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# *Prioritizing Re-Mapping and Analyses of Rivermouths in California Coastal Areas Following FEMA Region IX's Coastal Re-Study*

Vince Geronimo, PE, CFM  
Operations Manager, Oakland, CA

Edward Curtis, PE, CFM  
FEMA RIX Regional Engineer



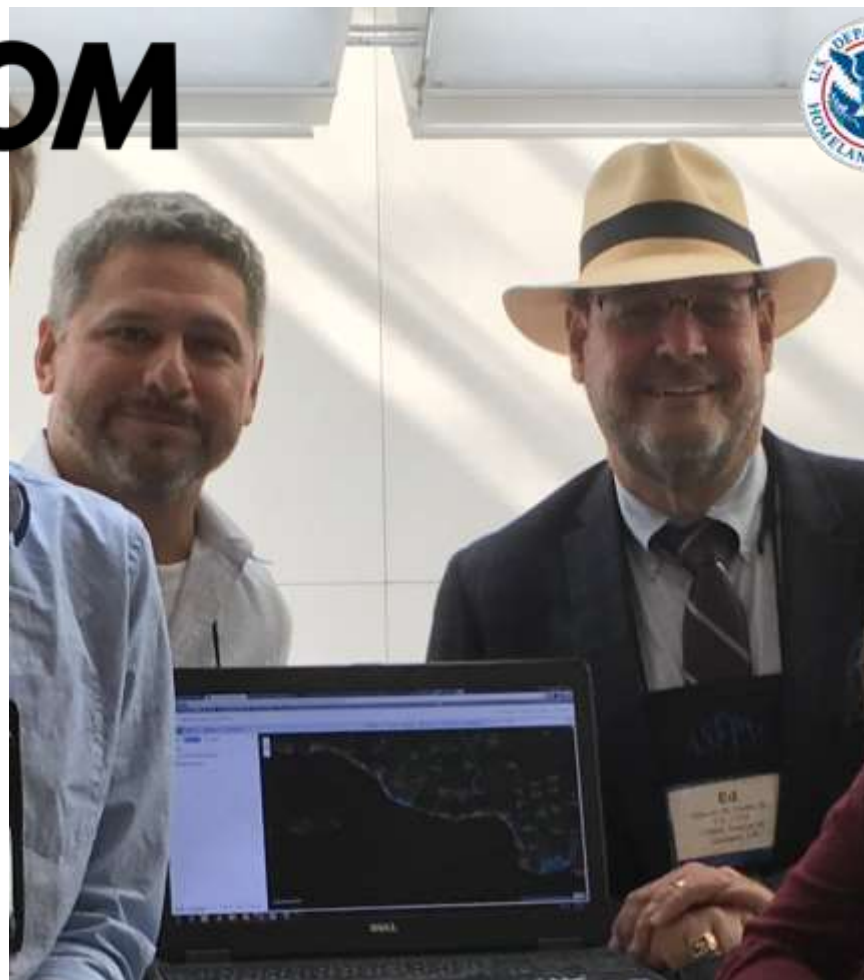
**Just as a drop of water in the ocean  
cannot avail much; but if a great  
river runneth into it, that maketh a  
great commotion**

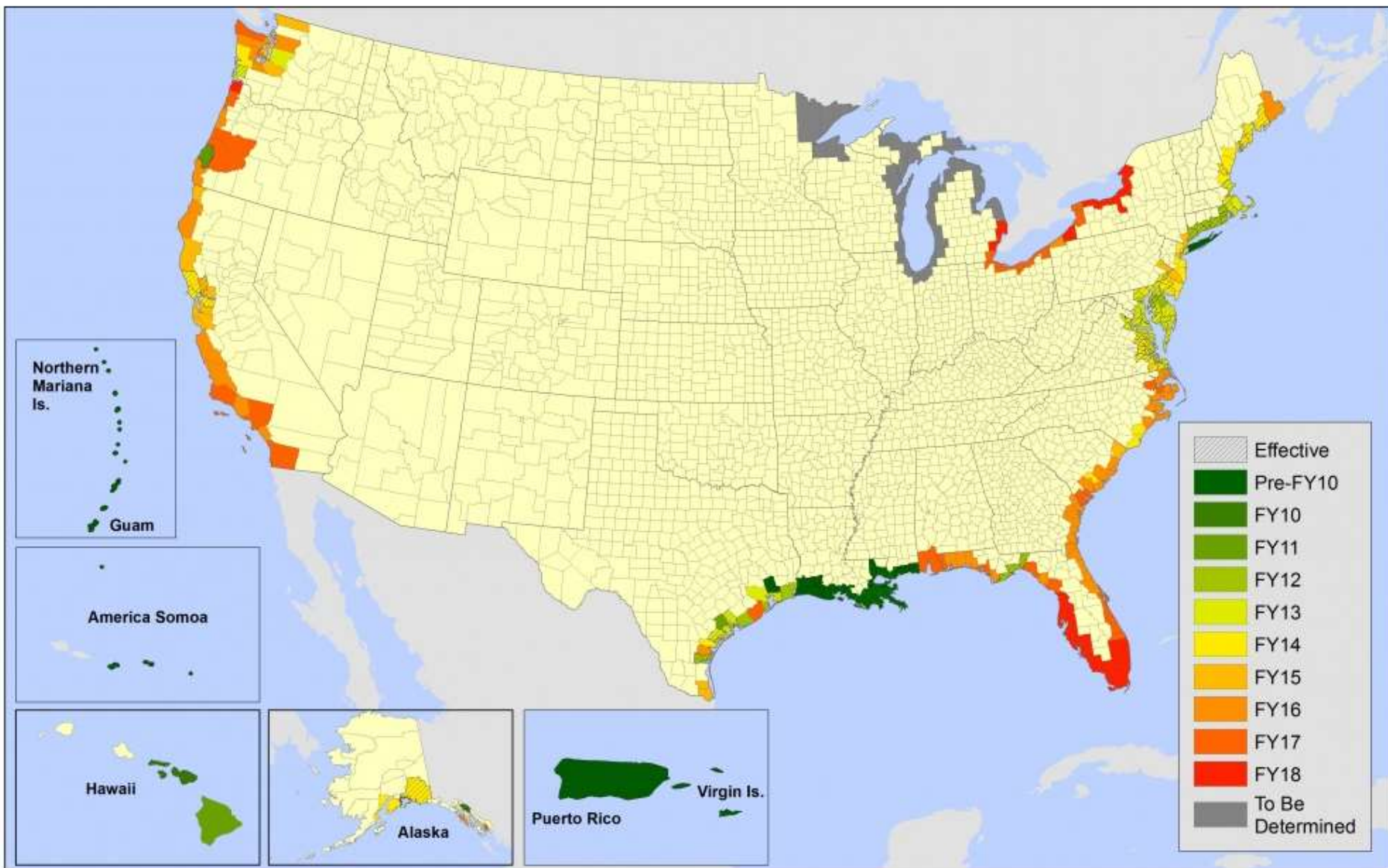
**Jakob Bohme (German Theologian b.1575)**

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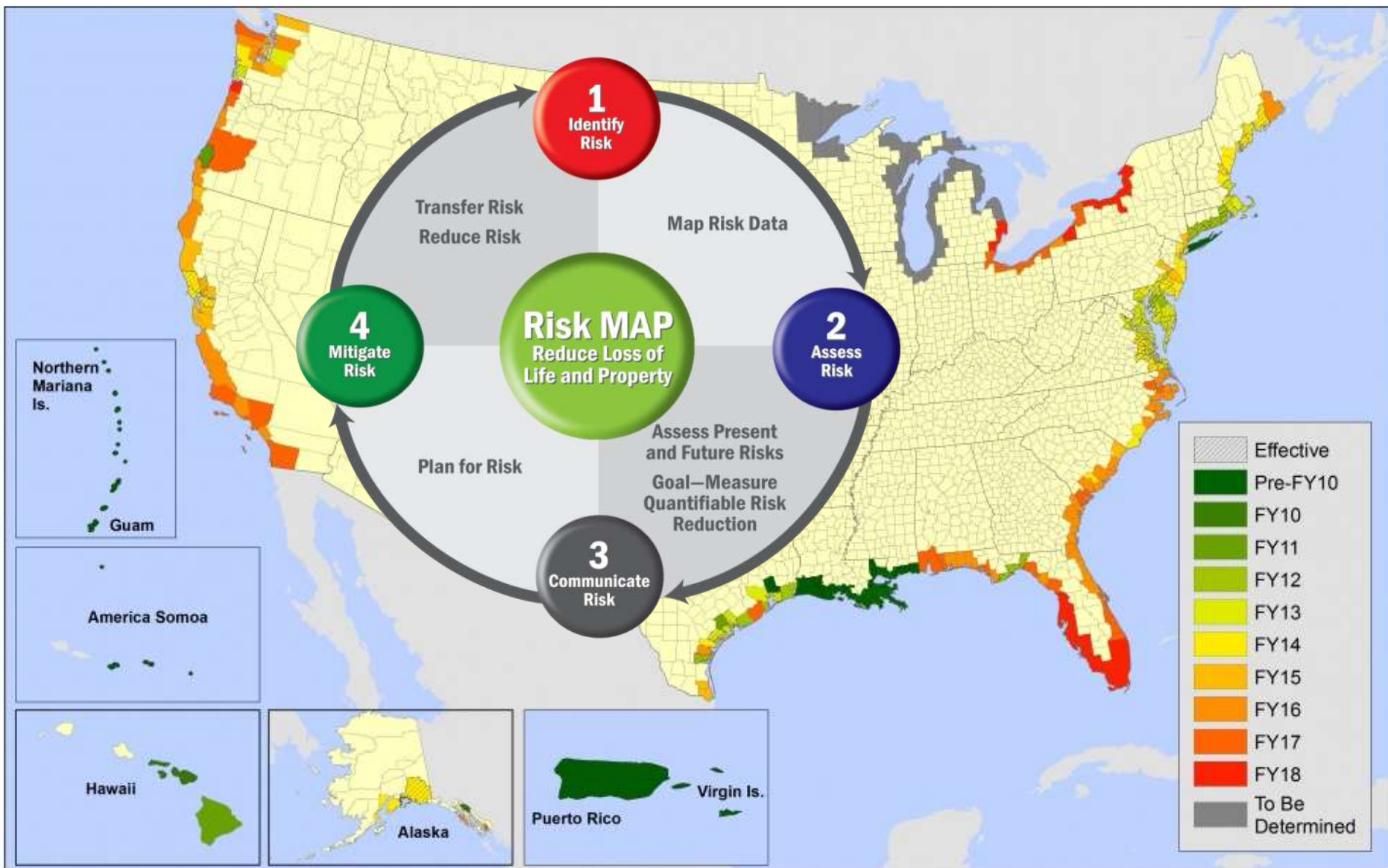


**FEMA**

A preliminary FIRM is a National Flood Insurance Program (NFIP) map that reflects the initial results of a flood risk project that is performed by or for FEMA. FIRMs are tracked by fiscal year (FY), which is October through September. Data is updated quarterly and therefore subject to change.  
 For more information, please call 1-877-FEMA MAP (1-877-336-2627), email [FEMAMapSpecialist@riskmapcde.com](mailto:FEMAMapSpecialist@riskmapcde.com), or visit <https://www.fema.gov/coastal-flood-risks>

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**FEMA**

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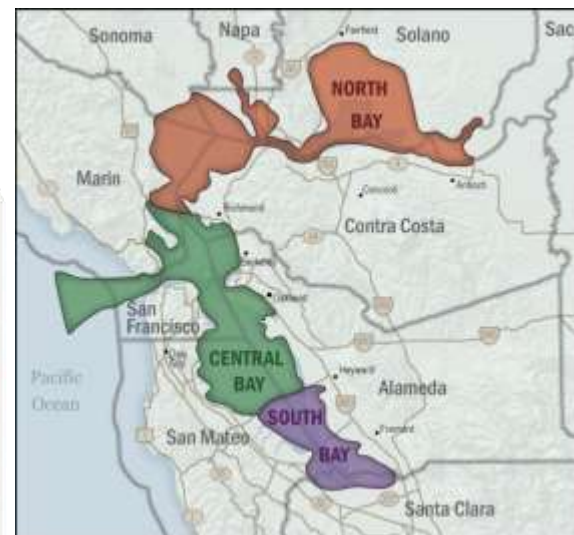




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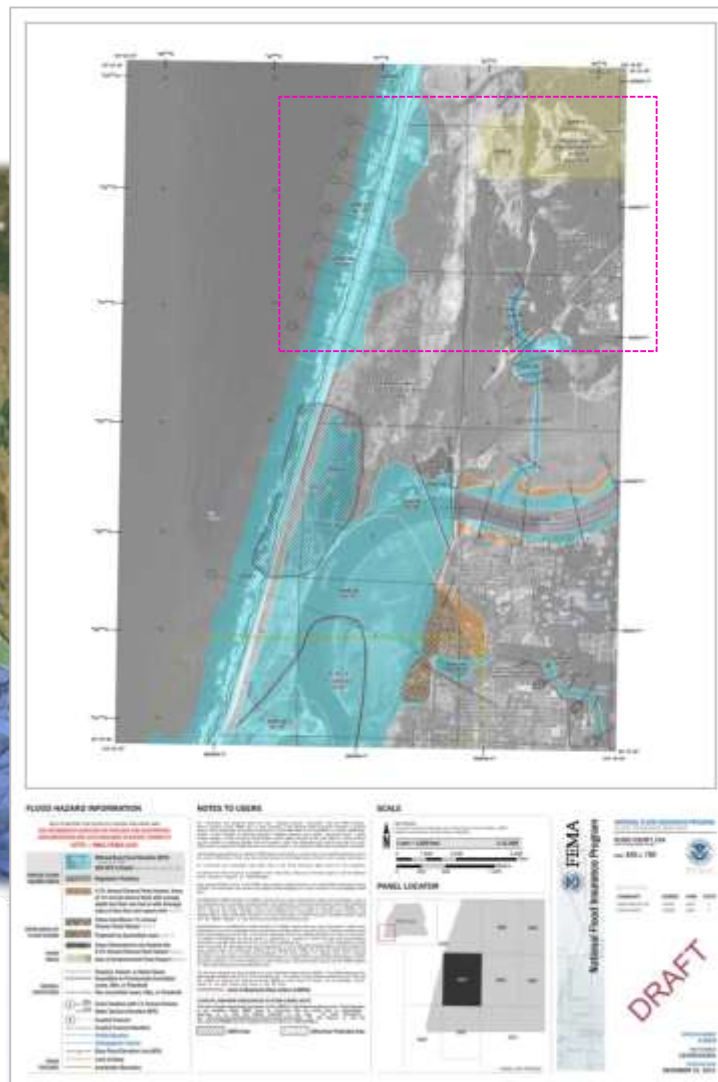
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Sonoma  
Marin  
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Monterey  
San Luis Obispo



San Diego





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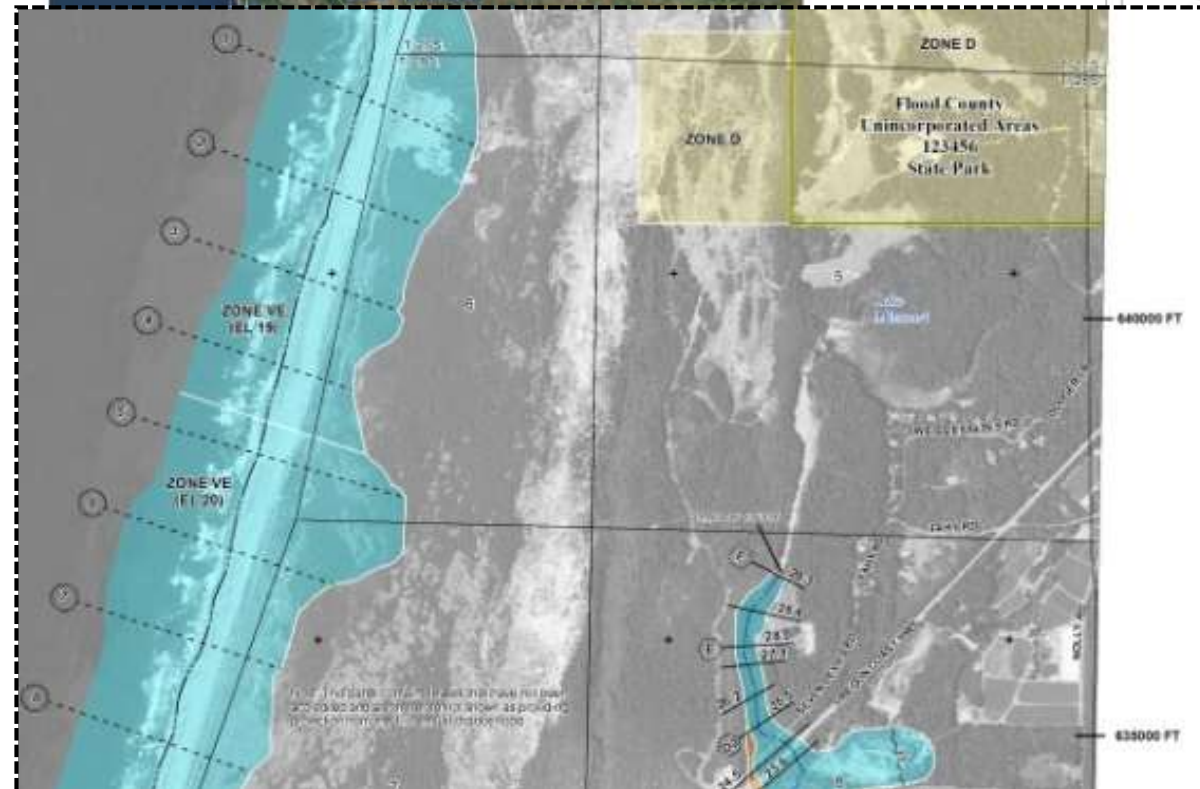


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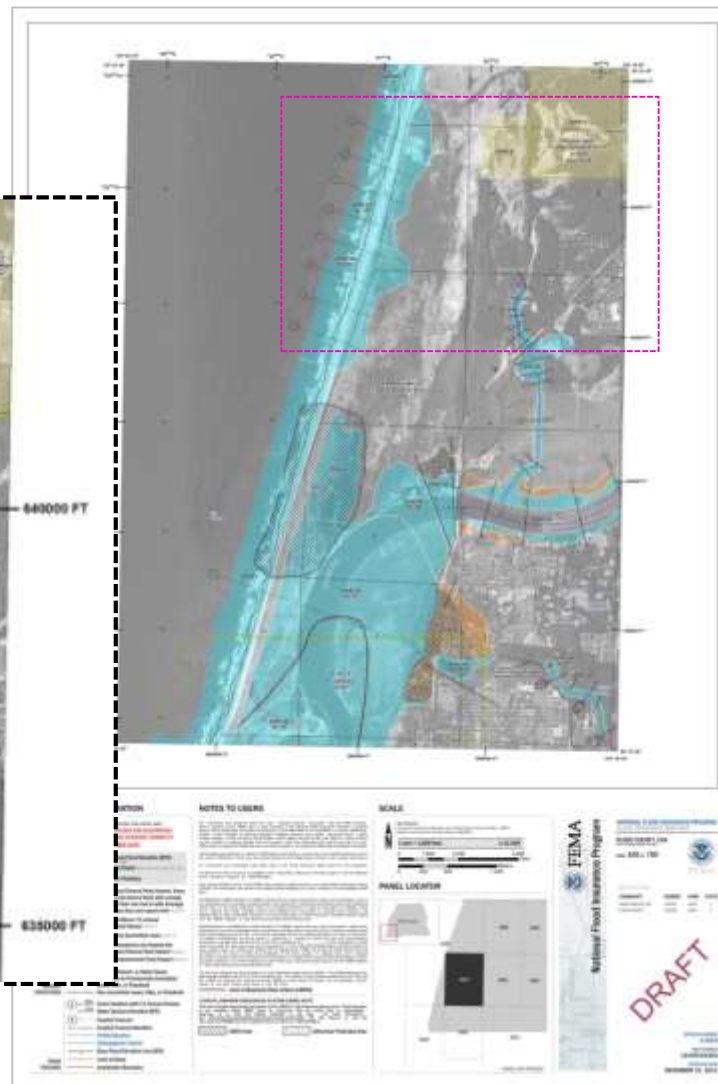


