

City of San Rafael Sea-Level Rise Adaption Study

Adaptation Measures

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Study Goals & Objectives

Goal

- Develop an implementable sea-level rise adaptation plan for City of San Rafael shoreline and residents

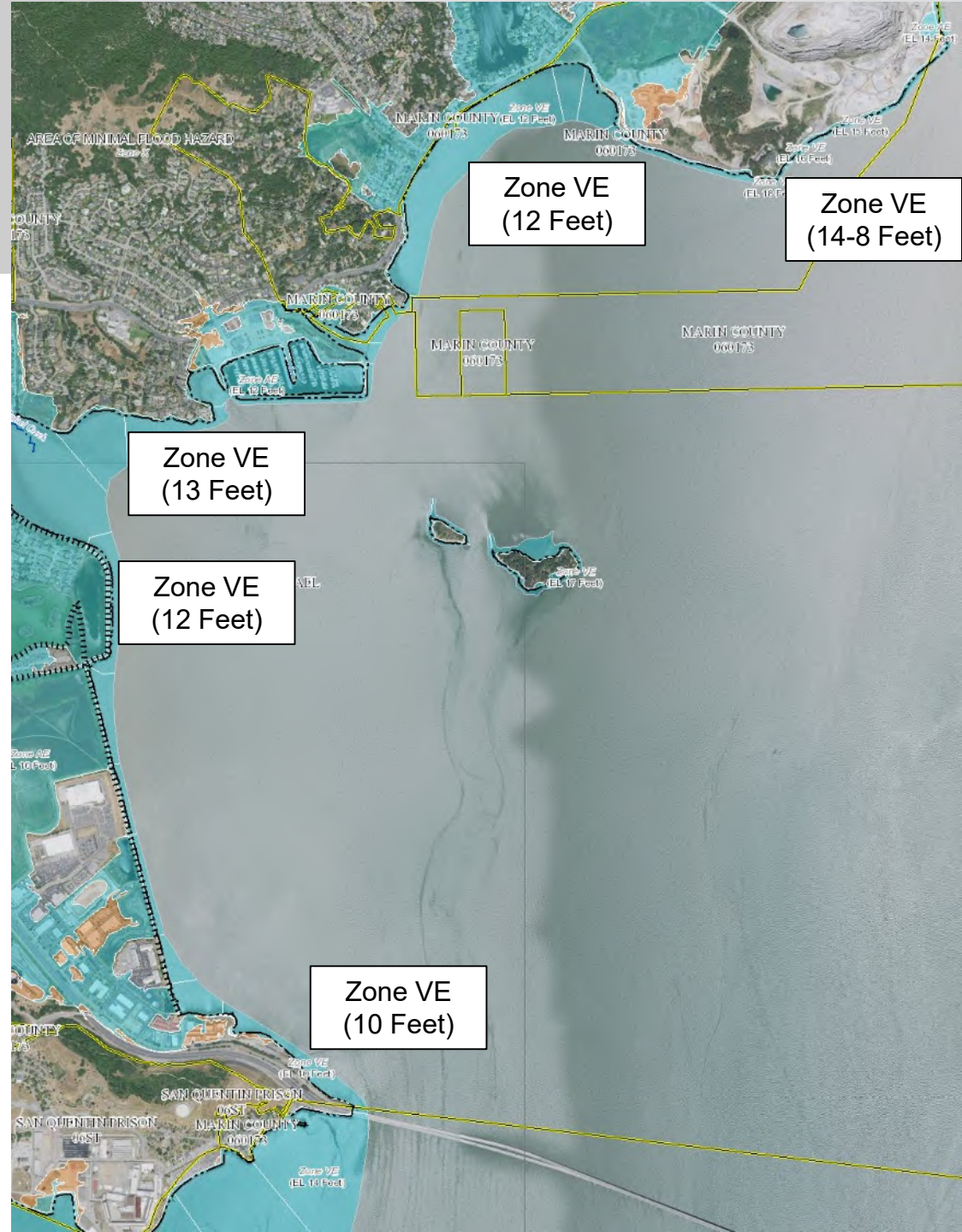
Objectives

- Assess baseline flood risk that includes future sea-level rise projections
- Develop reasonable & feasible sea level rise adaptations appropriate to San Rafael's setting
- Evaluate range of adaptation measures to inform the selection of recommended measures
- Integrate recommended measures into phased adaptation plan to guide implementation

FEMA SFHA Map

VE Zones

w/Nearshore Waves



NFHL

Base Flood Elevations
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Political Jurisdictions
□

