0382K 06059C0384K 06059C0401J 06059C0402J 06059C0403K 06059C0404K 06059C0406J[1] 06059C0408J	
Orange, City of	060228	18070201 18070203 18070204	06059C0142J 06059C0144J 06059C0151J 06059C0152J 06059C0153J 06059C0154J 06059C0158J 06059C0159J 06059C0161J 06059C0162J 06059C0163J 06059C0164J 06059C0166J 06059C0167J 06059C0168J 06059C0169J 06059C0180J 06059C0190J	

Orange County, Unincorporated Areas	060212	18070106 18070201 18070202 18070203 18070204 18070301	06059C0028J 06059C0029J 06059C0033J 06059C0034J[1] 06059C0038J 06059C0042J 06059C0055J[1] 06059C0058J 06059C0059J[1] 06059C0061J 06059C0062J 06059C0063J 06059C0064J 06059C0066J 06059C0067J[1] 06059C0068J 06059C0069J 06059C0090J 06059C0095J 06059C0108J 06059C0112J 06059C0113J 06059C0114K 06059C0116J 06059C0117J 06059C0118J 06059C0129J 06059C0136J 06059C0137J 06059C0138J 06059C0151J 06059C0153J 06059C0154J 06059C0156J 06059C0157J 06059C0158J 06059C0159J 06059C0162J 06059C0164J 06059C0166J 06059C0167J 06059C0168J 06059C0169J 06059C0180J 06059C0185J 06059C0190J 06059C0195J 06059C0225J[1] 06059C0226K 06059C0227K 06059C0229K 06059C0231K 06059C0233K 06059C0234J 06059C0241K	

			06059C0242K 06059C0251J 06059C0256J 06059C0264K 06059C0267J 06059C0269K 06059C0277J 06059C0278J 06059C0281J 06059C0282J 06059C0286J 06059C0294J 06059C0305J 06059C0306J 06059C0307J 06059C0308J[1] 06059C0309J 06059C0315J 06059C0316J 06059C0317J 06059C0326J 06059C0327J 06059C0328J 06059C0329J[1] 06059C0335J 06059C0336J 06059C0337J 06059C0338J 06059C0339J 06059C0345J 06059C0375J[1] 06059C0377K 06059C0404K 06059C0406J[1] 06059C0407J 06059C0408J 06059C0409J 06059C0412K 06059C0416K 06059C0417K 06059C0419K 06059C0426J 06059C0428J 06059C0432J 06059C0434J 06059C0436J 06059C0438K 06059C0441J 06059C0442J 06059C0444J 06059C0451J 06059C0452J 06059C0453J 06059C0454J 06059C0460J	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
			06059C0465J 06059C0470J 06059C0500J 06059C0526J 06059C0527J[1] 06059C0529J[1] 06059C0535J[1]	
Placentia, City of	060229	18070106	06059C0044J 06059C0061J 06059C0062J 06059C0063J 06059C0064J 06059C0132J 06059C0151J 06059C0152J	
Rancho Santa Margaritia, City of	060769	18070301	06059C0319J 06059C0336J 06059C0337J 06059C0338J 06059C0339J 06059C0345J 06059C0432J 06059C0451J 06059C0452J 06059C0453J 06059C0460J	
San Clemente, City of	060230	18070301	06059C0507J 06059C0508K 06059C0509K 06059C0517K 06059C0526J 06059C0527J[1] 06059C0528J 06059C0529J[1] 06059C0536K 06059C0537J[1] 06059C0538K 06059C0539J[1]	
San Juan Capistrano, City of	060231	18070301	06059C0441J 06059C0442J 06059C0443J 06059C0444J 06059C0465J 06059C0506J 06059C0507J 06059C0508K 06059C0509K 06059C0526J	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Santa Ana, City of	060232	18070201 18070203 18070204	06059C0139J 06059C0142J 06059C0143J 06059C0144J 06059C0163J 06059C0164J 06059C0252J 06059C0256J 06059C0257J 06059C0258J 06059C0259J 06059C0276J 06059C0277J 06059C0278J 06059C0279J	
Seal Beach, City of	060233	18070106 18070201	06059C0111J 06059C0112J 06059C0113J 06059C0114K 06059C0116J 06059C0118J 06059C0226K 06059C0227K	
Stanton, City of	060234	18070201	06059C0109J 06059C0117J 06059C0128J 06059C0136J 06059C0137J 06059C0138J	
Tustin, City of	060235	18070204	06059C0164J 06059C0168J 06059C0169J 06059C0277J 06059C0278J 06059C0279J 06059C0281J 06059C0282J 06059C0283J	
Villa Park, City of	060236	18070203	06059C0154J 06059C0158J 06059C0162J 06059C0166J	
Westminster, City of	060237	18070201	06059C0118J 06059C0119J 06059C0138J 06059C0231K 06059C0232J 06059C0251J 06059C0252J	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Yorba Linda, City of	060238	18070106 18070203	06059C0062J 06059C0063J 06059C0064J 06059C0066J 06059C0067J[1] 06059C0068J 06059C0069J 06059C0090J 06059C0095J 06059C0152J 06059C0156J 06059C0157J 06059C0180J 06059C0185J	

[1] Panel Not Printed

[2] No Special Flood Hazard Areas Identified

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 31, “Map Repositories,” within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

The initial Countywide FIS Report for Orange County became effective on September 15, 1989. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. In addition, former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X (unshaded)

- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

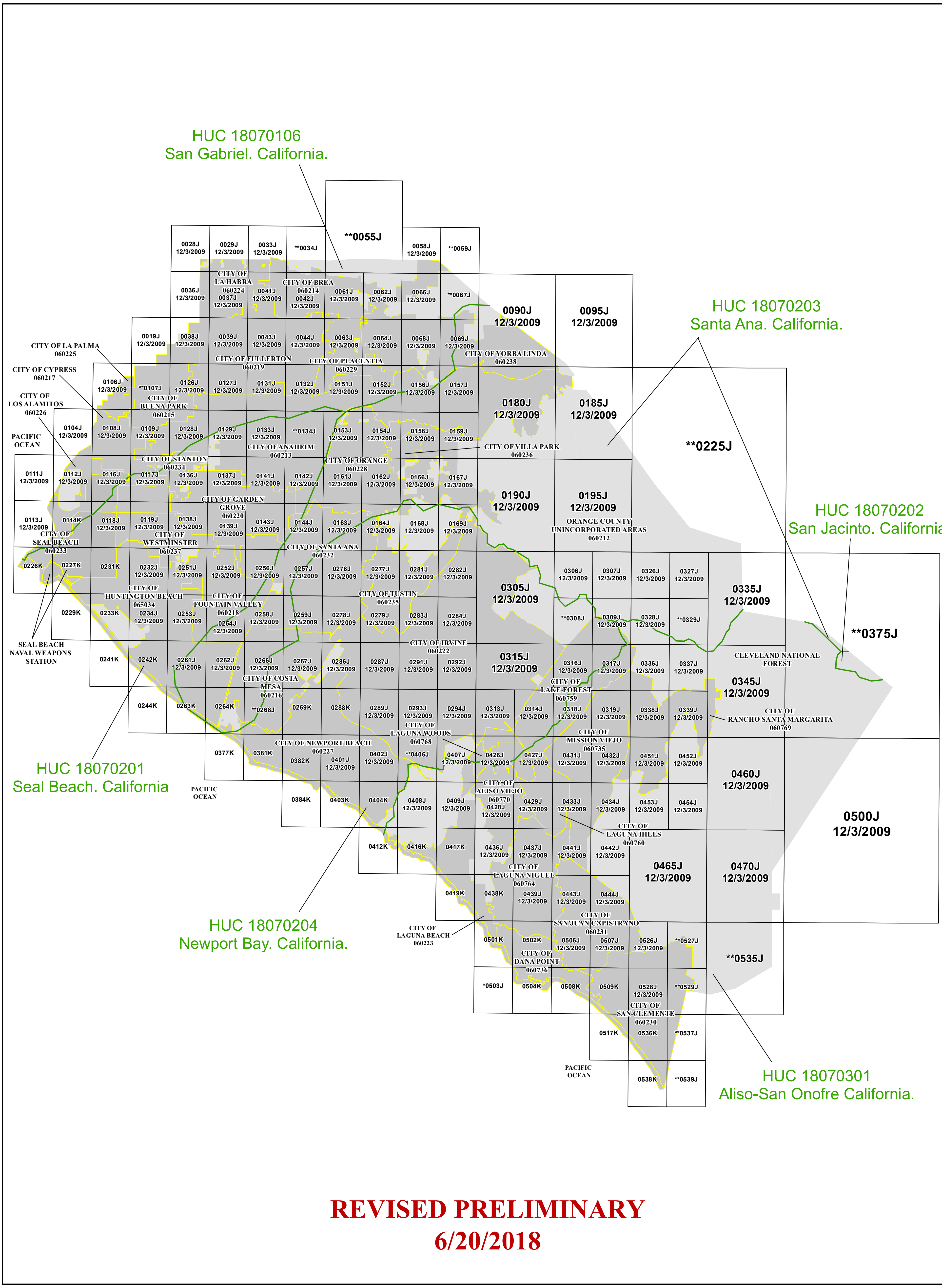
  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at **www.fema.gov/national-flood-insurance-program-community-rating-system** or contact your appropriate FEMA Regional Office for more information about this program.

- Previous FIS Reports and FIRMs may have included levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems."

  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database (**nld.usace.army.mil**). For all other levees, the user is encouraged to contact the appropriate local community.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at www.fema.gov/online-tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within Orange County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, flooding sources, watershed boundaries, and United States Geological Survey (USGS) Hydrologic Unit Code – 8 (HUC-8) codes.



1 inch = 23,333 feet 1:280,000

N

0 1 2 4 6 8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters; North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* OPEN WATER AREA
** NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANELS PRINTED:
0019, 0028, 0029, 0033, 0036, 0037, 0038, 0039, 0041, 0042, 0043, 0044, 0058, 0061, 0062, 0063, 0064, 0066, 0068, 0069, 0090, 0095, 0104, 0106, 0108, 0109, 0111, 0112, 0113, 0114, 0116, 0117, 0118, 0119, 0126, 0127, 0128, 0129, 0131, 0132, 0133, 0136, 0137, 0138, 0139, 0141, 0142, 0143, 0144, 0151, 0152, 0153, 0154, 0156, 0157, 0158, 0159, 0161, 0162, 0163, 0164, 0166, 0167, 0168, 0169, 0180, 0185, 0190, 0195, 0226, 0227, 0229, 0231, 0232, 0233, 0234, 0241, 0242, 0244, 0251, 0252, 0253, 0254, 0256, 0257, 0258, 0259, 0261, 0262, 0263, 0264, 0266, 0267, 0269, 0276, 0277, 0278, 0279, 0281, 0282, 0283, 0284, 0286, 0287, 0288, 0289, 0291, 0292, 0293, 0294, 0305, 0306, 0307, 0309, 0313, 0314, 0315, 0316, 0317, 0318, 0319, 0326, 0327, 0328, 0335, 0336, 0337, 0338, 0339, 0345, 0377, 0381, 0382, 0384, 0401, 0402, 0403, 0404, 0407, 0408, 0409, 0412, 0416, 0417, 0419, 0426, 0427, 0428, 0429, 0431, 0432, 0433, 0434, 0436, 0437, 0438, 0439, 0441, 0442, 0443, 0444, 0451, 0452, 0453, 0454, 0460, 0465, 0470, 0500, 0501, 0502, 0504, 0506, 0507, 0508, 0509, 0517, 0526, 0528, 0536, 0538

FEMA

MAP NUMBER
06059CIND0C
MAP REVISED

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 28 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Non-Coastal Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Coastal flood elevations are also provided in the Coastal Transect Parameters table in the FIS Report for this jurisdiction. Elevations shown in the Coastal Transect Parameters table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

Figure 2. FIRM Notes to Users

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator (UTM) Zone 11 North, Meters. The horizontal datum was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988**.** These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988**,** 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

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was derived from multiple sources. Coastal California LiDAR and Digital Imagery dated 2011 was compiled from the Coastal Services Center where available, and it was supplemented with 2014 USDA National Agriculture Imagery Program 2014 (NAIP) Imagery. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Figure 2. FIRM Notes to Users

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Orange County, CA, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 28 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Orange County, CA**,** effective **Month, Day, Year.**

ACCREDITED LEVEE: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit www.fema.gov/national-flood-insurance-program.

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Orange County.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood 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% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% 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 flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.

Figure 3: Map Legend for FIRM

	Regulatory Floodway determined in Zone AE.
	Non-encroachment zone (see Section 2.4 of this FIS Report for more information)
FLOOD INSURANCE IS NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR SUBSTANTIALLY IMPROVED ON OR AFTER APRIL 8, 1987, IN THE DESIGNATED COLORADO RIVER FLOODWAY	The Colorado River Floodway was established by Congress in the Colorado River Floodway Protection Act of 1986, Public Law 99-450 (100 Statute 1129). The Act imposes certain restrictions within the Floodway.
OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood. See Notes to Users for important information.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.
NO SCREEN	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
(ortho) (vector)	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet

Figure 3: Map Legend for FIRM

GENERAL STRUCTURES	
Aqueduct *Channel* *Culvert* *Storm Sewer*	Channel, Culvert, Aqueduct, or Storm Sewer
Dam *Jetty* *Weir*	Dam, Jetty, Weir
	Levee, Dike, or Floodwall
Bridge	Bridge
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas. See Notes to Users for important information.*	
CBRS AREA **09/30/2009**	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.
OTHERWISE **PROTECTED AREA** **09/30/2009**	Otherwise Protected Area
REFERENCE MARKERS	
22.0	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
B 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
5280 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
8	Coastal Transect

Figure 3: Map Legend for FIRM

	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
513	Base Flood Elevation Line
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity
BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}$E	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Orange County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Orange County.
Figure 3, “Map Legend for FIRM”, describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Orange County, California, respectively.

Table 2, “Flooding Sources Included in this FIS Report,” lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

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. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Pacific Ocean	Orange County	Entire Coastline	Entire Coastline	N/A	49		N	VE, AE, AO	2015, 2018
Agua Chinon Wash	City of Irvine	Confluence with San Diego Creek	Approximately 2800 feet downstream of State Route 241	18070204	5.8		N	A	2004
Airport Storm Channel	City of Costa Mesa	Confluence with Santa Ana Delhi Channel	Approximate 4000 upstream of confluence of Santa Ana Delhi Channel	18070204	0.8		N	A	2009
Aliso Creek	Cities of Laguna Beach, Laguna Niguel, Aliso Viejo, Laguna Hills, Laguna Woods, Lake Forest, Mission Viejo and Orange County, Unincorporated Areas	Pacific Ocean	Live Oak Canyon Road	18070301	20.0		Y	A, AE	1984
Aliso Creek	Cities of Laguna Beach, Laguna Niguel, Aliso Viejo, Laguna Hills, Laguna Woods, Lake Forest, Mission Viejo and Orange County, Unincorporated Areas	El Toro Road	Marguerite Parkway	18070301	2.2		Y	AE	1993

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi²) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Aliso Creek	Cities of Laguna Beach, Laguna Niguel, Aliso Viejo, Laguna Hills, Laguna Woods, Lake Forest, Mission Viejo and Orange County, Unincorporated Areas	Pacific Ocean	5200ft upstream of Pacific Ocean	18070301	1		Y	AE	2009
Anaheim-Barber City Channel	Cities of Westminster, Garden Grove, Stanton and Anaheim	Confluence with Bolsa Chica Channel	Ball Road	18070201	10.0		N	A	2009
Armstrong Channel	City of Irvine	Confluence with Lane Channel	Alton parkway	18070204	1.0		N	A	2009
Arroyo Salada	City of Laguna Niguel	Just upstream of Camino del Avion	Approximately 5200 feet upstream of Camino del Avion	18070301	1.0		N	A	2009
Atwood Channel	Cities of Placentia, Anaheim and Orange County, Unincorporated Areas	Confluence with Carbon Canyon Channel	Just downstream of Yorba Linda Blvd	18070106	5.3		Y	A, AE	2013, 1978
Barranca Channel	City of Irvine	Confluence with Peters Canyon Wash Channel	At Barranca Parkway	18070204	2.0		N	A	2009
Bee Canyon Wash	City of Irvine, Orange County, Unincorporated Areas	Confluence with San Diego Creek	At State Route 241	18070204	3.0		N	A	2011
Bell Canyon	Orange County, Unincorporated Areas	San Juan Creek	Approximately 1.9 mi upstream confluence of Bell Canyon	18070301	6.7		N	A	2009
Big Canyon	City of Newport Beach	Confluence with Upper Newport Bay	Approximately 740 feet upstream of Jamboree Road	18070204	1.0		N	AE	1977

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Bitterbush Channel	City of Orange	Confluence with Santa Ana River	West Collins Avenue	18070203	2.0		N	A	2009
Bixby Storm Channel	City of Seal beach; Orange County, Unincorporated Areas	Confluence with Montecito Storm Channel	Seal beach Blvd.	18070106	1.3		N	A	2009
Bluebird Canyon	City of Laguna Beach	Confluence with Pacific Ocean	Approximately 650 feet upstream of Cress Street	18070301	0.8		Y	AE	2006
Bolsa Chica Channel	City of Westminster	Approximately 200 downstream of confluence of Anaheim-Barber City Channel	Approximately 2200 downstream of State Route 22	18070106	1.6		N	A	2009
Bolsa Chica Channel	City of Seal Beach	Approximately 440 feet upstream of State Route 22	Lampson Avenue	18070106	0.5		N	A	2009
Bolsa Chica Channel	City of Cypress	City of Cypress corporate limits	Cerritos Avenue	18070106, 18070201	1.2		N	A	2009
Bonita Creek	Cities of Irvine and Newport Bay	Approximately 600 feet downstream of Veterans Memorial Highway	Approximately 850 feet upstream of Turtle Ridge	18070204	3.0		Y	A, AE	1977
Bonita Creek Tributary 1	City of Newport Beach	Approximately 315 feet upstream of Bonita Canyon Drive	Approximately 760 feet upstream of Bonita Canyon Drive	18070204	0.1		Y	AE	2009
Bonita Creek Tributary 2	City of Irvine	Confluence with Bonita Creek	Approximately 1800 feet upstream of confluence of Bonita Creek	18070204	0.3		N	A	2009
Borrego Canyon Wash	Cities of Lake Forest and Irvine	Approximately 4000 feet downstream of Irvine Blvd	Approximately 4800 feet upstream of State Route 241	18070204	4.5		N	A	2004

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Brea Canyon Channel	City of Brea	City of Brea corporate limits	City of Brea corporate limits	18070106	3.0		Y	AE	1978
Brush Canyon Creek	City of Yorba Linda	Confluence with Santa Ana River	Approximately 470 feet upstream of Brush Canyon Drive	18070203	0.4		N	A	2009
Buck Gully	City of Newport Beach	Approximately 1.8 miles downstream of Newport Coast Drive	Approximately 370 feet downstream of Newport Coast Drive	18070204	1.7		N	A	2009
Buckeye Storm Channel	City of Orange	Approximately 4100 feet upstream of confluence of Marlboro Channel	State Route 55	18070203	1.6		N	A	2009
Canada Chiquita	City of Rancho Santa Margarita; Orange County Unincorporated Areas	Confluence with San Juan Creek	Approximately 1500 feet upstream of Oso Parkway	18070301	5.6		N	A	2009
Canada Gobernadora	Orange County Unincorporated Areas	Confluence with San Juan Creek	Approximately 1400 feet upstream of Via Pajaro	18070301	9.0		N	A	1973
Canyon Acres wash	City of Laguna Beach	Confluence with Laguna Canyon	Approximately 0.6 mile upstream of confluence of Laguna Canyon	18070301	0.6		N	A	2012
Carbon Canyon Channel	Cities of Brea, Placentia, Yorba Linda, Anaheim; Orange County Unincorporated Areas	Confluence with Santa Ana River	San Bernardino and Orage Counties boundary limits	18070106	12.0		Y	A, AE	1978
Carbon Creek Channel	Cities of Placentia, Anaheim, Fullerton, Buena Park, Cypress, and Los Alamitos	Confluence with Coyote Creek Channel	Approximately 2600 feet upstream of State Route 57	18070106	14.9		N	A	1978

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Cascadita Creek	City of San Clemente	Approximately 285 feet downstream of Via Cascadita	Approximately 360 feet downstream of San Diego Freeway	18070301	0.6		Y	AE	1990
Collins Channel	City of Orange	Confluence of Santa Ana River	Approximately 490 feet downstream of BNSF railroad	18070203	2.2		N	A	2009
Como Storm Channel	City of Irvine	Confluence of Peters Canyon Wash Channel	Culver Drive	18070204	0.9		N	A	2009
Coyote Canyon Wash	City of Newport Beach	Bonita Creek	Approximately 0.6 mile upstream of Bonita Canyon drive	18070204	0.8		Y	AE	1977
Coyote Creek Channel	City of La Habra	Los Angeles and Orage Counties boundary limits	West Whittier Blvd	18070106	5.3		Y	A, AE	1978
Culver Storm Channel	City of Irvine	Confluence of San Joaquin Channel	Culver Drive	18070204	0.6		N	A	2009
Dry Lake	City of San Clemente	Calle Saluda	Approximately 920 feet upstream of City Limits	18070301	1.2		N	A	2009
East Garden Grove Wintersburg Channel	Cities of Garden Grove, Santa Ana, Westminster, Huntington Beach; Orange County Unincorporated Areas	Pacific Ocean	Chapman Avenue	18070201	14.3		N	A	2009
East Richfield Channel	Cities of Yorba Linda and Anaheim	Confluence of Santa Ana River	Approximately 681 feet upstream of Avenida del Este	18070106	3.6		Y	A, AE	1978

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
El Modena-Irvine Channel	Cities of Oranges, Tustin, Irvine; Orange County Unincorporated Areas	Confluence of Peters Canyon Wash Channel	Approximately 1300 feet upstream of East Marmon Avenue	18070203, 18070204	7.4		N	A, AE, AH	2009
English Canyon	Cities of Mission Viejo and Lake Forest	Confluence of Aliso Creek	Approximately 3110 feet upstream of Vista del Lago	18070301	2.9		N	AE	1973
Facility No. J05	City of Laguna Hills	Confluence of Aliso Creek	Paseo de Valencia	18070301	1.3		N	AE	2009
Facility No. L04P07	City of Mission Viejo	Confluence of La Paz Channel	Atchison and Santa Fe railroad	18070301	0.9		N	A	2009
Fairview Channel	City of Costa Mesa	Confluence of Greenville Banning Channel	Approximately 2600 feet upstream of Placentia Avenue	18070203	1.1		N	A	2009
Federal Storm Channel	City of Seal Beach	Confluence of Los Alamitos Channel	Seal Beach Blvd	18070106	1.3		N	A	2009
Fletcher Channel	City of Orange	Confluence of Santa Ana River	Orange-Olive Road	18070203	1.6		N	A	2009
Fountain Valley Channel	Cities of Fountain Valley and Huntington Beach	Confluence of Talbert Channel (D02)	Euclid Street	18070203	3.7		N	A	2001
Greenville Banning Channel	Cities of Santa Ana, Costa Mesa and Fountain Valley	Confluence of Santa Ana River	West Edinger Avenue	18070203	8.8		N	A	2009
Handy Creek	City of Orange; Orange County Unincorporated Areas	Confluence of Alameda Storm Channel	Peters Canyon Reservoir	18070203	3.3		Y	AE	2009
Hickey Canyon	Orange County Unincorporated Areas	Confluence of Trabuco Creek	Approximately 2.5 miles upstream of Trabuco Canyon Road	18070301	2.5		N	AE	1973

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Hicks Canyon Wash	City of Irvine	Confluence of Peters Canyon Wash Channel	Approximately 3550 feet upstream of Portola Parkway	18070204	3.3		N	A	2009
Horno Creek	City of San Juan Capistrano	Confluence of San Juan Creek	Boundaries Limits	18070301	2.8		Y	AE	1978
Houston Storm Channel	Cities of Buena Park and Fullerton	Confluence of Fullerton Creek Channel	Euclid Street	18070106	3.2		N	AO	1975
Huntington Beach Channel (D01)	City of Huntington Beach	Confluence of Talbert Channel (D02)	Adams Avenue	18070203	4.0		N	AE	2009
Imperial Channel	City of La Habra	Confluence of Coyote Creek Channel	North Harbor Blvd	18070106	2.2		N	A	2009
La Colina – Red Hill Channel	Orange County Unincorporated Areas	Confluence of El Modena-Irvine Channel	Approximately 530 feet upstream of Newport Avenue	18070204	1.9		N	A	2009
La Miranda Creek Channel	City of La Habra; Orange County Unincorporated Areas	County boundary	Approximately 2800 feet upstream of State Route 72	18070106	1.5		N	A, AO	2009
La Paz Channel	City of Mission Viejo	Confluence of Oso Creek	Approximately 2800 feet upstream of confluence of Facility No. L04p07	18070301	3.0		N	A, AE	1984
Laguna Canyon	City of Laguna Beach; Orange County Unincorporated Areas	Pacific Ocean	Approximate 1.5 miles upstream of State Route 73	18070301	6.4		Y	AE	2006
Lane Channel	Cities of Santa Ana and Irvine	San Diego Creek	Approximately 4500 feet upstream of East MacArthur Blvd	18070204	3.9		N	A	2009
Live Oak Canyon	Orange County Unincorporated Areas	Confluence of Trabuco Creek	County Boundary limits	18070301	2.7		N	A	2009

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Loftus Diversion Channel	City of Brea	City of Brea boundary limits	Approximately 450 feet downstream of South Valencia Avenue	18070106	2.4		Y	A, AE	1978
Los Alamitos Channel	Cities of Los Alamitos and Seal Beach	Los Alamitos Retarding Basin	3800 feet upstream of cities of Los Alamitos and Seal Beach boundaries	18070106	3.3		N	A	2009
Lucan Canyon	Orange County Unincorporated Areas	Confluence of San Juan Creek	Approximately 0.5 mile upstream of confluence of San Juan Creek	18070301	0.5		N	A	2009
Marlboro Channel	City of Orange	Confluence of Collins Channel	Costa Mesa Freeway	18070203	1.9		N	A	2009
Marshburn Channel	City of Irvine	Confluence of San Diego Creek Channel	Confluence of Marshburn Wash	18070204	1.4		N	A	2009
Marshburn Wash	City of Irvine; Orange County Unincorporated Areas	Approximately 1700 feet downstream of confluence of Bee Canyon Wash	Approximately 1800 feet upstream of Portola Parkway	18070204	5.4		N	A	2009
Memory Garden Storm Channel	City of brea	Confluence of Brea Canyon Channel	Northwood Avenue	18070106	1.9		N	A, AE	1978
Modjeska Canyon	Orange County Unincorporated Areas	Confluence of Upper Santiago Creek	Approximately 2.8 miles upstream of Santiago Canyon Road	18070203	3.0		N	AE	1973
Narco Channel (J04) (North Sulphur Creek)	City Of Laguna Niguel	Confluence of Aliso Creek	La Paz Road	18070301	0.8		N	AE	2009
Niguel Canyon (Emerald Bay Channel)	City of Laguna Beach; Orange County Unincorporated Areas	Pacific Ocean	Approximately 3.0 miles upstream of State Route 1	18070301	3.2		N	A, AE	1973

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Niguel Storm Drain (J03P01)	City of Laguna Niguel	Confluence of Sulphur Creek	Approximately 690 feet downstream of Niguel Road	18070301	0.4		N	AE	1973
North Tustin Channel	City of Tustin; Orange County Unincorporated Areas	Confluence of El Modena Irvine Channel	Approximately 2900 feet upstream of East 17th Street	18070204	2.3		N	A	2009
Ocean View Channel	Cities of Fountain Valley and Huntington Beach	Confluence of East Garden Grove Wintersburg Channel	Approximately 1600 feet upstream of Euclid Street	18070201	4.7		N	A	2009
Oso Creek	Cities of Mission Viejo, Laguna Niguel and San Juan Capistrano	Confluence of Trabuco Creek	Approximately 0.8 mile upstream of Casta Del Sol	18070301	9.6		N	A, AE	2009
Park Avenue Storm Drain	City of Laguna Beach	Pacific Ocean	Approximately 3600 feet upstream of State Route 1	18070301	0.8		N	A	2009
Paularino Channel	City of Costa Mesa	Confluence of Santa Ana Delhi Channel	Approximately 2500 feet upstream of Fairview Road	18070203, 18070204	2.2		N	A	2009
Peter Canyon Channel	Cities of Tustin and Irvine	State Route 261	Lower Peters Canyon Reservoir	18070204	2.7		N	A	2009
Peters Canyon Wash Channel	Cities of Orange, Tustin, Irvine; Orange County Unincorporated Areas	Barranca Parkway	Peter Canyon Reservoir	18070204	7.0		N	A, AE	1978
Placentia Storm Channel	City of Placentia	Orangethorpe Avenue	Placentia Avenue	18070106	0.5		N	A	2009
Rattlesnake Canyon	City of Irvine	Confluence of peter Canyon Wash Channel	Approximately 1700 feet upstream of Portola Parkway	18070204	2.5		N	A	2009
Red Hill Channel	City of Tustin; Orange County Unincorporated Areas	El Modena Irvine Channel	Approximately 430 feet upstream of Newport Avenue	18070204	1.6		N	A	2009