San Francisco  
9 Miles / 4 Panels / 1 Community

San Mateo



119 Miles / 34 Panels / 4 Communities

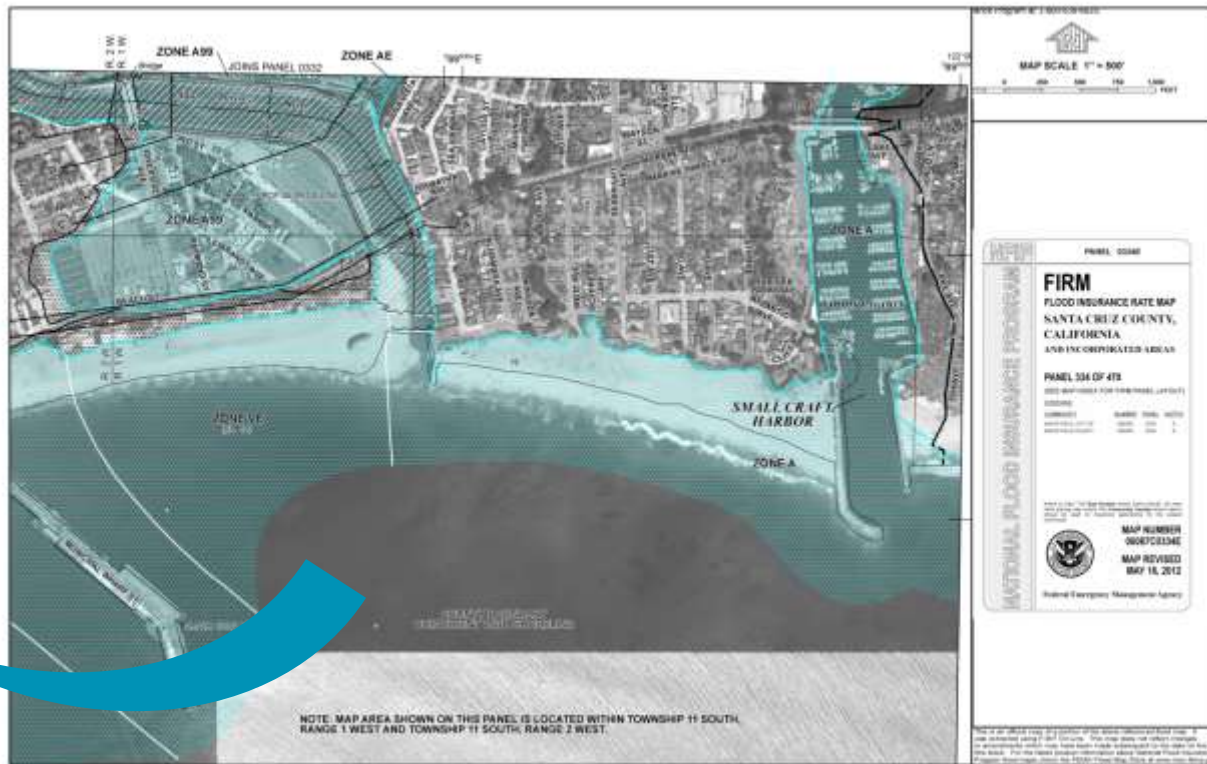
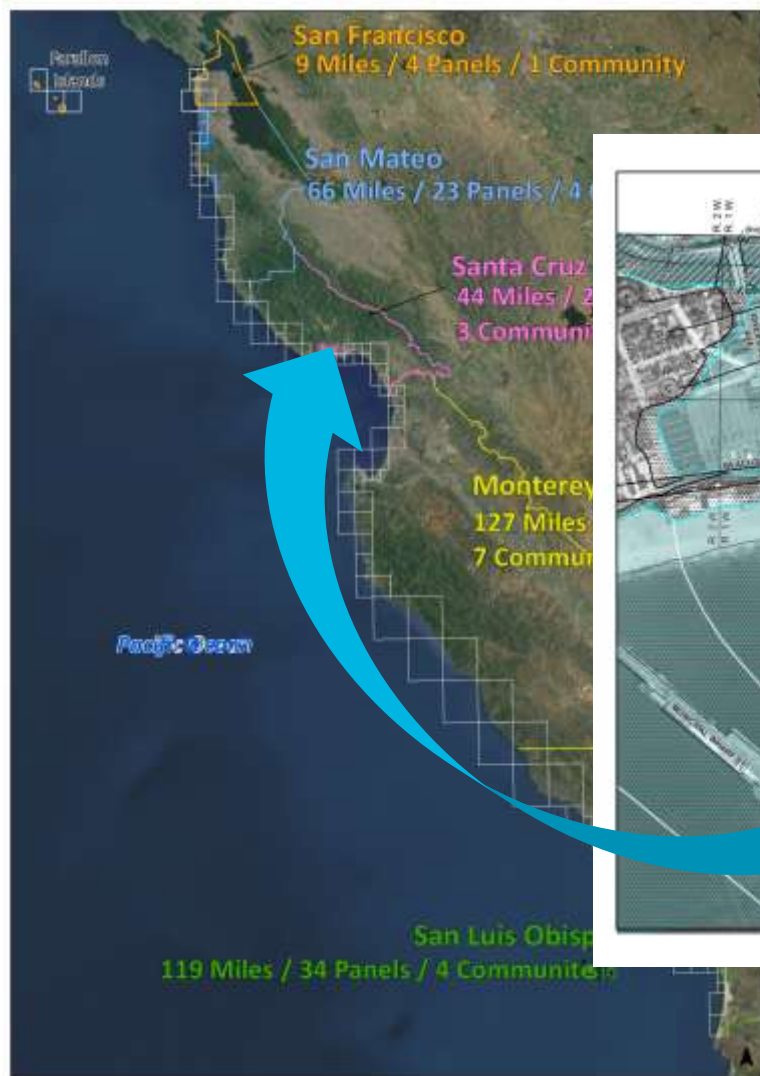




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# FLOOD INSURANCE STUDY



**SANTA CRUZ COUNTY,  
CALIFORNIA  
AND INCORPORATED AREAS**

Community Name	Community Number
CAPITOLA, CITY OF	060354
SANTA CRUZ, CITY OF	060355
SANTA CRUZ COUNTY (UNINCORPORATED AREAS)	060353
SCOTTS VALLEY, CITY OF	060356
WATSONVILLE, CITY OF	060357



REMOVED  
May 18, 2012



**Federal Emergency Management Agency**  
FLOOD INSURANCE STUDY NUMBER  
06087CV0008



# FLOOD INSURANCE STUDY



## SANTA CRUZ COUNTY, CALIFORNIA AND INCORPORATED AREAS

Community Name	Community Number
CAPITOLA, CITY OF	060354
SANTA CRUZ, CITY OF	060355
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REVISED  
May 16, 2012



**Federal Emergency Management Agency**

FLOOD INSURANCE STUDY NUMBER  
06087CV0008

# FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 3



## SANTA CRUZ COUNTY, CALIFORNIA AND INCORPORATED AREAS

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CAPITOLA, CITY OF	060354
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SANTA CRUZ COUNTY UNINCORPORATED AREAS	060353
SCOTTS VALLEY, CITY OF	060356
WATSONVILLE, CITY OF	060357



# FEMA

REVISED  
PRELIMINARY

OCT 31, 2016

REVISED:

FLOOD INSURANCE STUDY NUMBER:  
06087CV001C

Version Number 2.3.2.1

# FLOOD INSURANCE STUDY



## SANTA CRUZ COUNTY, CALIFORNIA AND INCORPORATED AREAS

Community Name	Community Number
CAPITOLA, CITY OF	060354
SANTA CRUZ, CITY OF	060355
SANTA CRUZ COUNTY (UNINCORPORATED AREAS)	060353
SCOTTS VALLEY, CITY OF	060356
WATSONVILLE, CITY OF	060357



Santa Cruz County

REVISED  
May 18, 2012



**Federal Emergency Management Agency**  
FLOOD INSURANCE STUDY NO. 06087CV0008

# FLOOD INSURANCE STUDY

## FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 3



## SANTA CRUZ COUNTY, CALIFORNIA AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
CAPITOLA, CITY OF	060354
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SANTA CRUZ COUNTY UNINCORPORATED AREAS	060353
SCOTTS VALLEY, CITY OF	060356
WATSONVILLE, CITY OF	060357

TABLE 6: SUMMARY OF STILLWATER ELEVATIONS

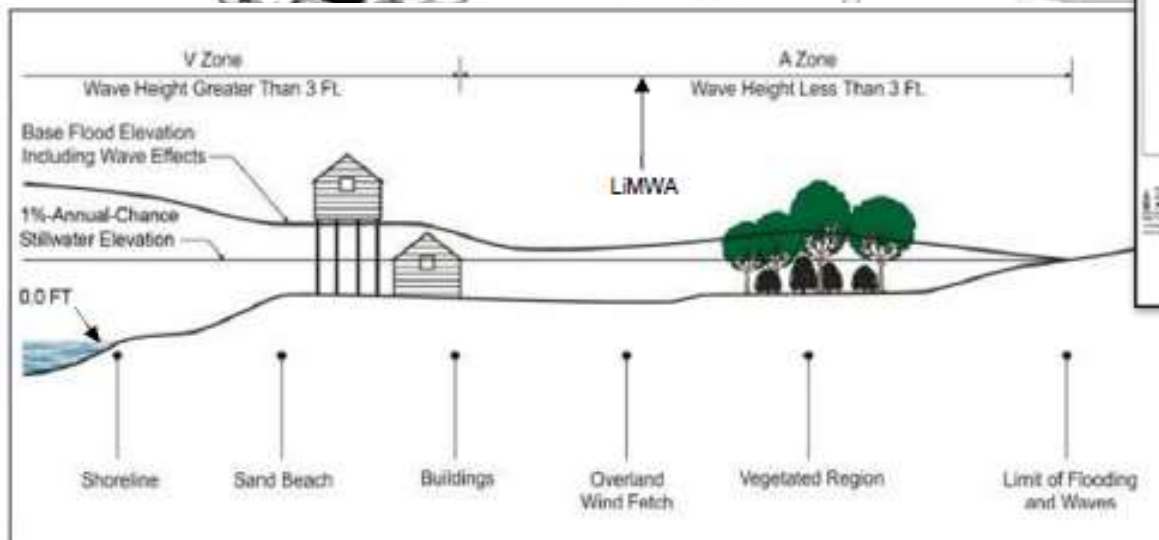
Flooding Source and Location	Stillwater Elevation (Feet NAVD)			
	10-percent	2-percent	1-percent	0.2-percent
COLLEGE LAKE NORTHWEST OF STATE HIGHWAY 152	66.9	72.2	72.9	74.5
SCHWANS LAGOON	13.5	15.3	15.8	16.5
LAKE TYNAN	44.2	44.5	44.6	45.0
PACIFIC OCEAN				
New Brighton State Beach	7.4	7.6	7.8	8.1
Seacliff State Beach	7.4	7.6	7.8	8.1
Sunset State Beach	7.3	7.5	7.6	7.8
Capitola State Beach	7.4	7.6	7.7	7.9
Cowell and Santa Cruz Beaches	7.4	7.6	7.7	7.9



# FLOOD INSURANCE STUDY



## FLOOD FEDERAL EMERGENCY VOLUME 1 OF 3



### STILLWATER ELEVATIONS

Stillwater Elevation (Feet NAVD)			
10-percent	2-percent	1-percent	0.2-percent
66.9	72.2	72.9	74.5
13.5	15.3	15.8	16.5
44.2	44.5	44.6	45.0
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May 18, 2012

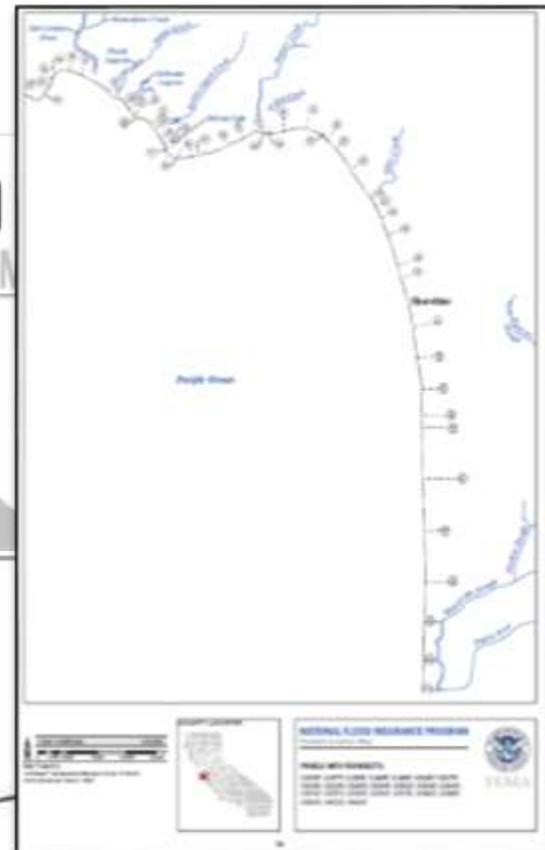
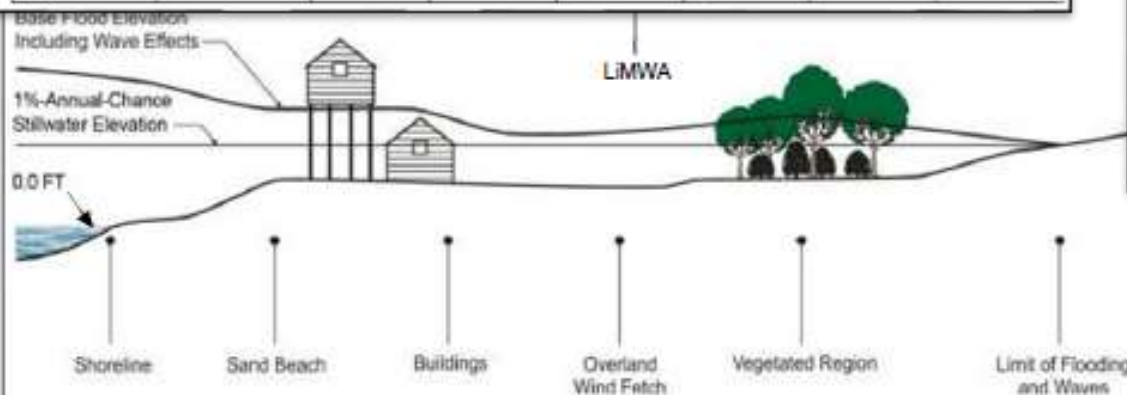


**Federal Emergency Management Agency**  
FLOOD INSURANCE STUDY NO. 06087CV0008

### PACIFIC OCEAN

New Brighton State Beach  
Seacliff State Beach  
Sunset State Beach  
Capitola State Beach  
Cowell and Santa Cruz Beaches

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Cornalitos Creek	Above confluence with Browns Creek	11.0	2,030	*	4,040	5,040	7,550
Coward Creek	At confluence with Pajaro River	3.2	310	*	460	600	1,250
Harkins Slough	At confluence with Pajaro River	9.8	860	*	1,920	2,540	4,140
Harkins Slough	Above confluence with Gallighan Slough	6.3	650	*	1,380	1,800	2,790
Moore Creek	At mouth	1.8	320	*	570	690	970
Moore Creek	At State Highway 1	1.4	270	*	480	580	830
Nobel Creek	At confluence with Soquel Creek	1.2	270	*	470	560	770
Pajaro River	Downstream confluence with Saltpuedes Creek	1,275	14,250	*	32,500	43,600	76,290
Rodeo Creek Gulch	At mouth	3.0	790	*	1,290	1,540	2,130
Saltpuedes Creek	At confluence with Pajaro Creek	46.0	2,000 <sup>1</sup>	*	4,500 <sup>1</sup>	5,950 <sup>1</sup>	12,500 <sup>1</sup>
San Lorenzo River	At mouth	136.0	23,700	*	42,300	50,600	70,100



#### LLWATER ELEVATIONS

Stillwater Elevation (Feet NAVD)			
10-percent	2-percent	1-percent	0.2-percent
66.9	72.2	72.9	74.5
13.5	15.3	15.8	16.5
44.2	44.5	44.6	45.0
7.4	7.6	7.8	8.1
7.4	7.6	7.8	8.1
7.3	7.5	7.6	7.8
7.4	7.6	7.7	7.9
7.4	7.6	7.7	7.9



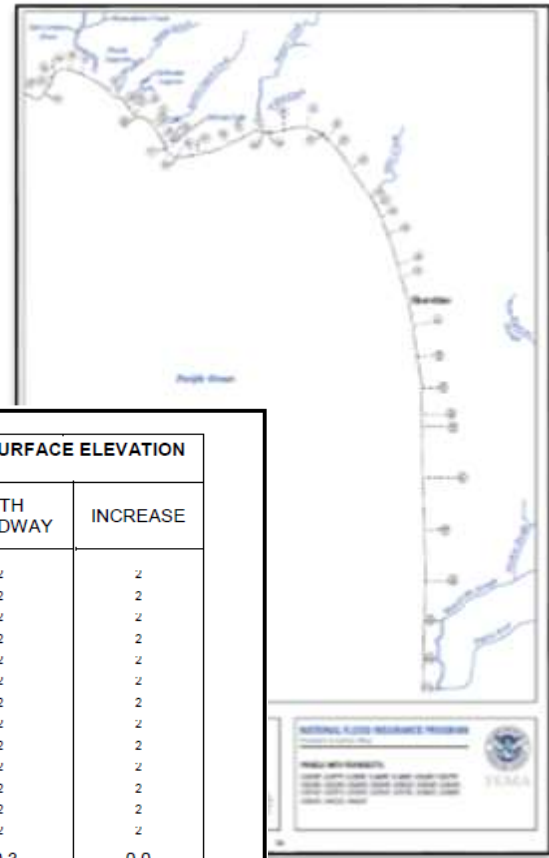
**Federal Emergency Management Agency**  
FLOOD INSURANCE STUDY NO. 06087CV0008

May 16, 2012

#### PACIFIC OCEAN

New Brighton State Beach  
Seacliff State Beach  
Sunset State Beach  
Capitola State Beach  
Cowell and Santa Cruz Beaches

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Moore Creek	At State Highway 1	1.4	270	*	480	580	830



LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	938	2	2	2	13.0	13.0	2	2
B	1,062	2	2	2	13.1	13.1	2	2
C	1,812	2	2	2	14.2	14.2	2	2
D	2,952	2	2	2	15.8	15.8	2	2
E	3,354	2	2	2	16.9	16.9	2	2
F	4,559	2	2	2	20.6	20.6	2	2
G	4,745	2	2	2	21.0	21.0	2	2
H	5,933	2	2	2	23.8	23.8	2	2
I	6,099	2	2	2	24.1	24.1	2	2
J	7,686	2	2	2	25.2	25.2	2	2
K	7,948	2	2	2	27.2	27.2	2	2
L	9,303	2	2	2	28.0	28.0	2	2
M	10,388	2	2	2	28.7	28.7	2	2
N	10,677	400	5,148	9.2	30.3	30.3	30.3	0.0
O	11,991	399	5,194	9.2	32.6	32.6	32.6	0.0
P	13,016	400	5,431	8.5	34.3	34.3	34.3	0.0
Q	16,428	260	3,184	14.6	39.9	39.9	40.6	0.7
R	17,903	237	3,347	13.9	45.5	45.5	45.7	0.2
S	18,578	246	5,248	8.8	51.6	51.6	51.6	0.0
T	19,558	234	3,133	14.8	51.8	51.8	52.0	0.2
U	20,898	240	3,097	13.0	57.4	57.4	58.0	0.6
V	21,828	233	4,326	10.7	63.6	62.8	64.2	1.4
W	23,088	234	3,963	11.7	65.8	65.8	66.8	1.0