Levees
||

Flood Hazard Boundaries
 - Limit Lines
 - SFHA / Flood Zone Boundary
 - Other Boundaries

Flood Hazard Zones
 ■ 1% Annual Chance Flood Hazard
 ■ Regulatory Floodway
 ■ Special Floodway
 ■ Area of Undetermined Flood Hazard
 ■ 0.2% Annual Chance Flood Hazard

Flood Still Water Levels (SWEL)

Return interval	San Rafael (ft NAVD)	San Francisco (ft NAVD)
Daily*	6.1	6.1
1-year	7.3	7.2
Feb 7, 2017 (coincident with ~1" precipitation)	7.9	7.4
Feb 14, 2019 (coincident with ~5" precipitation)	7.9	7.5
10-year	8.3	8.3
100-year	9.5	9.5

* MHHW

Flood Still Water Levels with Sea-Level Rise

	San Rafael Shoreline Water Level (ft NAVD)				
Return interval	0 ft SLR	1 ft SLR	2 ft SLR	3 ft SLR	5 ft SLR
Daily*	6.1	7.1	8.1	9.1	11.1
1-year	7.3	8.3	9.3	10.3	12.3
10-year	8.3	9.3	10.3	11.3	13.3
100-year	9.5	10.5	11.5	12.5	14.5