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Richfield Channel	Cities of Yorba Linda, Placentia and Anaheim	Confluence of Atwood Channel	Approximately 530 feet downstream of Buena Vista Avenue	18070106	1.6		N	A	2009
Round Canyon Wash	City of Irvine; Orange County Unincorporated Areas	Confluence of Bee Canyon Wash	State Route 241	18070204	1.4		N	A	2004
Salt Creek	Cities of Laguna Niguel and Dana Point	Pacific Coast Highway	Confluence of San Juan Canyon	18070301	2.7		N	A, AE	2014, 1973
San Diego Creek	City of Irvine	Confluence of Peters Canyon Wash Channel	Approximately 500 feet upstream Interstate 5	18070204	9.3		Y	A, AE	2014,2012, 2008
San Gabriel River	City of Seal Beach	Pacific Ocean	Orange County boundary limits	18070106	0.7		N	AE	2014
San Joaquin Channel	City of Irvine	Confluence of San Diego Creek Channel	Approximately 3170 feet upstream of Jeffrey Road	18070204	4.8		N	A	2009
San Juan Canyon	City of Laguna Niguel	Confluence of Salt Creek	Golden Lantern	18070301	1.9		N	A	2009
San Juan Creek	Cities of San Juan Capistrano and Dana Point; Orange County Unincorporated Areas	Pacific Ocean	Approximately 5.0 miles upstream of confluence of Bell Canyon	18070301	6.3		Y	A, AE	1992
Sand Canyon Wash	City of Irvine	Confluence of San Diego Creek Channel	Approximately 2350 feet upstream of Shady Canyon	18070204	6.6		Y	AE	1978
Santa Ana-Delhi Channel	Cities of Santa Ana, Costa Mesa, Newport Beach; Orange County Unincorporated Areas	Upper Newport Bay	West Edinger Avenue	18070204	7.2		N	A	2009

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Santa Ana River	Cities of Yorba Linda, Anaheim, Orange, Santa Ana, Huntington Beach, Fountain Valley; Orange County Unincorporated Areas	Pacific Ocean	Orange County boundary limits	18070203	34.0		Y	A, AE	1978
Santa Ana-Santa Fe Channel	Cities of Tustin and Santa Ana	Confluence of Peters Canyon Wash	Grand avenue	18070204	4.3		N	A, AE, AH	1978
Santiago Creek	Cities of Orange, Santa Ana; Orange County Unincorporated Areas	Confluence of Santa Ana River	Irvine Lake	18070203	16.0		Y	A, AE	2011, 1978
Santiago Creek (Upper)	Orange County Unincorporated Areas	Irvine Lake	Confluence of Modjeska Canyon	18070203	6.8		Y	AE	1973
Segunda Deschecha Canada	City of San Clemente	Pacific Ocean	Camino Vista Pacifica	18070301	4.7		Y	AE	1977
Segunda Deschecha Canada Tributary	City of San Clemente	Confluence of Segunda Deschecha Canada	Approximately 0.3 mile upstream of confluence of Segunda Deschecha Canada	18070301	0.3		Y	AE	1977
Serrano Creek	Cities of Lake Forest and Irvine	Blake Parkway	Portola parkway	18070204	4.7		Y	AE	1992
Shady Canyon Wash	City of Irvine	Confluence of Sand Canyon Wash	Approximately 1400 feet upstream of Shady Canyon	18070204	0.7		Y	AE	1978
Silverado Canyon	Orange County Unincorporated Areas	Confluence of Santiago Creek (Upper)	800 feet downstream of Maple Springs	18070203	8.0		N	AE	1973
Sulphur Creek	City of Laguna Niguel	Confluence of Narco Channel (J04)	Nueva Vista Drive	18070301	3.5		Y	A, AE	1973

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Talbert Channel (D02)	Cities of Huntington Beach and Fountain Valley	Pacific Ocean	Slater Avenue	18070203	6.6		N	A, AE	1980
Tijeras Canyon	City of Rancho Santa Margarita; Orange County Unincorporated Areas	Confluence of Trabuco Creek	Approximately 2300 feet upstream State Route 241	18070301	4.6		N	A	2009
Trabuco Creek	Cities of Mission Viejo, Rancho Santa Margarita, San Juan Capistrano; Orange County Unincorporated Areas	Confluence of San Juan Creek	Cleveland National Forect	18070301	16.0		Y	A, AE, AO	2013, 1973
Veeh Creek (San Diego Creek Tributary 2)	Cities of Laguna Hills and Irvine	Confluence of Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	Confluence with San Diego Creek Trib 2	18070204	1.5		Y	AE	1992
Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	City of Irvine	Confluence of San Diego Creek	City of Irvine boundary limits	18070204	1.7		Y	AE	2008, 1978
Walnut Canyon Creek	City of Anaheim	Confluence of Santa Ana River	East Walnut Canyon Road	18070203	2.9		N	A	2009
Westminster Channel	Cities of Westminster and Huntington Beach	Bolsa Chica Street	Magnolia Street	18070201	6.5		N	A	2009
Wintersburg Channel	City of Garden Grove	Haster Retarding Basin	Chapman Avenue	18070201	0.7		N	A	2009
Wood Canyon	Orange County Unincorporated Areas	Aliso Creek	Crimson Canyon	18070301	1.8		N	A	2009

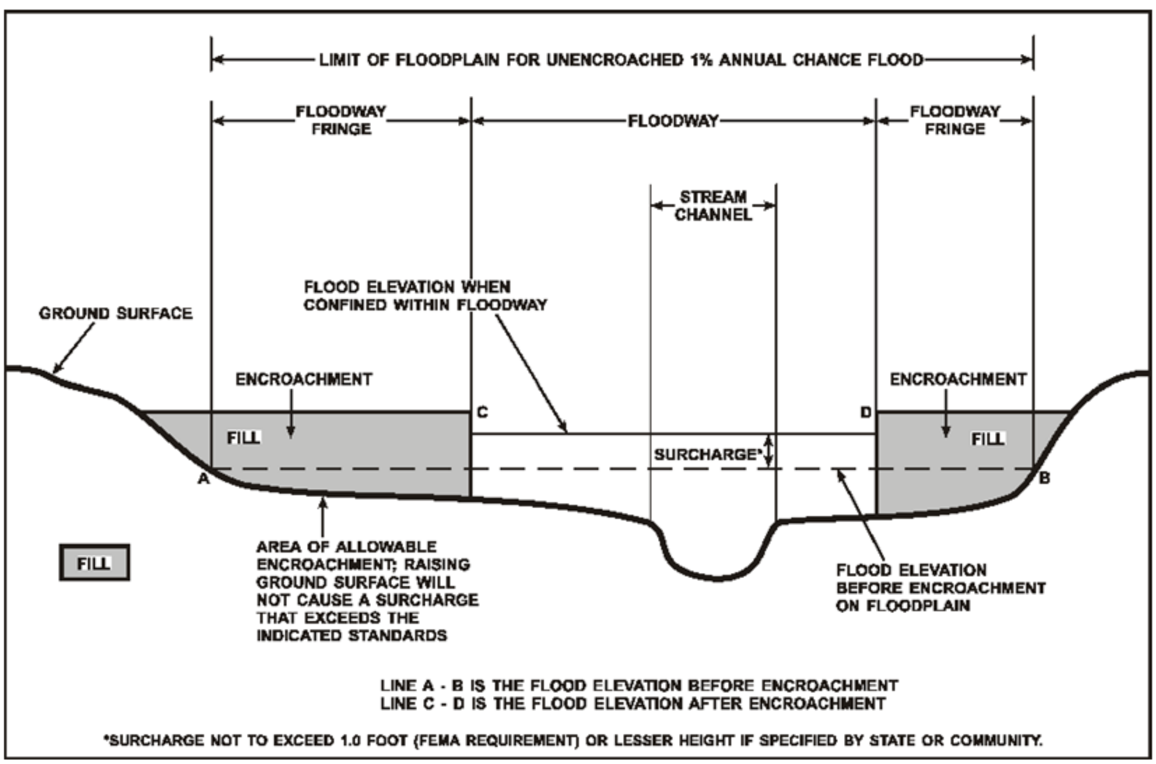
2.2 Floodways

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 balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs 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 Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

This section is not applicable to this Flood Risk Project.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

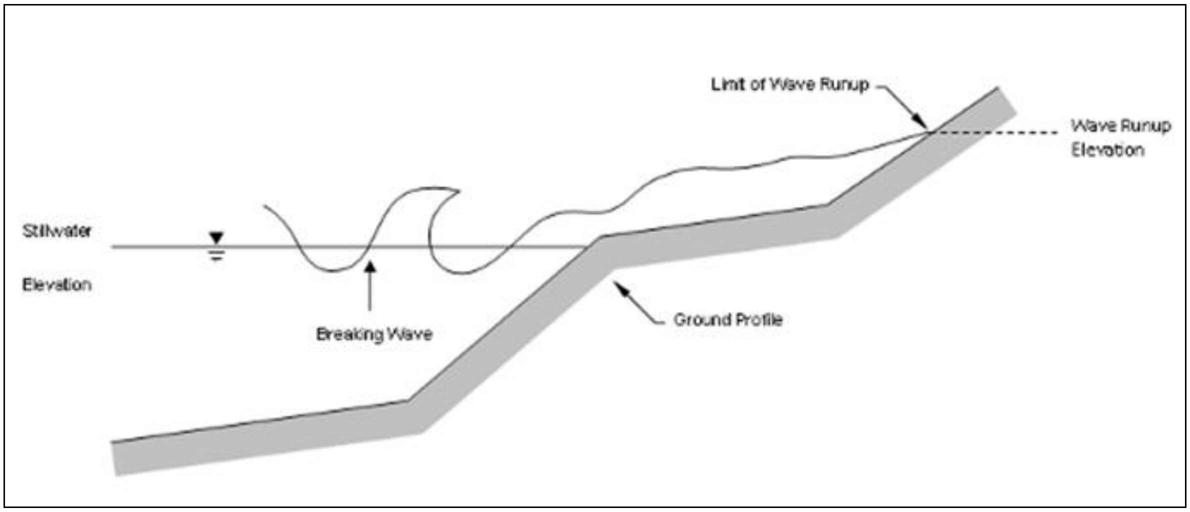
Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.

- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

The 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping along most of the open Pacific coast. The extent of the 1% annual chance floodplain in these areas is derived from the total water level elevation (storm surge combined with the effects of wave setup and runup) for the 1% annual chance storm. The methods that were used for calculation of total water level elevations for coastal areas are described in Section 5.3 of this FIS Report.

Table 26 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 17, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.
- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

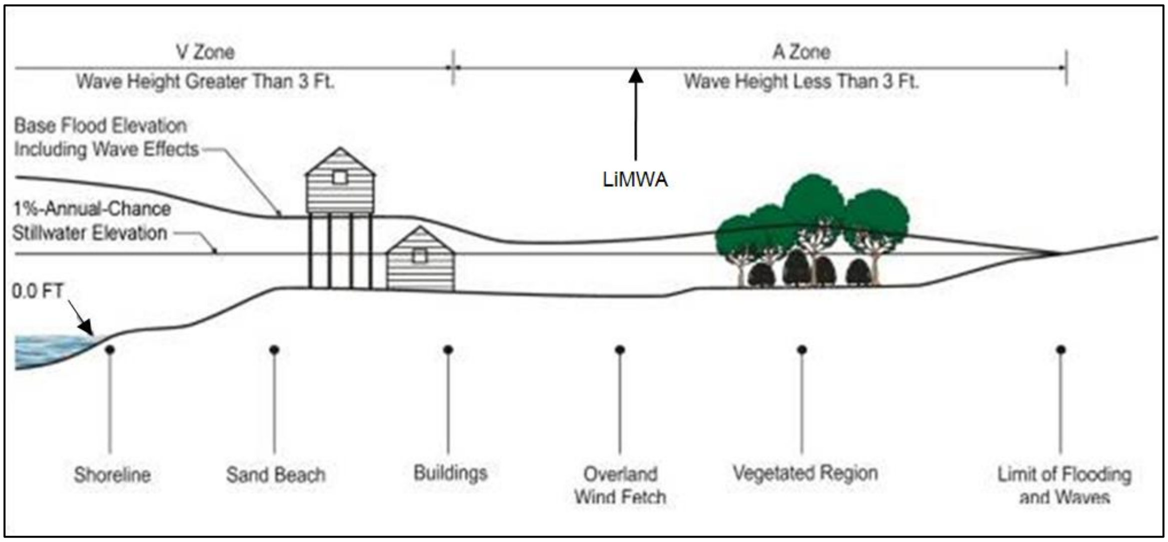
CHHAs are designated as "V" zones, which represent areas subject to high velocity waves and water, and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as "A" zones on the FIRM.

Figure 6, "Coastal Transect Schematic," illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this Flood Risk Project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3: Map Legend for FIRM. In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, or masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

Therefore, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 6.

The effects of wave hazards in Zone AE between Zone VE (or the shoreline where Zone VE is not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot or greater breaking waves are projected to occur during the 1% annual chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in the LiMWA. The NFIP Community Rating System provides credits for these actions.

Where wave runup elevations dominate over wave heights, there is no evidence to date of significant damage to residential structures by runup depths less than 3 feet. Examples of these areas include areas with steeply sloped beaches, bluffs, or flood protection structures that lie parallel to the shore. In these areas, a LiMWA is not mapped. Similarly, in areas where the zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA is not mapped.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3: Map Legend for FIRM. Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in Orange County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Aliso Viejo, City of	A, AE, X
Anaheim, City of	A, AE, AH, AO, X
Brea, City of	A, AE, X
Buena Park, City of	A, AE, AH, AO, X
Costa Mesa, City of	A, X
Cypress, City of	A, D, X
Dana Point, City of	A, AE, AO, VE, X
Fountain Valley, City of	A, D, X
Fullerton, City of	A, AE, AO, X
Garden Grove, City of	A, D, X
Huntington Beach, City of	A, AE, D, VE, X
Irvine, City of	A, AE, AH, X
La Habra, City of	A, AE, AO, X

Community	Flood Zone(s)
La Palma, City of	X
Laguna Beach, City of	A, AE, VE, X
Laguna Hills, City of	A, AE, X
Laguna Niguel, City of	A, AE, AH, X
Laguna Woods, City of	A, AE, X
Lake Forest, City of	A, AE, AO, X
Los Alamitos, City of	A, X
Mission Viejo, City of	A, AE, X
Newport Beach, City of	A, AE, AO, VE, X
Orange, City of	A, AE, AO, X
Orange County, Unincorporated Areas	A, AE, D, VE, X
Placentia, City of	A, AE, X
Rancho Santa Margaritia, City of	A, AE, D, X
San Clemente, City of	A, AE, AO, VE, X
San Juan Capistrano, City of	A, AE, AO, X
Santa Ana, City of	A, AE, D, X
Seal Beach, City of	A, AE, D, VE, X
Stanton, City of	A, X
Tustin, City of	A, AE, AH, X
Villa Park, City of	AE, AO, X
Westminster, City of	A, D, X
Yorba Linda, City of	A, AE, X

3.2 Coastal Barrier Resources System

This section is not applicable to this Flood Risk Project

Table 4: Coastal Barrier Resources System Information

[Not applicable to this Flood Risk Project]

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
San Gabriel	18070106	San Gabriel River	Area that drains to the San Gabriel River in northern Orange County	715
San Jacinto	18070202	San Jacinto River	Largely in neighboring Riverside County	1110
Seal Beach	18070201	East Garden Grove Wintersburg Channel	Smallest watershed within Orange County.	90
Santa Ana	18070203	Santa Ana River	Largest watershed within Orange County	1690
Newport Bay	18070204	San Diego Creek	Encompassed largely by Cities of Irvine and Newport Beach	159
Aliso-San Onofre	18070301	San Juan Creek	Area that drains towards Aliso and Juan Creeks in southern Orange County	494

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for Orange County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
Santa Ana River	The Santa Ana River experienced the earliest flood of record in 1810, when adobe buildings were washed into the Santa Ana River. Other large floods occurred during 1862, 1884, 1889, 1916, 1926, 1938, and 1969. Of these, the most severe occurred in January 1862, with an estimated recurrence interval of greater than 200 years. The flood of March 1938 was the largest recorded on the Santa Ana River. It had a peak discharge of 100,000 cubic feet per second (cfs) at the gaging station downstream of Prado Dam. The estimated recurrence interval for this flood was approximately 140 years. The largest peak flows occurring since the completion of the Prado Dam in 1941 were experienced in January and February 1969. These flows were 4,800 and 5,000 cfs, respectively, and represent the controlled outflow from Prado Dam. The recurrence intervals of these floods were estimated at 30 to 40 years, respectively, depending on location within the county. Although the Prado Dam helped to substantially reduce the flood damage, the 1969 storm caused the largest dollar loss in Orange County history as a result mainly of residential damage along Santiago Creek and agricultural and animal losses. The historic floodplain of the Santa Ana River spreads from the bluffs of the City of Costa Mesa on the south, around the Huntington Beach bluffs on the north, to Anaheim Bay. In the early 1900s, the river was somewhat channelized by levees along the south side of the Talbert gap, between the Cities of Costa Mesa and Huntington Beach. During the 1938 flood, the river levees failed in the Huntington Beach/Fountain Valley area, inundating a vast area that is now substantially developed. The flood left 43 people dead and brought substantial damage to the county. The river levees have since been intermittently improved by the Orange County Flood Control District.
Brea Canyon Channel	In the upstream portion of Brea Creek Channel within Buena Park the capacity is severely reduced just east of Dale Street. The resulting hydraulic jump elevates the water-surface elevation above the top of the wall, with resultant overflow to the south which is impounded by the levee containing the ATSFRR tracks. This impoundment reaches a maximum depth of 10 feet just upstream of the intersection of the ATSFRR and Brea Creek Channel and floods agricultural and vacant land. For a reach of approximately 1,000 feet on the east side of Dale Street, the overflow of 750 cfs to flow over the tracks during the 1-percent annual chance (100-year) flood, become sheet flow, and remain out of the channel. Downstream of Dale Street, obstructions caused by the double culvert at Beach Boulevard create a backwater situation for a distance of 1,200 feet. This backwater overtops the channel, causing shallow flooding in the overbanks. As before, the shallow flooding on the south side does not return to the channel. The floodwaters on the north, however, re-enter the creek downstream of Beach Boulevard.
Carbon Canyon Channel	Most of the flooding problem along Carbon Canyon Channel is associated with inadequate channel capacity with excessive debris accumulation, along with some poor alignment of the natural stream. However, the flooded area between Chapman Avenue and Palm Drive is in a non-developed section, with no structures involved.

Flooding Source	Description of Flood Problems
Carbon Creek Channel and Atwood Channel	Flooding problems along Carbon Creek Channel and Atwood Channel are associated with inadequate culverts and inadequate channel capacities. In the Cities of Anaheim and Buena Park, between Knott Avenue (upstream) and Holder Street (downstream), the 1-percent annual chance flood overtops the banks, but spreads out sufficiently so that the resulting depth of flooding is less than 1 foot.
Capistrano Beach Storm Channel	The underground facility on Capistrano Beach Storm Channel has an approximate flow capacity of a 10-percent annual chance frequency storm. The flood flows from this channel begin at Camino Capistrano, flow south along Sepulveda Avenue, and then west through the commercial area until joining backwater from San Juan Creek. The flood flows do not follow the underground facility alignment because of a diversion caused by a block wall constructed at Camino Capistrano and Sepulveda Avenue.
El Modena Irvine Channel	On El Modena Irvine Channel, which flows through the City of Tustin to Peters Canyon Channel in the City of Irvine, the 1-percent annual chance flood flows exceed the capacity of the channel, particularly at road culvert crossings, thereby becoming sheetflow.
Fullerton Creek Channel	In the segment of Fullerton Creek Channel within the City of Buena Park, the Santa Ana Freeway-Southern Pacific Railroad (SPRR) crossing is a severe obstruction of flow causing a backwater situation that results in local shallow flooding. From the SPRR Bridge to Beach Boulevard, the channel cannot contain the 1-percent annual chance flow, and over bank flow less than 1 foot deep occurs for most of the reach. From Knott Avenue to Valley View Street, over bank flooding less than 1 foot in depth also occurs.
Houston Storm Channel	The Houston Storm Channel, extending from Orangethorpe Avenue to Fullerton Creek, contains only half the 1-percent annual chance flood, resulting in shallow flooding of residential areas in the Cities of Fullerton and Buena Park.
Horno Creek	On Horno Creek, located in the City of San Juan Capistrano, there is heavy growth in the channel upstream of Acjachema Street. This debris tends to choke bridge openings and cause channel breakouts. The backwater caused by the Ortega Highway crossing causes flooding of the commercial, residential, and school properties from Ortega Highway upstream to the I-5 crossing.
Santiago Creek	Both Modjeska and Silverado Canyons which are tributary to Santiago Creek, are densely developed by construction in the narrow, steep canyon bottoms. Many retaining walls have been constructed along one side of the canyon floor to provide room for house pads. A substantial debris problem exists which, coupled with flow velocities of 15 to 20 feet per second, may destroy the numerous footbridges spanning the watercourse. Significant property damage occurred in this canyon during the 1969 flood.
Niguel Storm Drain (J03P01)	On Niguel Storm Drain, the poor trash rack inlet near Mirador Court will cause 1-percent annual chance flooding of adjacent downstream homes, with a resulting flood path heading north toward Crown Valley Parkway. Inlets within the area were found to be inadequate to alleviate the surplus flow.

Flooding Source	Description of Flood Problems
Oso Creek	Oso Creek flows through an orchard of large citrus trees. Flooding on this stream would cause damage to nearby trees and increase the debris load of Trabuco Creek. Flow separation occurs between the ATSFRR and Camino Capistrano upstream of Crown Valley Parkway because of the constriction at the railroad bridge.
San Juan Creek	San Juan Creek has been improved by the construction of concrete slope protection. However, the channel capacity is not adequate for large floods.
Trabuco Creek	Trabuco Creek has a dense growth of trees and brush in the main channel that may raise flood levels considerably. This debris tends to choke bridge openings and cause channel breakouts. The 1-percent annual chance flood breaks out of the channel at Del Obispo Street and the west bank levees return this flow from the main channel.

Table 7 contains information about historic flood elevations in the communities within Orange County.

Table 7: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Santa Ana River	NA	NA	1862	200	USGS gage
Santiago Creek	NA	NA	1884	NA	County

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within Orange County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Santa Ana River	Prado Dam	Dam	At outlet of Prado Reservoir	Constructed by USACE in 1941
Carbon Canyon Channel	Carbon Canyon Dam	Dam	0.8 mile upstream of Carbon Canyon Channel crossing with State Route 90	Constucted in 1961 with a capacity of 7,030 ac-ft.
Carbon Canyon Channel	Miller Retarding Basin	Retarding Basin	At East OrangeThorpe Avenue	Capacity of 360 ac-ft. Design to handle a 4-percent annual chance flood

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Oso Creek	Oso Creek Dam	Dam	At Upper Oso Reservoir	Provide a significant reduction of the peak 1-percent annual chance flood discharge for trhe 4-mile segment from dam downstream to the confluence with La Paz Channel
Santiago Creek	Villa Park Dam	Dam	Villa park	Owned and operated by OCEMA
Santiago Creek	Santiago Dam	Dam	At Irvine Lake	Creates Irvine Lake, a multiple-use recreational and water conservation facility with some flood control features
Coastline	Various	Seawalls, revetments,groins, breakwaters and jetties	Various locations	Constructed along the 74 miles of coastline in Orange County

4.4 Levees

For purposes of the NFIP, FEMA only recognizes levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with comprehensive floodplain management criteria. The Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) describes the information needed for FEMA to determine if a levee system reduces the risk from the 1% annual chance flood. This information must be supplied to FEMA by the community or other party when a flood risk study or restudy is conducted, when FIRMs are revised, or upon FEMA request. FEMA reviews the information for the purpose of establishing the appropriate FIRM flood zone.

Levee systems that are determined to reduce the risk from the 1% annual chance flood are accredited by FEMA. FEMA can also grant provisional accreditation to a levee system that was previously accredited on an effective FIRM and for which FEMA is awaiting data and/or documentation to demonstrate compliance with Section 65.10. These levee systems are referred to as Provisionally Accredited Levees, or PALs. Provisional accreditation provides communities and levee owners with a specified timeframe to obtain the necessary data to confirm the levee's certification status. Accredited levee systems and PALs are shown on the FIRM using the symbology shown in Figure 3: Map Legend for FIRM and in Table 9. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system not longer meets Section 65.10, FEMA will de-accredit the levee system and issue an effective FIRM showing the levee-impacted area as a SFHA.

FEMA coordinates its programs with USACE, who may inspect, maintain, and repair levee systems. The USACE has authority under Public Law 84-99 to supplement local efforts to repair flood control projects that are damaged by floods. Like FEMA, the USACE provides a program to allow public sponsors or operators to address levee system maintenance deficiencies. Failure to do so within the required timeframe results in the levee system being placed in an inactive status in the USACE Rehabilitation and Inspection Program. Levee systems in an inactive status are ineligible for rehabilitation assistance under Public Law 84-99.

FEMA coordinated with the USACE, the local communities, and other organizations to compile a list of levees that exist within Orange County. Table 9, "Levees," lists all accredited levees, PALs, and de-accredited levees shown on the FIRM for this FIS Report. Other categories of levees may also be included in the table. The Levee ID shown in this table may not match numbers based on other identification systems that were listed in previous FIS Reports. Levees identified as PALs in the table are labeled on the FIRM to indicate their provisional status.

Please note that the information presented in Table 9 is subject to change at any time. For that reason, the latest information regarding any USACE structure presented in the table should be obtained by contacting USACE and accessing the USACE national levee database. For levees owned and/or operated by someone other than the USACE, contact the local community shown in Table 31.

Table 9: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)
Anaheim, City of	Santa Ana River	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0142J 06059C0151J 06059C0152J 06059C0153J 06059C0156J 06059C0157J 06059C0161J 06059C0180J
Costa Mesa, City of	Santa Ana River	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0254J 06059C0258J 06059C0262J 06059C0264K
Dana Point, City of	San Juan Creek	Left and Right Banks	N/A	N/A	N/A	N/A	06059C0506J 06059C0508K
Fountain Valley, City of	Fountain Valley Channel	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0254J 06059C0258J
Fountain Valley, City of	Santa Ana River	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0254J 06059C0256J 06059C0258J 06059C0262J 06059C0264K

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)
Fountain Valley, City of	Talbert Channel (D02)	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0254J 06059C0262J
Huntington Beach, City of	East Garden Grove Wintersburg Channel	Left and Right Banks	N/A	N/A	N/A	N/A	06059C0234J 06059C0251J 06059C0253J
Huntington Beach, City of	Fountain Valley Channel	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0262J
Huntington Beach, City of	Talbert Channel (D02)	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0262J 06059C0263K 06059C0264K
Huntington Beach, City of	Huntington Beach Channel ((D01)	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0261J 06059C0263K 06059C0264K
Huntington Beach, City of	Santa Ana River	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0262J 06059C0264K
Irvine, City of	Bee Canyon Wash	Right Bank	N/A	N/A	N/A	N/A	06059C0305J
Irvine, City of	San Diego Creek Channel	Right Bank	N/A	N/A	N/A	N/A	06059C0286J 06059C0287J 06059C0288K
Irvine, City of	San Diego Creek Channel	Right Bank	N/A	N/A	N/A	N/A	06059C0287J
Laguna Niguel, City of	Sulphur Creek	Left Bank	N/A	N/A	N/A	N/A	06059C0437J

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)
Newport Beach, City of	Santa Ana River	Left Bank	USACE	Yes	N/A	N/A	06059C0264K
Orange, City of	Santa Ana River	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0142J 06059C0144J 06059C0151J 06059C0152J 06059C0153J 06059C0161J
Orange County, Unincorporated Areas	Santa Ana River		USACE	Yes	N/A	N/A	06059C0151J 06059C0153J 06059C0264K
San Juan Capistrano, City of	Arroyo Trabuco Creek	Left and Right Banks	N/A	N/A	N/A	N/A	06059C0443J 06059C0506J
San Juan Capistrano, City of	San Juan Creek	Right Bank	N/A	N/A	N/A	N/A	06059C0444J 06059C0506J 06059C0507J
Santa Ana, City of	Santa Ana River	Left and Right Banks	USACE	Yes	N/A	N/A	06059C0142J 06059C0143J 06059C0144J 06059C0256J
Seal Beach, City of	San Gabriel River	Left and Right Banks	N/A	N/A	N/A	N/A	06059C0111J 06059C0113J
Westminster, City of	East Garden Grove Wintersburg Channel	Left and Right Banks	N/A	N/A	N/A	N/A	06059C0251J

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources 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 are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 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-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual 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 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 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.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 27, "Incorporated Letters of Map Change", which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, "FIRM Revisions."