<sup>1</sup>Feet above mouth at Pacific Ocean (Monterey Bay)

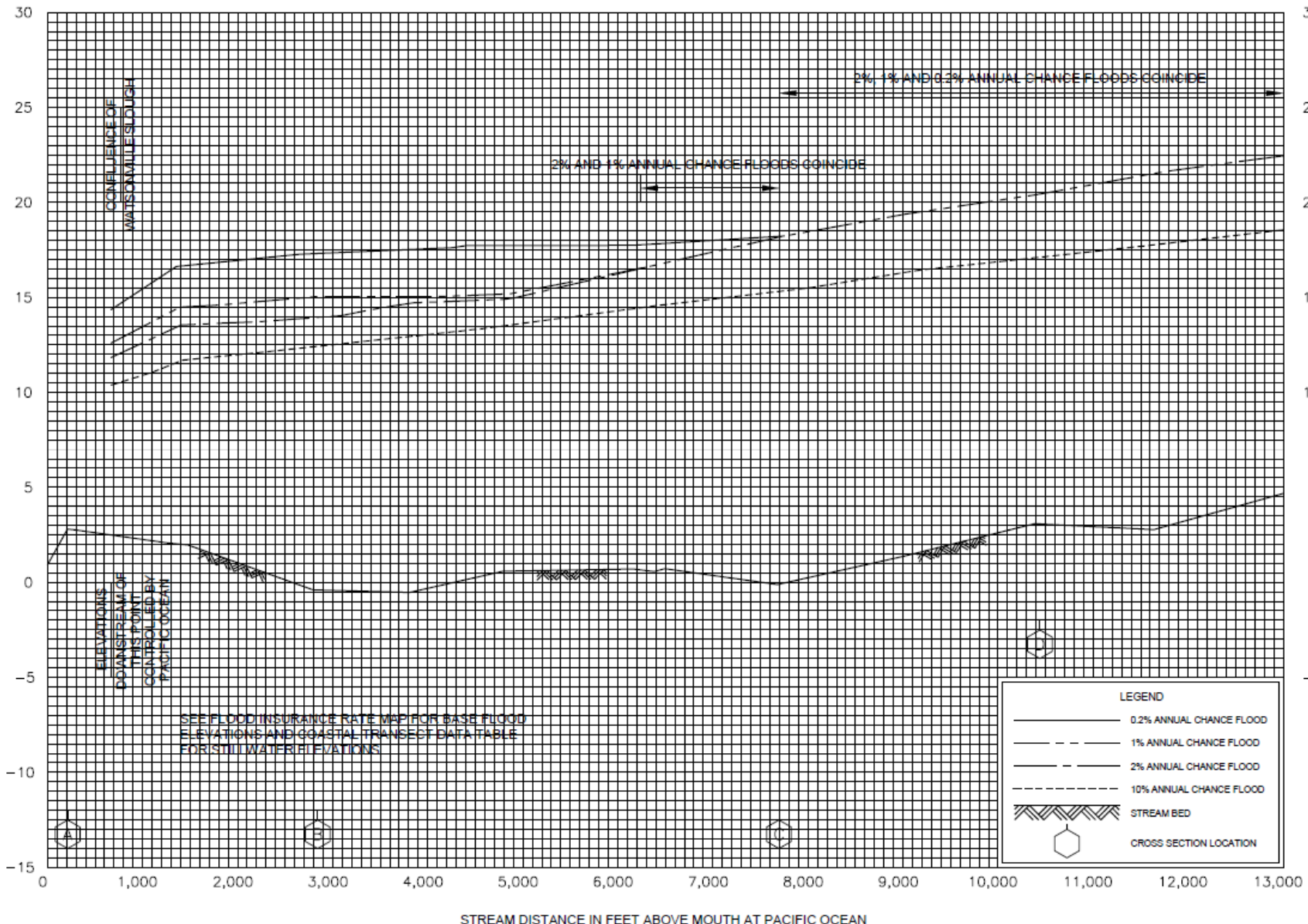
<sup>2</sup>Floodway computed without consideration of levee

TABLE 24	FEDERAL EMERGENCY MANAGEMENT AGENCY SANTA CRUZ COUNTY, CALIFORNIA AND INCORPORATED AREAS	FLOODWAY DATA	
		FLOODING SOURCE: SAN LORENZO RIVER	

IONS			
vation (Feet NAVD)			
percent	1-percent	0.2-percent	
72.2	72.9	74.5	
15.3	15.8	16.5	
44.5	44.6	45.0	
7.6	7.8	8.1	
7.6	7.8	8.1	
7.5	7.6	7.8	
7.6	7.7	7.9	
7.6	7.7	7.9	



ELEVATION IN FEET (NAVD)



FLOOD PROFILES

PAJARO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANTA CRUZ COUNTY, CA  
AND INCORPORATED AREAS



New Lookup

← Northwest 1



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Choose one of the three search options below and optionally enter a posting date range.

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CALIFORNIA

**County**

SANTA CRUZ COUNTY

**Community**

Select

CAPITOLA, CITY OF

SANTA CRUZ COUNTY ALL JURISDICTIONS

SANTA CRUZ COUNTY UNINCORPORATED AREAS

SANTA CRUZ, CITY OF

SCOTT'S VALLEY, CITY OF

WATSONVILLE, CITY OF

**Jurisdiction Name**

**Jurisdiction Name or FEMA ID**

(Ex. Fairfax County-wide or S1059C)

**Product ID**

**Product ID**

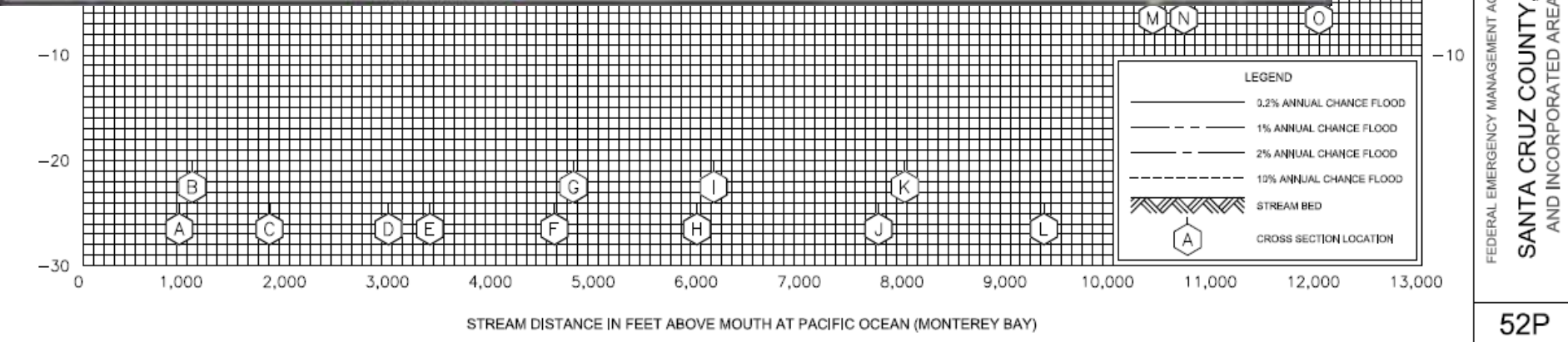
(Ex. Panel Number, LDMC Case Number)

**Search Results for SANTA CRUZ COUNTY ALL JURISDICTIONS**

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# FEMA Flood Map Service Center: Search All Products

Choose one of the three search options below and optionally enter a posting date range.

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CALIFORNIA

County

SANTA CRUZ COUNTY

Community

Jurisdiction Name

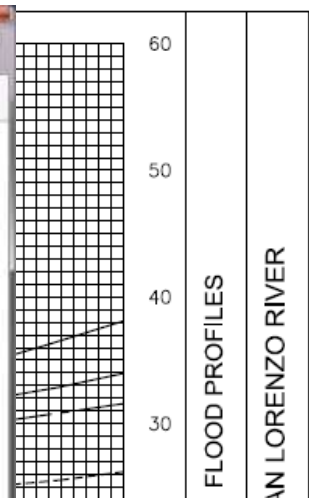
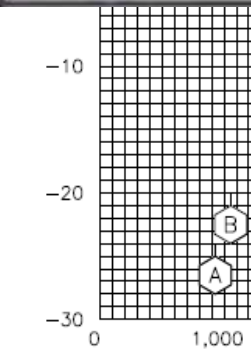
Jurisdiction Name or FEMA ID

(Ex. Fairfax County-wide or S1059C)

Product ID

Product ID

(Ex. Panel Number, LOMC Case Number)



Navigation

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FLOOD PROFILES

SAN LORENZO RIVER

AND INCORPORATED AREAS



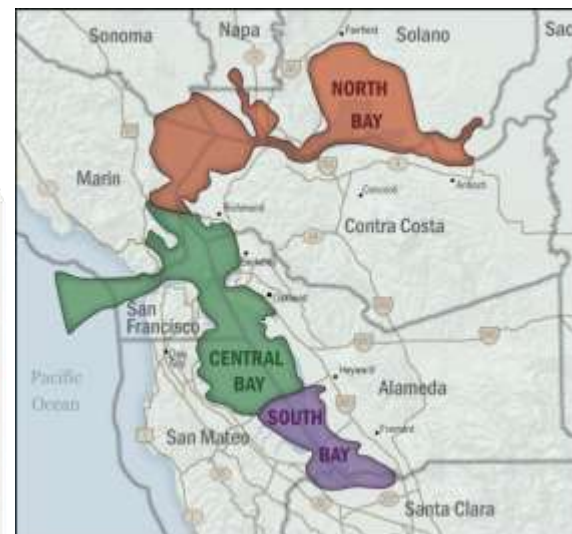
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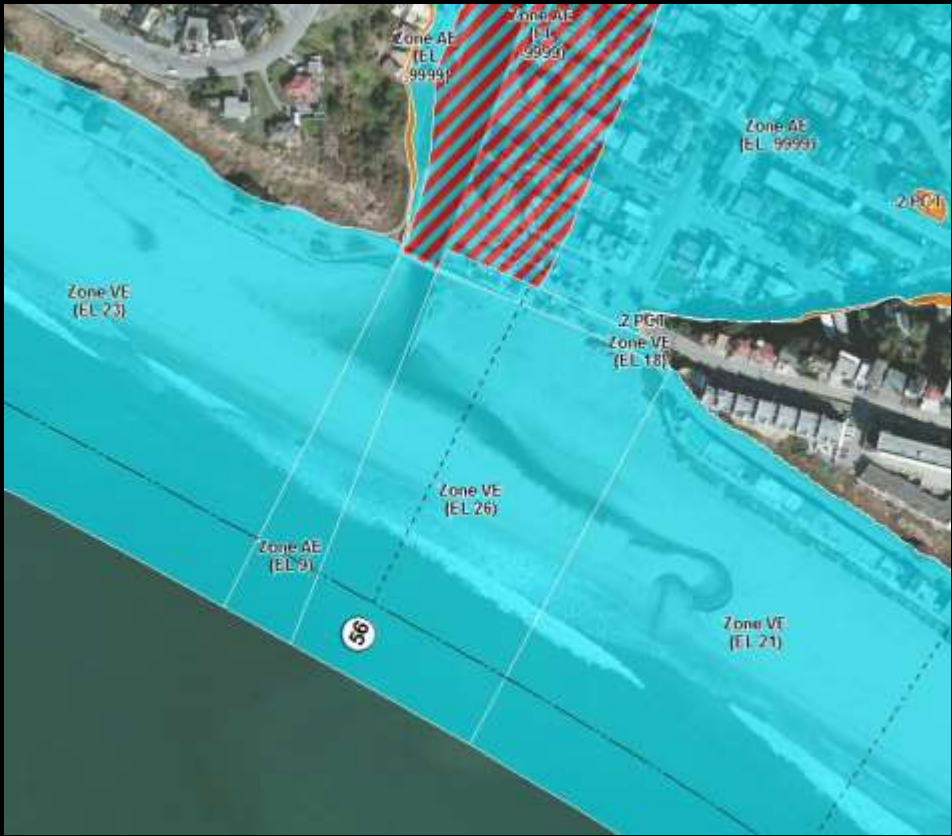
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Santa Barbara  
Ventura  
Los Angeles  
Orange  
San Diego









Zone VE  
(EL 23)

(EL 26)

56

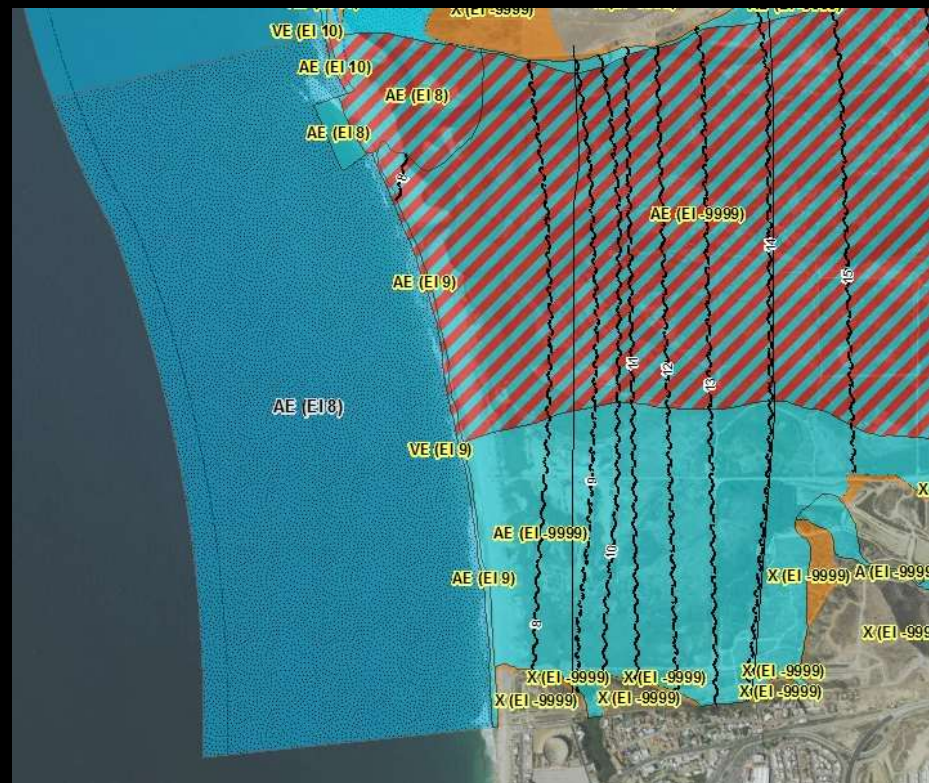
Zone VE  
(EL 21)

Zone AE  
(EL 9)

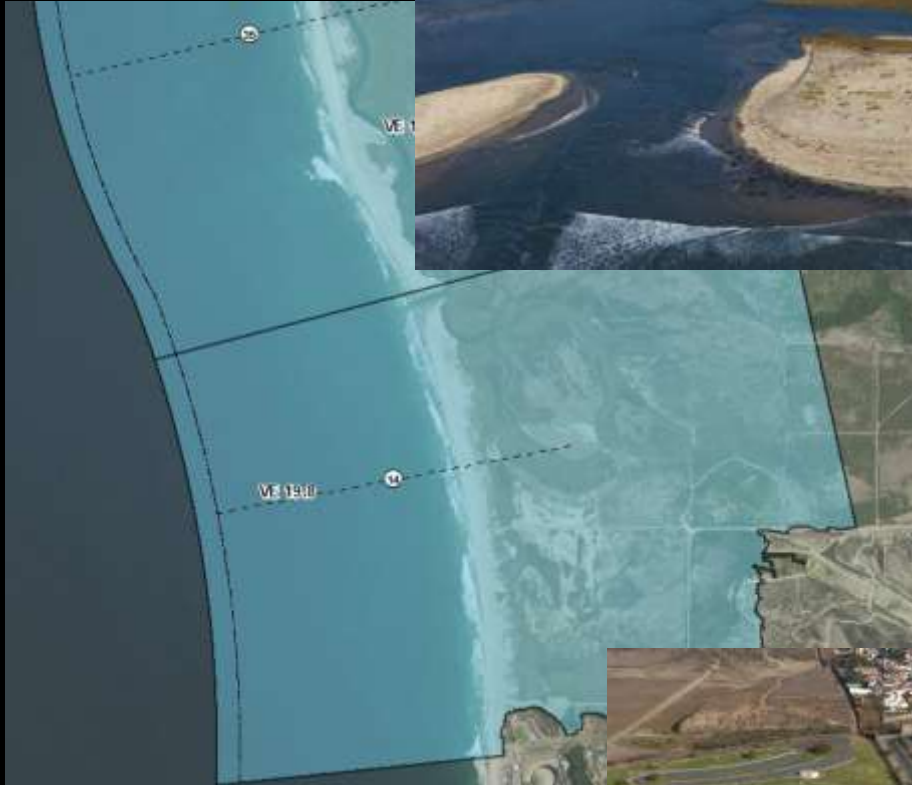
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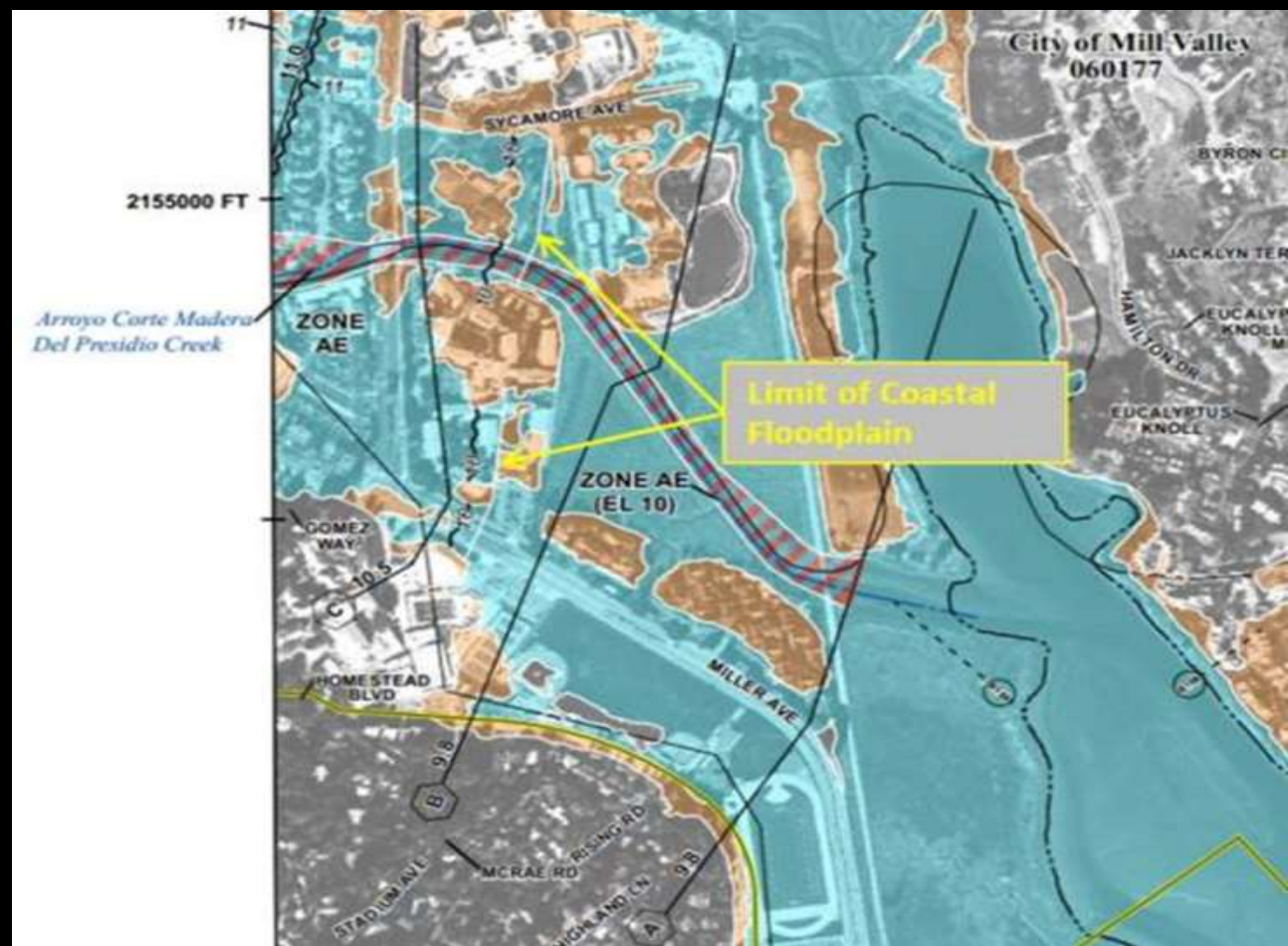
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(EL 21)