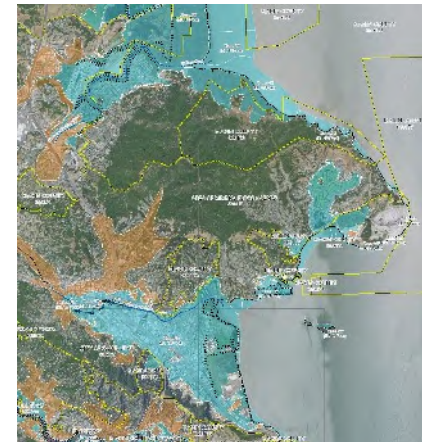
* MHHW



King tide (~1-yr), San Pedro Rd

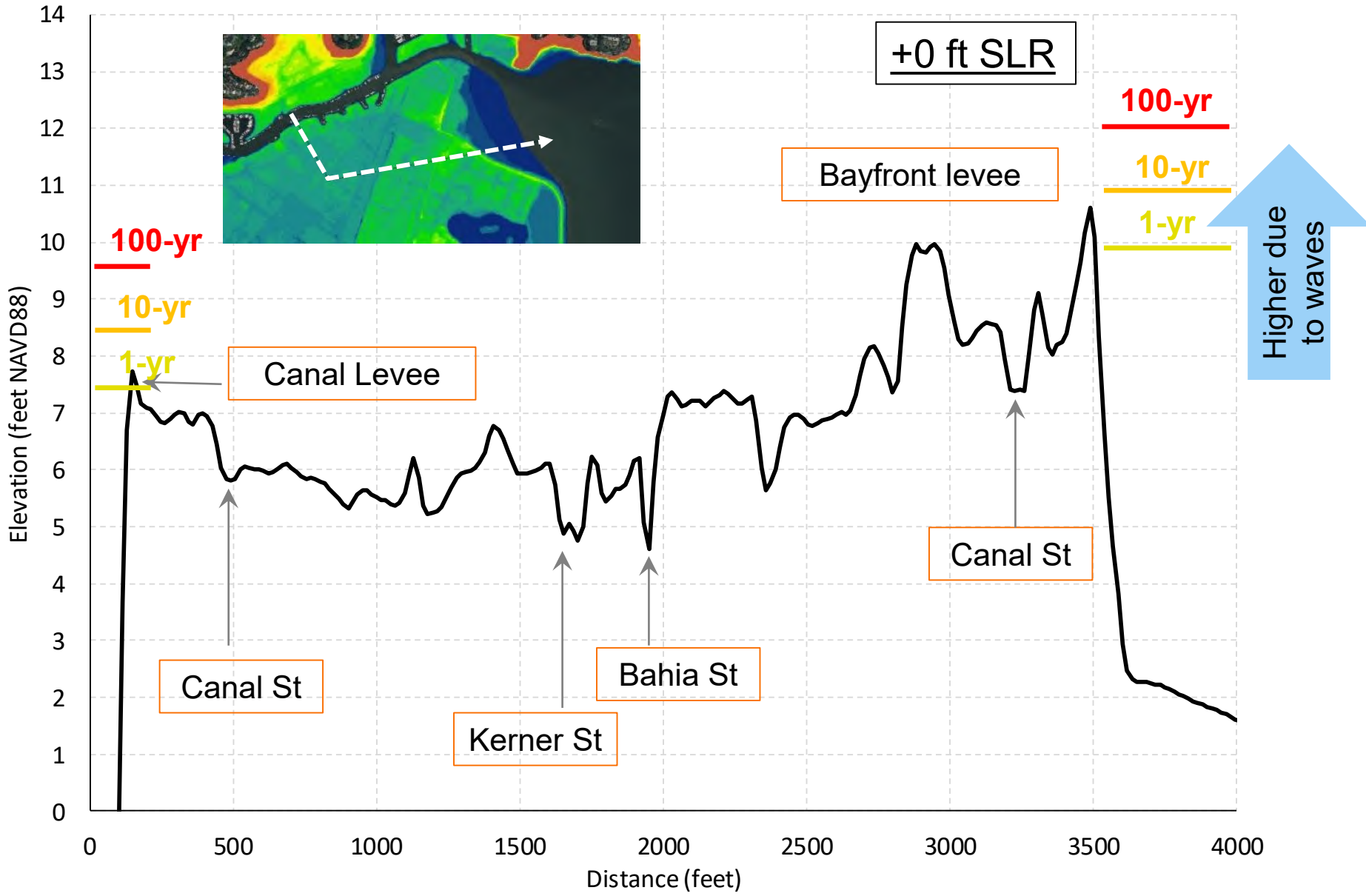