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17.) Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Alameda Storm Channel	At confluence Santiago Creek	4.5	850	2,100	2,800	5,100
Alameda Storm Channel	Approximately 800 feet downstream of Orange Park Acres Boulevard	4.1	800	2,000	2,700	4,800
Alipaz Storm Channel	At confluence Trabuco Creek	0.6	86	250	400	890
Alipaz Storm Channel	At Alpaz Street	0.3	50	140	220	490
Aliso Creek	At Outlet	35.04	7,414	10,620	12,185	18,083
Aliso Creek	At 28.01 Square Miles	28.01	6,490	9,132	10,495	15,266
Aliso Creek	At 13.60 Square Miles	13.60	3,002	4,255	4,884	7,223
Aliso Creek	At 6.73 Square Miles	6.73	1,493	2,166	2,480	3,734
Anaheim-Barber City Channel	At Euclid Street	3.9	500	950	1,300	2,800
Anaheim-Barber City Channel	At Cerritos Avenue	1.8	300	550	750	1,600
Anaheim-Barber City Channel	At Ball Road	1.3	230	450	600	1,300
Agua Chinon Wash	At San Diego Creek	11.4	1,600	3,800	5,100	9,300

			Peak Discharge (cfs)			
Flooding Source	Location	Drainage Area (Square Miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Agua Chinon Wash	At Santa Ana Freeway	10.4	1,400	3,200	4,700	8,300
Atwood Channel	At confluence Miller Basin-Carbon Canyon Diversion Channel	9.4	1,700	4,000	5,500	11,000
Atwood Channel	Upstream of confluence Richfield Channel	4.8	750	1,700	2,300	4,700
Atwood Channel	At Taylor Street	4.3	690	1,600	2,100	4,300
Atwood Channel	At Imperial Highway	1.8	500	1,100	1,400	2,900
Barranca Channel	At confluence San Diego Creek	2.3	340	740	1,000	1,900
Barranca Channel	At Barranca Road	1.2	210	450	630	1,150
Barranca Channel	At Red Hill Avenue	0.7	150	330	400	850
Bee Canyon Wash	At San Diego Creek	2.2	900	1,400	1,800	4,200
Bee Canyon Wash	At Santa Ana Freeway	1.7	900	1,100	1,600	8,000
Bitterbush Channel[1]	At confluence Santa Ana River	1.5	1,000	1,700	2,000	3,900
Bitterbush Channel[1]	Approximately 1,200 feet north of Chapman Avenue	1.3	920	1,500	1,800	3,300

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Bitterbush Channel[1]	Downstream of confluence Walnut Storm Channel	1.0	770	1,100	1,400	2,600
Bluebird Canyon	At Outlet	0.97	695	1003	1153	1764
Bluebird Canyon	Downstream of Cress Street	0.86	661	935	1056	1633
Bonita Creek	At confluence with San Diego Greek	5.0	1,100	2,500	3,750	7,000
Bonita Creek	Approximately 4,000 feet downstream of Bonita Reservoir	4.5	960	2,200	3,100	6,200
Bonita Creek	Approximately 3,500 feet downstream of Bonita Reservoir	4.0	900	2,000	2,900	5,800
Bonita Creek	At Bonita Reservoir	3.7	840	1,900	2,700	5,400
Bonita Creek	Downstream of confluence with Coyote Canyon	2.9	700	1,600	2,300	4,500
Bonita Creek	Downstream of confluence with Tributary 2	1.2	360	810	1,200	2,300
Borrego Canyon Wash	Approximately 3,800 feet downstream of Trabuco Road	5.1	1,000	2,500	3,400	6,400
Borrego Canyon Wash	At Trabuco Road	5.1	1,000	2,500	3,400	6,400

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Brea Canyon Channel	At the City of Brea-City of Fullerton corporate limits	21.5	1,700	5,600	8,300	18,000
Brea Canyon Channel	At Imperial Highway	21.2	1,600	5,300	7,900	17,000
Brea Canyon Channel	Downstream of Memory Gardens	20.8	1,600	5,200	7,800	17,000
Brea Canyon Channel	At Central Avenue	18.8	1,500	4,800	7,200	16,000
Brea Canyon Channel	At the City of Brea corporate limits	18.4	1,400	4,700	7,000	16,000
Brea Canyon Channel	At confluence with Coyote Creek	33.3	1,700	3,700	7,900	21,000
Brea Canyon Channel	At Beach Boulevard	33.1	1,700	3,700	7,900	21,000
Brea Canyon Channel	At Atchison, Topeka & Santa Fe Railway (ATSF)	31.9	1,600	3,400	7,200	19,000
Brea Canyon Channel	Approximately 2,000 feet downstream of CP 404	30.9	1,500	3,200	6,600	18,000
Brea Canyon Channel	At the City of Buena Park corporate limits	30.3	1,500	3,000	6,200	17,000

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Brea Canyon Channel	At the City of Fullerton corporate limits at Magnolia Avenue extended	30.7	1,850	3,000	6,000	11,250
Brea Canyon Channel	Downstream of confluence of Bastanchury Creek	28.4	1,250	2,550	5,000	10,600
Brea Canyon Channel	Upstream of confluence of Bastanchury Creek	26.1	760	1,140	3,500	8,800
Brea Canyon Channel	At intersection of Harbor Boulevard and Malvern Avenue	25.1	590	1,750	2,850	7,000
Buckeye Storm Channel	At Orange-Olive Road	1.5	630	1,200	1,500	3,000
Buckeye Storm Channel	At Shaffer Street	1.1	430	840	1,100	2,200
Buckeye Storm Channel	At Cambridge Street	1.0	370	770	990	2,000
Canyon Acres	Upstream of confluence with Laguna Canyon	0.46	248	351	407	620
Canyon Acres	2500 feet upstream from Laguna Canyon Road	0.20	112	158	181	273

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Carbon Canyon Channel	At confluence with Miller Basin, downstream of Atwood Channel	32.3	2,500	5,600	7,700	16,000
Carbon Canyon Channel	Downstream of confluence with D-1 Channel	22.9	1,500	3,200	4,200	8,900
Carbon Canyon Channel	Upstream of confluence with D-1 channel	22.1	1,200	2,500	3,300	7,100
Carbon Canyon Channel	At Chapman Drive	22.0	1,200	2,500	3,200	6,900
Carbon Canyon Channel	Downstream of Palm Drive	21.5	*	*	2,110	*
Carbon Canyon Channel	Upstream of Palm Drive	20.9	680	1,600	2,100	4,500
Carbon Canyon Channel	At Yorba Linda Boulevard	20.7	530	1,200	1,700	3,700
Carbon Canyon Channel	Approximately 2,000 feet downstream of Bastenchury Road	20.4	430	1,000	1,400	3,200
Carbon Canyon Channel	At Bastanchury Road	20.2	300	950	1,200	2,600
Carbon Canyon Channel	At Imperial Highway	20.0	200	950	1,100	2,100

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Carbon Canyon Channel	At Carbon Canyon Dam Outflow	19.3	130	900	900	1,600
Carbon Canyon Channel	Upstream of confluence of Telegraph Canyon	13.1	730	2,600	4,000	9,300
Carbon Canyon Channel	Downstream of confluence of Soquel Canyon	11.9	720	2,600	3,900	9,100
Carbon Canyon Channel	Downstream of confluence of Sonome Canyon	7.4	450	1,600	2,500	5,800
Carbon Canyon Channel	Upstream of confluence of Sonome Canyon	5.3	310	1,100	1,700	4,000
Carbon Canyon Channel	Downstream of confluence of Liona Canyon	4.1	260	940	1,400	3,400
Carbon Canyon Diversion Channel	At confluence with Santa Ana River	33.2	2,000	2,500	4,600	8,000
Carbon Canyon Diversion Channel	Downstream of confluence with Miller Basin	32.3	1,900	2,400	4,300	8,000
Carbon Creek Channel	At Southern Pacific Railroad	15.1	1,600	2,400	4,200	15,000
Carbon Creek Channel	At Knott Avenue	13.8	1,400	2,100	3,800	14,000

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Cascadita Creek	At Via Cascadita	1.1	*	*	950	*
Collins Channel	Downstream of confluence with Santa Ana River	6.4	1,100	3,000	4,100	9,200
Collins Channel	Upstream of confluence with Marlboro Channel	2.1	720	1,500	1,900	4,000
Como Storm Drain	At confluence with Peters Canyon Wash	1.7	480	1,100	1,600	3,100
Como Storm Drain	Downstream of Walnut Avenue Wash	0.7	250	560	800	1,600
Coyote Canyon Wash	At confluence of Bonita Creek	1.6	460	1,100	1,500	3,000
Coyote Canyon Wash	Approximately 3,000 feet upstream of confluence of Bonita Creek	1.4	390	880	1,300	2,500
Coyote Creek Channel	Approximately 2,400 feet downstream of Beach Boulevard	11.7	3,000	6,300	8,100	17,000
Coyote Creek Channel	Downstream of confluence of Imperial Channel	10.8	2,800	5,800	7,500	16,000
Coyote Creek Channel	Upstream of confluence of White Brook	6.8	1,800	3,700	4,800	10,000

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Coyote Creek Channel	At confluence with Monte Vista Storm Drain	6.3	1,700	3,500	4,500	9,200
Coyote Creek Channel	At Southern Pacific Railroad bridge	3.6	1,000	2,100	2,700	5,600
Coyote Creek Channel	At Harbor Boulevard	3.2	880	1,900	2,400	5,000
Coyote Creek Channel	At Palm Street	2.1	490	1,200	1,600	3,400
Coyote Creek Channel	At Central Avenue	2.0	480	1,100	1,600	3,200
Coyote Creek Channel	At Whittier Avenue	1.8	410	1,000	1,500	3,000
Coyote Creek Channel	Approximately 1,300 feet downstream of La Habra corporate limits	1.2	230	640	930	1,900
Coyote Creek Channel	At the City of La Habra corporate limits	0.7	120	360	530	1,100
East Garden Grove-Wintersburg Channel	At Euclid Street	7.0	600	1,200	1,600	3,500
East Garden Grove-Wintersburg Channel	At Westminster Boulevard	5.9	500	950	1,300	3,100

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
East Richfield Channel	At Santa Ana River confluence	2.5	720	1,800	2,600	5,300
East Richfield Channel	At Imperial Highway	2.4	700	1,700	2,400	5,000
East Richfield Channel	At Brookmont Drive	2.2	630	1,600	2,200	4,100
East Richfield Channel	Approximately 1,000 feet downstream of Fairmont Boulevard	2.0	500	1,400	2,000	4,100
East Richfield Channel	Approximately 1,000 feet upstream of Fairmont Boulevard	1.1	310	810	1,200	2,400
East Richfield Channel	Approximately 1,000 feet downstream of Yorba Linda Boulevard	1.0	290	750	1,100	2,200
El Modena-Irvine Channel	Downstream of confluence with Browning Avenue Channel	10.1	1,700	3,900	5,400	10,000
El Modena-Irvine Channel	At Browning Avenue	8.9	1,500	3,500	4,700	9,600
El Modena-Irvine Channel	Downstream of confluence of Redhill Channel	8.5	1,400	3,300	4,400	9,000

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
El Modena-Irvine Channel	Upstream of confluence of La Colima-Redhill Storm Channel	4.7	780	1,800	2,500	4,200
El Modena-Irvine Channel	At Newport Avenue	4.5	750	1,700	2,400	4,700
El Modena-Irvine Channel	Downstream of confluence of North Tustin Channel	3.8	600	1,400	2,000	3,700
El Modena-Irvine Channel	At Fairhaven Avenue	1.8	490	680	720	2,200
El Modena-Irvine Channel	Downstream of Jordan Avenue (Retarding Basin)	1.5	400	500	500	2,200
El Modena-Irvine Channel	Intersection of Solana Drive and Marmon Avenue	1.5	400	770	990	2,200
El Modena-Irvine Channel	Start of open channel downstream	1.3	340	670	870	1,900
Fletcher Channel	At confluence with Santa Ana River	1.4	440	1,000	1,300	2,800
Fletcher Channel	At Fletcher Street	1.3	570	1,100	1,400	2,800
Fletcher Channel	At Glassell Street	1.0	450	860	1,100	2,200
Fountain Valley Channel	At Talbert Channel confluence	3.8	*	*	1,250	*

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Fullerton Creek Channel	At Valley View Drive	20.6	1,500	3,900	6,200	14,000
Fullerton Creek Channel	Downstream of confluence of Buena Park Storm Channel	20.4	1,500	3,700	6,200	14,000
Fullerton Creek Channel	Upstream of confluence of Buena Park Storm Channel	19.3	1,500	3,500	5,900	13,000
Fullerton Creek Channel	Downstream of confluence of Melrose Channel	19.0	1,400	3,300	5,700	13,000
Fullerton Creek Channel	Upstream of confluence with Melrose Channel	17.5	1,300	3,300	5,300	12,000
Fullerton Creek Channel	At Manchester Avenue	17.0	1,300	3,300	5,300	12,000
Fullerton Creek Channel	At Dale Avenue	16.8	1,300	3,300	5,300	11,800
Fullerton Creek Channel	At confluence of Houston Channel	14.8	1,250	3,250	5,750	10,150
Fullerton Creek Channel	At ATSF Railway	8.92	750	1,900	3,000	7,000
Fullerton Creek Channel	At intersection of Bastanchury and Associated Roads	5.9	225	575	980	2,060

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Greenville-Banning Channel	At Huntzinger Avenue	2.8	460	900	1,200	2,500
Greenville-Banning Channel	At Warner Avenue	1.6	150	300	850	2,500
Greenville-Banning Channel	At Edinger Avenue	0.8	100	150	450	1,000
Handy Creek	At confluence with Santiago Creek	*	*	*	2,400	*
Handy Creek	Upstream of Amapola Avenue	3.0	680	1,600	2,300	4,000
Handy Creek	Downstream of Chapman Avenue	2.4	600	1,500	2,000	3,600
Hicks Canyon Wash	At Culver Drive	3.0	730	1,800	2,700	4,800
Hicks Canyon Wash	Approximately 1.3 miles upstream of Culver Drive	2.6	700	1,700	2,400	4,600
Horno Creek	At confluence with the City of San Juan Creek	4.5	350	1,100	1,700	3,800
Horno Creek	At San Juan Capistrano corporate limits	3.4	350	1,100	1,700	3,800
Houston Storm Channel	At confluence with Fullerton Creek	2.9	920	1,450	1,800	3,900

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Houston Storm Channel	At the City of Buena Park corporate limits	2.1	660	1,100	1,300	3,000
Huntington Beach Channel (D01)	At Talbert Channel confluence	4.5	*	*	1,480	*
Imperial Channel	At confluence with Coyote Creek	3.3	740	1,600	2,100	4,400
Imperial Channel	At Euclid Street	2.4	530	1,200	1,600	3,300
Imperial Channel	At Harbor Boulevard	1.9	400	910	1,200	2,500
La Colina-Redhill Storm Channel	At confluence with El-Modena Irvine Channel	1.3	230	580	780	1,500
Laguna Canyon	At Pacific Coast Highway	9.49	2,379	3,487	4,231	6,026
Laguna Canyon	Downstream of Canyon Acres Drive	8.71	2,221	3,217	3,881	5,613
Laguna Canyon	1.8 miles downstream of El Toro Road	7.71	2,015	2,884	3,459	5,096
Laguna Canyon	At El Toro Road	5.72	1,600	2,218	2,576	3,995
Laguna Canyon	6,550 feet upstream from El Toro Road	1.62	403	588	704	1,061
Laguna Canyon	9,700 feet upstream from El Toro Road	0.97	322	463	533	815
Laguna Wash Road	At San Diego Freeway	1.3	320	700	1,100	2,100

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Laguna Wash Road	Downstream of confluence of Laguna Road Wash Tributary	1.1	240	510	730	1,500
La Mirada Creek	At the City of La Habra corporate limits	3.2	720	1,800[2]	1,800[2]	6,000
La Mirada Creek	At Orange County limits	3.0	610	1,800	2,700	5,600
Lane Channel	At confluence with San Diego Creek	4.0	540	1,200	1,500	3,000
Lane Channel	At Red Hill Avenue	2.2	310	660	850	1,700
Loftus Diversion Channel	At Imperial Highway	3.5	570	1,900	2,900	5,800
Loftus Diversion Channel	Downstream of confluence of Fullerton Creek	3.3	530	1,700	2,700	5,400
Loftus Diversion Channel	Upstream of confluence of Fullerton Creek	2.19	370	1,200	1,900	3,700
Loftus Diversion Channel	At Pacific Electric Railroad	1.74	290	950	1,500	2,900
Loftus Diversion Channel	At Kraemer Boulevard	1.52	250	800	1,300	2,500
Loftus Diversion Channel	Approximately 1,500 feet east of Kraemer Boulevard	1.47	240	770	1,200	2,400

			Peak Discharge (cfs)			
Flooding Source	Location	Drainage Area (Square Miles)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Loftus Diversion Channel	Approximately 2,500 feet east of Kraemer Boulevard	0.85	140	450	700	1,400
Marlboro Channel	At confluence with Collins Channel	3.5	590	1,100	1,700	4,200
Marlboro Channel	At ATSF Railway	3.5	590	1,100	1,700	4,200
Marlboro Channel	At Cambridge Street	3.4	570	1,100	1,700	4,100
Marlboro Channel	Approximately 1,500 feet downstream of Tustin Avenue	3.3	530	1,100	1,600	4,000
Marlboro Channel	At Newport Freeway	2.9	460[3]	840[3]	1,300[3]	3,400[3]
Melrose Channel (Riverside Freeway Channel)	At confluence with Fullerton Creek	1.5	320	612	830	1,800
Melrose Channel (Riverside Freeway Channel)	At Stanton Avenue	1.2	250	480	650	1,400
Memory Garden Storm Channel	At confluence with Brea Canyon Wash	1.4	250	780	1,200	2,500
Memory Garden Storm Channel	At Central Avenue	1.3	230	750	1,100	2,400

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Memory Garden Storm Channel	At Memory Garden Cemetery	1.2	210	710	1,100	2,300
Memory Garden Storm Channel	Approximately 2,500 feet upstream of Memory Garden Cemetery	1.0	160	550	810	1,800
Peters Canyon Channel	At confluence with San Diego Creek	*	*	*	14,660	*
Peters Canyon Channel	At OCTA Metrolink	34.4	*	*	12,660	*
Peters Canyon Channel	Downstream of El Modena-Irvine Channel	32.6	*	*	11,580	*
Peters Canyon Channel	Downstream of Santa Ana Freeway	19.7	*	*	8,550	*
Peters Canyon Wash	Approximately 1,400 feet downstream of Peters Canyon Reservoir	0.24	*	*	320	*
Peters Canyon Wash	Approximately 1,700 feet upstream of Lower Peters Canyon Reservoir	0.48	*	*	570	*
Peters Canyon Wash	Approximately 1,300 feet upstream of Lower Peters Canyon Reservoir	0.77	*	*	840	*

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Peters Canyon Wash	At Lower Peters Canyon Reservoir	0.95	*	*	980	*
Placentia Storm Channel	At confluence with Carbon Creek Channel	3.4	1,100	1,700	2,200	4,800
Placentia Storm Channel	At ATSF Railway	3.1	960	1,600	1,900	4,200
Placentia Storm Channel	At Placentia Avenue	2.7	760	1,200	1,450	3,200
Prima Deshecha Canada	At El Camino Real	6.7	540	1,700	2,800	7,000
Prima Deshecha Canada	At San Diego Freeway	5.2	420	1,400	2,300	5,600
Prima Deshecha Canada	Downstream of confluence of Prima Deshecha Canada Tributary	4.0	360	1,100	1,900	4,600
Prima Deshecha Canada	At Portico del Norter	2.1	*	*	1,176	*
Reservoir Canyon	Downstream of I-5	1.0	130	360	570	1300
Reservoir Canyon	Downstream of confluence of Deep Canyon	0.9	130	360	570	1300
Reservoir Canyon	At Paseo Allegria	0.5	80	210	330	730
Richfield Channel	At confluence with Atwood Channel	4.6	860	2,300	3,300	6,700
Richfield Channel	At ATSF Railway	4.3	830	2,200	3,100	6,500

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Sand Canyon Wash	At confluence with San Diego Creek	8.6	920	2,600	3,900	8,500
Sand Canyon Wash	At Culver Drive	8.4	920	2,600	3,900	8,500
Sand Canyon Wash	At Sand Canyon Spillway	7.0	860	2,400	3,600	7,800
Sand Canyon Wash	At downstream side of Shady Canyon	5.7	1,100	2,600	3,700	7,400
Sand Canyon Wash	At upstream side of Shady Canyon	2.5	500	1,200	1,700	3,300
San Diego Creek	At MacArthur Boulevard	123.8	4,300	9,700	18,500	27,500
San Diego Creek	Downstream of confluence with Sand Canyon	115.1	4,300	9,700	18,500	27,500
San Diego Creek	Downstream of confluence with San Joaquin channel	105.8	4,200	9,500	17,500	27,000
San Diego Creek	At San Diego Freeway	101.1	4,000	9,200	17,500	26,000
San Diego Creek	Downstream of confluence of Peters Canyon Wash	86.5	3,900	8,800	16,000	25,000
San Diego Creek	At Sand Canyon Avenue	39.8	4,800	10,600	14,100	*
San Diego Creek	At Laguna Freeway	29.8	4,300	9,600	12,700	20,700

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
San Diego Creek	Upstream of confluence of Bee Canyon Wash	27.7	3,900	8,800	11,600	20,700
San Diego Creek	At San Diego Freeway	16.1	3,000	6,600	8,700	15,500
San Diego Creek	Approximately 2,000 feet downstream of confluence of Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	14.7	1,700	3,900	5,800	11,000
San Diego Creek	Downstream of confluence of Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	14.5	1,600	3,700	5,500	10,500
San Diego Creek	At Santa Ana Freeway	2.1	1,200	1,700	1,800	2,400
San Diego Creek	At Valencia Avenue	9.3	3,200	4,300	4,700	6,200
San Diego Creek	Downstream of confluence with Veeh Creek (San Diego Creek Tributary 2)	14.75	5,335	7,255	7,950	10,450
San Joaquin Channel	At confluence with San Diego Creek	4.9	910	2,100	2,650	5,900
San Joaquin Channel	Approximately 1,200 feet upstream of Culver Drive	3.3	720	1,600	2,050	4,600

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
San Joaquin Channel	Approximately 3,600 feet upstream of San Diego Freeway	1.2	360	810	1,250	2,300
San Juan Creek	At the City of San Juan Capistrano corporate limits	173.7	8,200	30,000	42,000	80,000
San Juan Creek	Downstream of confluence of Trabuco Creek	171.1	8,000	29,000	41,000	79,000
San Juan Creek	At confluence of Horno Creek	116.8	6,200	22,000	32,000	60,000
San Juan Creek	At the City of San Juan Capistrano corporate limits	108.5	6,000	21,000	30,000	56,000
Santa Ana-Delhi Channel	Upstream of confluence with Santa Ana Gardens Channel	4.2	580	1,100	1,500	3,200
Santa Ana-Delhi Channel	At Flower Street	3.5	540	1,000	1,400	3,000
Santa Ana-Delhi Channel	At Southern Pacific Railroad	2.9	470	880	1,200	2,600
Santa Ana-Delhi Channel	At Warner Avenue	1.1	220	400	550	1,200
Santa Ana Gardens Channel	At Sunflower Avenue	5.7	560	1,100	1,400	3,100
Santa Ana Gardens Channel	At Alton Avenue	5.3	540	1,000	1,400	3,000

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Santa Ana Gardens Channel	At Segerstrom Avenue	3.9	470	880	1,200	2,600
Santa Ana Gardens Channel	At Adams Avenue	3.0	530	820	1,100	2,400
Santa Ana Gardens Channel	At Edinger Avenue	2.5	400	750	1,000	2,200
Santa Ana Gardens Channel	At McFadden Avenue	1.4	260	400	650	1,400
Santa Ana River	At mouth	2,447[4]	*	*	12,000[5]	*
Santa Ana River	At Katella Avenue in Orange	2,346[4]	*	*	50,000	*
Santa Ana River	At Imperial Highway in City of Anaheim	2,306[4]	*	*	50,000	*
Santa Ana-Santa Fe Channel	At ATSF Railway crossing	4.2	500	1,300	2,000	3,700
Santa Ana-Santa Fe Channel	At ATSF Railway junction	3.9	490	1,300	1,900	3,500
Santa Ana-Santa Fe Channel	At Redhill Avenue	3.3	420	1,100	1,600	3,000
Santa Ana-Santa Fe Channel	At Newport Freeway	2.3	290	760	1,100	2,100
Santa Ana-Santa Fe Channel	Upstream of confluence of Southwest Tustin Channel	1.3	170	430	650	1,200
Santa Ana-Santa Fe Channel	At Grand Avenue	0.8	100	260	400	730
Santiago Creek	At Santa Ana River	102	1,500	4,000	12,000	27,000

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Santiago Creek	At Atchison Topeka and Santa Fe Railway	96	1,500	4,000	12,000	27,000
Segunda Deshecha Canada	At El Camino Real	7.4	590	1,800	3,000	7,600
Segunda Deshecha Canada	At San Diego Freeway	6.9	560	1,800	2,900	7,300
Segunda Deshecha Canada	Downstream of confluence of Segunda Deshecha Canada Tributary	6.4	520	1,700	2,800	6,800
Segunda Deshecha Canada	Approximately 1.6 miles upstream of Pacific Ocean	5.0	430	1,400	2,300	5,500
Segunda Deshecha Canada	Approximately 1.9 miles upstream of Pacific Ocean	4.7	410	1,300	2,100	4,800
Segunda Deshecha Canada	Approximately 2.5 miles upstream of Pacific Ocean	4.2	380	1,200	2,000	4,800
Segunda Deshecha Canada Tributary	At confluence with Segunda Deshecha Canada	1.2	150	420	670	1,600

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Segunda Deshecha Canada Tributary	Approximately 1,584 feet upstream of confluence with Segunda Deshecha Canada	1.1	120	380	620	1,500
Serrano Creek	At confluence with San Diego Creek	9.3	3,200	4,300	4,700	6,200
Serrano Creek	At OCTA Metrolink	6.3	850	2,200	3,000	5,600
Serrano Creek	Downstream of Tributary Junction	5.4	850	2,200	2,900	5,300
Serrano Creek	At Bake Parkway	4.9	*	*	2,800	*
Serrano Creek	Upstream of Tributary Junction	2.8	*	*	2,200	*
Serrano Creek	Approximately 12,500 feet upstream of Trabuco Road	1.7	*	*	1,700	*
Shady Canyon Wash	At confluence with Sand Canyon Wash	1.6	440	990	1,500	2,800
Shady Canyon Wash	Approximately 2,200 feet upstream of confluence with Sand Canyon Wash	1.5	420	950	1,400	2,700
Talbert Channel	At Huntington Beach Channel (D01) confluence	13.2	*	*	3,510	*

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Trabuco Creek	At Atchison, Topeka & Santa Fe Railway	35.46	*	*	13,000	*
Trabuco Creek	At confluence with San Juan Creek	53.9	2,800	11,000	15,000	23,000
Valencia Storm Channel	At Harvard Avenue	1.0	*	*	915	1174
Valencia Storm Channel	Approximately 2,000 feet southeast of Culver Drive	0.7	250	560	760	1,600
Veeh Creek (San Diego Tributary 2)	At confluence with Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	4.0	760	1,700	2,600	4,900
Veeh Creek (San Diego Tributary 2)	At confluence with San Diego Creek	5.4	2,540	3,490	3,810	5,030
Veeh Creek Tributary 1 (San Diego Tributary 1)	At confluence with San Diego Creek	5.4	900	2,000	3,100	5,800
Veeh Creek Tributary 1 (San Diego Tributary 1)	Upstream of confluence of San Diego Creek Tributary 2	1.2	360	810	1,250	2,300
Veeh Creek Tributary 1 (San Diego Tributary 1)	Approximately 4,400 feet upstream of confluence with San Diego Creek	1.0	310	700	1,100	2,000

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Villa Park Storm Drain	At intersection of Center Drive and Adams Ranch Road	0.1[6]	10	20	25	40
Villa Park Storm Drain	At intersection of Center Drive and Villa Park Road	0.1[6]	30	60	80	140
Villa Park Storm Drain	At intersection of Lemon Street and Villa Park Road	0.1[6]	55	95	125	230
Villa Park Storm Drain	At intersection of Center Drive and Santiago Boulevard	0.1[6]	40	75	100	170
Villa Park Storm Drain	At intersection of Lemon Street and Taft Avenue	0.2[6]	100	200	250	450
Villa Park Storm Drain	At Serrano Avenue	1.0	270	800	1,150	2,200
Villa Park Storm Drain	At Lemon Street	1.0	250	650	1,000	2,000
Walnut Canyon Channel	At Riverside Freeway	2.8	820	1,800	2,500	5,200
Walnut Canyon Channel	At Santa Ana Canyon Road	2.6	710	1,700	2,300	4,800
Walnut Canyon Channel	At 1,000 feet upstream of Walnut Canyon Road	2.0	380	1,100	1,700	3,500

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Walnut Canyon Channel	At 1,700 feet upstream of Walnut Canyon Road	1.8	340	1,000	1,500	3,100

*Not calculated for this Flood Risk Project

[1]Flow shown includes 300 cfs from Walnut Storm Channel

[2]Peak discharge reduced due to divergence of flow by streets

[3]Flows have been reduced to account for effects of upstream diversion channels

[4]Approximately 2,225 square miles controlled by Prado Dam

[5]Reduction in discharge due to Santa Ana River overflow

[6]Due to divided flows at street intersections, flow concentrations are not combined and routed

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this Flood Risk Project]

Table 11: Summary of Non-Coastal Stillwater Elevations

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Huntington Beach Channel (D01) – West Bank	Between Brookhurst Street and Magnolia	*	*	*	8.0	*
Huntington Beach Channel (D01) – West Bank	Near Banning Avenue	*	*	*	7.9	*

*Not calculated for this Flood Risk Project

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Alameda Storm Drain	11077100	USGS	Alameda Storm Drain	NA	NA	NA
Aliso Creek	11047500	USGS	Aliso Creek at El Toro	7.91	10/01/1930	09/30/1980
Arroyo Trabuco	11047000	USGS	Arroyo Trabuco near San Juan Capistrano	35.7	02/08/1932	01/29/1981
Peters Canyon Wash	221	OCEMA	Peters Canyon Wash near San Diego Freeway	NA	NA	NA
San Diego Creek	11048500	USGS	San Diego Creek Near Irvine	41.8	02/06/1950	11/24/1984
San Juan Creek	11046500	USGS	San Juan Creek near San Juan Capistrano	106	03/10/1929	02/25/1969
Santa Ana River	11074000	USGS	Santa Ana River below Prado Dam	1490	03/02/1938	Current
Santa Ana River	122	OCEMA	Santa Ana River at Imperial Highway	NA	NA	NA
Santiago Creek	11075800	USGS	Santiago Creek at Modjeska	12.5	02/11/1962	Current
Santiago Creek	214A	OCEMA	Santiago Creek below Villa Park Dam	NA	NA	NA
Santiago Creek	11077500	USGS	Santiago Creek at Santa Ana	98.6	11/25/1988	Current
Westminster Channel	207A	OCEMA	Westminster Channel at Beach Blvd.	NA	NA	NA

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Handy Creek	152	OCEMA	Handy Creek near Orange	NA	NA	NA
Carbon Canyon Creek	11075720	USGS	Carbon Canyon Creek below Cabon Canyon	19.5	02/13/1962	Current

5.2 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. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. 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 Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed on Table 24, “Floodway Data.”