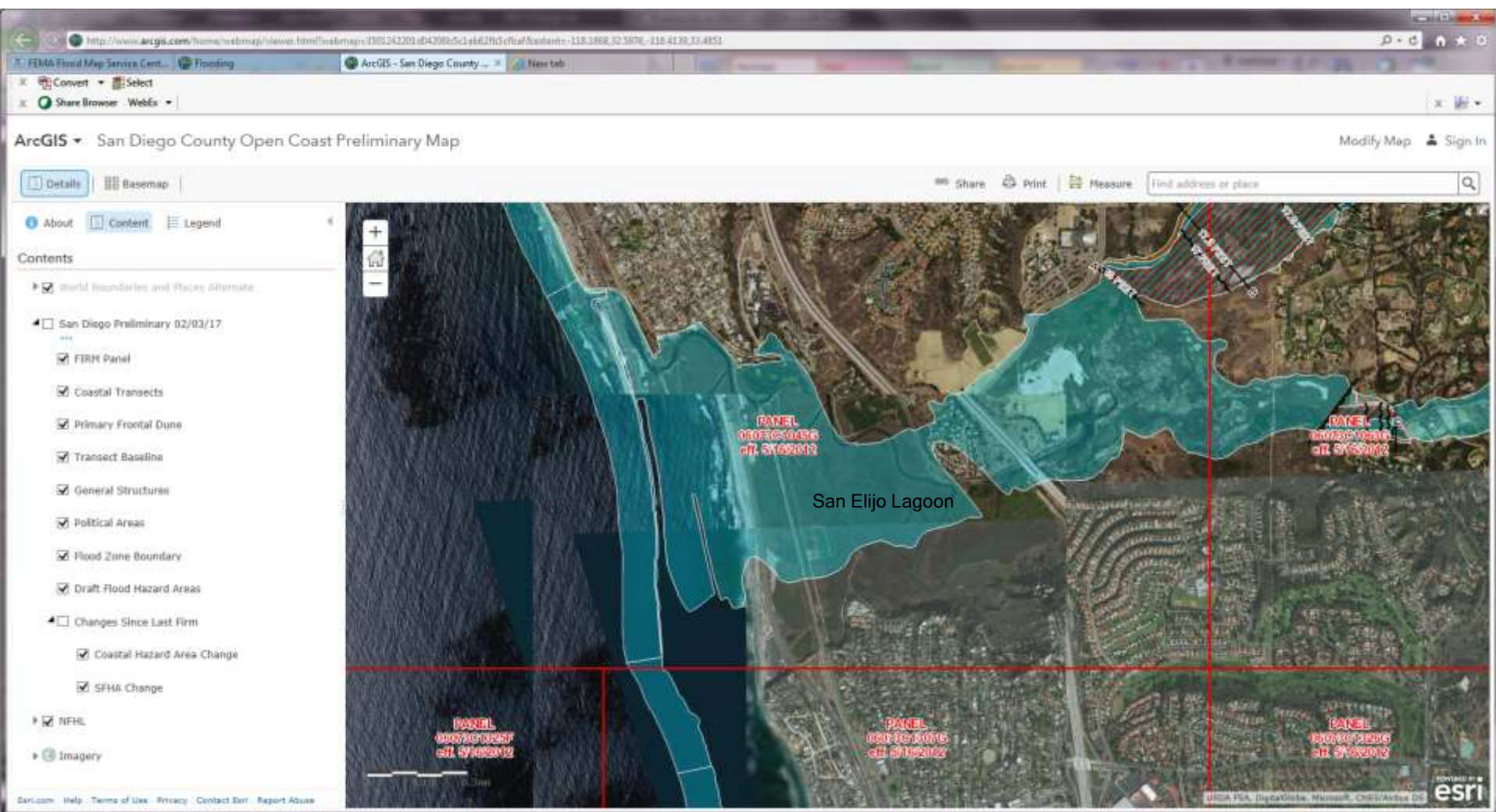








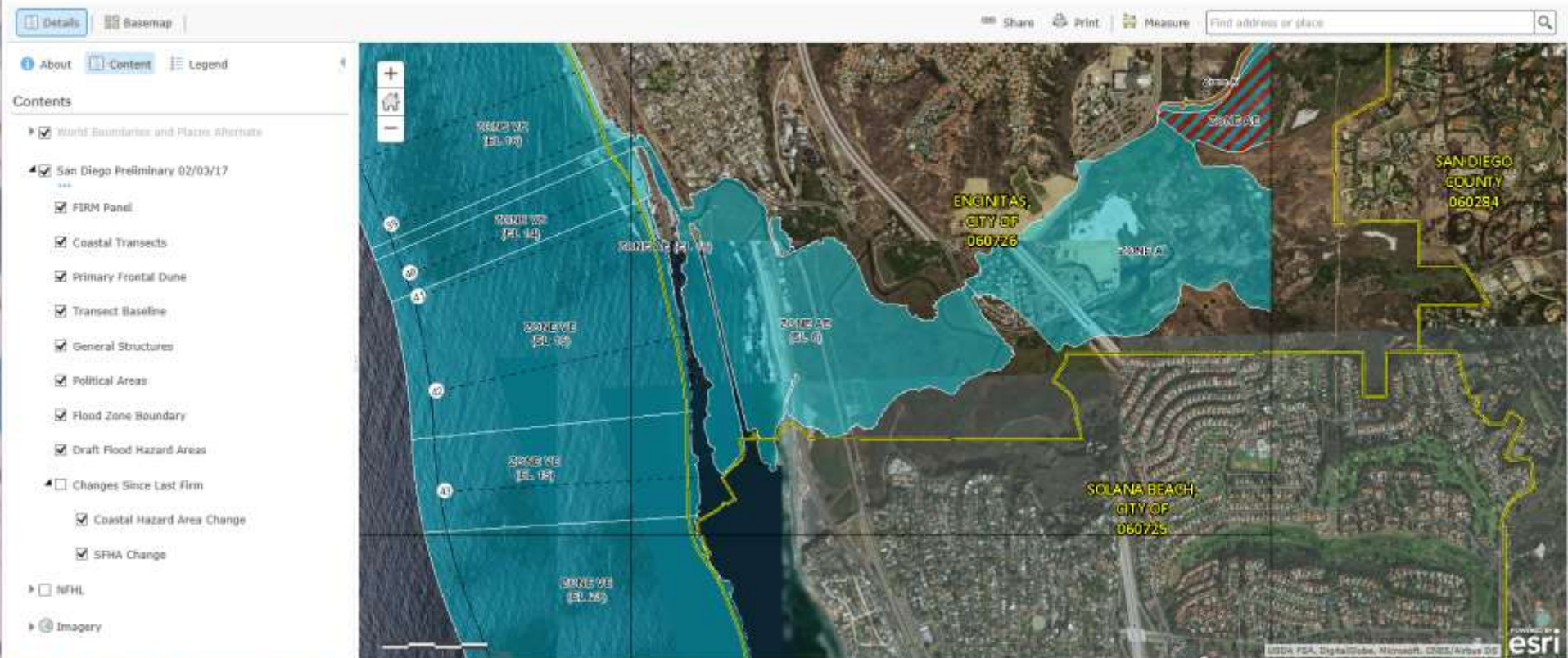


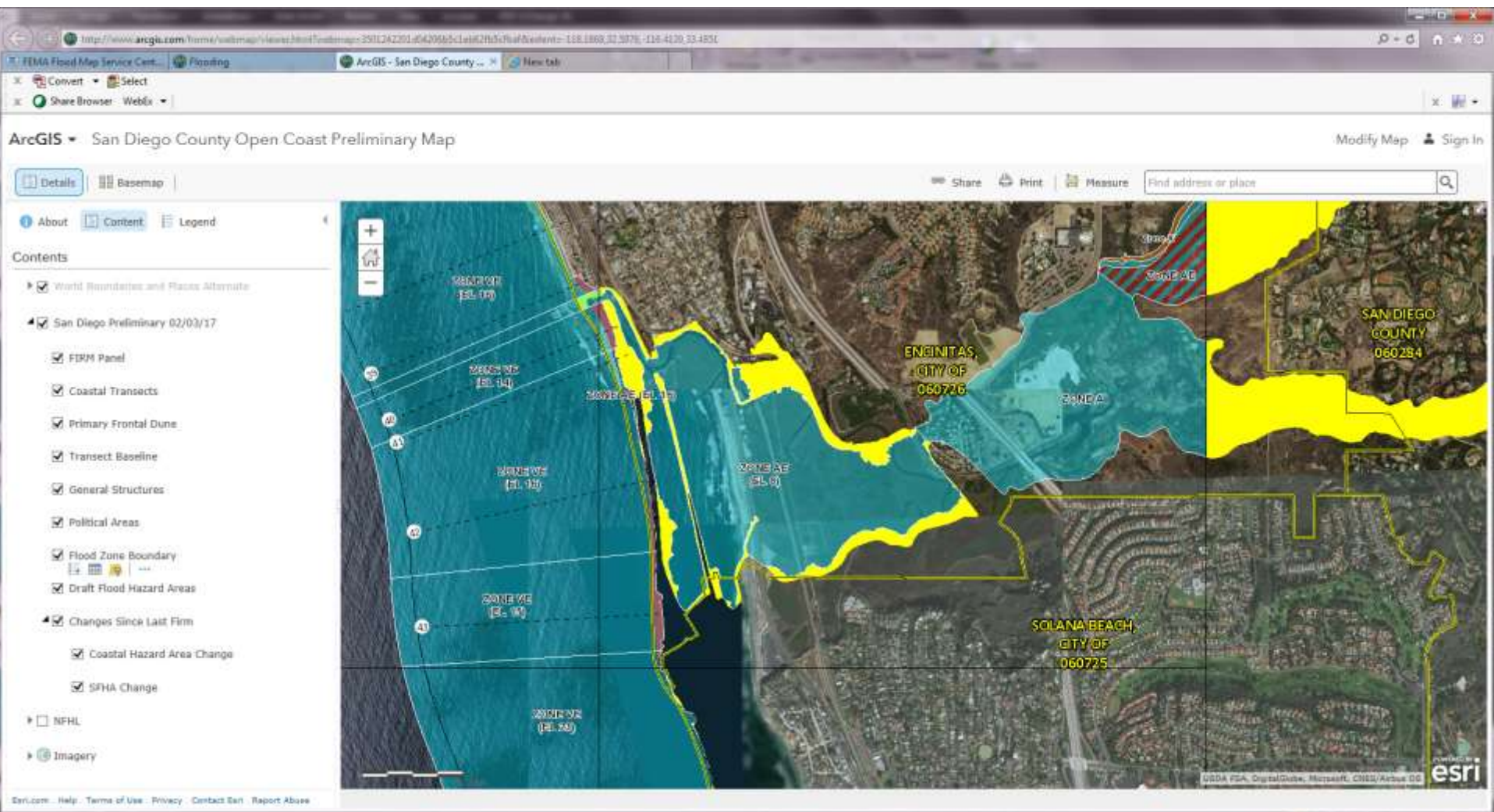




## ArcGIS - San Diego County Open Coast Preliminary Map

Modify Map | Sign In









# FEMA

## Guidance for Flood Risk Analysis and Mapping

### Combined Coastal and Riverine Floodplain

May 2015



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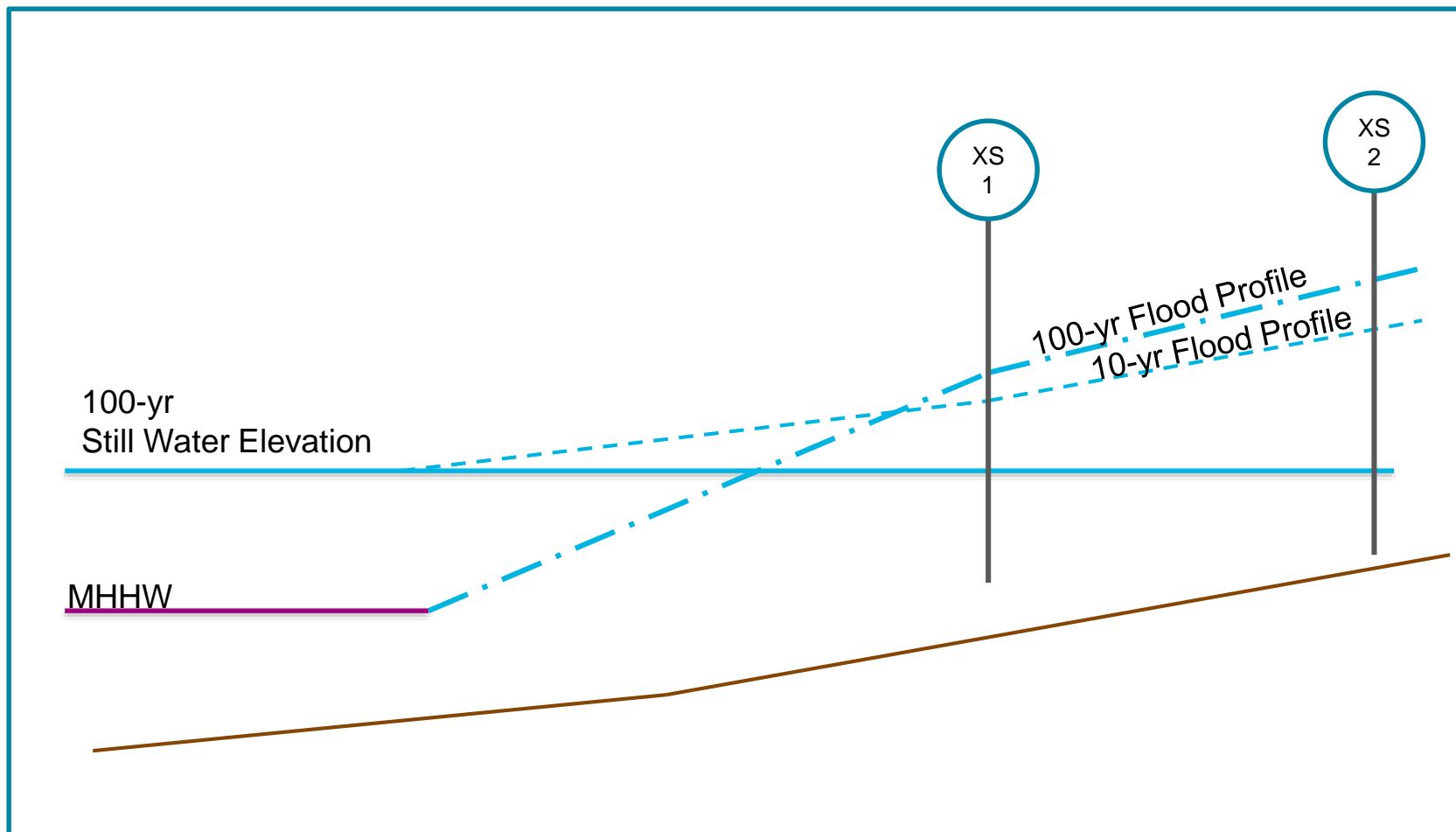
new item or edit this list

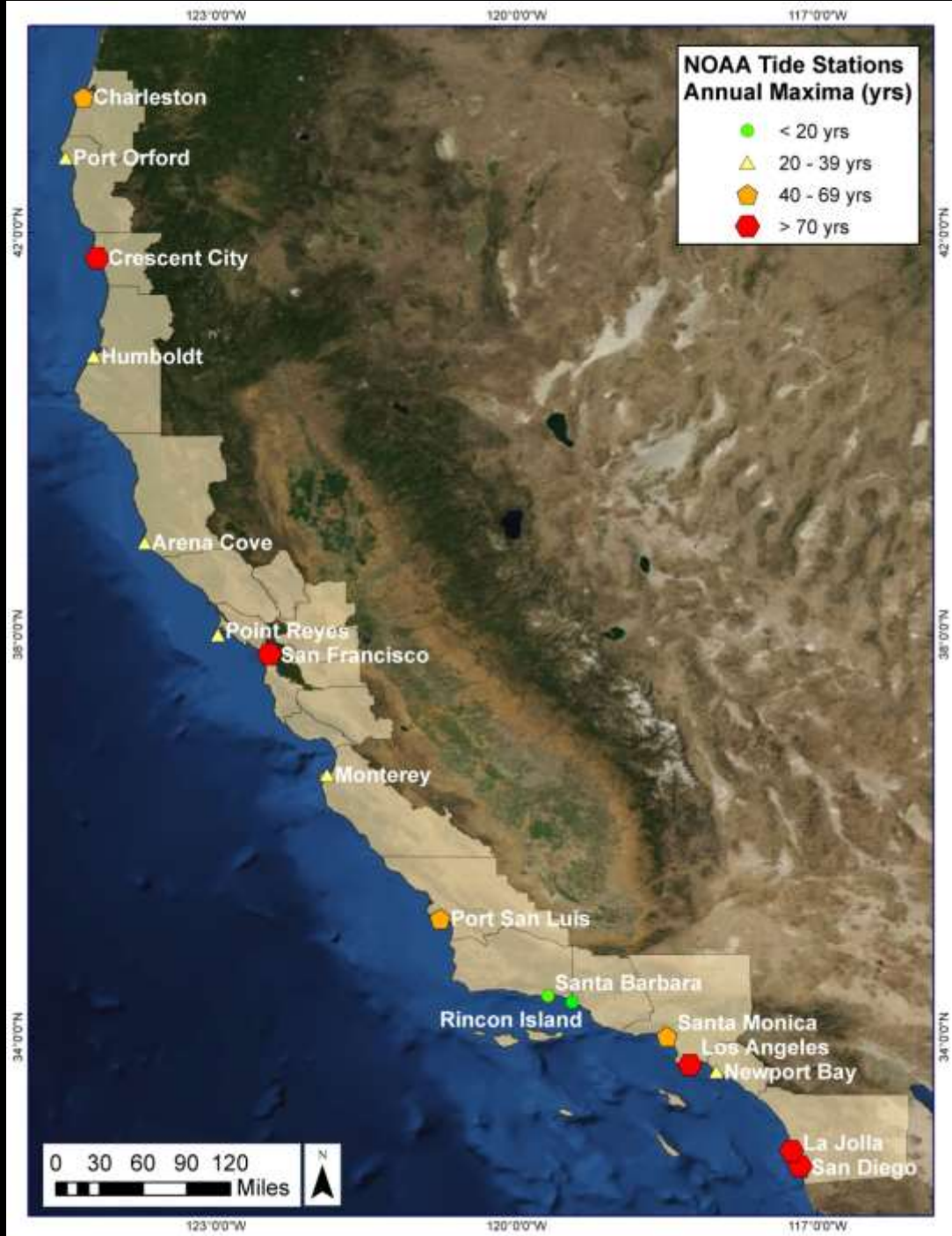
43 items

ID	Summary Title	Content	Report	Document ID/Number	Document Category/Name	Document Project Phase	Document Category	Document ID
8	The FEMA database shall be updated for engineering referenced information, validation status, and map issues throughout all project phases of the Flood Risk Project.	The FEMA database shall be updated for engineering referenced information, validation status, and map issues throughout all project phases of the Flood Risk Project.	Coordinated Flood Management System (CFMS)	Project Delivery	Program Management	Project Planning	Coord-6	1500
14	Regional decisions to provision, assess, and perform engineering analysis along critical flooding events must be supported by the data contained in CFMS.	Regional decisions to provision, assess, and perform engineering analysis along critical flooding events must be supported by the data contained in CFMS.	Coordinated Flood Management System (CFMS) (Decision) Meeting	Project Delivery	Program Management	Project Planning		1500
16	Regionally based flood hazard information and reach assessment provisions must be stored within the regional CFMS database.	Regionally based flood hazard information and reach assessment provisions must be stored within the regional CFMS database.	Coordinated Flood Management System (CFMS)	Project Delivery	Technical Production	Project Planning		1500
17	A Project Management Team shall be formed as soon as a Flood Risk Project is initiated, and this team shall manage the project for its entire lifecycle.	A Project Management Team shall be formed as soon as a Flood Risk Project is initiated, and this team shall manage the project for its entire lifecycle.	Coordinated Flood Management System (CFMS)	Project Delivery	Program Management	Project Planning		1510