10-yr, Feb '17

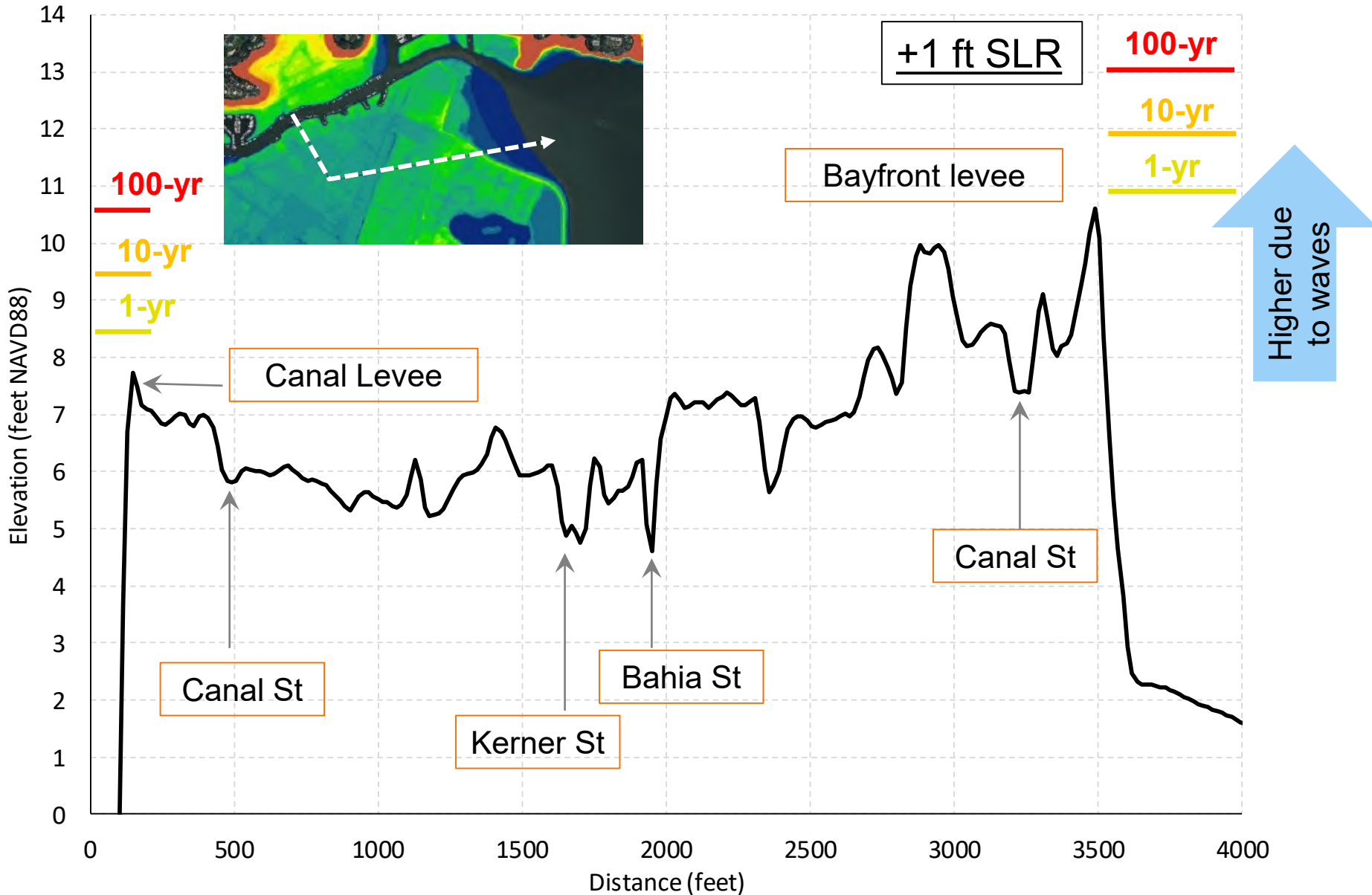


FEMA 100-yr Floodplain

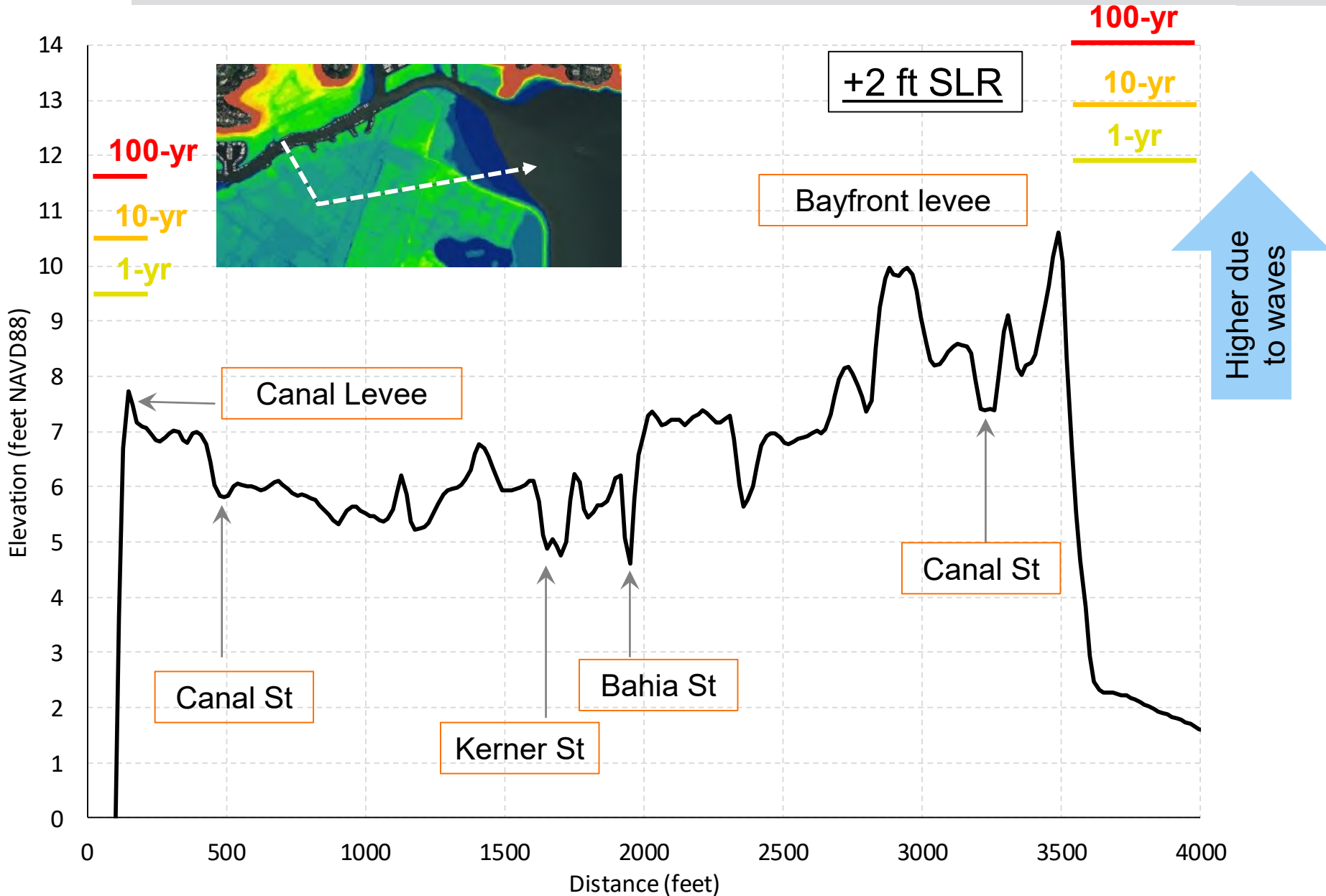