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Pacific Ocean	Coastlines in Seal Beach, Newport Beach, and Dana Point	Coastlines in Seal Beach, Newport Beach, and Dana Point	N/A	N/A	5/11/2018	VE, AE, AO	Analyses completed as part of appeals and comments received on the 2016 Preliminary FIRMs for the Open Pacific Coast of Orange County.
Pacific Ocean	Entire Coastline	Entire Coastline	N/A	N/A	7/1/2015	VE, AE	
Aliso Creek	Pacific Ocean	Live Oak Canyon Road	UNKNOWN	UNKNOWN	1/1/1984	AE	
Aliso Creek	El Toro Road	Marguerite Parkway	UNKNOWN	UNKNOWN	9/30/1993	AE	
Aliso Creek	Pacific Ocean	5200ft upstream of Pacific Ocean	UNKNOWN	UNKNOWN	12/03/2009	AE	
Atwood Channel	Confluence with Carbon Canyon Channel	Just downstream of Yorba Linda Blvd	UNKNOWN	HEC-2	3/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
Big Canyon	Confluence with Upper Newport Bay	Approximately 740 feet upstream of Jamboree Road	REGRESSION EQUATIONS	OTHER	5/1/1977	AE	Regression equations used from Crippen and Beall (1970), effects of urbanization accounted for; Step backwater program used for hydraulic analysis
Bluebird Canyon	Confluence with Pacific Ocean	Approximately 650 feet upstream of Cress Street	REGRESSION EQUATIONS	HEC-RAS	3/1/2006	AE w/ Floodway	Regression equations used from Crippen and Beall (1970), effects of urbanization accounted for; Step backwater program used for hydraulic analysis
Bonita Creek	Approximately 600 feet downstream of Veterans Memorial Highway	Approximately 850 feet upstream of Turtle Ridge	OTHER	HEC-2	5/1/1977	AE w/ Floodway	Correlation analysis used where stream gages not available; HEC-2 run for two separate reaches, upstream and downstream of the reservoir

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Bonita Creek Tributary 1	Approximately 315 feet upstream of Bonita Canyon Drive	Approximately 760 feet upstream of Bonita Canyon Drive	UNKNOWN	UNKNOWN	2009	AE	
Brea Canyon Channel	City of Brea corporate limits	City of Brea corporate limits	UNKNOWN	UNKNOWN	3/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
Carbon Canyon Channel	Confluence with Santa Ana River	San Bernardino and Orage Counties boundary limits	OTHER	HEC-2	3/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
Cascadita Creek	Approximately 285 feet downstream of Via Cascadita	Approximately 360 feet downstream of San Diego Freeway	UNKNOWN	UNKNOWN	3/1/1990	AE w/ Floodway	LOMR 14-09-1405P
Coyote Canyon Wash	Bonita Creek	Approximately 0.6 mile upstream of Bonita Canyon drive	UNKNOWN	UNKNOWN	5/1/1977	AE w/ Floodway	Correlation analysis used where stream gages not available
Coyote Creek Channel	Los Angeles and Orage Counties boundary limits	West Whittier Blvd	UNKNOWN	UNKNOWN	4/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
East Richfield Channel	Confluence of Santa Ana River	Approximately 681 feet upstream of Avenida del Este	UNKNOWN	NORMAL DEPTH	10/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
El Modena-Irvine Channel	Confluence of Peters Canyon Wash Channel	Approximately 1300 feet upstream of East Marmon Avenue	UNKNOWN	UNKNOWN	2009	AE, AH	
English Canyon	Confluence of Aliso Creek	Approximately 3110 feet upstream of Vista del Lago	OTHER	UNKNOWN	3/1/1973	AE	Correlation analysis used where stream gages not available

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Facility No. J05	Confluence of Aliso Creek	Paseo de Valencia	UNKNOWN	UNKNOWN	12/3/2009	AE	
Handy Creek	Confluence of Alameda Storm Channel	Peters Canyon Reservoir	GAGE ANALYSIS	HEC-2	12/3/2009	AE w/ Floodway	
Hickey Canyon	Confluence of Trabuco Creek	Approximately 2.5 miles upstream of Trabuco Canyon Road	OTHER	UNKNOWN	3/1/1973	AE	Correlation analysis used where stream gages not available
Horno Creek	Confluence of San Juan Creek	Boundaries Limits	UNKNOWN	UNKNOWN	2/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
Houston Storm Channel	Confluence of Fullerton Creek Channel	Euclid Street	UNKNOWN	UNKNOWN	5/1/1975	AO	Correlation analysis used where stream gages not available
Huntington Beach Channel (D01)	Confluence of Talbert Channel (D02)	Adams Avenue	UNKNOWN	UNKNOWN	2009	AE	LOMR 09-09-2810P
La Miranda Creek Channel	County boundary	Approximately 2800 feet upstream of State Route 72	UNKNOWN	UNKNOWN	2009	AO	
La Paz Channel	Confluence of Oso Creek	Approximately 2800 feet upstream of confluence of Facility No. L04p07	OTHER	HEC-2	1/1/1984	AE	Correlation analysis used where stream gages not available
Laguna Canyon	Pacific Ocean	Approximate 1.5 miles upstream of State Route 73	OTHER	HEC-RAS	3/1/2006	AE w/ Floodway	Correlation analysis used where stream gages not available
Loftus Diversion Channel	City of Brea boundary limits	Approximately 450 feet downstream of South Valencia Avenue	UNKNOWN	HEC-2	3/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available; breakout of the 1% chance flood occurs downstream of of Associated Rd

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Memory Garden Storm Channel	Confluence of Brea Canyon Channel	Northwood Avenue	UNKNOWN	HEC-2	3/1/1978	AE	Correlation analysis used where stream gages not available; hydraulically steep, critical depth used where supercritical flow indicated
Modjeska Canyon	Confluence of Upper Santiago Creek	Approximately 2.8 miles upstream of Santiago Canyon Road	UNKNOWN	UNKNOWN	3/1/1973	AE	Correlation analysis used where stream gages not available; hydraulic analysis determined wash out of the north bank levee
Narco Channel (J04) (North Sulphur Creek)	Confluence of Aliso Creek	La Paz Road	OTHER	UNKNOWN	12/3/2009	AE	Correlation analysis used where stream gages not available
Niguel Canyon (Emerald Bay Channel)	Pacific Ocean	Approximately 3.0 miles upstream of State Route 1	OTHER	UNKNOWN	3/1/1973	AE	Correlation analysis used where stream gages not available
Niguel Storm Drain (J03P01)	Confluence of Sulphur Creek	Approximately 690 feet downstream of Niguel Road	OTHER	HEC-2	3/1/1973	AE	Correlation analysis used where stream gages not available; calc of static head and energy losses done for trash rack, HEC-2 used for drop structures and the open swale
Oso Creek	Confluence of Trabuco Creek	Approximately 0.8 mile upstream of Casta Del Sol	OTHER	OTHER	12/3/2009	AE w/ Floodway	Approved calculations used for hydrology based on SCS method using gaged rainfall data; hydra = HWMs
Peters Canyon Wash Channel	Barranca Parkway	Peter Canyon Reservoir	HEC-1	HEC-RAS	3/1/1978	AE	Peak discharges taken directly from USACE studies (1974 & 1977); HEC-1 used to account for freeway barrier effect on flows
Salt Creek	Pacific Coast Highway	Confluence of San Juan Canyon	UNKNOWN	UNKNOWN	UNKNOWN	3/1/1973	Correlation analysis used where stream gages not available
San Diego Creek	Confluence of Peters Canyon Wash Channel	Approximately 500 feet upstream Interstate 5	UNKNOWN	UNKNOWN	UNKNOWN	AE	
San Gabriel River	Pacific Ocean	Orange County boundary limits	UNKNOWN	UNKNOWN	2014	AE	LOMR 14-09-140P

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
San Juan Creek	Pacific Ocean	Approximately 5.0 miles upstream of confluence of Bell Canyon	LOG-PEARSON TYPE III ANALYSIS	UNKNOWN	3/1/1973	AE w/ Floodway	
San Juan Creek	ATSFRR	Ortega HWY	UNKNOWN	UNKNOWN	1/1/1992	AE w/ Floodway	
Sand Canyon Wash	Confluence of San Diego Creek Channel	Approximately 2350 feet upstream of Shady Canyon	UNKNOWN	UNKNOWN	1/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
Santa Ana River	Pacific Ocean	Orange County boundary limits	OTHER	OTHER	10/1/1978	AE w/ Floodway	Peak discharges obtained from USACE (1970) study; an extensive hydraulic analysis was performed including sediment transport analysis, channel capacity analysis, breakout analysis, & overflow analysis
Santa Ana-Santa Fe Channel	Confluence of Peters Canyon Wash	Grand avenue	UNKNOWN	HEC-2	3/1/1978	AE	Correlation analysis used where stream gages not available
Santiago Creek	Confluence of Santa Ana River	Irvine Lake	OTHER	HEC-2	9/1/1978	AE w/ Floodway	Peak discharges taken directly from a USACE report (1975)
Santiago Creek (Upper)	Irvine Lake	Confluence of Modjeska Canyon	OTHER	OTHER	3/1/1973	AE w/ Floodway	Peak discharges taken directly from a USACE report (1975); Hydra = Normal Depth
Segunda Deschecha Canada	Pacific Ocean	Camino Vista Pacifica	UNKNOWN	UNKNOWN	11/1/1977	AE w/ Floodway	Correlation analysis used where stream gages not available
Segunda Deschecha Canada Tributary	Confluence of Segunda Deschecha Canada	Approximately 0.3 mile upstream of confluence of Segunda Deschecha Canada	OTHER	HEC-2	11/1/1977	AE w/ Floodway	Correlation analysis used where stream gages not available; 1% chance flood contained by canyon walls

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Serrano Creek	Blake Parkway	Portola parkway	OTHER	HEC-2	1/1/1992	AE w/ Floodway	Peak discharges taken directly from USACE studies (1974 & 1977) Peak discharges taken directly from USACE studies (1974 & 1977); two breakouts shown in hydraulic analysis determined by shallow flooding
Shady Canyon Wash	Confluence of Sand Canyon Wash	Approximately 1400 feet upstream of Shady Canyon	OTHER	UNKNOWN	1/1/1978	AE w/ Floodway	Correlation analysis used where stream gages not available
Silverado Canyon	Confluence of Santiago Creek (Upper)	800 feet downstream of Maple Springs	OTHER	UNKNOWN	3/1/1973	AE	Correlation analysis used where stream gages not available
Sulphur Creek	Confluence of Narco Channel (J04)	Nueva Vista Drive	OTHER	UNKNOWN	3/1/1973	AE w/ Floodway	Correlation analysis used where stream gages not available
Talbert Channel (D02)	Pacific Ocean	Slater Avenue	UNKNOWN	UNKNOWN	4/1/1980	AE	Correlation analysis used where stream gages not available
Trabuco Creek	Confluence of San Juan Creek	Cleveland National Forect	UNKNOWN	UNKNOWN	1/1/1992	AE w/ Floodway	Correlation analysis used where stream gages not available
Veeh Creek (San Diego Creek Tributary 2)	Confluence of Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	Confluence with San Diego Creek Trib 2	UNKNOWN	UNKNOWN	1/1/1978	AE w/ Floodway	Peak discharges taken directly from USACE studies (1974 & 1977)
Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	Confluence of San Diego Creek	City of Irvine boundary limits	UNKNOWN	UNKNOWN	1/1/1978	AE w/ Floodway	Peak discharges taken directly from USACE studies (1974 & 1977)

Table 14: Roughness Coefficients

Flooding Source	Channel “n”	Overbank “n”
Agua Chinon Wash	0.030-0.040	0.030-0.040
Aliso Creek	0.015-0.045	0.032-0.100
Arroyo Salada	0.030-0.065	0.030-0.080
Atwood Channel	0.014-0.040	0.022-0.070
Barranca Channel	0.025	N/A
Bee Canyon Wash	0.030-0.040	0.030-0.040
Bluebird Canyon	0.03-0.050	0.030-0.100
Bonita Creek	0.030-0.060	0.030-0.035
Borrego Canyon Wash	0.025-0.040	0.03
Brea Canyon Channel	0.025-0.040	0.025-0.100
Brea Creek Channel	0.015-0.060	0.020-0.120
Canada Gubernadora	0.030-0.045	0.050-0.100
Canyon Acres Wash	0.03-0.050	0.05-0.100
Carbon Canyon Channel	0.014-0.125	0.022-0.125
Carbon Creek Channel	0.014-0.040	0.020-0.100
Cascadita Creek	0.013-0.060	0.040-0.055
Como Storm Channel	0.03	N/A
Coyote Canyon Wash	0.040-0.050	0.035-0.040
Coyote Creek Channel	0.014-0.060	0.050-0.100
El Modena-Irvine Channel	0.035	0.030-0.035
English Canyon	0.035-0.065	0.045-0.100
Facility No. J05	0.030-0.080	0.030-0.080
Fullerton Creek Channel	0.015-0.060	0.060-0.140
Handy Creek	0.013-0.060	0.035-0.100
Hickey Canyon	0.035-0.065	0.045-0.100
Hicks Canyon Wash	0.03	N/A
Horno Creek	0.020-0.060	0.06
Imperial Channel	0.014-0.100	0.020-0.100
Laguna Canyon	0.030-0.045	0.050-0.100
Lane Channel	0.025	N/A
La Paz Channel	0.035-0.065	0.045-0.100

Flooding Source	Channel “n”	Overbank “n”
Loftus Diversion Channel	0.025	0.030-0.080
Lower San Juan Canyon	0.030-0.045	0.050-0.100
Lower San Juan Creek	0.030-0.045	0.050-0.100
Lower Santiago Creek	0.030-0.045	0.050-0.100
Memory Garden Storm Channel	0.025	0.035
Modjeska Canyon	0.035-0.065	0.045-0.100
Niguel Canyon (Emerald Bay Channel)	0.030-0.080	0.030-0.080
Niguel Storm Drain (J03P01)	0.035-0.065	0.045-0.100
North Sulphur Creek (Narco Channel) (J04)	0.030-0.045	0.050-0.100
Oso Creek	0.035-0.065	0.045-0.100
Peters Canyon Wash Channel	0.025-0.030	0.035
Placentia Storm Channel	0.014	N/A
Prima Deshecha Canada	0.020-0.050	0.035-0.050
Richfield Channel	0.014	N/A
San Diego Creek	0.025-0.050	0.025-0.035
San Juan Canyon	0.030-0.045	0.050-0.100
San Juan Creek	0.020-0.060	0.030-0.200
San Joaquin Channel	0.025-0.040	N/A
Sand Canyon Wash	0.030-0.060	0.025-0.050
Salt Creek	0.035-0.065	0.045-0.100
Santa Ana River	0.030-0.045	0.050-0.100
Segunda Deshecha Canada	0.015-0.060	0.030-0.060
Segunda Deshecha Canada Tributary	0.025	0.06
Serrano Creek	0.015-0.060	0.020-0.065
Shady Canyon Wash	0.035	0.035
Silverado Canyon	0.030-0.045	0.050-0.100
Sulphur Creek	0.030-0.045	0.050-0.100
Trabuco Creek	0.013-0.070	0.014-0.080
Upper Santiago Creek	0.030-0.045	0.050-0.100
Valencia Storm Channel	0.04	0.03
Veeh Creek (San Diego Creek Tributary 2)	0.040-0.080	0.035-0.050

Flooding Source	Channel “n”	Overbank “n”
Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	0.040-0.080	0.030-0.040

5.3 Coastal Analyses

For the areas of Orange County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 15: Summary of Coastal Analyses

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Pacific Ocean	Newport Bay	Newport Bay	Storm Surge	HEC-RAS 5.0	02/01/2018
Pacific Ocean	Seal Beach, Newport Beach, and Dana Point coastlines	Seal Beach, Newport Beach, and Dana Point coastlines	Wave Runup	Stockdon	05/10/2018
Pacific Ocean	Seal Beach, Newport Beach, and Dana Point coastlines	Seal Beach, Newport Beach, and Dana Point coastlines	Overtopping	Cox-Machemehl	05/10/2018
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Statistical Analyses	L-Moments	07/09/2015
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Statistical Analyses	GEV	07/09/2015
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Storm Surge	50-year Hindcast	12/11/2014

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Deepwater Waves	OWI SOCAL	12/11/2014
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Nearshore Waves	SIO SHELF	12/11/2014
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Erosion	MK&A	07/09/2015
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Wave Setup	Direct Integration Method (DIM)	07/09/2015
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Wave Runup	Stockdon	07/09/2015
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Wave Runup	TAW	07/09/2015
Pacific Ocean	Entire coastline of Orange County	Entire coastline of Orange County	Overtopping	Cox-Machemehl	07/09/2015

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge and tidal impacts) for the 1% annual chance flood were determined for areas subject to coastal flooding. The method that were used to determine storm surge is listed in Table 15.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas

[Not applicable to this Flood Risk Project]

Astronomical Tide

Astronomical tides were included in the 50-year hindcast used to quantify storm surge. This hindcast was based on local tide gage records and therefore includes water level contributions for astronomical tide.

Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of tidal gages. When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site. Historic records for storms were not used to calculate storm surge in Orange County.

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 16 provides the gage name, managing agency, gage type, gage identifier, start date, end date, and statistical methodology applied to each gage used to determine the stillwater elevations. For Orange County, the Los Angeles 1% annual chance stillwater elevation, 7.94 ft. NAVD 88, was used for the entire open coast and in most embayments. The only area of the county in which a different tide gage was used was in Newport Bay. The Newport Bay tide gage record was used to calculate the 1% annual chance stillwater elevation in this area, which is 7.88 ft. NAVD 88.

Table 16: Tide Gage Analysis Specifics

Gage Name	Managing Agency of Tide Gage Record	Gage Type	Start Date	End Date	Statistical Methodology
Los Angeles (ID 9410660)	NOAA	Tide	1923	2011	L-Moments
Newport Bay (ID 9410580)	NOAA	Tide	1955	1994	L-Moments

Combined Riverine and Tidal Effects

Combined riverine and tidal effects were not analyzed in this Flood Risk Project.

Wave Setup Analysis

Wave setup was computed as part of the one-dimensional transect-based wave hazard analysis through the methods and models listed in Table 15. Therefore wave setup was not included in the frequency analysis for the determination of the total stillwater elevations. The oscillating component of wave setup, *dynamic wave setup*, was calculated for areas subject to wave runup hazards.

5.3.2 Waves

Deepwater coastal waves were modeled by Oceanweather Inc. using a series of four nested grids with increasing grid resolution. The deepwater waves were then translated to the nearshore using Scripps Institute of Oceanography SHELF model. These nearshore wave fields were required for the addition of wave setup and runup effects at the coastline, as calculated along one-dimensional shore-perpendicular transects.

5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. Dune erosion was evaluated at relevant transects using the methods listed in Table 15. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

5.3.4 Wave Hazard Analyses

The coast of Orange County is dominated by wave runup, therefore overland wave propagation was not included in this study. Wave setup and runup were evaluated to determine the combined effects of ground elevation, shoretype, and other physical features on total water level elevations. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1% annual chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, "Transect Location Map," are also depicted on the FIRM. Table 17 provides the location and total water level elevations for each transect evaluated for wave hazards.

Wave Height Analysis

Wave height analyses are performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6 for a schematic of a coastal transect evaluated for overland wave propagation hazards.

There are no areas of Orange County suitable for overland wave propagation and therefore a wave height analysis was not performed for this Flood Risk Product.

Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1% annual chance flood. Wave runup elevations were modeled using the methods and models listed in Table 15

Table 17: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	1	*	*	10.1	10.6	11.1	11.7	13.5
Pacific Ocean	2	*	*	15.8	16.8	17.6	18.4	20.3
Pacific Ocean	3	*	*	19.0	20.4	21.4	22.4	24.8
Pacific Ocean	4	*	*	17.0	18.2	19.0	16.3^	22.2
Pacific Ocean	5	*	*	19.6	21.1	22.3	18.0^	26.9
Pacific Ocean	6	*	*	16.9	18.0	18.9	19.7	21.8
Pacific Ocean	7	*	*	19.4	20.8	21.9	23.0	25.6

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	8	*	*	14.7	15.5	16.1	16.7	18.1
Pacific Ocean	9	*	*	13.4	14.3	15.0	15.8	18.0
Pacific Ocean	10	*	*	11.2	11.8	12.2	12.7	14.0
Pacific Ocean	11	*	*	14.8	16.3	17.6	18.9	22.3
Pacific Ocean	12	*	*	12.1	12.6	13.0	13.5	14.5
Pacific Ocean	13	*	*	12.8	13.1	13.4	13.6	13.9
Pacific Ocean	14	*	*	11.7	12.0	12.3	12.4	12.8
Pacific Ocean	15	*	*	13.8	14.5	15.0	15.5	16.6

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	16	*	*	13.7	14.1	14.3	13.6^	14.9
Pacific Ocean	17	*	*	15.0	15.6	16.1	14.8^	17.5
Pacific Ocean	18	*	*	12.5	12.9	13.2	13.0^	14.1
Pacific Ocean	19	*	*	11.5	11.8	12.0	12.2	12.5
Pacific Ocean	20	*	*	19.1	19.6	19.9	17.8^	20.6
Pacific Ocean	21	*	*	19.8	20.3	20.6	20.9	21.3
Pacific Ocean	22	*	*	16.1	16.5	16.8	18.4^	17.4
Pacific Ocean	23	*	*	18.5	19.0	19.3	18.3^	19.9

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	24	*	*	19.1	19.6	19.8	18.3^	20.3
Pacific Ocean	25	*	*	11.3	11.4	11.5	11.6	11.7
Pacific Ocean	26	*	*	13.2	13.7	14.0	14.3	14.9
Pacific Ocean	27	*	*	12.3	12.6	12.9	13.1	13.5
Pacific Ocean	28	*	*	13.1	14.4	15.6	16.9	20.9
Pacific Ocean	29	*	*	12.5	13.9	15.1	16.6	21.3
Pacific Ocean	30	*	*	11.5	12.2	12.8	13.4	15.0
Pacific Ocean	31	*	*	12.2	12.6	12.8	13.0	13.3

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	32	*	*	12.5	12.8	12.9	13.1	13.3
Pacific Ocean	33	*	*	11.9	12.2	12.5	12.8	13.4
Pacific Ocean	34	*	*	12.4	13.3	14.0	14.8	16.9
Pacific Ocean	35	*	*	12.7	13.2	13.5	13.9	14.6
Pacific Ocean	36	*	*	13.3	13.9	14.3	14.6	15.4
Pacific Ocean	37	*	*	21.7	23.7	25.2	26.7	30.4
Pacific Ocean	38	*	*	12.2	12.7	13.1	13.4	14.2
Pacific Ocean	39	*	*	13.3	13.7	14.0	14.2	14.7

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	40	*	*	19.1	20.6	21.7	22.7	25.2
Pacific Ocean	41	*	*	13.3	13.9	14.3	14.6	15.4
Pacific Ocean	42	*	*	13.6	14.2	14.6	15.0	16.0
Pacific Ocean	43	*	*	14.2	14.9	15.5	16.1	17.9
Pacific Ocean	44	*	*	19.2	20.4	21.4	22.4	25.0
Pacific Ocean	45	*	*	13.6	14.7	15.6	16.4	18.3
Pacific Ocean	46	*	*	12.6	12.8	12.9	13.0	13.2
Pacific Ocean	47	*	*	13.3	13.7	14.0	14.2	14.6

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	48	*	*	12.7	13.7	14.6	15.7	18.5
Pacific Ocean	49	*	*	12.3	12.9	13.3	13.7	14.6
Pacific Ocean	50	*	*	12.0	12.9	13.8	15.0	19.0
Pacific Ocean	51	*	*	23.1	25.0	26.5	28.1	32.0
Pacific Ocean	52	*	*	16.8	18.5	19.9	21.5	25.9
Pacific Ocean	53	*	*	17.9	19.0	19.7	20.5	22.2
Pacific Ocean	54	*	*	13.9	14.5	14.9	15.3	16.2
Pacific Ocean	55	*	*	18.3	19.4	20.3	21.2	23.5

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	56	*	*	13.7	14.6	15.3	16.0	17.7
Pacific Ocean	57	*	*	22.8	24.3	25.5	26.7	29.6
Pacific Ocean	58	*	*	21.3	22.7	23.7	24.8	27.2
Pacific Ocean	59	*	*	22.3	24.8	26.8	28.9	33.9
Pacific Ocean	60	*	*	20.0	21.0	21.8	22.6	24.3
Pacific Ocean	61	*	*	20.3	22.0	23.6	25.5	30.9
Pacific Ocean	62	*	*	17.1	18.1	18.9	19.7	21.7
Pacific Ocean	63	*	*	18.3	20.0	21.5	23.1	27.6

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	64	*	*	13.4	14.3	15.0	15.8	18.0
Pacific Ocean	65	*	*	16.5	18.9	21.0	23.6	31.6
Pacific Ocean	66	*	*	12.5	13.3	13.9	14.5	15.9
Pacific Ocean	67	*	*	12.8	14.2	15.7	17.7	25.4
Pacific Ocean	68	*	*	12.5	14.3	16.2	18.6	27.6
Pacific Ocean	69	*	*	19.2	21.3	23.2	25.4	31.5
Pacific Ocean	70	*	*	24.6	26.3	27.5	28.7	31.5
Pacific Ocean	71	*	*	14.1	15.5	16.6	17.9	21.5

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	72	*	*	31.8	34.9	37.1	39.3	44.2
Pacific Ocean	73	*	*	31.2	35.7	39.5	43.8	55.7
Pacific Ocean	74	*	*	21.3	22.0	22.5	22.9	23.8
Pacific Ocean	75	*	*	18.3	18.9	19.3	19.6	20.1
Pacific Ocean	76	*	*	14.7	15.6	16.3	18.5^	18.6
Pacific Ocean	77	*	*	14.7	15.0	15.2	18.9^	15.5
Pacific Ocean	78	*	*	19.3	19.9	20.3	19.0^	21.2
Pacific Ocean	79	*	*	15.5	15.9	16.1	16.2	16.4

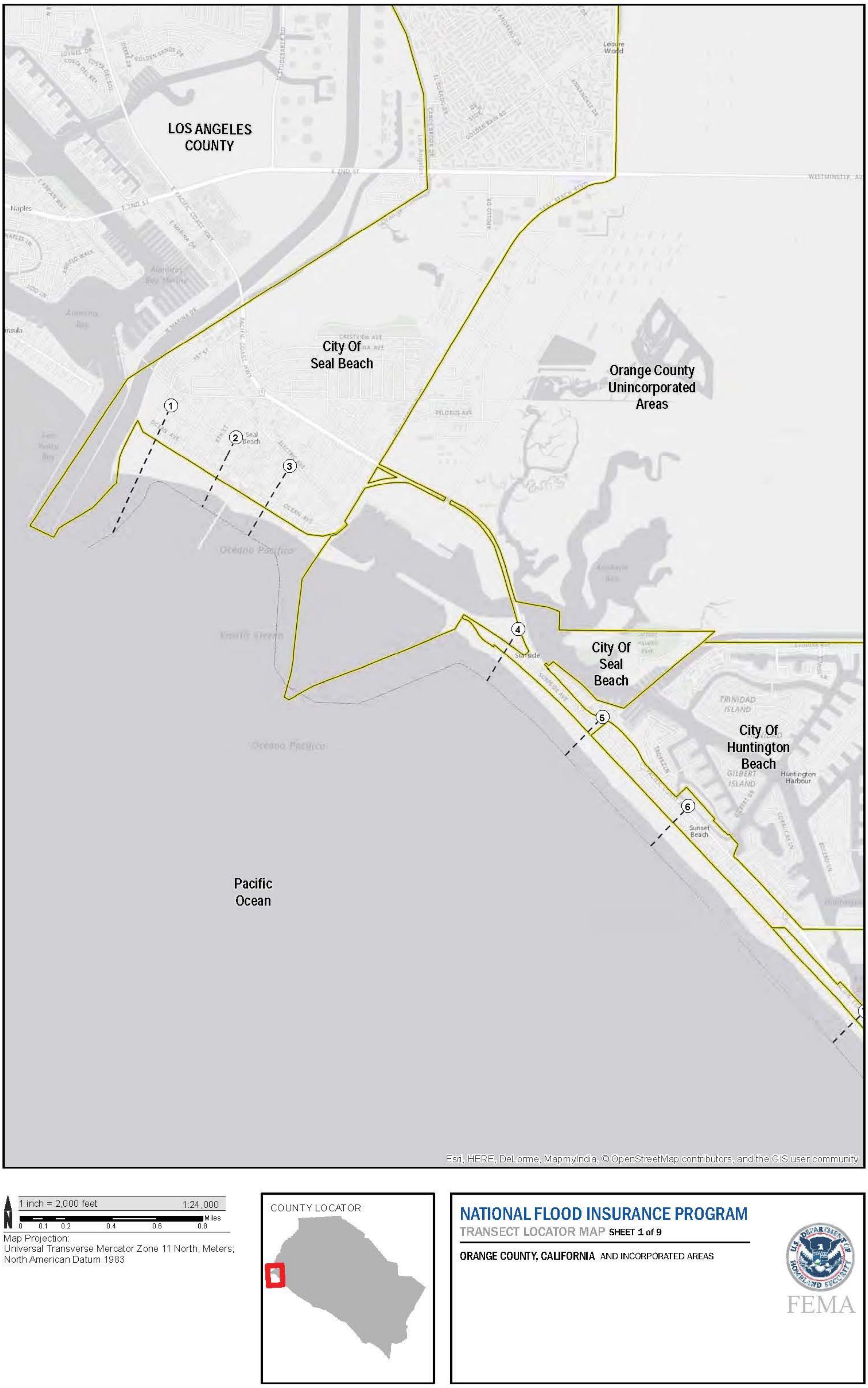
Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	80	*	*	12.4	13.7	14.8	16.1	19.9
Pacific Ocean	81	*	*	17.3	18.9	20.4	22.0	27.0
Pacific Ocean	82	*	*	13.8	14.1	14.3	14.5	14.7
Pacific Ocean	83	*	*	12.1	12.5	12.8	13.1	13.8
Pacific Ocean	84	*	*	12.5	12.8	13.1	13.4	13.9
Pacific Ocean	85	*	*	12.6	13.5	14.3	15.2	17.7
Pacific Ocean	86	*	*	19.4	20.0	20.3	20.6	21.1
Pacific Ocean	87	*	*	18.6	19.5	20.2	20.8	22.3

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Total Water Level Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	88	*	*	24.3	26.2	27.9	29.6	34.3

*Not calculated for this Flood Risk Project

^1%-Annual-Chance value updated in Revised Preliminary Maps based on appeals and comments. This analysis did not update Total Water Level Elevations for other annual exceedance probabilities.