4,18%







## Datums for 9410660, Los Angeles CA

### Elevations on Station Datum

Station: 9410660, Los Angeles, CA

T.M.: 120

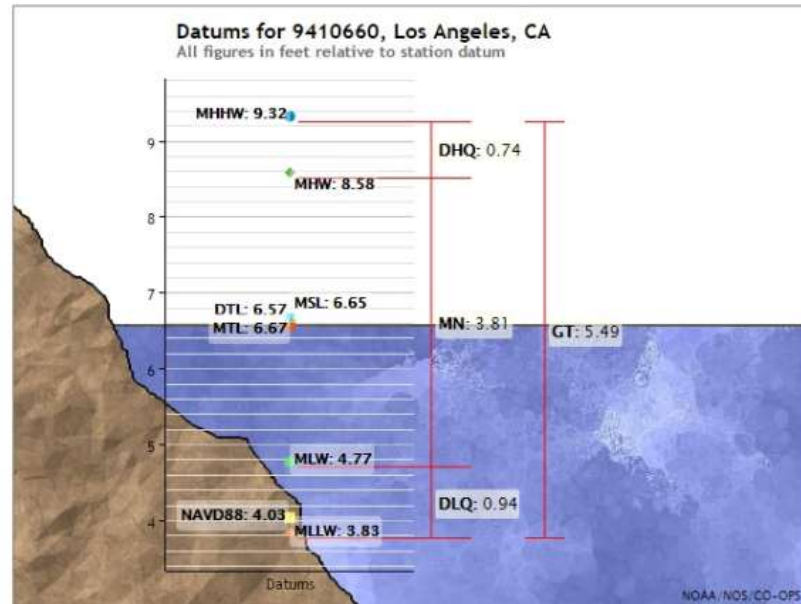
Status: Accepted (Oct 7 2011)

Epoch: 1983-2001

Units: Feet

Datum: STND

Datum	Value	Description
MHHW	9.32	Mean Higher-High Water
MHW	8.58	Mean High Water
MTL	6.67	Mean Tide Level
MSL	6.65	Mean Sea Level
DTL	6.57	Mean Diurnal Tide Level
MLW	4.77	Mean Low Water
MLLW	3.83	Mean Lower-Low Water
NAVD88	4.03	North American Vertical Datum of 1988
STND	0.00	Station Datum
GT	5.49	Great Diurnal Range
MN	3.81	Mean Range of Tide
DHQ	0.74	Mean Diurnal High Water Inequality
DLQ	0.94	Mean Diurnal Low Water Inequality
HWI	5.14	Greenwich High Water Interval (in hours)
LWI	11.21	Greenwich Low Water Interval (in hours)
Maximum	11.75	Highest Observed Water Level
Max Date & Time	01/10/2005 16:12	Highest Observed Water Level Date and Time
Minimum	1.10	Lowest Observed Water Level
Min Date & Time	12/17/1933 08:00	Lowest Observed Water Level Date and Time
HAT	11.17	Highest Astronomical Tide
HAT Date & Time	12/02/1990 16:06	HAT Date and Time
LAT	1.85	Lowest Astronomical Tide
LAT Date & Time	01/01/1987 00:00	LAT Date and Time

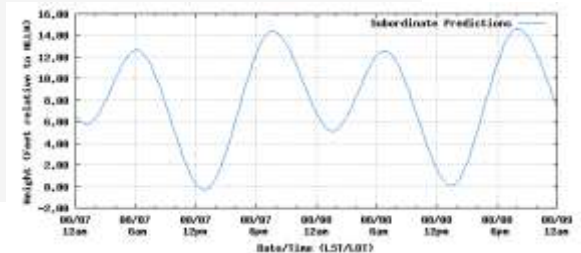


Showing datums for

9410660 Los Angeles, CA ▼

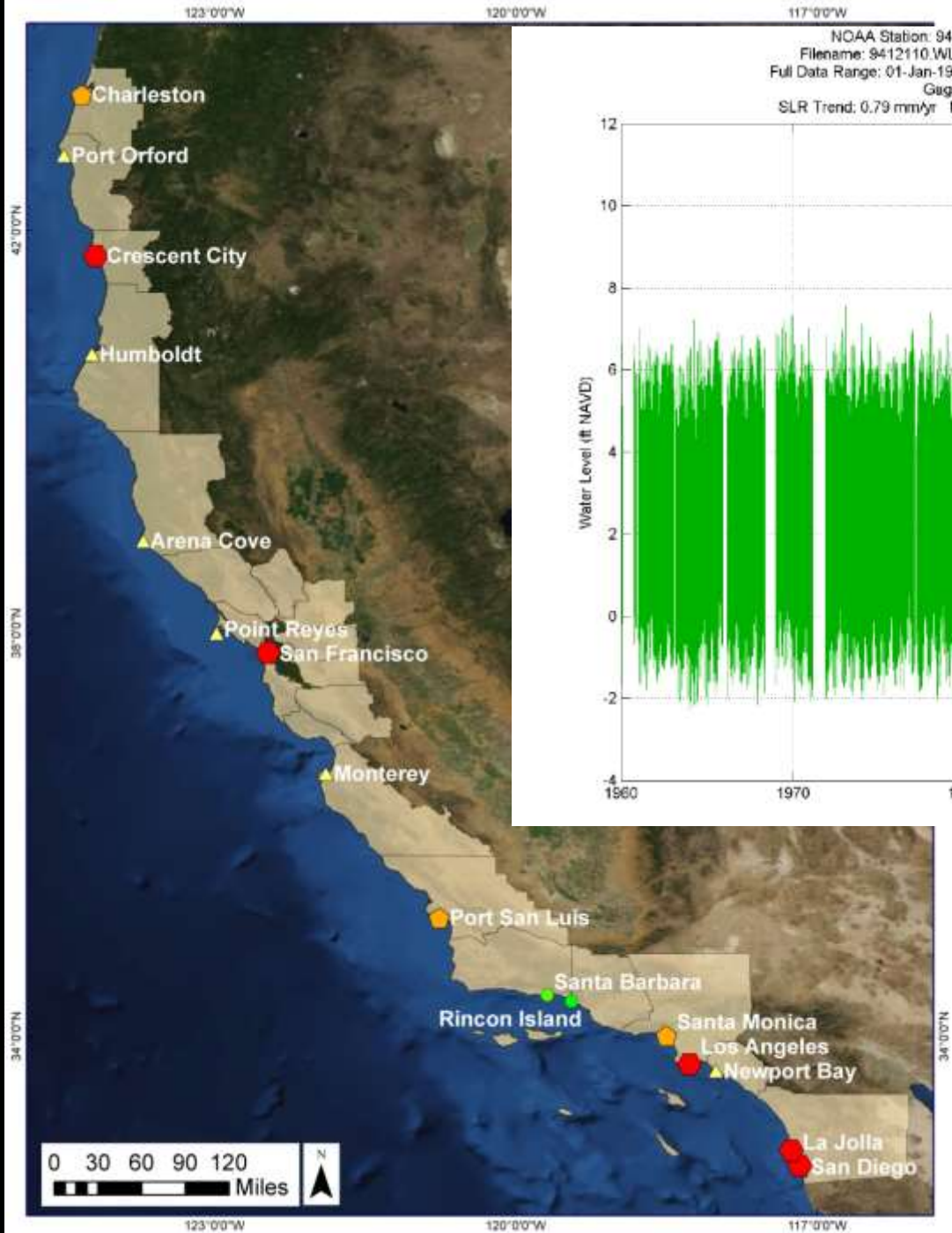
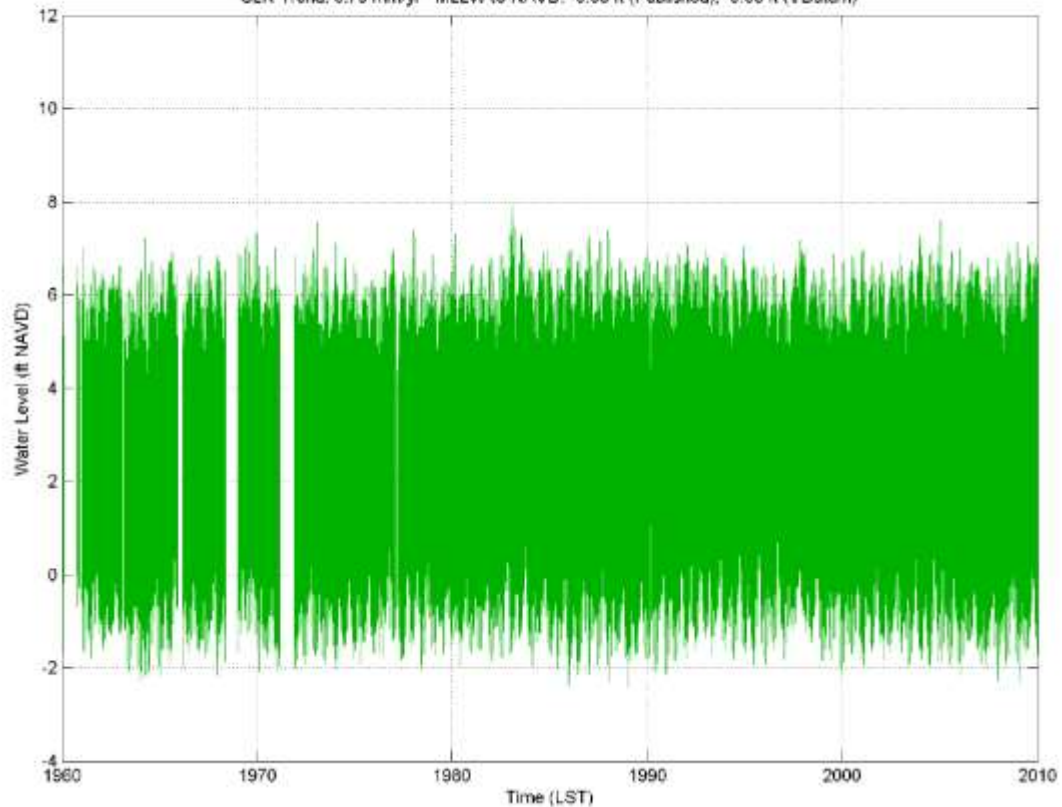
Data Units ☒ Feet☐ MetersEpoch ☐ Present (1983-2001)☒ Superseded (1960-1978)

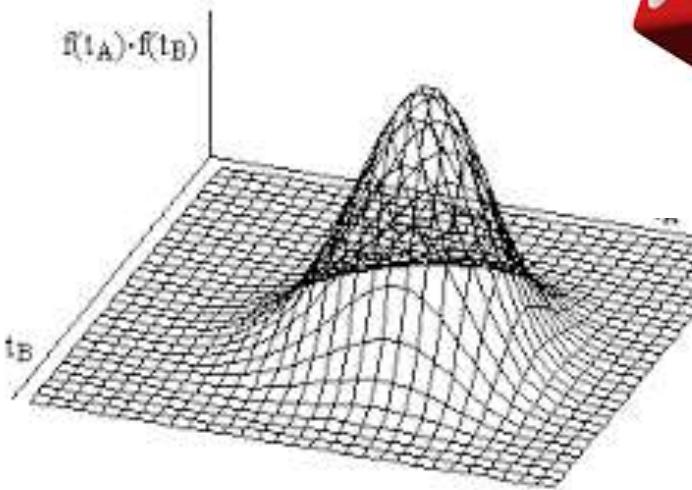
Submit





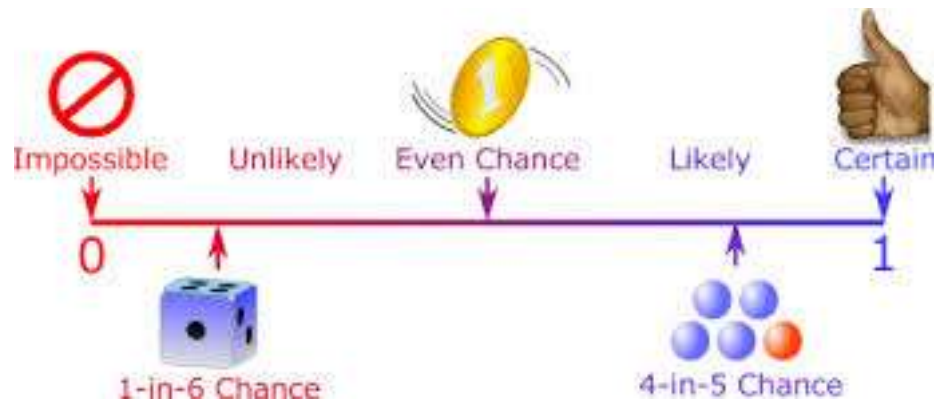
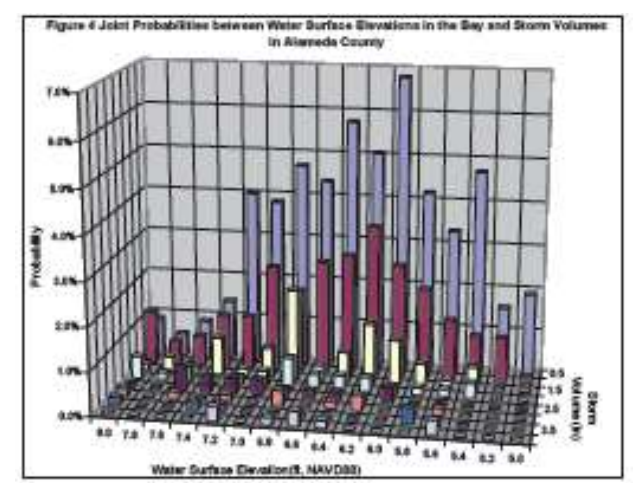
NOAA Station: 9412110 Port San Luis (San Luis Obispo County)  
Filename: 9412110.WL Data Compiled.mat Data Type: Hourly Measured  
Full Data Range: 01-Jan-1948 to 31-Jul-2011 23:00:00 1960-2010 Coverage: 94%  
Gage Location: 35.1767 N -120.76 W  
SLR Trend: 0.79 mm/yr MLLW to NAVD: -0.08 ft (Published); -0.08 ft (VDatum)



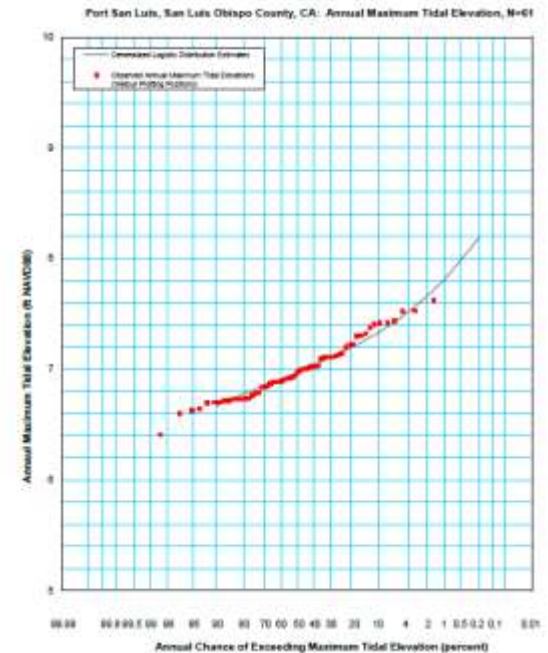


$$P(A/B) = \frac{P(A \cap B)}{P(B)}$$

$$P(B/A) = \frac{P(A \cap B)}{P(A)}$$



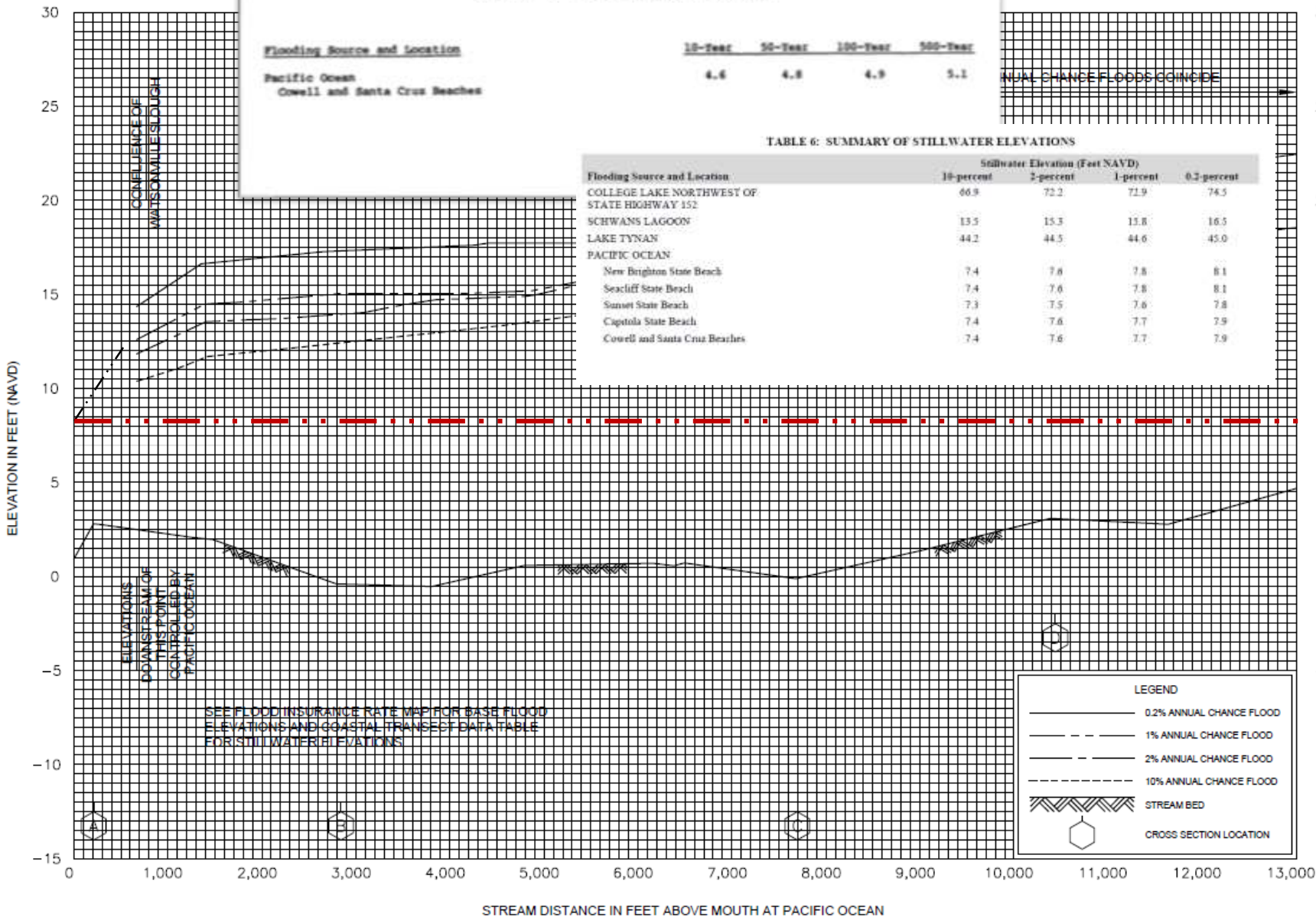
Station	Region	Regional 50-percent (feet, NAVD)	Regional 20-percent (feet, NAVD)	Regional 10-percent (feet, NAVD)	Regional 4-percent (feet, NAVD)	Regional 2-percent (feet, NAVD)	Regional 1-percent (feet, NAVD)	Regional 0.2-percent (feet, NAVD)	At-site 1-percent (feet, NAVD)
San Diego	Southern	7.17	7.39	7.54	7.72	7.88	8.03	8.42	7.95
La Jolla	Southern	6.19	7.13	7.27	7.44	7.59	7.74	8.12	7.69
Newport Bay	Southern	7.03	7.25	7.40	7.57	7.73	7.88	8.26	7.85
Los Angeles	Southern	7.09	7.31	7.45	7.63	7.79	7.94	8.33	7.82
Santa Monica	Southern	7.11	7.33	7.47	7.65	7.81	7.96	8.35	8.09
Santa Barbara	Southern	6.99	7.21	7.35	7.53	7.68	7.83	8.21	7.89
Port San Luis	Southern	6.97	7.19	7.33	7.51	7.66	7.81	8.19	7.99
Monterey	Central	7.16	7.51	7.74	8.05	8.30	8.55	9.23	8.50
San Francisco	Central	7.51	7.88	8.12	8.45	8.70	8.97	9.68	8.88
Point Reyes	Central	7.57	7.94	8.19	8.52	8.77	9.05	9.76	9.62
Arena Cove	Central	7.79	8.18	8.43	8.77	9.03	9.31	10.05	9.39
Humboldt Bay	Central	8.50	8.92	9.20	9.56	9.85	10.16	10.96	10.32
Crescent City	Central	8.79	9.20	9.48	9.86	10.16	10.48	11.30	10.28
Port Orford	Northern	9.24	9.79	10.15	10.63	11.01	11.41	12.45	12.02
Charleston	Northern	9.51	10.08	10.45	10.94	11.33	11.75	12.82	11.38