Figure 9: Transect Location Map

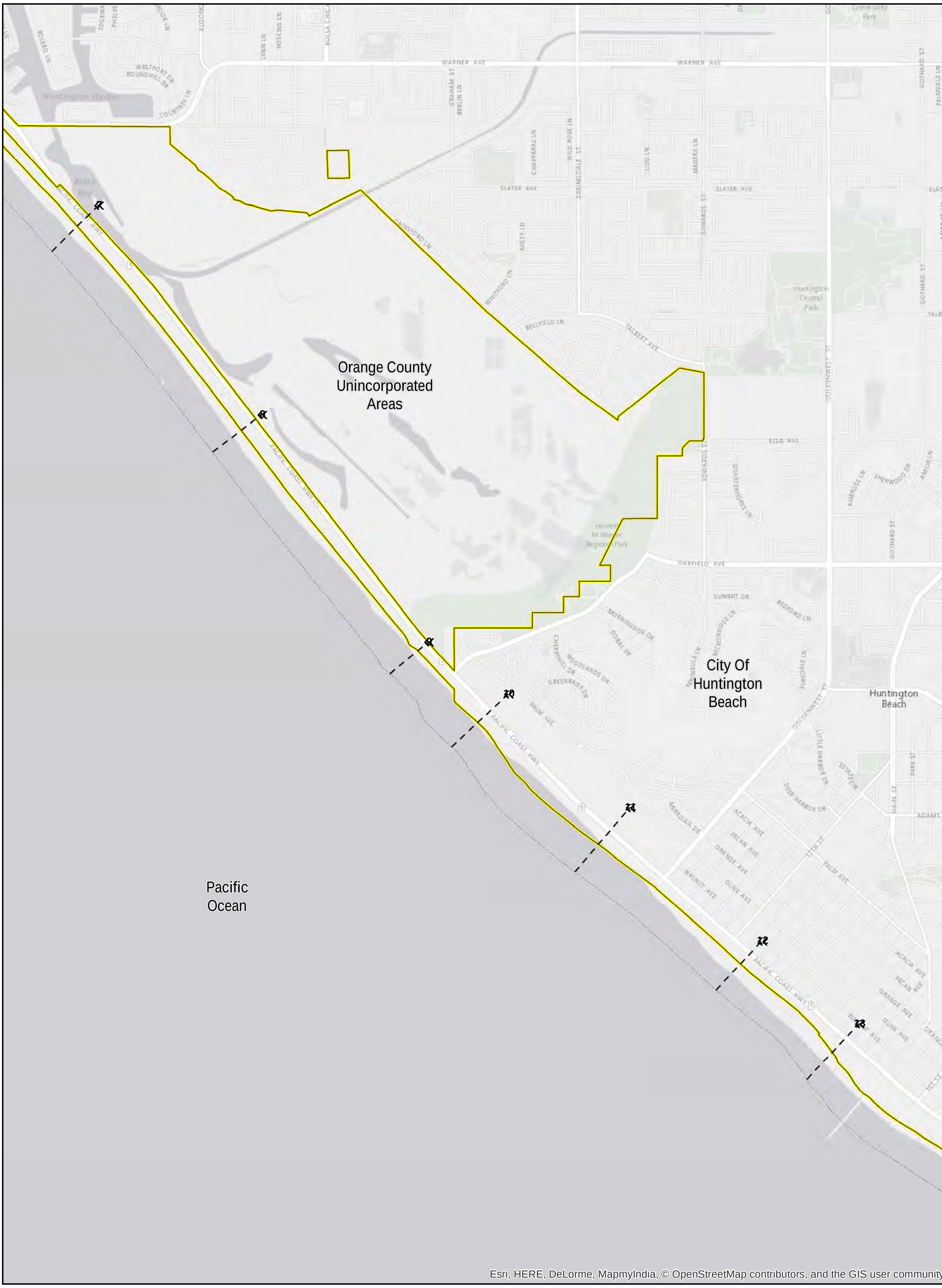


NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 1 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA



N

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

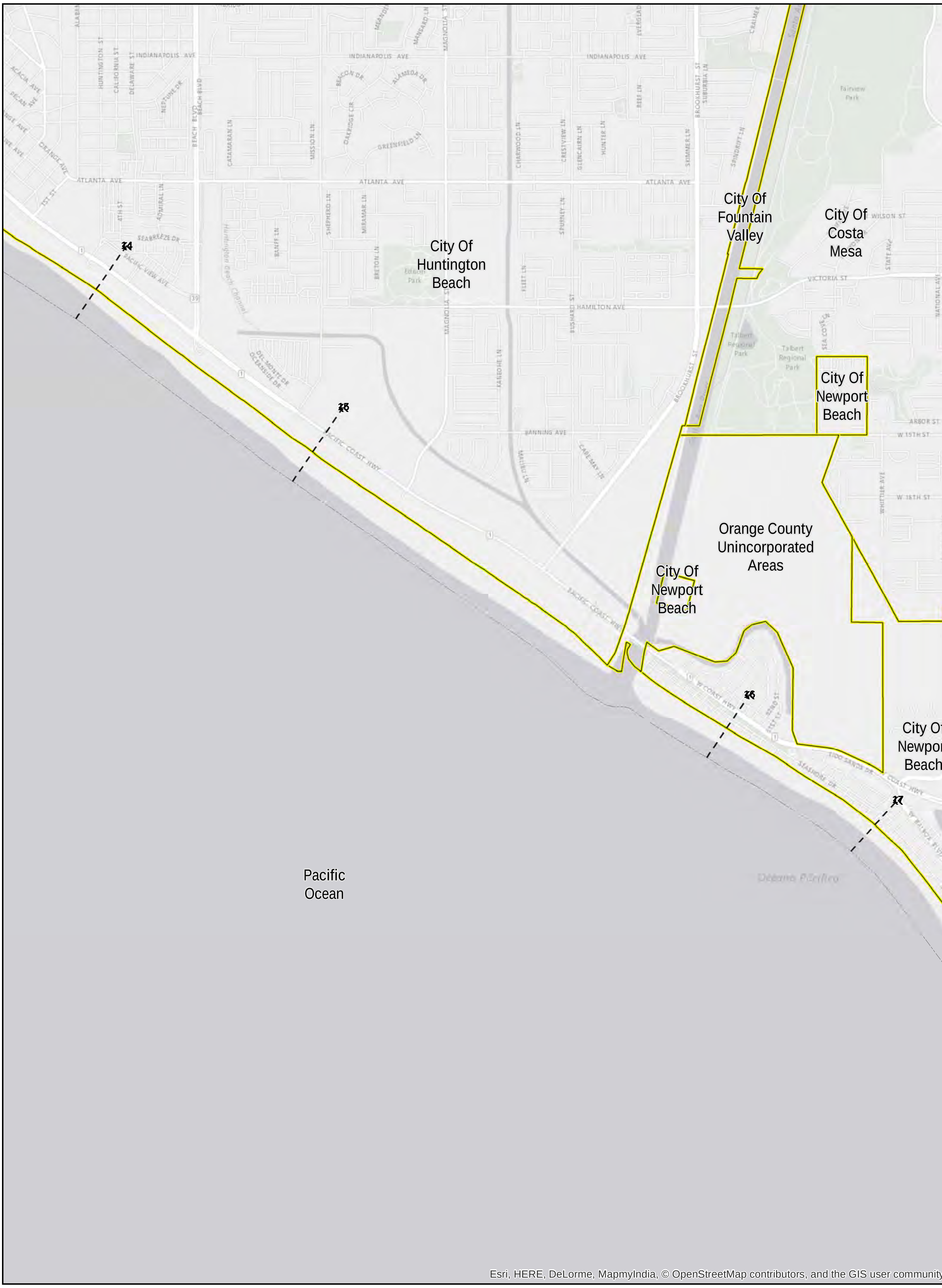
COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 2 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA



N

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 3 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

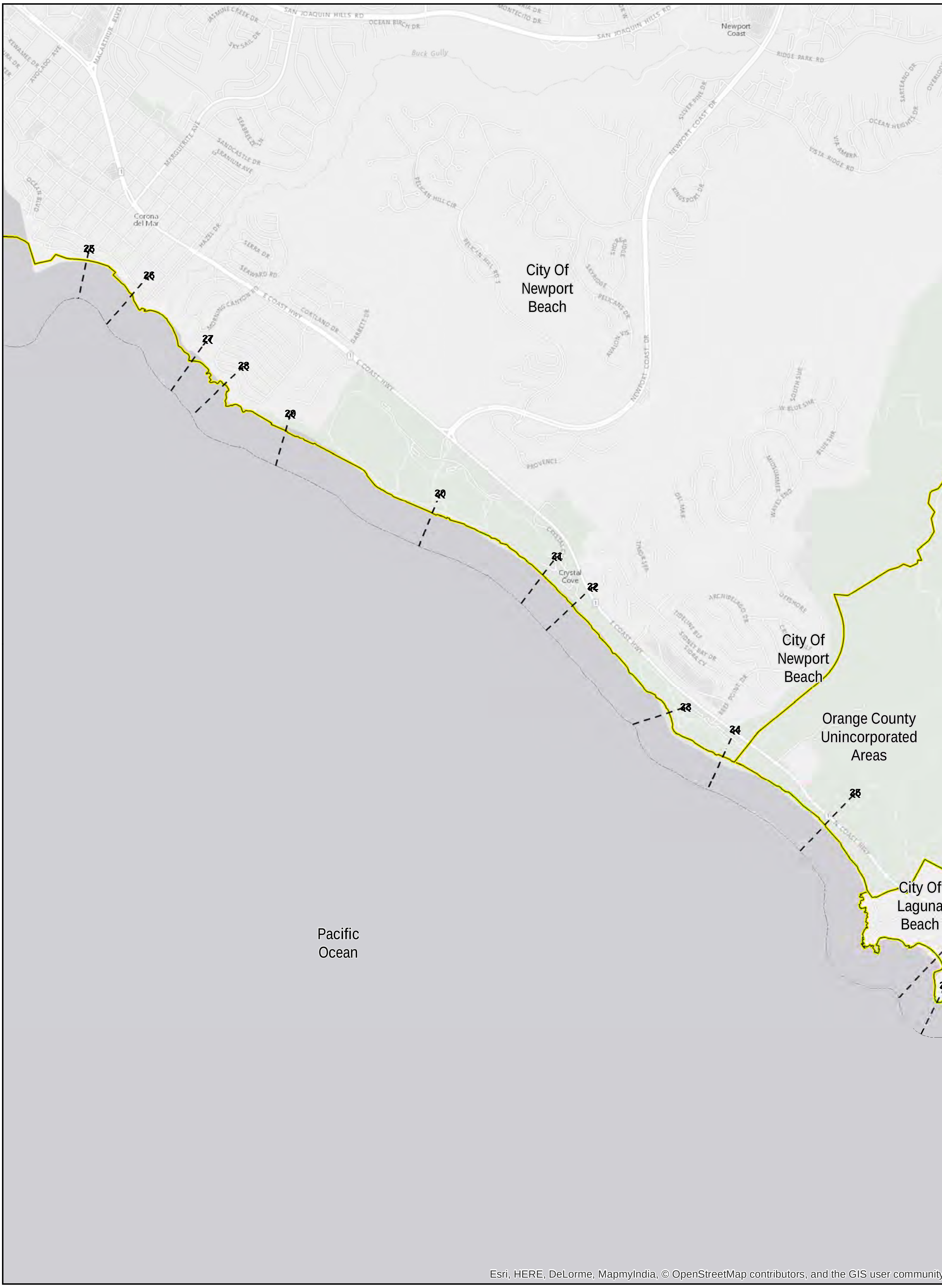
COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 4 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA



N

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

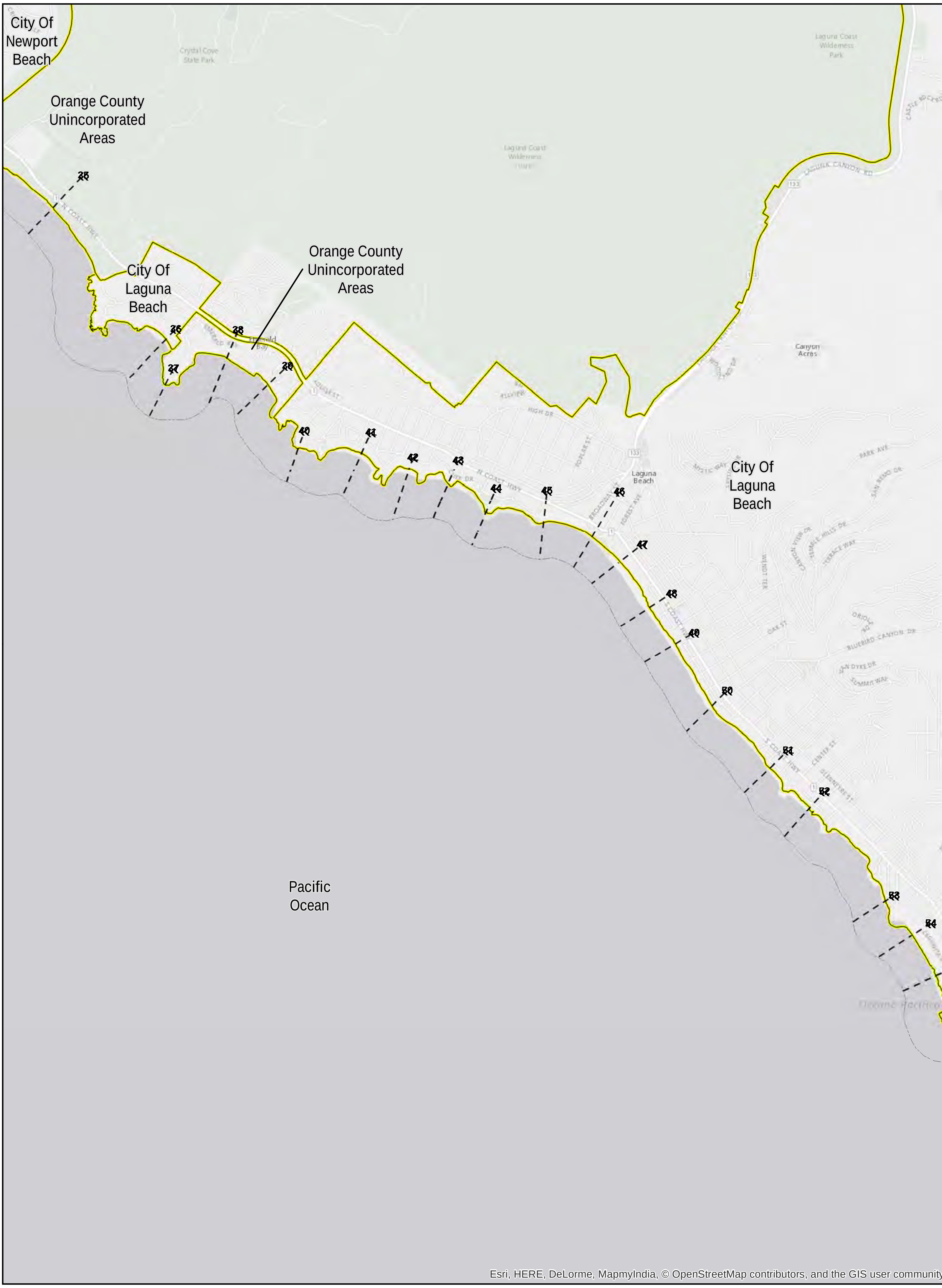
COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 5 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA



N

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 6 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA

N

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

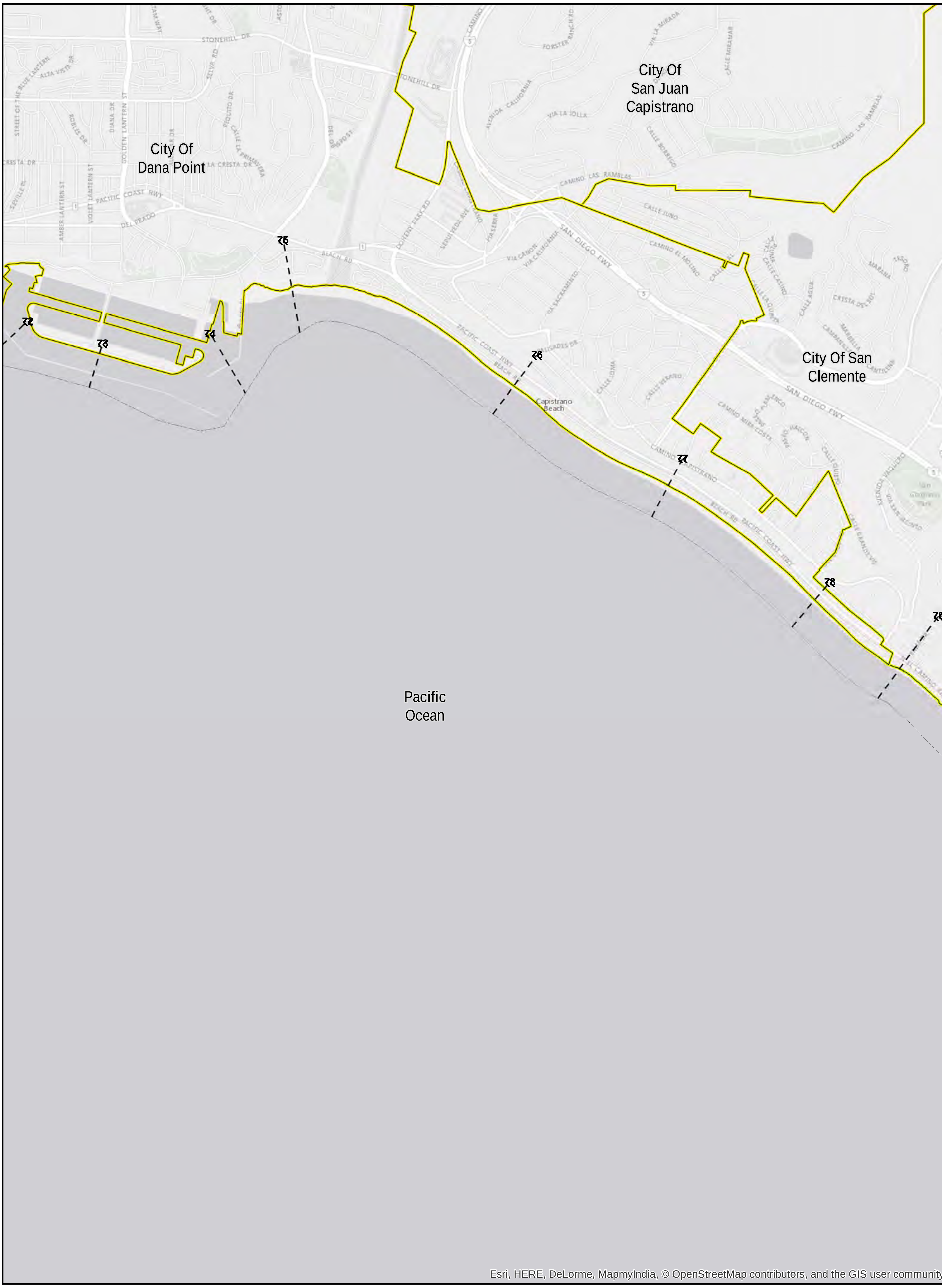
COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 7 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA



N

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

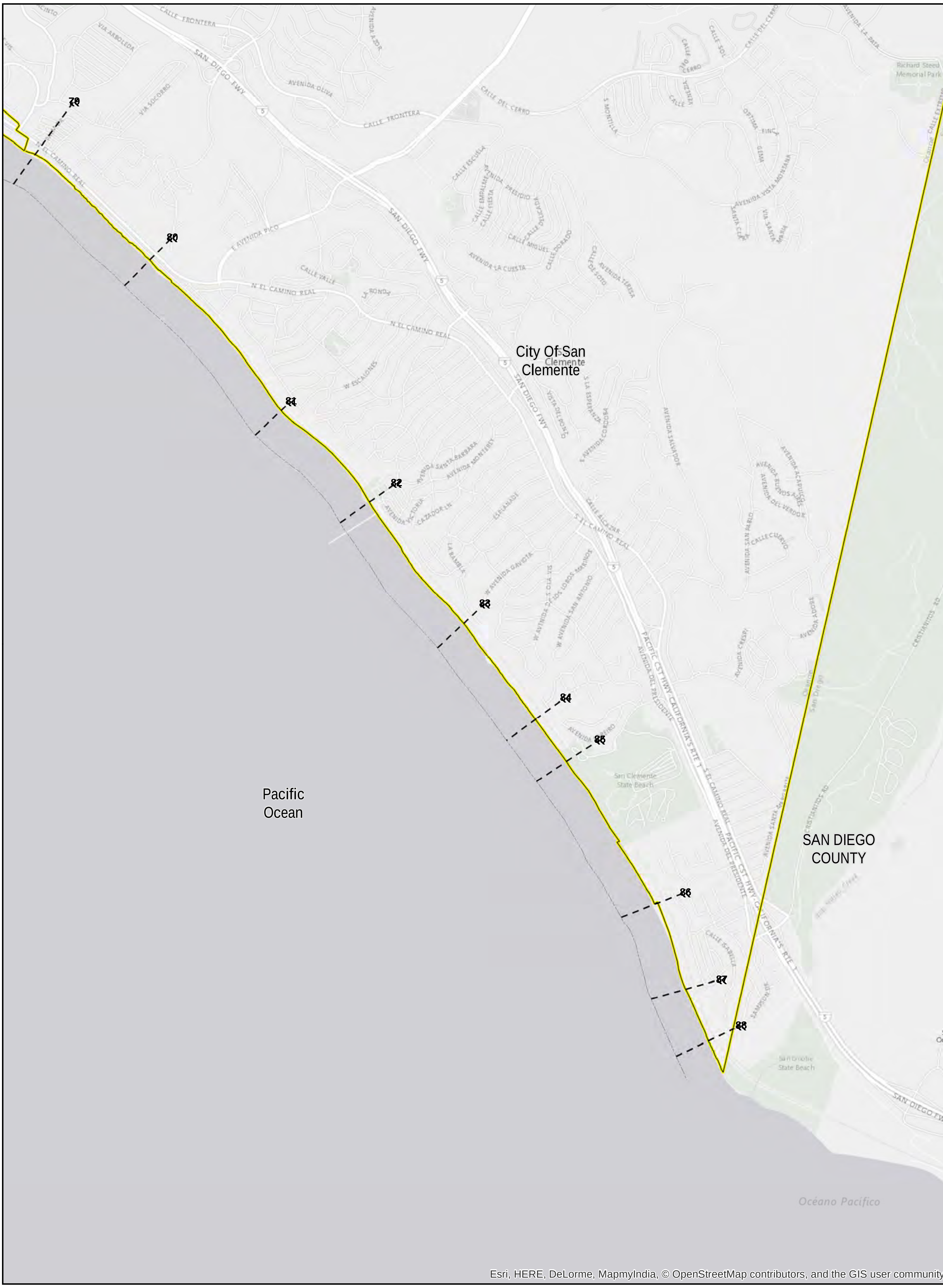
COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 8 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA



N

1 inch = 2,000 feet 1:24,000

0 0.1 0.2 0.4 0.6 0.8 Miles

Map Projection:
Universal Transverse Mercator Zone 11 North, Meters;
North American Datum 1983

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

TRANSECT LOCATOR MAP SHEET 9 of 9

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

FEMA

5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project

Table 18: Summary of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

Table 19: Results of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

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 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey (NGS) 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

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for Orange County are provided in Table 20.

Table 20: Countywide Vertical Datum Conversion

[Not Applicable to this Flood Risk Project]

Table 21: Stream-Based Vertical Datum Conversion

[Not Applicable to this Flood Risk Project]

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's

FIRM database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping*, www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
Geodetic bench mark positions and descriptions	National Geodetic Survey	12/3/2009	24000	National Geodetic Survey reference points (bench marks). S_FLD_HAZ_AR S_FLD_HAZ_LN S_PROFIL_BASLN S_BFE S_GEN_STRUCT
USGS 7.5-Minute Quadrangle Grid	USGS	12/1/2002	24000	USGS 7.5-Minute Series Topographic Maps. S_GEN_STRUCT S_SUBBASINS
National Agriculture Imagery Program	U.S. Department of Agriculture Farm Service Agency	1/1/2005	12000	Location of roads, railroads, bridges, streams, and other physical features. S_GEN_STRUCT S_WTR_LN S_WTR_AR S_BASE_INDEX S_PROFIL_BASLN
Orange County, California, USA and Incorporated Areas Jurisdictional Boundaries	Orange County Department of Public Works	11/26/2007	12000	Spatial and attribute information for jurisdictional boundaries. S_POL_AR
Coastal California LiDAR and Digital Imagery	NOAA's Ocean Service, Coastal Services Center (CSC)	9/12/2011	6000	Coastal California LiDAR and Digital Imagery. S_BASE_INDEX
National Agriculture Imagery Program	U.S. Department of Agriculture Farm Service Agency	1/1/2014	12000	Location of roads, railroads, bridges, streams, and other physical features. S_BASE_INDEX
Huntington Beach Jurisdictional Boundary	Orange County Department of Public Works	2016	12000	Spatial and attribute information for Huntington Beach jurisdictional boundaries. S_POL_AR

Data Type	Data Provider	Data Date	Data Scale	Data Description
TIGER/Line Shapefile, 2015, county, Orange County, CA, All Roads County-based Shapefile	U.S. Department of Commerce	2015	6000	Location of roads and railroads. S_TRNSPORT_LN

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 23, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 23.

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% 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.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, “Floodway Data.”

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1% annual chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1% annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. All topographic data used for modeling or mapping has been converted as necessary to NAVD88. The 1% annual chance elevations for selected cross sections along these flooding sources, along with their non-encroachment widths, if calculated, are shown in Table 25, “Flood Hazard and Non-Encroachment Data for Selected Streams.”

Table 23: Summary of Topographic Elevation Data used in Mapping

Community	Flooding Source	Source for Topographic Elevation Data					
		Description	Scale	Contour Interval	$RMSE_z$	$Accuracy_z$	Citation
Orange County and Incorporated Areas	Pacific Ocean	High Res Coastal LiDAR blend with Bathymetry	1:6,000	2 ft	10 cm	19 cm	Coastal Services Center 2011

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.

Table 24: Floodway Data

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	74,991	81	673	4.5	616.4	616.4	616.4	0.0
B	75,266	58	252	11.9	619.1	619.1	619.1	0.0
C	75,515	65	309	9.7	621.6	621.6	621.6	0.0
D	75,863	52	243	12.3	626.9	626.9	626.9	0.0
E	76,080	45	232	12.9	631.4	631.4	631.4	0.0
F	76,296	68	316	9.5	635.9	635.9	635.9	0.0
G	76,507	51	304	9.9	638.1	638.1	638.1	0.0
H	76,676	50	340	8.8	639.8	639.8	639.8	0.0
I	76,787	91	496	6.1	641.3	641.3	641.3	0.0
J	76,940	81	313	9.6	641.7	641.7	641.7	0.0
K	77,109	58	252	11.9	644.7	644.7	644.7	0.0
L	77,268	82	479	6.3	649.1	649.1	649.1	0.0
M	77,495	63	339	8.8	650.8	650.8	650.8	0.0
N	77,843	66	347	8.6	655.4	655.4	655.4	0.0
O	77,975	73	369	8.1	657.3	657.3	657.3	0.0
P	78,287	35	213	14.1	664.8	664.8	664.8	0.0
Q	78,503	54	318	9.4	668.8	668.8	669.3	0.5
R	78,815	114	529	5.7	671.9	671.9	672.0	0.1
S	79,142	53	282	10.6	677.7	677.7	677.7	0.0
T	79,538	88	430	7.0	681.4	681.4	681.5	0.1
U	80,003	67	448	6.7	686.4	686.4	686.5	0.1
V	80,098	60	254	11.8	686.3	686.3	686.3	0.0
W	80,499	88	318	9.4	695.0	695.0	695.0	0.0
X	80,668	70	270	11.1	698.9	698.9	699.1	0.2
Y	81,043	84	282	10.6	702.9	702.9	702.9	0.0
Z	81,291	60	278	10.8	705.7	705.7	705.9	0.2

[1]Feet above mouth at Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: ALISO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Aliso Creek (Continued)								
AA	81,492[1]	69	394	7.6	708.7	708.7	708.8	0.1
AB	81,851[1]	115	413	7.3	710.7	710.7	711.0	0.3
AC	82,273[1]	130	574	4.5	711.9	711.9	712.0	0.1
AD	82,352[1]	246	652	4.0	712.4	712.4	712.9	0.5
AE	82,452[1]	66	240	10.8	715.1	715.1	715.1	0.0
AF	83,181[1]	68	262	9.9	728.2	728.2	728.2	0.0
AG	83,413[1]	66	239	10.9	737.8	737.8	737.8	0.0
AH	83,582[1]	108	411	6.3	741.4	741.4	741.4	0.0
AI	83,831[1]	69	243	10.7	744.0	744.0	744.0	0.0
AJ	84,132[1]	84	329	7.9	748.4	748.4	748.7	0.3
AK	85,177[1]	50	207	11.6	765.3	765.3	765.3	0.0
AL	86,275[1]	119	321	7.5	783.0	783.0	783.3	0.3
AM	86,476[1]	155	304	7.9	786.9	786.9	786.9	0.0
Atwood Channel								
A	5,100[2]	73	320	7.2	243.4	243.4	243.4	0.0
B	5,950[2]	85	482	4.8	246.5	246.5	246.5	0.0
C	6,450[2]	85	432	5.3	246.5	246.5	246.6	0.1
D	7,061[2]	115	497	4.6	246.9	246.9	247.4	0.5

[1]Feet above mouth at Pacific Ocean
[2]Feet above confluence with Miller Retarding Basin (Carbon Canyon Channel)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: ALISO CREEK – ATWOOD CHANNEL

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	783	44	426	2.7	62.4	62.4	62.4	0.0
B	1,054	50	161	7.2	62.9	62.9	62.9	0.0
C	1,166	22	100	11.5	65.2	65.2	65.4	0.2
D	1,558	39	123	8.6	75.8	75.8	75.8	0.0
E	1,910	44	299	3.5	85.1	85.1	85.1	0.0
F	1,912	30	55	7.6	107.6	107.6	107.9	0.3
G	2,111	30	55	7.6	116.9	116.9	117.4	0.5
H	2,376	53	66	6.3	120.7	120.7	121.3	0.6
I	2,439	40	60	7.0	123.0	123.0	123.5	0.5
J	2,439	85	869	1.2	123.4	123.4	124.3	0.9
K	2,923	18	97	10.9	123.5	123.5	123.6	0.1

[1]Feet above mouth at Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BLUEBIRD CANYON

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Bonita Creek								
A	3,150[1]	22	212	17.7	40.1	40.1	40.1	0.0
B	3,850[1]	52	283	13.3	45.3	45.3	45.3	0.0
C	4,550[1]	316	573	6.5	54.4	54.4	54.7	0.3
D	5,120[1]	440	670	4.6	61.4	61.4	61.4	0.0
E	5,720[1]	165	404	7.2	65.6	65.6	66.3	0.7
F	6,670[1]	116	339	8.6	79.5	79.5	80.0	0.5
G	7,590[1]	67	264	10.8	85.5	85.5	85.5	0.0
H	8,420[1]	87	269	3.2	92.9	92.9	92.9	0.0
I	11,200[1]	42	124	9.7	160.1	160.1	160.1	0.0
Brea Canyon Channel								
A	400[2]	100	1,080	7.3	302.6	302.6	302.6	0.0
B	1,980[2]	86	800	9.8	312.3	312.3	312.3	0.0
C	3,900[2]	86	796	9.9	324.1	324.1	324.1	0.0
D	4,915[2]	60	781	10.1	327.5	327.5	327.7	0.2
E	5,970[2]	80	617	12.6	332.0	332.0	332.0	0.0
F	7,005[2]	50	652	12.0	343.8	343.8	343.8	0.0
G	8,735[2]	60	698	10.3	356.4	356.4	357.0	0.6
H	10,215[2]	56	550	13.0	364.5	364.5	365.4	0.9
I	12,535[2]	60	580	12.0	380.3	380.3	381.2	0.9

[1]Feet above confluence with San Diego Creek
[2]Feet above mouth (at Brea Flood-Control Reservoir)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: BONITA CREEK – BREA CANYON CHANNEL

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Carbon Canyon Channel								
A	1,933[1]	55	447	7.4	248.3	248.3	248.3	0.0
B	2,522[1]	160	1,092	3.0	250.3	250.3	251.1	0.8
C	2,918[1]	86	673	4.9	253.4	253.4	254.0	0.6
D	3,938[1]	51	354	9.3	259.5	259.5	260.5	1.0
E	4,938[1]	62	300	9.0	265.2	265.2	265.5	0.3
F	5,188[1]	148	490	5.5	268.4	268.4	269.4	1.0
G	5,758[1]	140	495	5.5	272.2	272.2	272.2	0.0
H	6,518[1]	66	243	11.1	275.8	275.8	276.5	0.7
I	6,918[1]	159	367	7.3	280.6	280.6	281.0	0.4
J	28,280[2]	100	570	7.4	499.5	499.5	499.7	0.2
Carbon Creek Channel								
A	65,356[3]	40	293	6.8	207.5	207.5	207.5	0.0
B	66,283[3]	40	293	6.8	208.5	208.5	209.5	1.0
Cascadita Creek								
A	605[4]	7	65	14.6	31.7	31.7	32.7	1.0
B	750[4]	7	53	15.7	34.2	34.2	34.2	0.0
C	895[4]	90	432	2.2	42.9	42.9	43.6	0.7
D	1,165[4]	28	88	10.7	43.2	43.2	43.7	0.5
E	1,665[4]	29	112	8.5	51.3	51.3	52.1	0.8
F	2,160[4]	30	148	6.4	63.7	63.7	63.7	0.0
G	2,660[4]	47	328	2.9	66.1	66.1	66.2	0.1
H	2,900[4]	26	91	10.4	74.1	74.1	74.5	0.4
I	3,140[4]	38	198	4.8	78.2	78.2	79.0	0.8
J	3,320[4]	16	99	9.6	79.3	79.3	80.2	0.9

[1]Feet above confluence with Miller Retarding Basin
[2]Feet above confluence with Carbon Creek Channel (Miller Retarding Basin)
[3]Feet above confluence with Coyote Creek Channel
[4]Feet above confluence with Prima Deshecha Canada

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: CARBON CANYON CHANNEL – CARBON CREEK CHANNEL – CASCADITA CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Coyote Canyon Wash								
A	800[1]	84	210	6.2	155.3	155.3	155.3	0.0
B	1,300[1]	94	281	4.6	172.8	172.8	172.8	0.0
C	1,980[1]	48	154	8.4	179.6	179.6	179.6	0.0
D	2,380[1]	52	227	5.7	185.4	185.4	185.4	0.0
E	2,990[1]	23	106	12.3	198.8	198.8	198.8	0.0
F	3,770[1]	20	101	12.8	209.1	209.1	209.1	0.0
Coyote Creek Channel								
A	64,770[2]	72	558	8.6	226.4	226.4	226.4	0.0
B	65,220[2]	104	1,014	4.7	229.1	229.1	229.5	0.4
C	65,440[2]	92	872	5.5	229.4	229.4	229.9	0.5
D	66,520[2]	43	423	11.3	237.4	237.4	237.9	0.5
East Richfield Channel								
A	3,783[3]	178	378	6.3	309.3	309.3	310.0	0.7
B	4,060[3]	250	373	6.4	312.3	312.3	312.5	0.2
C	4,450[3]	249	822	2.9	323.9	323.9	323.9	0.0
D	4,790[3]	121	277	8.7	326.5	326.5	326.6	0.1
E	5,240[3]	114	268	9.0	338.8	338.8	338.8	0.0
F	5,790[3]	82	619	3.9	349.0	349.0	349.4	0.4

[1]Feet above confluence with Bonita Creek
[2]Feet above confluence with San Gabriel River
[3]Feet above confluence with Santa Ana River

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: COYOTE CANYON WASH – COYOTE CREEK CHANNEL – EAST RICHFIELD CHANNEL

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0.459	25	377	6.4	403.0	403.0	404.0	1.0
B	0.484	90	266	9.0	407.2	407.2	407.2	0.0
C	0.518	69	230	10.4	411.8	411.8	411.8	0.0
D	0.543	99	338	7.1	413.4	413.4	414.2	0.8
E	0.592	34	191	12.6	417.4	417.4	417.7	0.3
F	0.651	91	457	5.3	421.0	421.0	421.9	0.9
G	0.742	76	264	9.1	426.8	426.8	427.2	0.4
H	0.819	157	694	3.5	435.5	435.5	436.2	0.7
I	0.910	168	747	3.2	435.8	435.8	436.8	1.0
J	0.981	95	299	8.0	439.3	439.3	439.6	0.3
K	1.082	123	649	3.7	445.9	445.9	446.9	1.0
L	1.132	51	265	9.1	446.3	446.3	446.9	0.6
M	1.206	116	439	5.5	449.2	449.2	450.0	0.8
N	1.245	70	268	9.0	452.8	452.8	452.8	0.0
O	1.322	95	383	6.3	456.1	456.1	456.5	0.4
P	1.413	35	188	12.8	460.3	460.3	460.3	0.0
Q	1.494	45	200	12.0	467.6	467.6	467.6	0.0
R	1.573	185	644	3.7	474.8	474.8	475.7	0.9
S	1.611	68	252	9.5	476.4	476.4	476.4	0.0
T	1.778	72	230	10.4	482.4	482.4	482.4	0.0
U	1.913	99	295	8.1	489.4	489.4	489.4	0.0
V	2.091	39	146	11.0	498.3	498.3	498.3	0.0
W	2.180	85	418	3.8	507.3	507.3	507.3	0.0
X	2.270	220	839	1.9	510.1	510.1	510.1	0.0

[1]Miles above confluence with Santiago Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: HANDY CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	3,010	135	225	7.6	123.0	123.0	123.7	0.7
B	3,590	231	282	6.0	132.6	132.6	133.2	0.6
C	4,330	115	1,099	1.5	145.8	145.8	145.9	0.1
D	5,174	156	1,003	1.7	147.0	147.0	147.0	0.0
E	6,230	67	187	9.1	156.6	156.6	156.6	0.0
F	7,234	41	501	3.4	173.4	173.4	173.4	0.0
G	7,709	99	399	4.3	175.0	175.0	175.0	0.0
H	8,184	50	308	5.5	177.0	177.0	177.1	0.1
I	8,395	61	686	2.5	186.9	186.9	186.9	0.0
J	8,659	68	369	4.6	186.9	186.9	186.9	0.0
K	11,088	68	585	2.9	206.0	206.0	205.9	0.0
L	12,197	63	364	4.7	208.1	208.1	208.2	0.1

[1]Feet above confluence with San Juan Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: HORNO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	929	183	1,223	7.4	19.3	19.3	19.6	0.3
B	1,039	206	1,081	8.0	20.1	20.1	20.1	0.0
C	1,105	160	897	8.2	20.7	20.7	21.0	0.3
D	1,332	130	840	8.4	24.4	24.4	25.3	0.9
E	1,433	169	406	7.7	26.0	26.0	26.6	0.6
F	1,754	164	401	7.7	31.5	31.5	31.9	0.4
G	1,888	100	552	9.1	33.4	33.4	33.8	0.4
H	1,976	220	623	3.9	34.3	34.3	35.2	0.9
I	2,045	175	322	7.6	35.1	35.1	35.5	0.4
J	2,097	145	301	8.1	36.2	36.2	36.3	0.1
K	2,549	85	244	9.7	43.4	43.4	43.5	0.1
L	2,875	66	226	10.5	48.0	48.0	48.3	0.3
M	3,468	75	238	10.0	55.1	55.1	55.8	0.7
N	3,515	85	247	9.6	55.5	55.5	56.3	0.8
O	3,537	85	317	7.5	56.2	56.2	57.1	0.9
P	3,814	98	259	9.2	58.8	58.4	59.2	0.8
Q	4,673	124	285	8.3	70.4	70.4	71.3	0.9
R	4,715	124	278	8.5	71.4	71.4	72.2	0.8
S	4,996	124	328	7.2	74.1	74.1	74.6	0.5
T	5,291	129	288	8.2	79.5	79.5	80.5	1.0
U	5,331	123	271	7.7	79.9	79.9	80.9	1.0
V	5,446	145	322	6.5	82.1	82.1	83.1	1.0
W	6,000	81	429	9.0	87.3	87.3	87.6	0.3
X	6,350	115	256	8.1	91.2	91.2	91.4	0.2
Y	6,713	108	228	8.0	96.6	96.6	96.8	0.2
Z	6,916	149	397	6.3	100.4	100.4	100.4	0.0

[1]Feet above confluence with Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: LAGUNA CANYON

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Laguna Canyon (continued)								
AA	7,366	44	1,126	11.1	107.9	107.9	107.9	0.0
AB	7,580	70	1,286	5.6	109.4	109.4	110.4	1.0
AC	7,905	65	813	9.7	110.0	110.0	111.0	1.0
AD	8,407	95	538	7.7	117.0	117.0	118.0	1.0
AE	8,437	82	524	9.0	117.0	117.0	118.0	1.0
AF	8,730	125	293	7.3	120.1	120.1	120.3	0.2
AG	8,745	77	214	9.2	120.5	120.5	120.5	0.0
AH	8,762	58	196	10.0	120.5	120.5	121.5	1.0
AI	9,065	26	174	11.2	126.8	126.8	127.0	0.2
AJ	9,116	25	232	7.1	129.8	129.8	129.9	0.1
AK	9,241	25	137	12.1	130.2	130.2	130.2	0.0
AL	9,327	23	139	11.9	132.7	132.7	132.7	0.0
AM	9,509	38	192	8.6	135.6	135.6	135.8	0.2
AN	9,670	45	348	4.8	136.2	136.2	136.9	0.7
AO	10,060	53	154	6.2	136.3	136.3	137.0	0.7
AP	13,100	65	123	7.8	161.3	161.3	161.6	0.3
AQ	13,703	53	115	8.3	175.2	175.2	175.5	0.3
AR	13,817	49	239	12.6	175.3	175.3	175.3	0.0
AS	13,875	195	423	7.1	177.4	177.4	177.4	0.0
AT	13,935	160	404	7.4	177.8	177.8	177.8	0.0
AU	14,167	82	289	10.4	179.7	179.7	179.9	0.2
AV	14,608	53	260	11.5	182.6	182.6	182.8	0.2
AW	14,677	110	337	8.9	185.2	185.2	185.2	0.0
AX	14,798	76	306	9.8	186.4	186.4	186.4	0.0
AY	15,026	39	253	11.8	191.1	191.1	191.4	0.3

[1]Feet above confluence with Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: LAGUNA CANYON

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Laguna Canyon (continued)								
AZ	15,147	74	291	10.3	193.4	193.4	194.0	0.6
BA	15,441	59	266	11.7	197.0	197.0	197.2	0.2
BB	15,788	57	548	11.7	202.6	202.6	202.6	0.0
BC	15,974	57	588	9.4	204.5	204.5	205.5	1.0
BD	16,282	73	600	10.2	211.3	211.3	211.4	0.1
BE	16,484	110	454	8.2	213.6	213.6	213.8	0.2
BF	16,837	164	353	8.5	218.9	218.9	219.5	0.6
BG	17,065	86	363	8.3	220.1	220.1	220.7	0.6
BH	17,168	75	356	8.4	220.7	220.7	221.4	0.7
BI	17,315	161	810	3.7	221.8	221.8	222.8	1.0
BJ	17,581	148	480	6.3	222.2	222.2	223.1	0.9
BK	17,705	171	618	4.9	224.1	224.1	225.0	0.9
BL	18,154	150	385	7.8	229.1	229.1	229.6	0.5
BM	18,471	184	342	7.5	232.7	232.7	233.6	0.9
BN	18,505	203	346	7.4	234.3	234.3	235.2	0.9
BO	18,664	187	402	6.4	237.2	237.2	238.2	1.0
BP	18,841	140	328	7.9	239.5	239.5	240.5	1.0
BQ	18,913	182	398	6.5	240.7	240.7	241.7	1.0
BR	19,300	111	430	6.0	246.8	246.8	247.0	0.2
BS	19,426	114	309	8.3	247.0	247.0	247.4	0.4
BT	19,566	164	531	4.9	248.7	248.7	249.6	0.9
BU	19,933	138	339	7.6	250.2	250.2	250.8	0.6
BV	20,534	101	303	4.5	257.0	257.0	258.0	1.0
BW	20,700	68	195	7.0	258.9	258.9	259.5	0.6
BX	20,920	58	270	5.1	263.6	263.6	264.1	0.5

[1]Feet above confluence with Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: LAGUNA CANYON

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Laguna Canyon (continued)								
BY	21,083	57	307	4.5	264.7	264.7	265.4	0.7
BZ	21,336	52	160	8.6	267.4	267.4	268.1	0.7
CA	21,498	56	283	4.8	271.0	271.0	271.9	0.9
CB	21,537	40	243	5.6	271.8	271.8	272.6	0.8
CC	21,630	46	267	5.1	272.1	272.1	273.0	0.9
CD	21,891	49	397	3.5	283.7	283.7	283.7	0.0
CE	21,920	73	579	2.4	283.8	283.8	282.8	0.0
CF	22,566	87	292	4.7	290.7	290.7	290.7	0.0
CG	23,054	43	142	9.6	301.1	301.1	301.2	0.1
CH	23,177	90	149	7.0	304.6	304.6	304.6	0.0
CI	23,351	63	448	2.3	305.5	305.5	305.5	0.0
CJ	23,469	100	152	6.9	308.8	308.8	309.8	1.0
CK	23,654	50	119	8.8	311.3	311.3	312.1	0.8
CL	23,851	33	119	8.8	315.2	315.2	315.8	0.6
CM	24,560	45	186	5.6	327.0	327.0	328.0	1.0
CN	24,722	52	144	7.3	329.2	329.2	329.6	0.4
CO	24,873	87	287	3.7	330.2	330.2	330.8	0.6
CP	25,004	151	672	1.0	330.3	330.3	331.0	0.7
CQ	25,324	281	1,115	0.6	330.4	330.4	331.1	0.7
CR	25,483	205	339	2.1	330.4	330.4	331.1	0.7
CS	25,541	85	114	6.1	331.0	331.0	331.7	0.7
CT	25,607	86	126	5.6	332.6	332.6	333.2	0.6
CU	25,842	61	172	4.1	336.1	336.1	337.1	1.0
CV	25,970	58	109	6.4	339.5	339.5	339.9	0.4
CW	26,210	60	206	3.4	344.3	344.3	345.3	1.0
CX	27,192	70	165	4.9	360.0	360.0	360.5	0.5

[1]Feet above confluence with Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: LAGUNA CANYON

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Loftus Diversion Channel								
A	1,992[1]	62	500	5.4	314.7	314.7	315.6	0.9
B	3,205[1]	42	290	6.5	330.2	330.2	330.2	0.0
Oso Creek								
A-R*	*	*	*	*	*	*	*	*
S	3.698[2]	254	699	9.5	284.0	284.0	285.0	1.0
T	3.792[2]	180	868	6.8	289.5	289.5	290.3	0.8
U	3.887[2]	185	951	6.3	294.3	294.3	295.1	0.8
V	3.982[2]	210	1,141	5.9	297.6	297.6	298.6	1.0

[1]Feet above mouth (at Fullerton Flood-Control Reservoir)
[2]Miles above confluence with Trabuco Creek
*Floodway not computed

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: LOFTUS DIVERSION CHANNEL – OSO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	700	108	513	7.6	24.9	24.9	24.9	0.0
B	2,430	410	686	5.7	33.4	33.4	34.2	0.8
C	3,375	491	665	5.9	42.3	42.3	42.3	0.0
D	4,030	405	699	5.6	48.9	48.9	49.9	1.0
E	4,815	794	4,805	0.7	63.1	63.1	63.1	0.0
F	5,850	407	672	5.4	64.7	64.7	65.4	0.7
G	6,450	384	641	5.6	68.6	68.6	68.9	0.3
H	7,380	287	555	6.5	76.2	76.2	76.9	0.7
I	8,720	170	564	6.4	85.0	85.0	85.4	0.4
J	9,400	119	584	6.2	88.0	88.0	88.3	0.3
K	10,540	60	276	12.3	96.4	96.4	96.4	0.0
L	11,180	150	944	3.6	100.2	100.2	100.5	0.3
M	11,520	129	403	8.4	100.8	100.8	101.1	0.3
N	12,120	103	340	10.0	108.5	108.5	109.0	0.5
O	13,000	165	495	6.9	116.6	116.6	117.6	1.0
P	14,000	86	311	10.9	127.1	127.1	127.8	0.7
Q	15,000	99	435	7.8	136.2	136.2	137.2	1.0
R	15,750	78	332	10.2	141.9	141.9	142.6	0.7
S	16,490	124	362	9.4	168.0	168.0	168.9	0.9
T	21,500	40	256	14.5	206.5	206.5	206.5	0.0
U	22,740	34	144	11.8	224.2	224.2	224.2	0.0
V	25,960	73	186	5.4	259.5	259.5	260.1	0.6
W	26,480	124	148	6.8	267.9	267.9	267.9	0.0
X	27,340	47	152	6.6	276.1	276.1	276.2	0.1
Y	28,220	52	116	8.6	290.1	290.1	290.1	0.0
Z	29,200	31	99	10.1	310.7	310.7	310.7	0.0

[1]Feet above confluence with San Diego Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SAND CANYON WASH

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	35,740	120	728	14.0	116.1	116.1	116.1	0.0
B	36,345	333	1,478	6.9	123.9	123.9	124.9	1.0
C	36,945	452	1,415	7.2	125.7	125.7	126.1	0.4
D	38,300	136	1,237	8.2	129.6	129.6	130.6	1.0
E	39,090	109	700	14.6	133.7	133.7	133.7	0.0
F	40,240	141	1,480	6.9	138.7	138.7	139.1	0.4
G	40,690	228	2,272	4.5	139.5	139.5	139.9	0.4
H	41,305	100	683	14.9	141.4	141.4	141.4	0.0
I	47,600	146	1,372	9.3	173.8	173.8	174.2	0.4
J	48,113	131	1,180	10.8	174.8	174.8	174.8	0.0
K	48,815	269	2,006	8.3	176.8	176.8	176.9	0.1
L	49,344	66	536	16.2	185.9	185.9	185.9	0.0
M	49,984	318	1,236	4.7	190.5	190.5	190.5	0.0
N	50,624	384	1,584	3.7	191.8	191.8	191.8	0.0
O	51,514	374	1,286	4.5	193.5	193.5	193.5	0.0
P	52,324	315	1,318	4.4	195.5	195.5	195.5	0.0
Q	53,470	200	533	10.9	200.0	200.0	200.9	0.9
R	54,510	110	614	9.5	208.5	208.5	209.4	0.9
S	55,535	200	621	9.4	213.6	213.6	214.3	0.7
T	56,065	200	812	9.8	215.8	215.8	216.6	0.8
U	57,826	400	1,330	3.6	226.4	226.4	226.5	0.1
V	59,079	500	1,750	3.0	232.8	232.8	232.8	0.0
W	63,814	82	235	6.8	257.4	257.4	257.4	0.0

[1]Feet above confluence with Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SAN DIEGO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	2.51	183	2,503	12.8	75.7	75.7	75.7	0.0
B	2.54	190	2,497	12.8	76.3	76.3	76.3	0.0
C	2.62	218	3,274	9.8	80.1	80.1	80.6	0.5
D	2.77	215	2,651	12.1	81.0	81.0	81.4	0.4
E	2.86	305	4,358	7.3	86.7	86.7	86.7	0.0
F	2.97	449	5,085	6.3	88.0	88.0	88.3	0.3
G	3.09	443	4,441	7.2	89.1	89.1	90.0	0.9
H	3.21	417	3,834	7.8	91.9	91.9/91.7[2]	92.5	0.8
I	3.34	573	3,722	8.1	95.2	95.2/94.7[2]	95.6	0.9
J	3.48	421	3,897	7.7	100.0	100.0/99.0[2]	99.5	0.5
K	3.57	356	3,451	8.7	102.2	102.2/100.5[2]	101.1	0.6
L	3.63	347	3,325	9.0	103.0	103.0/101.4[2]	102.1	0.7
M	3.71	217	2,421	12.4	105.1	105.1/106.1[2]	106.1	0.0
N	3.82	408	4,251	7.1	108.9	108.9/109.3[2]	109.3	0.0
O	3.92	441	3,341	9.0	112.0	112.0/110.0[2]	110.3	0.3
P	4.01	474	3,677	8.2	114.4	114.4/113.1[2]	113.1	0.0
Q	4.09	568	3,378	8.9	115.5	115.5/114.2[2]	114.3	0.1
R	4.17	554	3,631	8.3	116.6	116.6/116.2[2]	116.5	0.3
S	4.25	443	3,136	9.6	118.0	118.0/117.9[2]	118.1	0.2
T	4.32	615	3,929	7.6	120.2	120.2/120.3[2]	120.4	0.1
U	4.39	713	3,355	8.9	122.0	122.0	122.3	0.3
V	4.47	771	3,773	8.0	125.7	125.7	125.7	0.0
W	4.55	1,014	3,425	8.8	127.7	127.7/127.6[2]	127.7	0.1
X	4.62	832	3,323	9.0	131.8	131.8/131.4[2]	131.4	0.0
Y	4.70	550	2,425	12.4	133.5	133.5/132.7[2]	132.7	0.0
Z	4.78	296	2,176	13.8	134.3	134.3/133.8[2]	133.8	0.0

[1]Miles above confluence with Pacific Ocean
[2]River side/land side of levee

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SAN JUAN CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
San Juan Creek (continued)								
AA	4.90	325	2,630	11.4	139.6	139.6	139.6	0.0
AB	4.98	342	2,892	10.4	141.4	141.4	141.4	0.0
AC	5.10	387	2,994	10.0	143.4	143.4	143.4	0.0
AD	5.19	340	2,316	13.0	145.1	145.1	145.1	0.0
AE	5.28	363	2,480	12.1	151.0	151.0	151.0	0.0
AF	5.37	323	3,707	8.1	155.8	155.8	155.8	0.0
AG	5.44	270	2,680	11.2	157.8	157.8	157.8	0.0
AH	5.51	227	2,417	12.4	161.3	161.3	161.3	0.0
AI	5.54	637	6,819	4.4	173.0	173.0	173.9	0.9
AJ	5.63	667	7,236	4.1	173.2	173.2	174.1	0.9

[1]Miles above confluence with Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SAN JUAN CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A-S*	*	*	*	*	*	*	*	*
T	24.39	860	6,259	12.1	359.9	359.9	360.0	0.1
U	24.54	1,020	7,415	9.0	363.1	363.1	363.3	0.2
V	24.69	900	6,841	7.4	364.7	364.7	364.9	0.2
W	24.87	1,049	6,507	7.5	366.0	366.0	366.2	0.2
X	25.00	1,410	4,341	9.8	368.7	368.7	369.0	0.3
Y	25.15	1,520	8,594	7.1	374.7	374.7	375.2	0.5
Z	25.30	1,450	8,849	6.4	376.8	376.8	377.4	0.6
AA	25.45	1,260	9,137	6.0	380.3	380.3	380.7	0.4
AB	25.60	1,241	7,981	6.6	381.3	381.3	832.0	0.7
AC	25.75	990	6,151	7.8	382.7	382.7	383.2	0.5
AD	25.91	1,020	5,180	9.3	385.5	385.5	386.0	0.5
AE	26.06	913	5,625	8.6	389.0	389.0	389.6	0.6
AF	26.21	883	5,367	10.7	393.7	393.7	394.0	0.3
AG	26.36	867	4,830	11.5	397.4	397.4	397.6	0.2
AH	26.51	730	5,859	8.4	403.4	403.4	403.4	0.0
AI	26.66	832	7,827	6.1	405.2	405.2	405.2	0.0
AJ	26.82	593	3,838	8.8	410.1	410.1	410.1	0.0
AK	26.97	430	4,546	10.8	416.9	416.9	416.9	0.0
AL	27.12	574	6,309	8.8	419.2	419.2	419.2	0.0
AM	27.27	969	9,942	5.7	420.5	420.5	420.5	0.0
AN	27.42	972	6,568	9.7	420.6	420.6	420.6	0.0
AO	27.57	1,106	5,669	12.5	421.1	421.1	421.7	0.6
AP	27.72	1,070	7,435	8.9	423.5	423.5	424.2	0.7
AQ	27.87	900	6,255	10.6	424.5	424.5	425.2	0.7