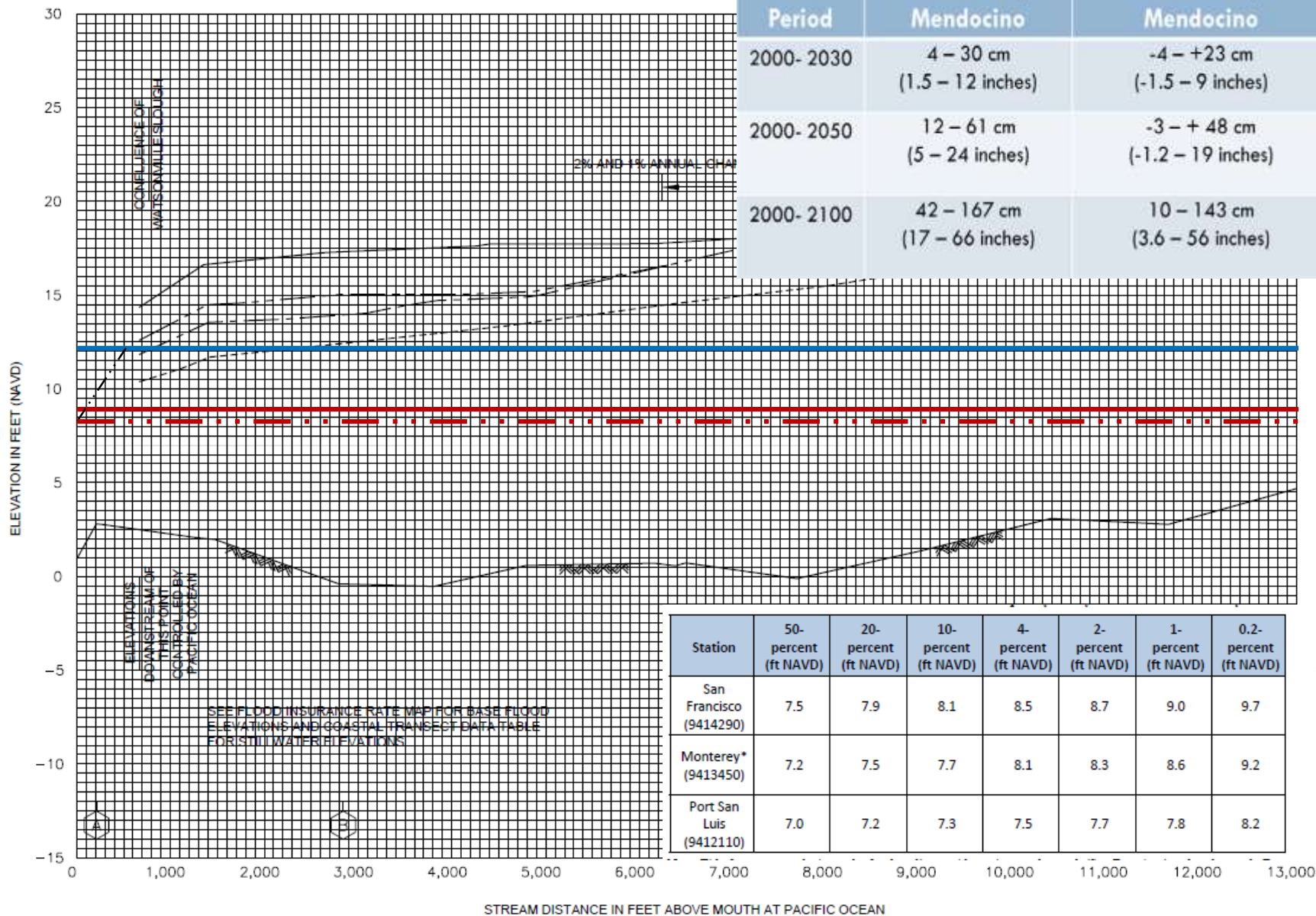


		Predictor Station															
		CH	PO	CC	HU	AC	PR	SF	MO	SL	SB	RI	SM	LA	NB	LJ	SD
Inferred Station	CH	-	0.93	0.95	1.04												
	PO	0.96	-	1.01	1.09												
	CC	0.81	0.83	-	1.07	0.92	0.97	0.94									
	HU	0.70	0.70	0.86	-	0.85	0.92	0.90	1.04								
	AC			0.76	0.91	-	1.00	1.03	1.19	1.10							
	PR			0.63	0.76	0.80	-	0.94	1.14	1.06							
	SF			0.56	0.73	0.77	0.92	-	1.11	0.89							
	MO				0.54	0.61	0.73	0.73	-	0.96	0.72	0.75		0.84	0.87	0.81	0.83
	SL					0.49	0.60	0.60	0.85	-	0.76	0.77	0.67	0.86	0.91	0.81	0.84
	SB								0.74	0.86	-	0.93	0.78	0.99	1.12	0.85	0.99
	RI								0.72	0.85	0.86	-		0.95	0.98	0.96	0.82
	SM									0.73	0.83		-	0.93	0.95	0.80	0.90
	LA								0.63	0.64	0.72	0.77	0.72	-	0.96	0.82	0.91
	NB								0.68	0.80	0.69	0.81	0.54	0.94	-	0.97	0.93
	LJ								0.63	0.63	0.70	0.68	0.65	0.87	0.88	-	0.90
	SD								0.66	0.67	0.76	0.78	0.79	0.93	0.97	0.87	-

Station ID	Station	County	1960-2009 Coverage	Annual Maxima (yrs)*	MLLW to NAVD88 (ft)	Mean Sea Level Trend (mm/yr)
9432780	Charleston	Coos, OR	72%	40 (42)	-0.50	1.29
9431647	Port Orford	Curry, OR	52%	26 (31)	-0.49	0.18
9419750	Crescent City	Del Norte	96%	70 (77)	-0.38	-0.65
9418767	Humboldt North Spit	Humboldt	64%	33 (34)	-0.33	4.73
9416841	Arena Cove	Mendocino	45%	24 (27)	-0.13	2.10**
9415020	Point Reyes	Marin	69%	36 (37)	-0.02	2.10
9414290	San Francisco	San Francisco	99%	114 (114)	0.06	2.01
9413450	Monterey	Monterey	72%	37 (38)	0.14	1.34
9412110	Port San Luis	San Luis Obispo	94%	61 (66)	-0.08	0.79
9411340	Santa Barbara	Santa Barbara	26%	18 (23)	-0.13	1.25
9411270	Rincon Island	Ventura	22%	15 (24)	-0.10	3.22
9410840	Santa Monica	Los Angeles	68%	64 (71)	-0.19	1.46
9410660	Los Angeles	Los Angeles	98%	84 (88)	-0.20	0.83
9410580	Newport Bay	Orange	29%	37 (39)	-0.18	2.22
9410230	La Jolla	San Diego	94%	75 (86)	-0.19	2.07
9410170	San Diego	San Diego	66%	83 (85)	-0.43	2.06

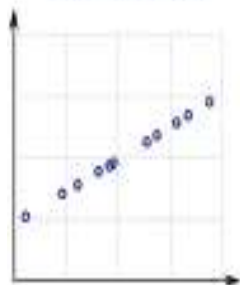






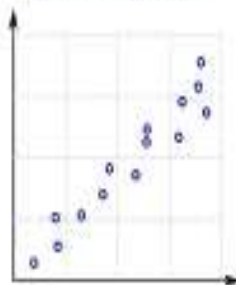
Time Period	South of Cape Mendocino	North of Cape Mendocino
2000- 2030	4 – 30 cm (1.5 – 12 inches)	-4 – +23 cm (-1.5 – 9 inches)
2000- 2050	12 – 61 cm (5 – 24 inches)	-3 – + 48 cm (-1.2 – 19 inches)
2000- 2100	42 – 167 cm (17 – 66 inches)	10 – 143 cm (3.6 – 56 inches)

Perfect  
Positive  
Correlation



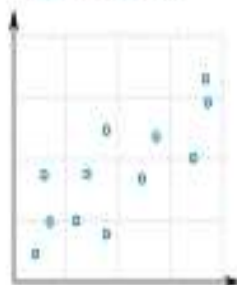
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High  
Positive  
Correlation



0.8

Low  
Positive  
Correlation



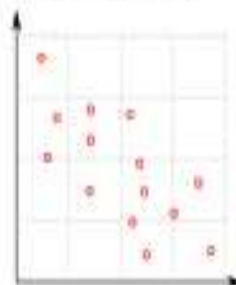
0.3

No  
Correlation



0

Low  
Negative  
Correlation



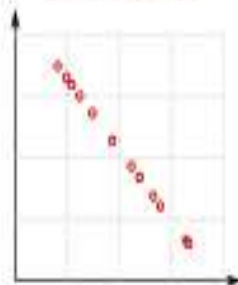
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High  
Negative  
Correlation



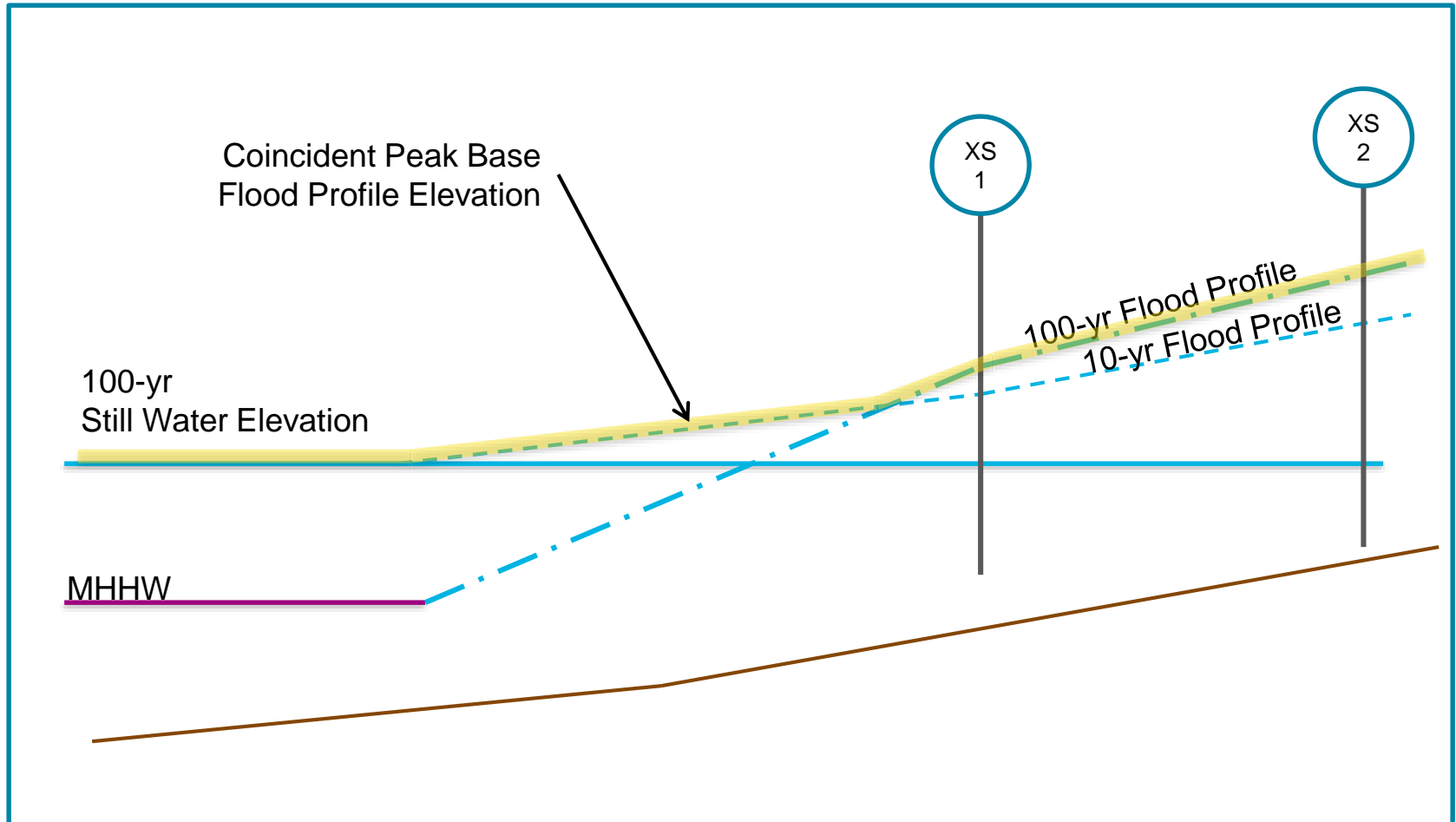
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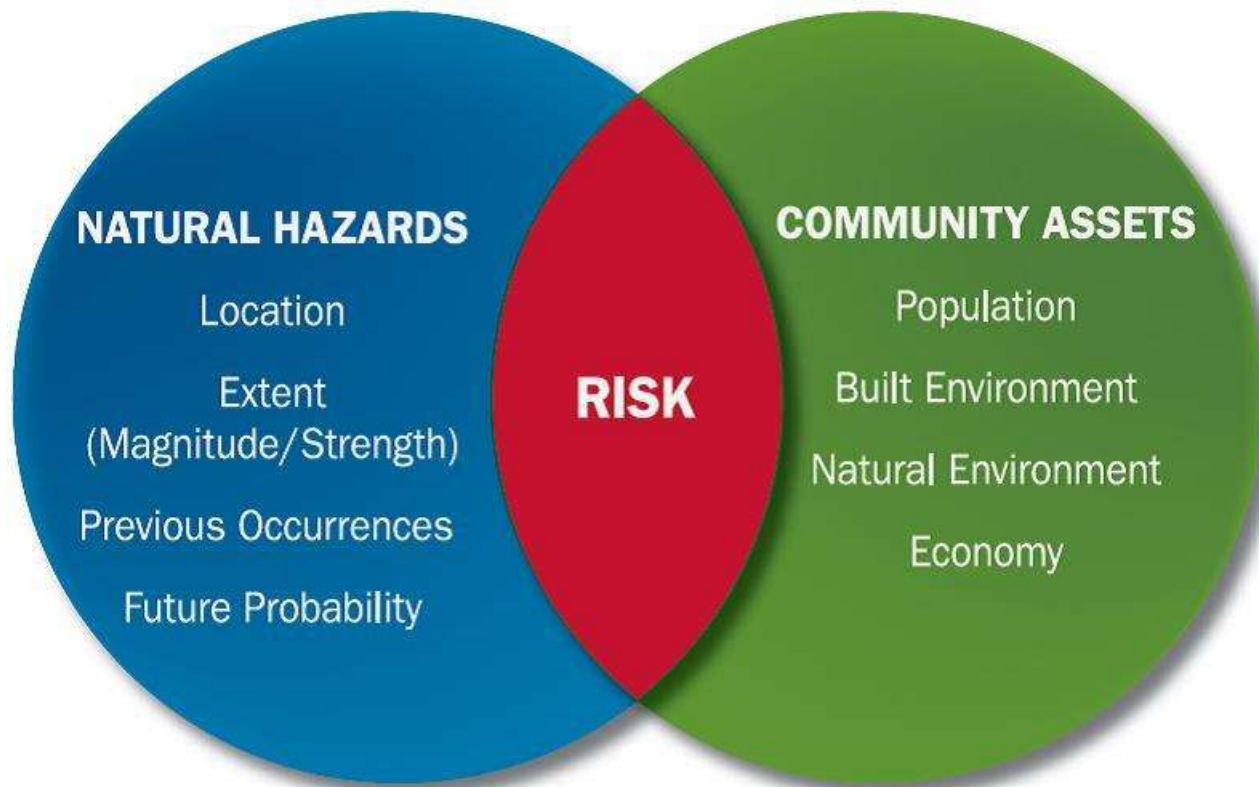
Perfect  
Negative  
Correlation