[1]Miles above confluence with Pacific Ocean
*Floodway not computed

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SANTA ANA RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	972	90	770	10.4	115.0	115.0	115.0	0.0
B	1,901	102	814	12.3	119.2	119.2	119.3	0.1
C	3,210	80	805	12.4	126.7	126.7	126.8	0.1
D	3,823	85	829	12.1	129.4	129.4	129.7	0.3
E	4,921	113	1,256	8.0	134.5	134.5	134.6	0.1
F	5,407	74	608	16.4	135.3	135.3	135.3	0.0
G	6,748	185	1,541	7.8	143.8	143.8	143.8	0.0
H	7,302	135	1,306	9.2	146.3	146.3	147.0	0.7
I	8,559	86	935	12.8	150.6	150.6	151.4	0.8
J	9,187	115	1,002	12.0	153.4	153.4	153.7	0.3
K	10,006	148	1,347	8.9	158.4	158.4	159.0	0.6
L	10,745	191	1,661	7.2	162.4	162.4	163.2	0.8
M	11,363	150	1,291	9.3	165.1	165.1	165.9	0.8
N	11,848	231	1,353	8.9	167.0	167.0	167.7	0.7
O	12,482	101	1,145	10.5	173.6	173.6	173.6	0.0
P	12,904	165	1,254	9.6	177.4	177.4	178.4	1.0
Q	13,464	112	782	15.3	179.3	179.3	179.3	0.0
R	15,492	175	1,265	9.5	196.9	196.9	197.3	0.4
S	16,289	199	2,049	5.9	204.7	204.7	204.9	0.2
T	19,103	149	116	10.3	222.6	222.6	223.6	1.0
U	19,768	180	1,188	10.1	225.2	225.2	225.5	0.3
V	20,724	192	1,708	7.0	233.8	233.8	233.8	0.0
W	21,711	174	1,208	9.1	236.9	236.9	237.2	0.3
X	22,361	176	1,541	7.1	242.4	242.4	243.4	1.0
Y	23,723	159	877	12.5	250.9	250.9	256.7	0.0
Z	24,462	560	1,763	6.2	258.8	258.8	256.9	0.0
AA	25,312	263	1,473	7.5	266.1	266.1	259.5	0.0

[1]Feet above confluence with Santa Ana River

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SANTIAGO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Santiago Creek (continued)								
AB	29,547	296	1,581	7.6	304.9	304.9	305.1	0.2
AC	30,534	134	1,684	7.1	309.1	309.1	309.7	0.6
AD	31,427	910[2]	6,464	1.9	310.2	310.2	310.7	0.5
AE	32,567	2,064[2]	29,484	0.4	310.3	310.3	310.8	0.5
AF	33,713	241	4,185	2.9	310.3	310.3	310.8	0.5
AG	34,352	555	10,538	1.1	310.3	310.3	310.8	0.5
AH	36,374	506	3,474	3.5	330.5	330.5	330.6	0.1
AI	37,245	155	1,327	4.5	368.3	368.3	368.3	0.0
AJ	40,244	69	438	13.7	395.4	395.4	395.5	0.1
AK	41,295	123	1,070	11.2	413.0	413.0	413.0	0.0
AL	41,923	419	2,253	6.4	417.5	417.5	417.5	0.0
AM	43,386	286	1,977	6.1	430.0	430.0	430.8	0.8
AN	45,477	187	1,755	6.8	454.3	454.3	454.5	0.2
AO	47,604	354	2,642	4.5	474.7	474.7	475.4	0.7

[1]Feet above confluence with Santa Ana River
[2]Floodway width adjusted to updated waterlines, does not match model

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SANTIAGO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Segunda Deshecha Canada								
B-M[1]	*	*	*	*	*	*	*	*
N	1.17[3]	20	160	18.1	73.0	73.0	73.8	0.8
O	1.28[3]	39	221	13.1	79.6	79.6	79.9	0.3
P	1.45[3]	44	415	6.7	89.4	89.4	90.3	0.9
Q	1.60[3]	42	432	5.3	92.1	92.1	92.7	0.6
Serrano Creek								
A[2]	*	*	*	*	*	*	*	*
B	2,020[4]	43	227	13.2	251.7	251.7	251.7	0.0
C	2,420[4]	28	198	15.2	255.5	255.5	255.5	0.0
D	2,790[4]	112	355	11.4	262.1	262.1	262.1	0.0
E	3,990[4]	113	354	11.3	274.8	274.8	274.8	0.0
F	4,590[4]	55	317	9.5	280.1	280.1	280.1	0.0
G	4,990[4]	73	297	10.1	281.3	281.3	281.3	0.0
H	5,390[4]	70	268	11.2	285.3	285.3	285.3	0.0
I-V[2]	*	*	*	*	*	*	*	*
W	14,234[4]	142	514	5.4	374.2	374.2	374.2	0.0
X	14,444[4]	217	791	3.5	374.7	374.7	374.7	0.0
Y	14,674[4]	132	316	8.9	375.0	375.0	375.0	0.0
Z	15,174[4]	99	516	5.4	382.7	382.7	382.9	0.2
AA	16,389[4]	63	357	7.8	395.0	395.0	396.0	1.0
AB	17,214[4]	55	246	11.4	401.6	401.6	401.8	0.2
AC	17,739[4]	86	497	5.6	408.4	408.4	408.8	0.4
AD	18,164[4]	60	240	11.6	412.0	412.0	412.0	0.0
AE	19,259[4]	45	223	12.6	436.9	436.9	436.9	0.0
AF	19,408[4]	46	223	12.5	440.4	440.4	440.4	0.0
AG	21,315[4]	86	394	7.1	486.3	486.3	486.3	0.0

[1]Floodway contained in improved channel
[2]Contained in channel
[3]Miles above confluence with Pacific Ocean
[4]Feet above confluence with San Diego Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SEGUNDA DESHECHA CANADA – SERRANO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Serrano Creek (continued)								
AH	22,251	65	248	11.3	511.2	511.2	511.2	0.0
AI	23,581	72	319	8.8	552.4	552.4	552.4	0.0
AJ	24,910	51	195	11.3	606.0	606.0	606.0	0.0
AK	25,347	40	180	12.2	626.7	626.7	626.7	0.0
AL	25,807	61	314	7.0	636.2	636.2	636.2	0.0
AM	26,232	64	212	10.4	646.8	646.8	646.8	0.0
AN	26,464	46	232	9.5	654.2	654.2	654.2	0.0
AO	27,309	58	208	10.6	670.6	670.6	670.6	0.0
AP	27,627	85	314	7.0	678.5	678.5	678.5	0.0
AQ	27,971	247	331	6.7	689.3	689.3	690.0	0.7
AR	28,128	130	553	4.0	690.0	690.0	691.0	1.0
AS	28,555	50	193	11.4	693.7	693.7	693.7	0.0
AT	29,336	60	206	10.7	713.2	713.2	713.2	0.0
AU	30,178	41	197	11.2	725.6	725.6	725.6	0.0
AV	30,744	57	343	5.5	731.7	731.7	732.0	0.3
AW	31,416	43	169	11.3	756.4	756.4	756.4	0.0
AX	31,566	47	259	7.3	758.4	758.4	758.4	0.0
AY	31,934	46	167	11.4	761.4	761.4	761.4	0.0
AZ	32,205	72	199	9.6	766.1	766.1	766.3	0.2
BA	32,935	62	191	10.0	775.4	775.4	775.4	0.0
BB	34,194	64	192	9.9	793.3	793.3	793.3	0.0

[1]Feet above confluence with San Diego Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SERRANO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Shady Canyon Wash								
A	200[1]	79	383	3.9	207.9	207.9	207.9	0.0
B	670[1]	51	145	0.6	210.0	210.0	210.0	0.0
C	1,330[1]	29	120	11.7	221.5	221.5	221.5	0.0
D	1,990[1]	95	143	9.8	230.3	230.3	230.3	0.0
E	2,590[1]	50	172	8.1	235.9	235.9	235.9	0.0
F	3,430[1]	35	127	11.0	251.8	251.8	251.8	0.0
Sulphur Creek								
A	0.000[2]	94	426	6.8	198.3	198.3	198.3	0.0
B	0.197[2]	114	608	4.9	203.8	203.8	204.3	0.5
C	0.266[2]	196	686	4.5	204.6	204.6	205.4	0.8
D	0.384[2]	76	281	11.1	209.6	209.6	209.7	0.1
E	0.446[2]	36	234	12.4	212.2	212.2	212.8	0.6
F	0.583[2]	154	1,045	2.8	217.7	217.7	218.7	1.0
G	0.723[2]	80	566	5.1	222.0	222.0	222.0	0.0

[1]Feet above confluence with Sand Canyon Wash
[2]Miles above Laguna Niguel Regional Park

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: SHADY CANYON WASH – SULPHUR CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	2.24	186	2,100	6.2	159.8	159.8	159.8	0.0
B	2.33	191	1,462	8.9	162.3	162.3	162.3	0.0
C	2.44	138	1,263	10.3	166.8	166.8	166.8	0.0
D	2.54	109	967	13.4	170.2	170.2	170.2	0.0
E	2.65	117	1,196	10.9	179.6	179.6	179.6	0.0
F	2.71	163	1,994	6.5	181.7	181.7	181.7	0.0
G	2.76	70	696	18.7	191.0	191.0	191.0	0.0
H	2.89	117	1,051	12.4	198.6	198.6	198.6	0.0
I	2.94	77	733	17.7	202.9	202.9	202.9	0.0
J	3.00	81	889	14.6	207.9	207.9	207.9	0.0
K	3.05	99	1,103	11.8	211.3	211.3	211.7	0.4
L	3.11	59	686	18.9	211.3	211.3	211.3	0.0
M	3.21	84	989	13.1	218.4	218.4	218.4	0.0
N	3.33	106	1,264	10.3	223.6	223.6	223.6	0.0
O	3.44	87	886	14.7	231.0	231.0	231.0	0.0
P	3.55	76	865	15.0	235.1	235.1	235.5	0.4
Q	3.66	112	1,668	7.8	241.0	241.0	241.3	0.3
R	3.76	78	947	13.7	241.3	241.3	241.6	0.3
S	3.87	112	1,529	8.5	245.9	245.9	246.0	0.1
T	3.99	174	2,199	5.9	247.4	247.4	247.5	0.1
U	4.10	108	1,006	12.9	247.4	247.4	247.5	0.1
V	4.21	200	2,344	5.5	251.6	251.6	251.6	0.0
W	4.33	272	6,444	2.0	252.1	252.1	252.2	0.1
X	4.36	314	2,371	5.5	252.0	252.0	252.0	0.0
Y	4.42	313	2,473	5.3	252.4	252.4	252.7	0.3
Z	4.48	363	3,762	3.5	252.8	252.8	253.2	0.4

[1]Miles above confluence with San Juan Creek

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: TRABUCO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Trabuco Creek (continued)								
AA	4.59[1]	587	2,211	5.9	254.0	254.0	254.5	0.5
AB	4.70[1]	559	3,903	3.3	255.1	255.1	256.0	0.9
AC	4.81[1]	806	3,654	3.6	256.0	`256.0	256.9	0.9
AD	4.91[1]	824	3,189	4.1	257.3	257.3	258.2	0.9
AE	4.97[1]	570	1,447	9.0	260.4	260.4	260.5	0.1
AF	5.02[1]	615	2,086	6.2	263.9	263.9	264.1	0.2
AG	5.13[1]	390	1,347	9.7	271.7	271.7	271.9	0.2
AH	5.19[1]	340	1,340	9.7	277.5	277.5	277.6	0.1
Upper Santiago Creek								
A	15.330[2]	580	2,470	10.1	818.9	818.9	819.7	0.8
B	15.470[2]	376	2,740	9.2	828.5	828.5	829.5	1.0
C	15.655[2]	521	2,656	9.2	837.2	837.2	838.0	0.8
D	15.825[2]	425	2,527	10.0	848.4	848.4	848.4	0.0
E	15.960[2]	420	2,475	10.1	854.4	854.4	855.2	0.8
F	16.089[2]	530	2,539	9.9	861.5	861.5	862.1	0.6
G	16.213[2]	570	3,280	7.6	871.0	871.0	872.0	1.0
H	16.373[2]	640	2,459	10.1	881.0	881.0	881.8	0.8
I	16.687[2]	416	2,492	10.0	901.3	901.3	901.3	0.0
J	17.420[2]	382	1,060	9.9	936.2	936.2	936.6	0.4
K	17.590[2]	510	1,055	10.1	952.6	952.6	952.6	0.0
L	17.775[2]	250	965	8.7	962.5	962.5	963.3	0.8
M	17.884[2]	168	682	11.5	975.7	975.7	975.7	0.0
N	18.174[2]	159	673	1.8	996.9	996.9	996.9	0.0
O	18.545[2]	164	1,208	10.0	1,016.6	1,016.6	1,017.2	0.6
P	18.689[2]	440	1,231	10.0	1,029.2	1,029.2	1,029.3	0.1
Q	18.845[2]	620	1,408	10.4	1,039.1	1,039.1	1,039.4	0.3

[1]Miles above confluence with San Juan Creek
[2]Miles above confluence with Santa Ana River

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: TRABUCO CREEK-UPPER SANTIAGO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Upper Santiago Creek (continued)								
R	19.000[1]	658	1,650	9.8	1,049.9	1,049.9	1,050.0	0.1
S	19.128[1]	393	1,196	9.8	1,058.8	1,058.8	1,059.5	0.7
T	19.238[1]	335	1,280	9.7	1,065.8	1,065.8	1,066.4	0.6
U	19.346[1]	407	1,156	12.1	1,073.4	1,073.4	1,073.4	0.0
V	19.467[1]	370	1,378	10.0	1,080.8	1,080.8	1,081.6	0.8
W	19.620[1]	543	1,288	10.7	1,094.9	1,094.9	1,095.0	0.1
X	19.720[1]	320	946	10.2	1,103.1	1,103.1	1,103.6	0.5
Y	19.814[1]	190	855	12.6	1,113.3	1,113.3	1,113.3	0.0
Z	19.893[1]	243	999	10.0	1,120.3	1,120.3	1,121.1	0.8
AA	20.019[1]	180	804	10.0	1,129.6	1,129.6	1,129.7	0.1
AB	20.104[1]	261	793	10.0	1,136.5	1,136.5	1,136.6	0.1
AC	20.332[1]	155	725	10.9	1,148.7	1,148.7	1,148.7	0.0
AD	20.360[1]	160	723	10.9	1,158.6	1,158.6	1,158.6	0.0
AE	20.472[1]	272	933	9.9	1,163.9	1,163.9	1,164.3	0.4
AF	20.597[1]	186	711	11.2	1,174.0	1,174.0	1,174.0	0.0
AG	20.735[1]	242	840	9.8	1,184.5	1,184.5	1,184.7	0.2
AH	20.879[1]	310	1,111	10.1	1,196.7	1,196.7	1,196.7	0.0
AI	21.043[1]	201	716	11.0	1,211.8	1,211.8	1,211.8	0.0

[1]Miles above confluence with Santa Ana River

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: UPPER SANTIAGO CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Veeh Creek (San Diego Creek Tributary 2)								
A	1,340[2]	210	358	7.7	227.7	227.7	227.7	0.0
B	1,720[2]	250	405	6.4	229.1	229.1	230.0	0.9
C	2,519[2]	87	443	5.9	241.8	241.8	241.8	0.0
D	3,666[2]	71	556	4.7	245.5	245.5	246.2	0.7
E	4,504[2]	92	500	5.2	247.5	247.5	248.3	0.8
Veeh Creek Tributary 1 (San Diego Creek Tributary 1)								
A[1]	50[3]	425	2,500	1.5	225.5	225.5	226.5	1.0
B[1]	485[3]	380	787	1.6	226.1	226.1	227.1	1.0
C	1,260[3]	150	152	8.2	233.1	233.1	233.7	0.6
D	1,720[3]	60	150	8.4	237.7	237.7	238.1	0.4
E	2,600[3]	67	148	8.5	245.8	245.8	245.8	0.0
F	3,200[3]	120	141	8.9	255.8	255.8	255.9	0.1
G	4,080[3]	80	119	10.5	264.5	264.5	264.7	0.2

[1]Cross Sections A and B on San Diego Creek Tributary 1 also cross Veeh Creek
[2]Feet above confluence with San Diego Creek
[3]Feet above confluence with Veeh Creek (San Diego Creek Tributary 2)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: VEEH CREEK – VEEH CREEK TRIBUTARY 1

Non-encroachment areas may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this Flood Risk Project have been tabulated for selected cross sections and are shown in Table 25. The non-encroachment width indicates the measured distance left and right (looking downstream) from the mapped center of the stream to the non-encroachment boundary based on a surcharge of 1.0 foot or less.

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams

[Not applicable to this Flood Risk Project]

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 23.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- The *primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

- The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- The *wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.

- The *breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either "V" zones or "A" zones.

Table 26 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 26: Summary of Coastal Transect Mapping Considerations

		Wave Runup Analysis	Wave Height Analysis		
Coastal Transect	Primary Frontal Dune (PFD) Identified	Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)	Zone VE Limit	SFHA Boundary
1		VE 12	*	Runup	Runup
2		VE 18	*	High-velocity flow zone	Overtopping
3		VE 22	*	High-velocity flow zone	Overtopping
4		VE 16	*	High-velocity flow zone	Overtopping
5		VE 18	*	High-velocity flow zone	Overtopping
6		VE 20	*	High-velocity flow zone	Overtopping
7		VE 23	*	High-velocity flow zone	Overtopping
8		VE 17	*	High-velocity flow zone	Overtopping
9		VE 16	*	Runup	Runup
10		VE 13	*	Runup	Runup
11		VE 19	*	Runup	Runup
12		VE 14	*	High-velocity flow zone	Overtopping
13		VE 14	*	Overtopping	Overtopping
14		VE 12	*	Runup	Runup
15		VE 16	*	High-velocity flow zone	Overtopping
16		VE 14	*	High-velocity flow zone	Overtopping
17		VE 15	*	High-velocity flow zone	Overtopping

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis Zone Designation and BFE (ft NAVD88)	Wave Height Analysis Zone Designation and BFE (ft NAVD88)	Zone VE Limit	SFHA Boundary
18		VE 13	*	High-velocity flow zone	Overtopping
19		VE 12	*	Runup	Runup
20		VE 18	*	High-velocity flow zone	Overtopping
21		VE 21	*	High-velocity flow zone	Overtopping
22		VE 18	*	High-velocity flow zone	Overtopping
23		VE 18	*	Runup	Runup
24		VE 18	*	Runup	Runup
25		VE 12	*	Runup	Runup
26		VE 14	*	Runup	Runup
27		VE 13	*	Runup	Runup
28		VE 17	*	Runup	Runup
29		VE 17	*	Runup	Runup
30		VE 13	*	Runup	Runup
31		VE 13	*	Runup	Runup
32		VE 13	*	Runup	Runup
33		VE 13	*	Runup	Runup
34		VE 15	*	Runup	Runup
35		VE 14	*	Runup	Runup
36		VE 15	*	Runup	Runup
37		VE 27	*	Runup	Runup
38		VE 13	*	Runup	Runup
39		VE 14	*	Runup	Runup
40		VE 23	*	Runup	Runup
41		VE 15	*	Runup	Runup
42		VE 15	*	Runup	Runup
43		VE 16	*	Runup	Runup
44		VE 22	*	Runup	Runup

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD88)	Zone Designation and BFE (ft NAVD88)		
45		VE 16	*	Runup	Runup
46		VE 13	*	Runup	Runup
47		VE 14	*	Runup	Runup
48		VE 16	*	Runup	Runup
49		VE 14	*	Runup	Runup
50		VE 15	*	Runup	Runup
51		VE 28	*	Runup	Runup
52		VE 22	*	Runup	Runup
53		VE 21	*	Runup	Runup
54		VE 15	*	Runup	Runup
55		VE 21	*	Wave overtopping splash zone	Overtopping
56		VE 16	*	Runup	Runup
57		VE 27	*	High-velocity flow zone	Overtopping
58		VE 25	*	Overtopping	Overtopping
59		VE 29	*	Runup	Runup
60		VE 23	*	Overtopping	Overtopping
61		VE 26	*	Runup	Runup
62		VE 20	*	Overtopping	Overtopping
63		VE 23	*	Runup	Runup
64		VE 16	*	Runup	Runup
65		VE 24	*	Runup	Runup
66		VE 15	*	Runup	Runup
67		VE 18	*	Runup	Runup
68		VE 19	*	Wave overtopping splash zone	Overtopping
69		VE 25	*	High-velocity flow zone	Overtopping
70		VE 29	*	Runup	Runup

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis Zone Designation and BFE (ft NAVD88)	Wave Height Analysis Zone Designation and BFE (ft NAVD88)	Zone VE Limit	SFHA Boundary
71		VE 18	*	Runup	Runup
72		VE 39	*	High-velocity flow zone	Overtopping
73		VE 44	*	High-velocity flow zone	Overtopping
74		VE 23	*	High-velocity flow zone	Overtopping
75		VE 20	*	High-velocity flow zone	Overtopping
76		VE 19	*	Overtopping	Overtopping
77		VE 19	*	Overtopping	Overtopping
78		VE 19	*	Overtopping	Overtopping
79		VE 16	*	Runup	Runup
80		VE 16	*	Runup	Runup
81		VE 22	*	Runup	Runup
82		VE 15	*	Runup	Runup
83		VE 13	*	Runup	Runup
84		VE 13	*	Runup	Runup
85		VE 15	*	Runup	Runup
86		VE 21	*	Overtopping	Overtopping
87		VE 21	*	Overtopping	Overtopping
88		VE 30	*	Overtopping	Overtopping

*Not applicable for this Flood Risk Product

A LiMWA boundary may be applicable in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. Due to the lack of overland wave propagation in Orange County, there is no LiMWA present.

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions may take several private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies. These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 31, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA. A LOMA cannot be issued for properties located on the PFD (primary frontal dune).

To obtain an application for a LOMA, visit www.fema.gov/floodplain-management/letter-map-amendment-loma and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at www.fema.gov/online-tutorials.

For more information about how to apply for a LOMA, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting www.fema.gov/floodplain-management/letter-map-amendment-loma for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Map Information eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at www.fema.gov/online-tutorials.

6.5.3 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a

LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/mt-2-application-forms-and-instructions and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a LOMR. For more information about how to apply for a LOMR, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the Orange County FIRM are listed in Table 27. Please note that this table only includes LOMCs that have been issued on the FIRM panels updated by this map revision dated (MONTH, DATE, YEAR). For all other areas within this county, users should be aware that revisions to the FIS Report made by prior LOMRs may not be reflected herein and users will need to continue to use the previously issued LOMRs to obtain the most current data.

Table 27: Incorporated Letters of Map Change

Case Number	Effective Date	Flooding Source	FIRM Panel(s)
14-09-2974P	11-28-2014	Bixby Storm Channel	06059C0114K
11-09-3647P	03-12-2012	Canyon Acres Wash	06059C0417K
09-09-1502P	03-31-2010	Prima Deshecha Canada	06059C0507J[1] 06059C0509K
09-09-2810P	12-15-2009	Huntington Beach Channel (D01)	06059C0261J[1] 06059C0262J[1] 06059C0263K 06059C0264K

[1] Although a portion of LOMR falls within the scope of this map revision, these panels were not revised. Therefore, users must continue to refer to the annotated FIRM attachment for this LOMR for respective FIRM panels.

6.5.4 Physical Map Revisions

Physical Map Revisions (PMRs) are an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period.

When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit www.fema.gov and visit the "Flood Map Revision Processes" section.

6.5.5 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.6 Community Map History

The current FIRM presents flooding information for the entire geographic area of Orange County. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 28, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 28 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first Flood Hazard Boundary Map (FHBM). This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as Physical Map Revisions (PMR) of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the Orange County FIRMs in countywide format was 09/15/1989.

Table 28: Community Map History

Community Name	Initial Identification Date	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Aliso Viejo, City of[1, 3]	01/10/1975	01/10/1975	N/A	09/14/1979	12/03/2009 09/15/1989
Anaheim, City of	07/26/1974	07/26/1974	04/16/1976	06/04/1980	12/03/2009 09/15/1989 09/16/1982
Brea, City of	05/24/1974	05/24/1974	11/14/1975	12/02/1980	12/03/2009 09/15/1989
Buena Park, City of	11/01/1974	11/01/1974	04/09/1976	02/01/1979	12/03/2009 09/15/1989
Costa Mesa, City of	05/17/1974	05/17/1974	06/27/1978 07/02/1976	09/30/1982	9/9/9999 12/03/2009 09/15/1989
Cypress, City of	06/07/1974	06/07/1974	04/09/1976	09/15/1989	12/03/2009
Dana Point, City of	09/15/1989	N/A	N/A	09/15/1989	9/9/9999 12/03/2009
Fountain Valley, City of	03/29/1974	03/29/1974	10/01/1976 05/28/1976	11/17/1982	9/9/9999 12/03/2009 09/15/1989
Fullerton, City of	06/28/1974	06/28/1974	07/02/1976	07/05/1977	12/03/2009 09/15/1989 04/05/1983 04/20/1982
Garden Grove, City of	06/14/1974	06/14/1974	05/07/1976	09/30/1982	12/03/2009 09/15/1989

Community Name	Initial Identification Date	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Huntington Beach, City of	08/09/1974	08/09/1974	08/27/1976	02/16/1983	9/9/9999 12/03/2009 09/15/1989
Irvine, City of	06/21/1974	06/21/1974	07/12/1977 02/20/1976 09/19/1975	02/15/1980	9/9/9999 12/03/2009 09/15/1989
La Habra, City of	05/03/1974	05/03/1974	04/09/1976	02/15/1980	12/03/2009 09/15/1989
La Palma, City of[2]	07/21/1978	N/A	N/A	07/21/1978	12/03/2009 09/15/1989
Laguna Beach, City of	06/21/1974	07/21/1974	07/09/1976	09/28/1979	9/9/9999 12/03/2009 09/15/1989 09/18/1985
Laguna Hills, City of[1, 3]	01/10/1975	01/10/1975	N/A	09/14/1979	12/03/2009 09/15/1989
Laguna Niguel, City of[1, 3]	01/10/1975	01/10/1975	N/A	09/14/1979	9/9/9999 12/03/2009 09/15/1989
Laguna Woods, City of[1, 3]	01/10/1975	01/10/1975	N/A	09/14/1979	12/03/2009 09/15/1989
Lake Forest, City of[1, 3]	01/10/1975	01/10/1975	N/A	09/14/1979	12/03/2009 09/15/1989
Los Alamitos, City of	06/07/1974	06/07/1974	01/16/1976	09/15/1989	12/03/2009
Mission Viejo, City of	09/15/1989	N/A	N/A	09/15/1989	12/03/2009
Newport Beach, City of	03/15/1974	03/15/1974	07/09/1976	09/01/1978	9/9/9999 12/03/2009 09/15/1989
Orange, City of	03/28/1978	03/28/1978	N/A	12/04/1979	12/03/2009 09/15/1989 09/30/1982
Orange County, Unincorporated Areas	01/10/1975	01/10/1975	N/A	09/14/1979	9/9/9999 12/03/2009 09/15/1989

Community Name	Initial Identification Date	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Placentia, City of	06/14/1974	06/14/1974	09/19/1975	02/15/1980	12/03/2009 09/15/1989
Rancho Santa Margarita, City of[1, 3]	01/10/1975	01/10/1975	N/A	09/14/1979	12/03/2009 09/15/1989
San Clemente, City of	06/14/1974	06/14/1974	11/14/1975	12/04/1979	9/9/9999 12/03/2009 09/15/1989
San Juan Capistrano, City of	05/10/1974	05/10/1974	10/03/1975	09/14/1979	9/9/9999 12/03/2009 09/15/1989
Santa Ana, City of	06/21/1974	06/21/1974	04/09/1976	09/14/1979	12/03/2009 09/15/1989 09/02/1982
Seal Beach, City of	06/21/1974	06/21/1974	04/09/1976	07/03/1978	9/9/9999 12/03/2009 09/15/1989
Stanton, City of	09/15/1989	N/A	N/A	09/15/1989	12/03/2009
Tustin, City of	06/21/1974	06/21/1974	07/16/1976	09/14/1979	12/03/2009 09/15/1989
Villa Park, City of	03/22/1974	03/22/1974	10/31/1975	12/04/1979	12/03/2009 09/15/1989
Westminster, City of	06/14/1974	06/14/1974	11/15/1977 07/02/1976	08/08/1978	9/9/9999 12/03/2009 09/15/1989 09/30/1982
Yorba Linda, City of	08/09/1974	08/09/1974	08/06/1976	08/01/1978	12/03/2009 09/15/1989 05/12/1981

[1] This community did not have a FIRM prior to the first countywide FIRM for Orange County
[2] No Special Flood Hazard Areas Identified
[3] Dates for this community were taken from Orange County, Unincorporated Areas

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 29 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