-1









**NATURAL HAZARDS**

**COMMUNITY ASSETS**

**RISK**

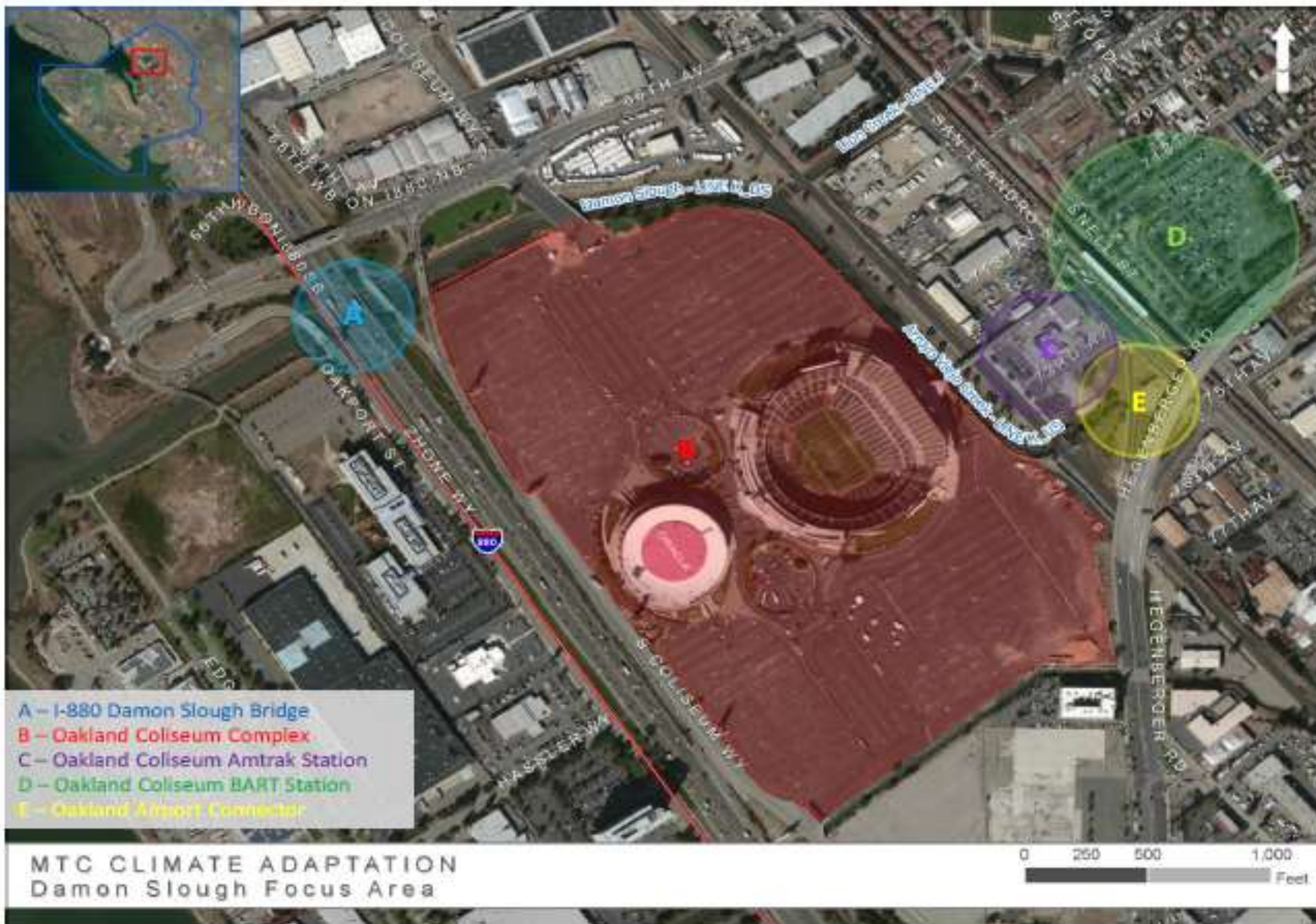






	Daily Tide	Extreme Tide (Storm Surge)						
Sea Level Rise Scenario	Water Level above MHHW	1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Existing Conditions	0	15	20	24	27	32	36	41
MHHW + 6-inch	6	21	26	30	33	38	42	47
MHHW + 12-inch	12	27	32	36	39	44	48	53
MHHW + 18-inch	18	33	38	42	45	50	54	59
MHHW + 24-inch	24	39	44	48	51	56	60	65
MHHW + 30-inch	30	45	50	54	57	62	66	71
MHHW + 36-inch	36	51	56	60	63	68	72	77
MHHW + 42-inch	42	57	62	66	69	74	78	83
MHHW + 48-inch	48	63	68	72	75	80	84	89
MHHW + 54-inch	54	69	74	78	81	86	90	95
MHHW + 60-inch	60	75	80	84	87	92	96	101









RAS XS	0	340	432.89	637.86	561.66	I-895 Crossing g	1305.12	1496.36	1765.06	2020	2043.66	Coliseum Way Crossing	2186.26	2206	2596.03	2581.22
RAS XS	DS-1	DS-2	DS-3	DS-4	DS-5		DS-6	DS-7	DS-8	DS-9	DS-10		DS-11	DS-12	DS-13	DS-14
LB   RB Elev.	10.67   9.62	12.14   12.44	12.23   12.63	11.70   11.8	11.06   10.54		11.14   11.32	11.18   16.57	9.36   10.3	12.2   12.06	12.2   12.06		10.95   13.07	10.99   13.07	12.01   12.01	12.00   12.09
Scenario	Water Surface Elevation (FT-NAVB8)															
MHHW + 10-year	8.81	8.84	8.98	7.14	7.31	-	7.55	7.59	7.86	8.11	8.13	-	8.27	8.28	8.48	8.47
+ 12" SLR	7.81	7.73	7.82	7.01	8.02	-	9.15	9.29	8.4	8.57	8.59	-	8.89	8.7	8.84	9.18
+ 24" SLR	8.81	8.83	8.73	8.78	8.88	-	9.55	9.01	8.1	9.22	9.23	-	9.44	9.44	9.52	9.74
MHHW + 100-year	8.81	7.15	7.48	7.73	8.03	-	8.4	8.59	8.85	9.2	9.21	-	9.74	9.78	9.89	10.32
+ 12" SLR	7.81	7.89	8.1	8.28	8.5	-	9.78	8.93	9.15	9.45	9.48	-	10	10.02	10.12	10.5
+ 24" SLR	8.81	8.77	8.91	8.02	8.17	-	9.37	9.47	9.54	9.88	9.88	-	10.45	10.48	10.53	10.84
10-year Extreme Tide + 10-year	8.84	8.9	8.95	9	9.08	-	-	-	-	-	-	-	-	-	-	-
+ 12" SLR	9.84 LB, RB	9.87	9.91	9.94	9.98	-	-	-	-	-	-	-	-	-	-	-
+ 24" SLR	10.84 LB, RB	10.88	10.89	10.91	10.93	-	-	-	-	-	-	-	-	-	-	-
10-year Extreme Tide + 100-year	8.84	8.98	9.11	8.21	9.35	-	-	-	-	-	-	-	-	-	-	-
+ 12" SLR	9.84 LB, RB	9.92	10.01	10.08	10.17	-	-	-	-	-	-	-	-	-	-	-
+ 24" SLR	10.84 LB, RB	10.89	10.95	11	11.08	-	-	-	-	-	-	-	-	-	-	-
100-year Extreme Tide + 10-year	10.01	10.04	10.08	10.11	10.14	-	-	-	-	-	-	-	-	-	-	-
+ 12" SLR	11.01 LB, RB	11.03	11.05	11.07	11.1	-	-	-	-	-	-	-	-	-	-	-

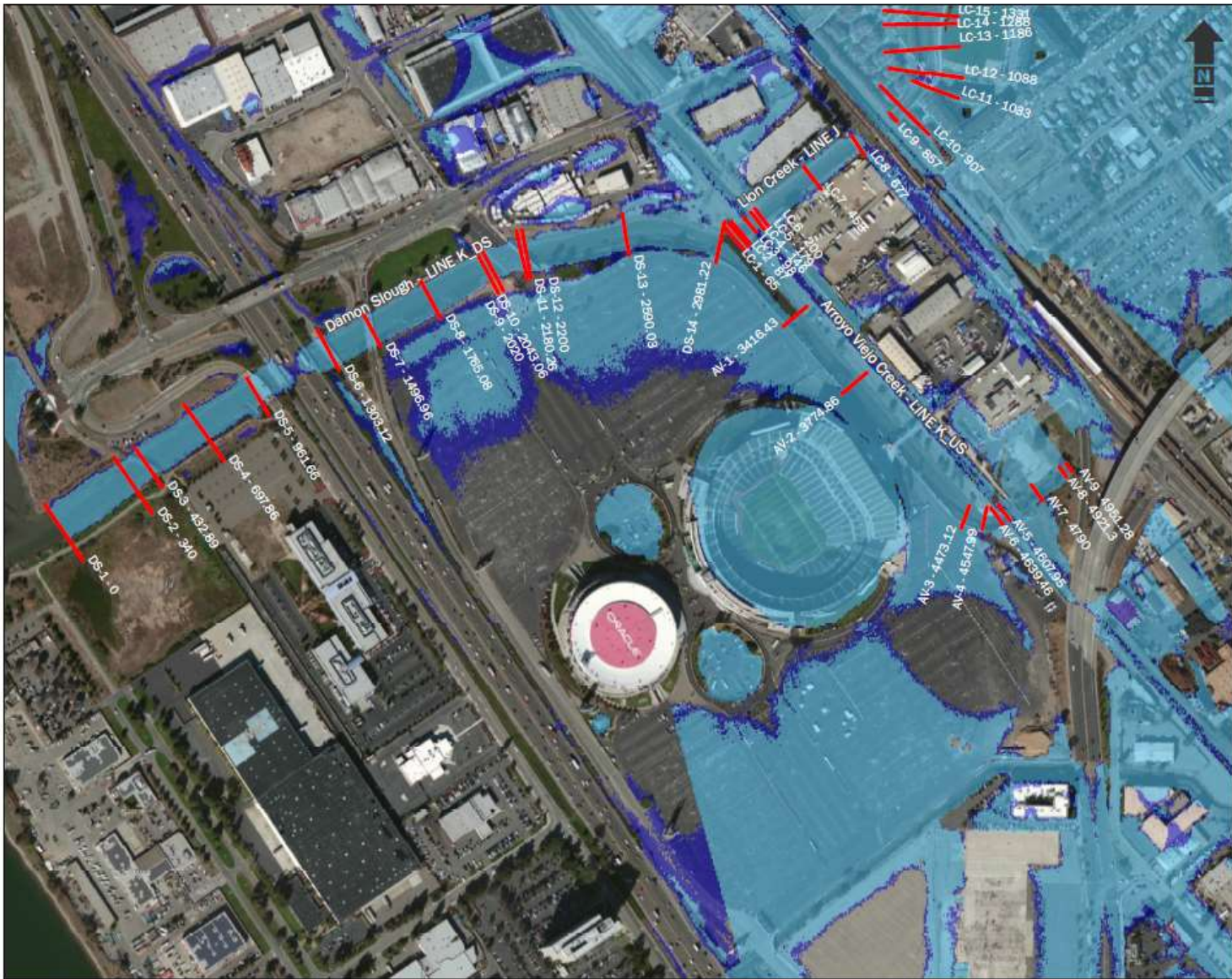
RAS XS	85	87	89	98	146
RAS XS	LC-1	LC-2	Bridge	LC-3	LC-4
LB   RB Elev.	13.12   13.24	13.12   13.24		13.16   13.21	10.24   10.97
Scenario	WSR (FT-NAVB8)				
MHHW + 10-year	9.16	9.17	-	9.18	9.18
+ 12" SLR	9.42	9.42	-	9.48	9.48
+ 24" SLR	9.93	9.94	-	10.03	10.02
MHHW + 100-year	10.72	10.73	-	10.98	10.98
+ 12" SLR	10.88	10.88	-	11.15	11.14
+ 24" SLR	11.17	11.18	-	11.48	11.48

RAS XS	85	87	90	96	146	160	179	208	453	667
RAS XS	LC-1	LC-2	Bridge	LC-3	LC-4	Bridge	LC-5	LC-6	LC-7	LC-8
LB   RB Elev.	13.12   13.24	13.12   13.24		13.16   13.21	10.24   10.57		16.16   10.23	12.09   12.09	12.78   12.49	13.00   13.09
Scenario	WSCL (FT-NAVB)									
MHHW + 10-year	9.16	9.17	-	9.18	9.18	-	9.3	9.31	9.39	9.48
+ 12" SLR	9.42	9.42	-	9.48	9.48	-	9.61	9.62	9.69	9.79
+ 24" SLR	9.93	9.94	-	10.03	10.03	-	10.18	10.17	10.22	10.28
MHHW + 100-year	10.72	10.73	-	10.89	10.98	-	11.37 (LB   RB)	11.4	11.47	11.54
+ 12" SLR	10.88	10.89	-	11.15	11.14 (LB   RB)	-	11.55 (LB   RB)	11.58	11.64	11.71
	11.17	11.18	-	11.48	11.41 (LB   RB)	-	11.8 (LB   RB)	11.83	11.88	11.94

RAS XS	3416.43	3744.86	4473.12	4547.99	4607.95	4639.46	Amtrak Crossing	4790	4921.3	4951.28
RAS XS	AV-1	AV-2	AV-3	AV-4	AV-5	AV-6		AV-7	AV-8	AV-9
LB   RB Elev.	10.4   10.65	11.02   10.83	11.86   10.73	12.09   10.67	10.74   10.26	11.11   10.86		12.53   11.27	12.97   12.97	17.02   12.51
Scenario	Water Surface Elevation (FT-NAVB8)									
MHHW + 10--year	9.38 -	9.55 -	9.92 -	10.01 -	10.01 -	9.99 -	-	10.26 -	10.36 -	10.31 -
+ 12" SLR	9.6 -	9.75 -	10.08 -	10.16 -	10.16 -	10.15 -	-	10.39 -	10.48 -	10.42 -
+ 24" SLR	10.07 -	10.19 -	10.44 -	10.51 -	10.5 RB	10.49 -	-	10.69 -	10.76 -	10.7 -
MHHW + 100-year	10.89 LB; RB	11.13 LB; RB	11.59 RB	11.69 RB1	11.67 LB1; RB	11.63 LB; RB	-	12.03 RB	12.02 -	11.78 -
+ 12" SLR	11.02 LB; RB	11.25 LB; RB	11.67 RB	11.77 RB	11.76 LB1; RB	11.72 LB; RB	-	12.09 RB	12.07 -	11.81 -
+ 24" SLR	11.29 LB; RB	11.48 LB; RB	11.88 RB1	11.94 RB1	11.93 LB1; RB	11.89 LB1; RB	-	12.22 -	12.19 -	11.93 -
10-year Extreme Tide + 10-year	10.2 -	10.3 -	10.55 -	10.61 -	10.6 RB	10.59 -	-	10.78 -	10.84 -	10.78 -
+ 12" SLR	10.83 LB; RB	10.91 -	11.08 RB	11.12 -	11.12 LB; RB	11.1 RB	-	11.26 -	11.29 -	11.23 -
+ 24" SLR	11.59 LB1; RB	11.64 LB; RB	11.75 RB1	11.78 RB1	11.78 RB1	11.77 LB; RB	-	11.87 RB	11.87 -	11.8 -
10-year Extreme Tide + 100-year	11.37 LB; RB	11.56 LB; RB	11.91 LB; RB1	12 RB1	11.99 LB1; RB1	11.95 LB; RB1	-	12.26 RB	12.23 -	11.97 -
+ 12" SLR	11.62 LB1; RB	11.98 LB; RB1	12.26 LB; RB1	12.32 LB; RB1	12.31 LB1; RB2	12.26 LB1; RB1	-	12.53 RB1	12.47 -	12.22 -
+ 24" SLR	12.42 LB2; RB1	12.54 LB1; RB	12.74 LB; RB2	12.79 LB; RB2	12.78 LB2; RB2	12.75 LB1; RB1	-	12.94 LB; RB1	12.86 -	12.62 RB
100-year Extreme Tide + 10-year	10.95 LB; RB	11.03 LB; RB	11.19 RB	11.23 RB	11.22 LB; RB	11.21 LB; RB	-	11.35 RB	11.38 -	11.31 -
+ 12" SLR	11.73 LB1; RB	11.78 -	11.88 LB; RB1	11.91 -	11.9 LB1; RB1	11.89 LB; RB1	-	11.99 -	11.98 -	11.92 -
+ 24" SLR	12.58 LB2; RB1	12.62 LB1; RB	12.68 LB; RB1	12.7 LB; RB2	12.7 LB1; RB2	12.69 LB1; RB	-	12.74 LB; RB1	12.73 -	12.66 RB

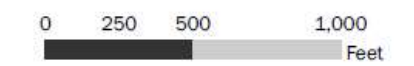
-	10.30	10.31	10.38	10.41
-	11.01	11.02	11.06	11.10
-	11.8	11.81	11.83	11.86
-	11.88	11.81	11.88	12.02
-	12.31	12.35	12.39	12.44
-	12.82	12.82	12.85	12.96
-	11.17	11.18	11.22	11.25
-	11.83	11.85	11.87	11.90
-	12.19	12.19	12.81	12.82





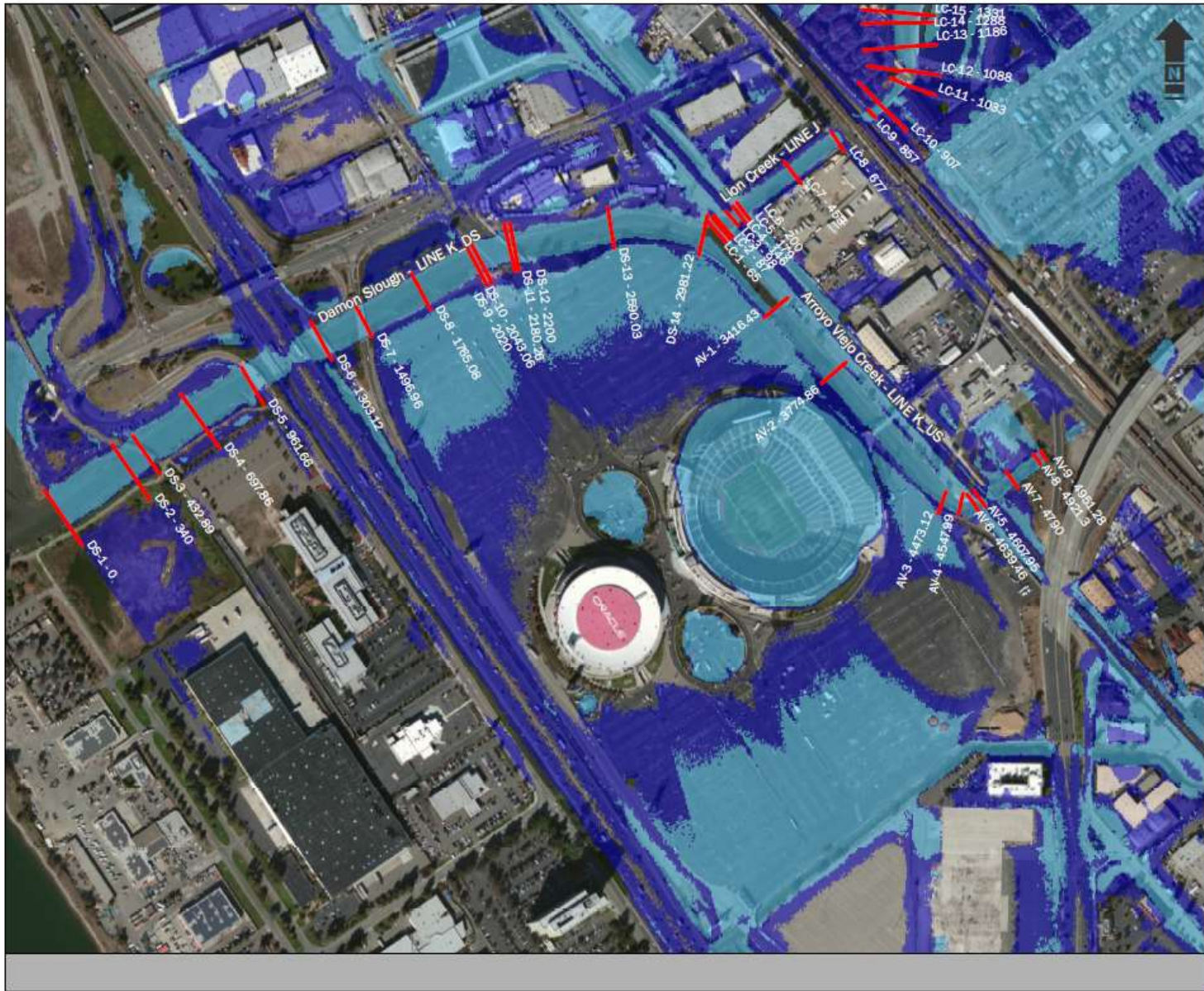
**MTC CLIMATE ADAPTATION**  
**Damon Slough Focus Area**  
**Alameda County**

- FLOODING EXTENTS**
- MHHW + 100-YR Peak Flow
  - MHHW (24" SLR) + 100-YR Peak Flow
  - HEC-RAS XS



North American Vertical Datum 1988  
 NAD 1983 StatePlane California III FIPS 0403 Feet





**MTC CLIMATE ADAPTATION**  
**Damon Slough Focus Area**  
**Alameda County**

**FLOODING EXTENTS**

- 10-YR Extreme Tide + 10-YR Peak Flow
- 10-YR Extreme Tide (24" SLR) + 10-YR Peak Flow
- HEC-RAS XS



0 250 500 1,000  
 Feet

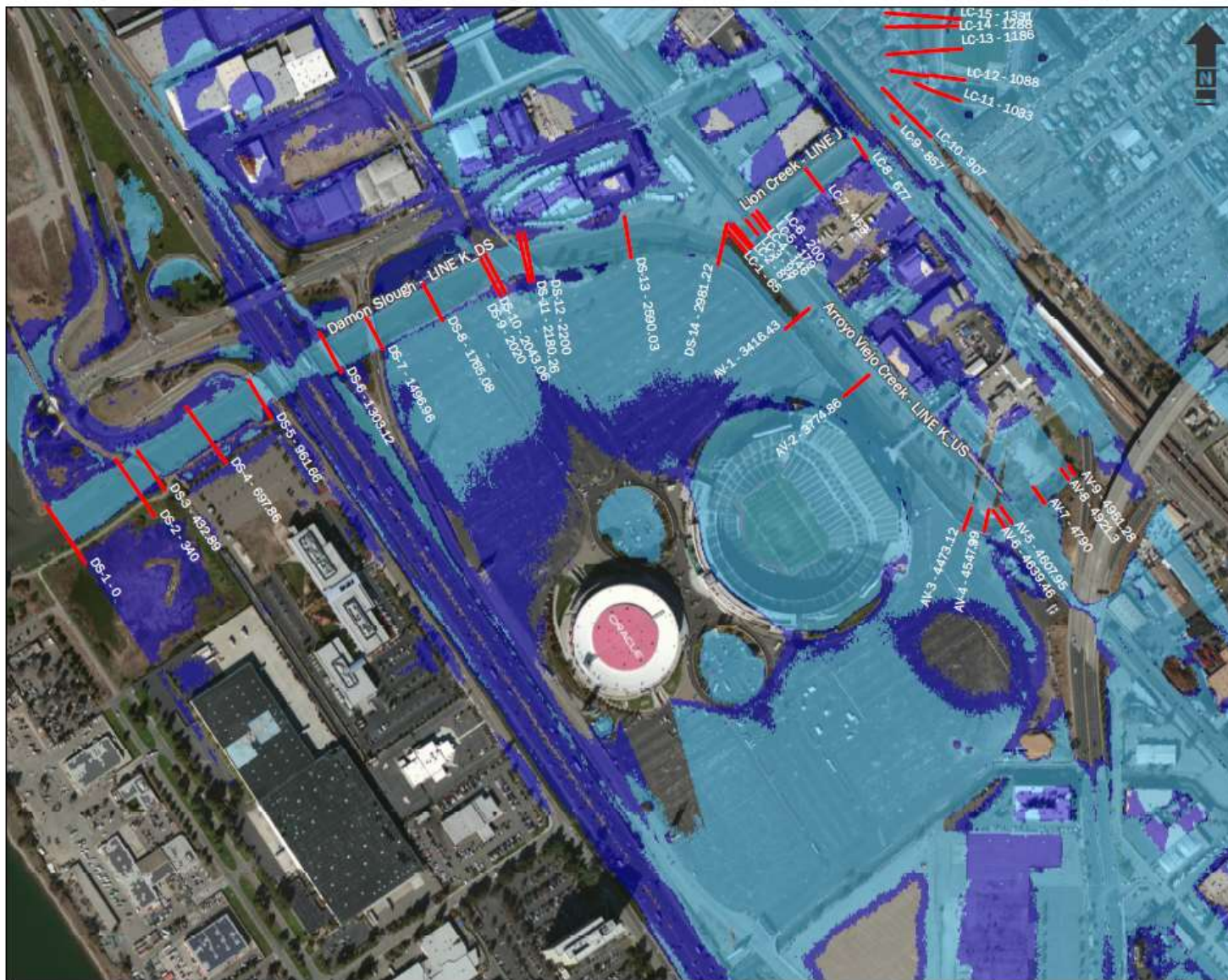
North American Vertical Datum 1988  
 NAD 1983 StatePlane California III FIPS 0403 Feet

**AECOM**

4/20/2014

**FIGURE 2**

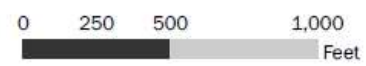




**MTC CLIMATE ADAPTATION**  
**Damon Slough Focus Area**  
**Alameda County**

**FLOODING EXTENTS**

- 10-YR Extreme Tide + 100-YR Peak Flow
- 10-YR Extreme Tide (24" SLR) + 100-YR Peak Flow
- HEC-RAS XS



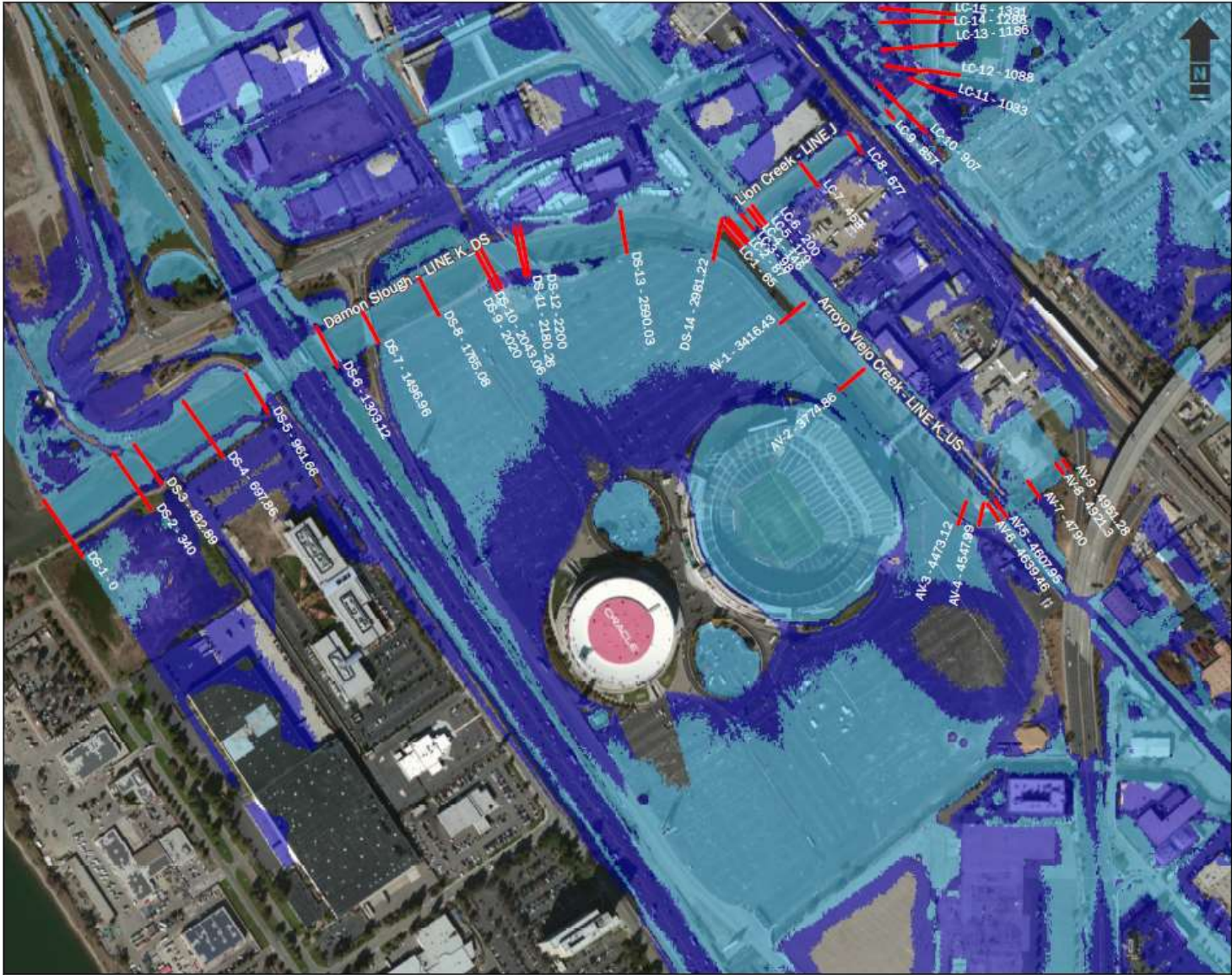
North American Vertical Datum 1988  
 NAD 1983 StatePlane California III FIPS 0403 Feet



4/20/2014

**FIGURE 3**





**MTC CLIMATE ADAPTATION**  
**Damon Slough Focus Area**  
**Alameda County**

**FLOODING EXTENTS**

- 100-YR Extreme Tide + 10-YR Peak Flow
- 100-YR Extreme Tide (24" SLR) + 10-YR Peak Flow
- HEC-RAS XS



North American Vertical Datum 1988  
NAD 1983 StatePlane California III FIPS 0403 Feet

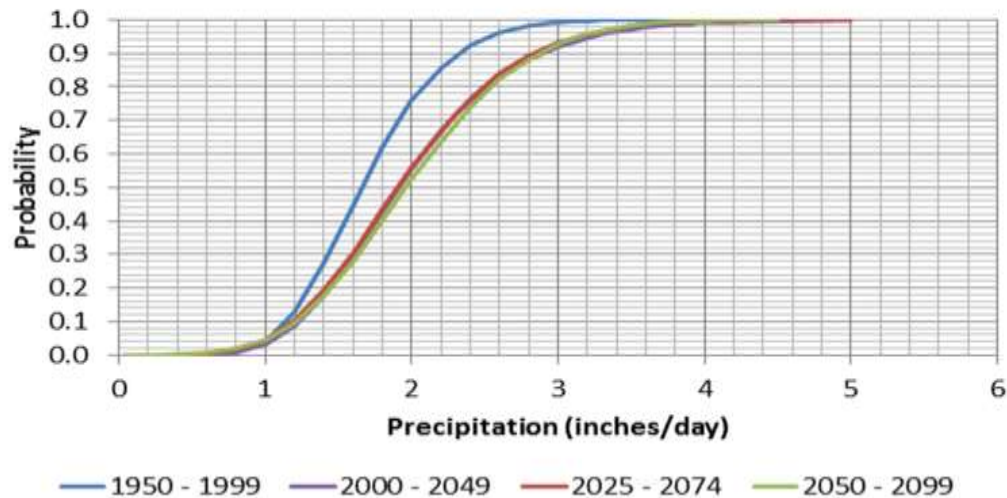


4/20/2014

**FIGURE 4**



# Generalized Extreme Value Probability Distribution For Precipitation at Mussel Rock (GFDL Model, RCP 8.5)



25-Year

100-Year

Precipitation Intensity (inches)

10-Year

Return Periods

- ◆ BNU-ESM
- CCSM4
- ▲ CNRM-CM5
- × CSIRO-Mk3-6-0
- × CanESM2
- GFDL-ESM2G
- + GFDL-ESM2M
- HadGEM2-CC365
- HadGEM2-ES365
- ◆ IPSL-CM5A-LR
- IPSL-CM5A-MR
- ▲ IPSL-CM5B-LR
- × MIROC-ESM
- × MIROC-ESM-CHEM
- MIROC5
- + MRI-CGCM3
- NorESM1-M
- bcc-csm1-1
- ◆ bcc-csm1-1-m
- inmcm4
- NWS Gauge
- Observed Gridded Baseline
- ▲ NOAA Atlas 14
- Ensemble Average















Stream	County	City	SFHA Designation	Floodway Score	Community Rating (1-5) Map errors, New Terrain, etc	Change in 1% Boundary Elevation	Distance Upstream	Study age	Levee Scale (1-5)	Scale (1-5) 1 = many homes in SFHA	FINAL Rank Score
Pajaro River	Santa Cruz	Pajaro Dunes	5	5	1	3.0	3	3	5	5	16875
Aptos Creek	Santa Cruz	Santa Cruz	5	5	1	4.0	2	3	1	5	3000
Willow Creek	San Luis Obispo	Cayucos	5	5	1	3	2	4	1	5	3000
Elkhorn Slough	Monterey	Moss Landing	5	5	1	2	3	3	3	2	2700
San Lorenzo River	Santa Cruz	Santa Cruz	5	5	1	1	2	2	5	5	2500
Parajo River	Monterey	Moss Landing	5	5	1	3	3	3	3	1	2025
San Luis Obispo Creek	San Luis Obispo	Pismo Beach	5	5	1	3	1	4	1	5	1500
Cayucos Creek	San Luis Obispo	Cayucos	5	5	1	3	1	3	1	5	1125
Little Cayucos Creek	San Luis Obispo	Cayucos	5	5	1	3	1	3	1	5	1125
Watsonville Slough	Santa Cruz	Pajaro Dunes	5	5	1	1	3	3	1	5	1125
Pismo Creek	San Luis Obispo	Avila Beach	5	5	1	3	1	4	1	3	900
Carmel River	Monterey	Carmel	5	1	1	1	2	3	5	5	750
Soquel Creek	Santa Cruz	Santa Cruz	5	5	1	1.0	2	2	1	5	500
Pescadero Creek	San Mateo	Pescadero	5	5	1	1	3	5	1	1	375
Unnamed Creek	San Luis Obispo	Morro Bay	5	1	1	3	1	4	1	5	300
Salinas River	Monterey	Salinas	5	1	1	3	1	3	3	2	270
Arroyo Grande Creek	San Luis Obispo	Oceano	5	1	1	3	1	3	1	5	225
Morro Creek	San Luis Obispo	Morro Bay	5	1	1	3	1	3	1	5	225
Moore Creek	Santa Cruz	Santa Cruz	5	5	1	2	1	2	1	2	200
Santa Rosa Creek	San Luis Obispo	Cambria	5	5	1	1	1	2	1	4	200
Canyon Del Ray	Monterey	Sand City	5	1	1	3	1	3	1	4	180
Rodeo Creek Gulch	Santa Cruz	Santa Cruz	5	5	1	1	1	2	1	3	150
Montara Creek	San Mateo	Montara	5	1	1	1	1	4	1	5	100
Alva Paul Creek	San Luis Obispo	Morro Bay	5	1	1	1	1	3	1	5	75
San Pedro Creek	San Mateo	Pacifica	3	1	1	1	1	4	1	5	60
San Vicente Creek	Santa Cruz	Davenport	5	1	1	1	1	3	1	4	60
Toro Creek	San Luis Obispo	Morro Bay	5	1	1	3	1	4	1	1	60
San Vicente Creek	San Mateo	Montara	5.00	1	1	1	1	3	1	3	45
Demistion Creek	San Mateo	Princeton	5.00	1	1	1	1	3	1	3	45
San Bernardo Creek	San Luis Obispo	Morro Bay	5	1	1	1	1	3	1	3	45
Schwan Lagoon	Santa Cruz	Santa Cruz	5	1	1	1	1	2	1	4	40
Old Creek	San Luis Obispo	Cayucos	5	1	1	1	1	2	1	4	40
Osos Creek	San Luis Obispo	Morro Bay	5	1	1	1	1	2	1	3	30
Castroville Boulevard	Monterey	Moss Landing	1	1	1	1	1	3	4	2	24
Unnamed Creek	San Mateo	Montara	1	1	1	1	1	4	1	5	20
Van Gordon Creek	San Luis Obispo	San Simeon	1	1	1	1	1	4	1	4	16
Younger Lagoon	Santa Cruz	Santa Cruz	5	1	1	1	1	3	1	1	15
Coon Creek	San Luis Obispo	Los Osos	5	1	1	1	1	3	1	1	15
Islay Creek	San Luis Obispo	Los Osos	5	1	1	1	1	3	1	1	15
Calera Creek	San Mateo	Pacifica	1	1	1	1	1	4	1	3	12
Unnamed Creek	San Mateo	Pacifica	1	1	1	1	1	4	1	3	12
Leffingwell Creek	San Luis Obispo	San Simeon	1	1	1	1	1	3	1	4	12
Oso Flaco Creek	San Luis Obispo	-	5	1	1	1	1	2	1	1	10
Moran Lake	Santa Cruz	Santa Cruz	1	1	1	1	1	2	1	4	8
Laguna Salada	San Mateo	Fairway Park	1	1	1	1	1	2	1	3	6
Tembladero Slough	Monterey	Moss Landing	1	1	1	1	1	3	1	2	6
Broken Bridge Creek	San Luis Obispo	San Simeon	1	1	1	1	1	3	1	2	6
Frenchmans Creek	San Mateo	Halfmoon Bay	1	1	1	1	1	2	1	2	4
Pico Creek	San Luis Obispo	San Simeon	1	1	1	1	1	2	1	2	4
Gazos Creek	San Mateo	Pescadero	1	1	1	1	1	3	1	1	3
Cascade Creek	San Mateo	-	1	1	1	1	1	3	1	1	3
Green Oaks Creek	San Mateo	-	1	1	1	1	1	3	1	1	3
Finnay Creek	San Mateo	Davenport	1	1	1	1	1	3	1	1	3
Elliot Creek	San Mateo	Davenport	1	1	1	1	1	3	1	1	3
Waddell Creek	Santa Cruz	Swanton	1	1	1	1	1	3	1	1	3
Scott Creek	Santa Cruz	Swanton	1	1	1	1	1	3	1	1	3
Molino Creek	Santa Cruz	Swanton	1	1	1	1	1	3	1	1	3
Laguna Creek	Santa Cruz	Davenport	1	1	1	1	1	3	1	1	3
Majors Creek	Santa Cruz	Davenport	1	1	1	1	1	3	1	1	3
Baldwin Creek	Santa Cruz	Santa Cruz	1	1	1	1	1	3	1	1	3
Lombardi Gulch	Santa Cruz	Santa Cruz	1	1	1	1	1	3	1	1	3
Old Dairy Gulch	Santa Cruz	Santa Cruz	1	1	1	1	1	3	1	1	3
Wilder Creek	Santa Cruz	Santa Cruz	1	1	1	1	1	3	1	1	3
Big Sur River	Monterey	Big Sur	1	1	1	1	1	3	1	1	3
Bixby Creek	Monterey	Carmel	1	1	1	1	1	3	1	1	3
Little Sur River	Monterey	Carmel	1	1	1	1	1	3	1	1	3
San Jose Creek	Monterey	Carmel	1	1	1	1	1	3	1	1	3
Arroyo de la Laguna	San Luis Obispo	-	1	1	1	1	1	3	1	1	3
Little Pico Creek	San Luis Obispo	San Simeon	1	1	1	1	1	3	1	1	3
Pomponio Creek	San Mateo	San Gregorio	1	1	1	1	1	2	1	1	2
Purissima Creek	San Mateo	Halfmoon Bay	1	1	1	1	1	2	1	1	2
Tunitas Creek	San Mateo	Halfmoon Bay	1	1	1	1	1	2	1	1	2
San Gregorio Creek	San Mateo	Halfmoon Bay	1	1	1	1	1	2	1	1	2
Arroyo de los Frijoles	San Mateo	Pescadero	1	1	1	1	1	2	1	1	2
Oak Knoll Creek	San Luis Obispo	-	1	1	1	1	1	2	1	1	2
San Carpoforo Creek	San Luis Obispo	-	1	1	1	1	1	2	1	1	2
Villa Creek	San Luis Obispo	-	1	1	1	1	1	2	1	1	2

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Elkhorn Slough	Monterey	Moss Landing	2700
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Cayucos Creek	San Luis Obispo	Cayucos	1125
Little Cayucos Creek	San Luis Obispo	Cayucos	1125
Watsonville Slough	Santa Cruz	Pajaro Dunes	1125
Pismo Creek	San Luis Obispo	Avila Beach	900
Carmel River	Monterey	Carmel	750
Soquel Creek	Santa Cruz	Santa Cruz	500
Pescadero Creek	San Mateo	Pescadero	375
Unnamed Creek	San Luis Obispo	Morro Bay	300
Salinas River	Monterey	Salinas	270
Arroyo Grande Creek	San Luis Obispo	Oceano	225
Morro Creek	San Luis Obispo	Morro Bay	225
Moore Creek	Santa Cruz	Santa Cruz	200
Santa Rosa Creek	San Luis Obispo	Cambria	200
Canyon Del Ray	Monterey	Sand City	180
Rodeo Creek Gulch	Santa Cruz	Santa Cruz	150
Montara Creek	San Mateo	Montara	100
Alva Paul Creek	San Luis Obispo	Morro Bay	75









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