Table 29: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Pacific Ocean	9/9/9999	BakerAECOM	HSFEHQ-09-D-0368	9/9/9999	Orange County and Incorporated Areas
Aliso Creek	N/A	N/A	N/A	1/1/1984	N/A
Aliso Creek	09/30/1993	Schaaf and Wheeler, Inc.	EMW-89-C-2843	1/1/1992	Orange County
Aliso Creek	12/03/2009	URS, Dewberry, Schaaf, Wheeler, Airborne 1 and TerraPoint	EMF-2003-CO-0047, Task Order 014	3/1/2006	Laguna Beach, City of
Atwood Channel	N/A	N/A	N/A	3/1/1978	N/A
Big Canyon	N/A	N/A	N/A	5/1/1977	N/A
Bluebird Canyon	12/03/2009	URS, Dewberry, Schaaf, Wheeler, Airborne 1 and TerraPoint	EMF-2003-CO-0047, Task Order 014	3/1/2006	Laguna Beach, City of
Bonita Creek	N/A	N/A	N/A	5/1/1977	N/A
Bonita Creek Tributary 1	N/A	N/A	N/A	2009	N/A
Brea Canyon Channel	N/A	N/A	N/A	3/1/1978	N/A
Carbon Canyon Channel	N/A	N/A	N/A	3/1/1978	N/A
Cascadita Creek	02/05/1992	Schaaf and Wheeler, Inc.	EMW-87-C-2843	3/1/1990	San Clemente, City of

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Coyote Canyon Wash	N/A	N/A	N/A	5/1/1977	N/A
Coyote Creek Channel	N/A	N/A	N/A	4/1/1978	N/A
East Richfield Channel	N/A	N/A	N/A	10/1/1978	N/A
El Modena-Irvine Channel	N/A	N/A	N/A	2009	N/A
English Canyon	N/A	N/A	N/A	3/1/1973	N/A
Facility No. J05	N/A	N/A	N/A	12/3/2009	N/A
Handy Creek	12/3/2009	N/A	N/A	12/3/2009	Orange County
Hickey Canyon	N/A	N/A	N/A	3/1/1973	N/A
Horno Creek	N/A	N/A	N/A	2/1/1978	N/A
Houston Storm Channel	N/A	N/A	N/A	5/1/1975	N/A
Huntington Beach Channel (D01)	N/A	N/A	N/A	2009	N/A
La Miranda Creek Channel	N/A	N/A	N/A	2009	N/A
La Paz Channel	N/A	N/A	N/A	1/1/1984	N/A
Laguna Canyon	12/03/2009	URS, Dewberry, Schaaf, Wheeler, Airborne 1 and TerraPoint	EMF-2003-CO-0047, Task Order 014	3/1/2006	Laguna Beach, City of
Loftus Diversion Channel	N/A	N/A	N/A	3/1/1978	N/A
Memory Garden Storm Channel	N/A	N/A	N/A	3/1/1978	N/A

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Modjeska Canyon	N/A	N/A	N/A	3/1/1973	N/A
Narco Channel (J04) (North Sulphur Creek)	N/A	N/A	N/A	12/3/2009	N/A
Niguel Canyon (Emerald Bay Channel)	N/A	N/A	N/A	3/1/1973	N/A
Niguel Storm Drain (J03P01)	N/A	N/A	N/A	3/1/1973	N/A
Oso Creek	N/A	N/A	N/A	12/3/2009	N/A
Peters Canyon Wash Channel	N/A	N/A	N/A	3/1/1978	N/A
Salt Creek	N/A	N/A	N/A	UNKNOWN	N/A
San Diego Creek	N/A	N/A	N/A	UNKNOWN	N/A
San Gabriel River	N/A	N/A	N/A	2014	N/A
San Juan Creek	N/A	N/A	N/A	3/1/1973	N/A
San Juan Creek	09/30/1993	Schaaf and Wheeler, Inc.	EMW-89-C-2843	1/1/1992	Orange County
Sand Canyon Wash	N/A	N/A	N/A	1/1/1978	N/A
Santa Ana River	N/A	N/A	N/A	10/1/1978	N/A
Santa Ana-Santa Fe Channel	N/A	N/A	N/A	3/1/1978	N/A
Santiago Creek	N/A	N/A	N/A	9/1/1978	N/A
Santiago Creek (Upper)	N/A	N/A	N/A	3/1/1973	N/A
Segunda Deschecha Canada	N/A	N/A	N/A	11/1/1977	N/A

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Segunda Deschecha Canada Tributary	N/A	N/A	N/A	11/1/1977	N/A
Serrano Creek	09/30/1993	Schaaf and Wheeler, Inc.	EMW-89-C-2843	1/1/1992	Orange County
Shady Canyon Wash	N/A	N/A	N/A	1/1/1978	N/A
Silverado Canyon	N/A	N/A	N/A	3/1/1973	N/A
Sulphur Creek	N/A	N/A	N/A	3/1/1973	N/A
Talbert Channel (D02)	N/A	N/A	N/A	4/1/1980	N/A
Trabuco Creek	09/30/1993	Schaaf and Wheeler, Inc.	EMW-89-C-2843	1/1/1992	Orange County
Veeh Creek (San Diego Creek Tributary 2)	N/A	N/A	N/A	1/1/1978	N/A
Veeh Creek Tributary 1 (San Diego Creek Tributary 1)	N/A	N/A	N/A	1/1/1978	N/A

7.2 Community Meetings

The dates of the community meetings held for this Flood Risk Project are shown in Table 30. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 30: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Aliso Viejo, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Anaheim, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Brea, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Buena Park, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Costa Mesa, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Cypress, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Dana Point, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Fountain Valley, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Fullerton, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Garden Grove, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Huntington Beach, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Irvine, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
La Habra, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
La Palma, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Laguna Beach, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Laguna Hills, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Laguna Niguel, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Laguna Woods, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Lake Forest, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Los Alamitos, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Mission Viejo, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Newport Beach, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Orange, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Orange County, Unincorporated Areas	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, Orange County Flood Control Division, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, Orange County Flood Control Division, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, Orange County Flood Control Division, and the study contractor
Placentia, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Rancho Santa Margaritia, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
San Clemente, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
San Juan Capistrano, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Santa Ana, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Seal Beach, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Stanton, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Tustin, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Villa Park, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Westminster, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor
Yorba Linda, City of	9/9/9999	01/11/2012	Initial CCO Meeting	FEMA, the community, and the study contractor
		03/08/2016	Flood Risk Review	FEMA, the community, and the study contractor
		9/9/9999	Final CCO Meeting	FEMA, the community, and the study contractor

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see www.fema.gov.

The additional data that was used for this project includes the FEMA Region IX coastal engineering study of the Open Pacific Coast (OPC) of California which was completed in January 2016.

Table 31 is a list of the locations where FIRMs for Orange County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 31: Map Repositories

Community	Address	City	State	Zip Code
Aliso Viejo, City of	City Hall, 12 Journey Suite 100	Aliso Viejo	CA	92656
Anaheim, City of	City Hall, 200 South Anaheim Boulevard	Anaheim	CA	92805
Brea, City of	Civic and Cultural Center, 1 Civic Center Circle	Brea	CA	92821
Buena Park, City of	City Hall, 6650 Beach Boulevard	Buena Park	CA	90622
Costa Mesa, City of	City Hall, 77 Fair Drive	Costa Mesa	CA	92626
Cypress, City of	City Hall, 5275 Orange Avenue	Cypress	CA	90630
Dana Point, City of	City Hall, 33282 Golden Lantern Street	Dana Point	CA	92629
Fountain Valley, City of	City Hall, 10200 Slater Avenue	Fountain Valley	CA	92708
Fullerton, City of	City Hall, 303 W. Commonwealth Avenue	Fullerton	CA	92832
Garden Grove, City of	City Hall, 11222 Acacia Parkway	Garden Grove	CA	92840
Huntington Beach, City of	City Hall, 2000 Main Street	Huntington Beach	CA	92648
Irvine, City of	City Hall, 1 Civic Center Plaza	Irvine	CA	92623

Community	Address	City	State	Zip Code
La Habra, City of	City Hall, 201 E. La Habra Boulevard	La Habra	CA	90633
La Palma, City of[1]	City Hall, 7822 Walker Street	La Palma	CA	90623
Laguna Beach, City of	City Hall, 505 Forest Avenue	Laguna Beach	CA	92651
Laguna Hills, City of	City Hall, 24035 El Toro Road	Laguna Hills	CA	92653
Laguna Niguel, City of	City Hall, 30111 Crown Valley Parkway	Laguna Niguel	CA	92677
Laguna Woods, City of	City Hall, 24264 El Toro Road	Laguna Woods	CA	92637
Lake Forest, City of	City Hall, 25550 Commercentre Drive, Suite 100	Lake Forest	CA	92630
Los Alamitos, City of	City Hall, 3191 Katella Avenue	Los Alamitos	CA	90720
Mission Viejo, City of	City Hall, 200 Civic Center	Mission Viejo	CA	92691
Newport Beach, City of	City Hall, 100 Civic Center Drive	Newport Beach	CA	92660
Orange, City of	City Hall, 300 E. Chapman Avenue	Orange	CA	92866
Orange County, Unincorporated Areas	Orange County Flood Control Division, 300 North Flower Street	Santa Ana	CA	92703
Placentia, City of	City Hall, 401 E. Chapman Avenue	Placentia	CA	92870
Rancho Santa Margaritia, City of	City Hall, 22112 El Paseo	Rancho Santa Margaritia	CA	92688
San Clemente, City of	City Hall, 100 Avenida Presidio	San Clemente	CA	92672
San Juan Capistrano, City of	City Hall, 32400 Paseo Adelanto	San Juan Capistrano	CA	92675
Santa Ana, City of	City Hall, 20 Civic Center Plaza	Santa Ana	CA	92701
Seal Beach, City of	City Hall, 211 8th Street	Seal Beach	CA	90740
Stanton, City of	City Hall, 7800 Katella Avenue	Stanton	CA	90680

Community	Address	City	State	Zip Code
Tustin, City of	City Hall, 300 Centennial Way	Tustin	CA	92780
Villa Park, City of	City Hall, 17855 Santiago Boulevard	Villa Park	CA	92861
Westminster, City of	City Hall, 8200 Westminster Boulevard	Westminster	CA	92683
Yorba Linda, City of	City Hall, 4845 Casa Loma Avenue	Yorba Linda	CA	92886

[1] No Special Flood Hazard Areas Identified

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 32.

Table 32 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the State NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of State and local GIS data in their state.

Table 32: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/engineering-library
NFIP website	www.fema.gov/national-flood-insurance-program
NFHL Dataset	msc.fema.gov
FEMA Region IX	1111 Broadway, Suite 1200 Oakland, CA 94607 (510) 627-7029
Other Federal Agencies	
USGS website	www.usgs.gov
Hydraulic Engineering Center website	www.hec.usace.army.mil
State Agencies and Organizations	

State NFIP Coordinator	Ricardo Pineda, PE, CFM California Dept. of Water 1416 9th Street, Room 1601 Sacramento, CA 95814 (916) 574-0611 rpineda@water.ca.gov
State GIS Coordinator	James Eto California Dept. of Water Resources 3464 El Camino Avenue, Suite 200 Sacramento, CA 95821 (916) 574-1409 jeto@water.ca.gov

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 33 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 33: Bibliography and References

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
NGS 2009	National Geodetic Survey	*Geodetic bench mark positions and descriptions*		Silver Spring, MD	12/3/2009	
12-09-1324S	FEMA	*Orange County, California, USA and Incorporated Areas, Digital Flood Insurance Rate Map OPC PMR*	FEMA	Washington, D.C.	10/19/2015	
FEMA 2004	Federal Emergency Management Agency	*Flood Insurance Study*	FEMA	Washington, D.C.	2/18/2004	
FEMA 2009a	Federal Emergency Management Agency	*Orange County, California, USA and Incorporated Areas, Digital Flood Insurance Rate Map*	FEMA	Washington, D.C.	12/3/2009	
2005 NAIP	U.S. Department of Agriculture Farm Service Agency	*National Agriculture Imagery Program*		Washington, D.C.	1/1/2005	
Orange DPW 2007	Orange County Department of Public Works	*Orange County, California, USA and Incorporated Areas Jurisdictional Boundaries*		Santa Ana, CA	11/26/2007	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FEMA 2009b	Federal Emergency Management Agency	*Orange County, California, USA and Incorporated Areas, Digital Flood Insurance Rate Map san gabriel river x protected*	FEMA	Washington, D.C.	12/3/2009	
FEMA 2009c	Federal Emergency Management Agency	*Orange County, California, USA and Incorporated Areas, Digital Flood Insurance Rate Map aliso creek*	FEMA	Washington, D.C.	12/3/2009	
FEMA 2004	Federal Emergency Management Agency	*MAPIX Task Order 14 - Laguna Beach Restudy*	FEMA	Washington, D.C.	10/23/2004	
2014 NAIP	U.S. Department of Agriculture Farm Service Agency	*National Agriculture Imagery Program*		Washington, D.C.	1/1/2014	
NOAA 2011	NOAA's Ocean Service, Coastal Services Center (CSC)	*Coastal California LiDAR and Digital Imagery*		Charleston, SC	9/12/2011	http://www.csc.noaa.gov/dataviewer
various	FEMA	*Various Letters of Map Revision, Orange County, California, USA and Incorporated Areas*	FEMA	Washington, D.C.	various	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USDC 2015	U.S. Department of Commerce	*TIGER/Line Shapefile, 2015, county, Orange County, CA, All Roads County-based Shapefile*	U.S. Census Bureau		2015	
USGS various dates	USGS	*USGS 7.5-Minute Quadrangle Grid*		Redlands, CA	various	
AbAerial 1978	Abrams Aerial Survey Corporation	*Aerial Photographs*			August 1978	
WRD 1987	U.S. Department of the Interior, Geological Survey	*Water Resources Data California, Water Year 1985, Volume 1, page 139*	Bowers, McConaughy, Polinoski, and Smith	California	1987	https://pubs.er.usgs.gov
Boyle 1973	Boyle Engineering Corporation				October 1973	
Boyle 1972	Boyle Engineering Corporation	*Master Plan of Drainage, Santa Ana Canyon Area*			October 1972	
Brea 1966	City of Brea	*Topographic Maps, City of Brea, Scale 1:4,800, Contour Interval 5 feet*			2/3/1966	
Laguna Beach 1960	City of Laguna Beach	*Topographic Maps for the City of Laguna Beach, Scale 1:2,400, Contour Intervals 2 and 4 feet.*			October 1960	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Clemente Undated	City of San Clemente	*Topographic Maps of City of San Clemente, California, Scale 1:6,000, Contour Interval 5 feet*				
Capistrano 1967	City of San Juan Capistrano Topographic Maps, Scale 1:4,800	*Topographic Maps, Scale 1:4,800*			1967	
Geology 1981	California Geology	Tsunamis	Diane Pierzinski		March 1981	
Pearson 1970	E. L. Pearson and Associates	*Aerial Photographs, Santa Ana River, Scale 1:2,400, Contour Interval 4 feet*			June 1970	
Pearson 1969	E. L. Pearson and Associates	*Master Plan of Drainage for the El Modena-Irvine Area, Orange County*			November 1969	msc.fema.gov
FEMA 1985	Federal Emergency Management Agency	*Flood Insurance Study, City of Seal Beach, Orange County, California*		Washington, D.C.	September 1985	
FEMA 1984	Federal Emergency Management Agency	*Coastal Flood Frequencies in Southern California*	Donald M. Thomas, Dame & Moore	Washington, D.C.	July 1984	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FEMA 1982a	Federal Emergency Management Agency	*Flood Insurance Study, City of Huntington Beach, Orange County, California*		Washington, D.C.	August 1982	msc.fema.gov
FEMA 1982b	Federal Emergency Management Agency	*Flood Insurance Study, City of Fountain Valley, Orange County, California*		Washington, D.C.	May 1982	msc.fema.gov
FEMA 1982c	Federal Emergency Management Agency	*Flood Insurance Study, City of Costa Mesa, Orange County, California*		Washington, D.C.	March 1982	msc.fema.gov
FEMA 1982d	Federal Emergency Management Agency	*Flood Insurance Study, City of Westminster, Orange County, California*		Washington, D.C.	March 1982	msc.fema.gov
FEMA 1982e	Federal Emergency Management Agency	*Flood Insurance Study, City of Garden Grove, Orange County, California*		Washington, D.C.	March 1982	msc.fema.gov
FEMA 1981	Federal Emergency Management Agency	*Flood Insurance Study, City of Yorba Linda, Orange County, California*		Washington, D.C.	May 1981	msc.fema.gov
FEMA 1980	Federal Emergency Management Agency	*Flood Insurance Study, City of Brea, Orange County, California*		Washington, D.C.	June 1980	msc.fema.gov

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FEMA 1979a	Federal Emergency Management Agency	*Flood Insurance Study, City of Anaheim, Orange County, California*		Washington, D.C.	December 1979	msc.fema.gov
FEMA 1979b	Federal Emergency Management Agency	*Flood Insurance Study, City of La Habra, Orange County, California*		Washington, D.C.	August 1979	msc.fema.gov
FEMA 1979c	Federal Emergency Management Agency	*Flood Insurance Study, City of Placentia, Orange County, California*		Washington, D.C.	August 1979	msc.fema.gov
Harris Undated	Harris-Toups Associates	*Topographic Maps for the City of San Juan Capistrano, California, Scale 1:4,800, Contour Interval 4 feet*				
Jennings 1973	Jennings-Halderman-Hood	*Master Plan of Drainage, San Joaquin Hill Area, Orange County*			May 1973	
Keith 1974	Keith and Associates	*Master Plan of Drainage for the Canyon Area, Orange County*			February 1974	
Keith 1970	Keith and Associates	*Master Plan of Drainage for the Ranch-Bryan Area*			October 1970	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Keith 1987	Keith Companies	*Topographic Maps of the City of San Juan Capistrano, California, Scale 1:480 Contour Interval 1 foot*			1987	
Lampman undated	Lampman and Associates	*Master Plan of Drainage for the Telegraph Canyon Area, Orange County*				
Lowry 1969	Lowry Engineering-Science	*Master Plan of Drainage for the San Juan Capistrano, Capistrano Beach Area, Orange County*			December 1969	
More 1977	Moore and Taber, Consulting Engineers and Geologists	*Levee Embankment Stability: Santiago Creek from Santiago Canyon Road to Modjeska Canyon Road, Job No. 177-33*			July 19, 1977	
OCEMA 1986a	Orange County Environmental Management Agency	*Orange County Hydrology Manual*		Orange County. CA	October 1986	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
OrangeFC 1959	Orange County Flood Control District	*Topographic Maps of Laguna Canyon, Scale 1:2,400, Contour Intervals 2 and 4 feet*		Orange County. CA	October 1959	
OCEMA 1986b	Orange County Environmental Management Agency	*Topographic Map for Trabuco Creek, Scale 1:2,400, Contour Interval 5 feet*		Orange County. CA	1986	
Pacific 1960	Pacific Air Industries	*Orange County Flood Control District Topographic Maps, Scale 1:1,200*			1960	
Raub 1984	Raub, Bien, Frost & Associates	*Topographic Maps of the City of San Juan Capistrano, Scale 1:480, Contour Interval 1 foot*			1984	
Raub 1973	Raub, Bien, Frost & Associates	*Master Plan of Drainage for the Ortega Area, Orange County*			June 1973	
Raub 1972a	Raub, Bien, Frost & Associates	*Photogrammetric Maps, Santa Ana, California, Scale 1:1,200, Contour Interval 2 Feet*			August 30, 1972	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Raub 1972b	Raub, Bien, Frost & Associates	*Aerial Topographic Maps, Orange County, California, Scale 1:1,200, Contour Interval 2 feet*			1972	
Raub 1972c	Raub, Bien, Frost & Associates	*Topographic Maps of Santiago Creek, Scale 1:2,400, Contour Interval 2 feet*			1972	
Raub 1971	Raub, Bien, Frost & Associates	*Master Plan of Drainage for the Viejo Area, Orange County*			September 1971	
Raub 1931	Raub, Bien, Frost & Associates	*Final Draft, Master Plan of Drainage for the East Irvine Area, Orange County*			June 1913	
SIO 1980	Scripps Institution of Oceanography	*Artificial Sediment Transport and Structures in Coastal Southern California*	Martha J. Shaw		December 1980	
Tetra 1982	Tetra Tech, Inc	*Methodology for Computing Coastal Flood Statistics in Southern California, Report No. TC-320S*			1982	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Irvine 1960	The Irvine Company	*Topographic Maps of IrvineÆs Subdivision, Scale 1:2,400, Contour Intervals 1 and 5 feet*			July 1960	
Toups 1977a	Toups Corporation	*Topographic Maps of City of Placentia, Scale 1:2.400, Contour Interval 4 feet*			June 1977	
Toups 1977b	Toups Corporation	*Topographic Maps, Scale 1:2,400, Contour Interval 4 feet*			April 1977	
Toups 1977c	Toups Corporation	*Aerial Photographs, City of Anaheim, Scale 1:2,400, Contour Interval 4 feet*			April 1977	
Toups 1977d	Toups Corporation	*Aerial Photographs, City of San Juan Capistrano, Scale 1:2,400*			April 1977	
Toups 1976	Toups Corporation	*Photogrammetric Maps, Buena Park, California, Scale 1:2,400, Contour Interval 4 feet*			December 1976	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Toups 1972	Toups Corporation	*Topographic Maps, Scale 1:2,400, Contour Interval 4 feet*			1972	
Toups 1960	Toups Corporation	*Topographic Maps for City of Tustin, Scale 1:2,400, Contour Intervals 2 and 4 feet*			October 1960	
Toups 1973	Toups Engineering, Inc	*Master Plan of Drainage for the Central Irvine Ranch Area, Orange County*			October 1973	
Toups 1971a	Toups Engineering, Inc	*Master Plan of Drainage for the Laguna Hills Area, Orange County*			September 1971	
Toups 1971b	Toups Engineering, Inc	*Master Plan of Drainage for Alisos Area, Orange County*			August 1971	
Topus 1969	Toups Engineering, Inc	*Master Plan of Drainage for the Irvine Ranch-Valencia Area, Orange County*			August 1969	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USACE 1977	U.S. Army Corps of Engineers	*Hydrology for Flood Plain Information Studies, San Diego Creek and Tributaries, Orange County*			1977	www.usace.army.mil
USACE 1976	U.S. Army Corps of Engineers	*HEC-6 Sediment-Transport Computer Program*			November 1976	www.usace.army.mil
USACE 1975	U.S. Army Corps of Engineers	*Review Report on the Santa Ana River Main Stem (Including Santiago Creek and Oak Street Drain*			December 1975	www.usace.army.mil
USACE 1974a	U.S. Army Corps of Engineers	*Flood Plain Information, Tributaries of Upper San Diego Creek*			December 1974	www.usace.army.mil
USACE 1974b	U.S. Army Corps of Engineers	*Hydrology for Flood Plain Information Studies, Upper Peters Canyon Wash, Upper San Diego Creek, and Tributaries, Orange County*			July 15, 1974	www.usace.army.mil
USACE 1973a	U.S. Army Corps of Engineers	*HEC-1 Flood Hydrograph Package*			1973	www.usace.army.mil

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USACE 1973b	U.S. Army Corps of Engineers	*HEC-2 Water-Surface Profiles, Generalized Computer Program*			October 1973	www.usace.army.mil
USACE 1973c	U.S. Army Corps of Engineers	*Flood Plain Information, Lower Santiago Creek*			June 1973	www.usace.army.mil
USACE 1973d	U.S. Army Corps of Engineers	*Flood Plain Information, Aliso Creek, Orange County*			March 1973	www.usace.army.mil
USACE 1972a	U.S. Army Corps of Engineers	*Flood Plain Information, San Diego Creek and Peters Canyon Wash, Orange County*			June 1972	www.usace.army.mil
USACE 1972b	U.S. Army Corps of Engineers	*Flood Plain Information, Upper Peters Canyon Wash*			June 1972	www.usace.army.mil
USACE 1971a	U.S. Army Corps of Engineers	*National Shoreline Study: California Regional Inventory*			August 1971	www.usace.army.mil
USACE 1971b	U.S. Army Corps of Engineers	*Flood Plain Information, Santa Ana River (Imperial Highway to Prado Dam)*	Los Angeles District		June 1971	www.usace.army.mil

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USACE 1970	U.S. Army Corps of Engineers	*Flood Plain Information, San Juan Creek (Including Arroyo Trabuco and Oso Creek), Orange County*	Los Angeles District		November 1970	www.usace.army.mil
USACE 1969	U.S. Army Corps of Engineers	*Flood Plain Information, Laguna Canyon, Orange County*	Los Angeles District		March 1969	www.usace.army.mil
USDA 1964	U.S. Department of Agriculture, Soil Conservation Service	*National Engineering Handbook*			August 1964	
FIA 1979a	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Orange, Orange County*			June 1979	
FIA 1979b	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of San Clemente, Orange County*			June 1979	
FIA 1979c	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Villa Park, Orange County*			June 1979	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FIA 1979d	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Laguna Beach, Orange County*			March 1979	
FIA 1979e	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of San Juan Capistrano, Orange County*			March 1979	
FIA 1979f	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Santa Ana, Orange County*			March 1979	
FIA 1979g	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Tustin, Orange County*			March 1979	
FIA 1978	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Buena Park, Orange County*			August 1978	
FIA 1978	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Newport Beach, Orange County*			March 1978	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FIA 1978	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Irvine, Orange County*			January 1978	
FIA 1977	U.S. Department of Housing and Urban Development, Federal Insurance Administration	*Flood Insurance Study, City of Fullerton, Orange County*			July 1977	
USGS 1981	U.S. Department of the Interior, Geological Survey, Office of Water Data Coordination	*Guidelines for Determining Flood Flow Frequency,ö Bulletin 17B*			September 1981	
USGS Undated	U.S. Department of the Interior, Geological Survey	*7.5-Minute Series Topographic Maps, Scale 1:24,000, Dana Point, Laguna Beach, Long Beach, Los Alamitos, Newport Beach, San Clemente, San Juan Capistrano, Seal Beach, Tustin, Anaheim, Orange and La Habra*		Washington, D.C.	Various	topomaps.usgs.gov
USGS 1974	U.S. Department of the Interior, Geological Survey	*Digital Simulation of the Effects of Urbanization on Runoff in the Upper Santa Ana Valley, California*	T. J. Durban	Washington, D.C.	February 1974	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USGS 1970	U.S. Department of the Interior, Geological Survey	*Open-File Report, A Proposed Streamflow Data Program for California*	J. R. Crippen and R. M. Beall	Washington, D.C.	1970	
USGS 1977	U.S. Department of the Interior, Geological Survey	*A Method For Adjusting Values of ManningÆs Roughness Coefficient for Flooded Urban Areas, Volume 5*	H. R. Hejl and Lawrence Kans	Washington, D.C.	September-October 1977	
USWRC 1967	U.S. Water Resources Council	*A Uniform Technique for Determining Flood Flow Frequencies, Bulletin 15*			December 1967	
VTN 1974a	VTN Consolidated, Inc	*Aerial Photographs, Film 1J1-B*			August 28, 1974	
VTN1974b	VTN Consolidated, Inc	*Master Plan of Drainage for the Trabuco Canyon Area, Orange County*			February 1974	
VTN1972	VTN Consolidated, Inc	*Master Plan of, Drainage for the Esperanza Area, Orange County*			December 1972	
VTN 1971a	VTN Consolidated, Inc	*Master Plan of Drainage for Niguel Area, prepared for Orange County*			September 1971	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
VTN 1971b	VTN Consolidated, Inc	*Master Plan of Drainage for the Unincorporated West Orange County Area*			August 1971	
Willdan 1979	Willdan Associates	*Ortega Properties Assessment District A.D. 78-3, Scale 1:1,200 and 1:480, Contour Interval 1 foot*			1979 and 1980	
Williamson Undated	Williamson and Schmid	*Master Plan of Drainage for Industrial Area, Orange County*	Williamson and Schmid			
Yorba WD Undated	Yorba Linda County Water District	*Topographic Maps of the City of Yorba Linda, Contour Interval 2 feet*	Yorba Linda County Water District			
USGS 1993	U.S. Geological Survey	*Nationwide Summary of U.S. Geological Survey Regional Regional Equations for Estimating Magnitude and Frequency of Floods for Ungaged Sites*	M.E. Jennings, W.O. Thomas and H.C. Riggs	Washington, D.C.	1993	
USACE 2003	U.S. Army Corps of Engineers	*HEC-RAS, Version 3.1.1*	Hydrologic Engineering Center		2003	

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
OrangeFC 1966	Orange County Flood Control District	*As-Built Drawings "Bluebird Storm Drain - Ocean Outlet to Glenneyre Street*			November 1966	
FEMA 1997	Federal Emergency Management Agency	*Flood Insurance Study – Orange County, California, and Incorporated Areas*		Washington, D.C.	January 3, 1997	msc.fema.gov
OCEMA 1995	Orange County Environmental Management Agency	*Orange County Hydrology Manual, Addendum No. 1*		Orange County. CA		December 13, 1995
NRCS 2005	National Resources Conservation Service	*Soil Survey Geographic (SSURGO) database for Orange & Western Part of Riverside Counties in California*			January 2005	

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USGS 1993	U.S. Department of the Interior, Geological Survey	*Nationwide Summary of U.S. Geological Survey Regional Regression Equations for Estimating Magnitude and Frequency of Floods for Ungaged Sites, Water Resources Investigations 94-4002*			1993	
OrangePF 1999	County of OrangePublic Facilities & Resources Department	*Hydrology Study for Laguna Canyon Channel Facility I02 – Existing and Ultimate Condition*			March 1999	
USGS 1970	U.S. Department of the Interior, Geological Survey	*Open-File Report, A Proposed Streamflow Data program for California 1970*			1970	
FEMA 2003	Federal Emergency Management Agency	*Guidelines and Specifications for Flood Hazard Mapping Partners*			April 2003	