Water Levels Relative to Topography



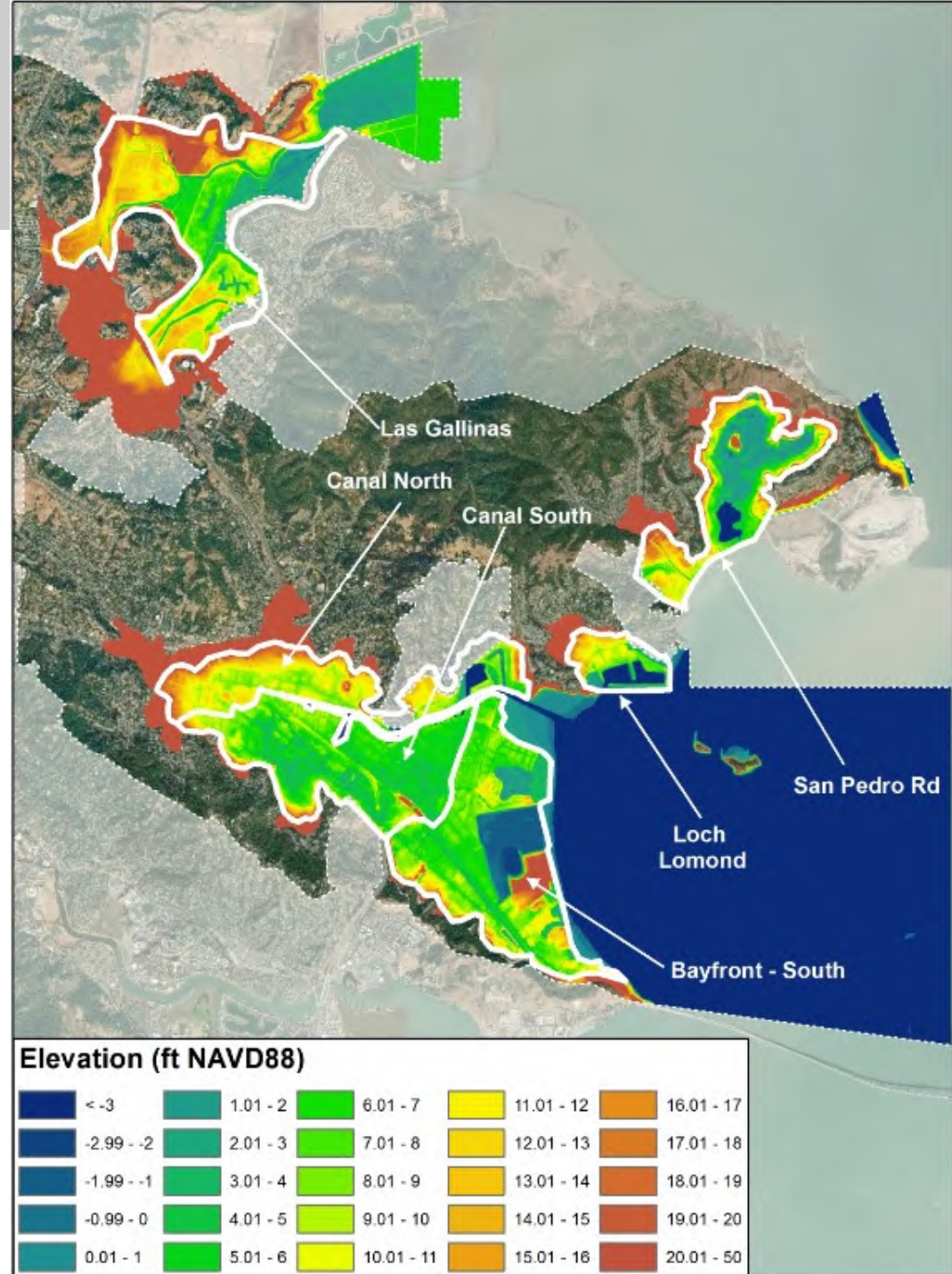
Water Levels Relative to Topography



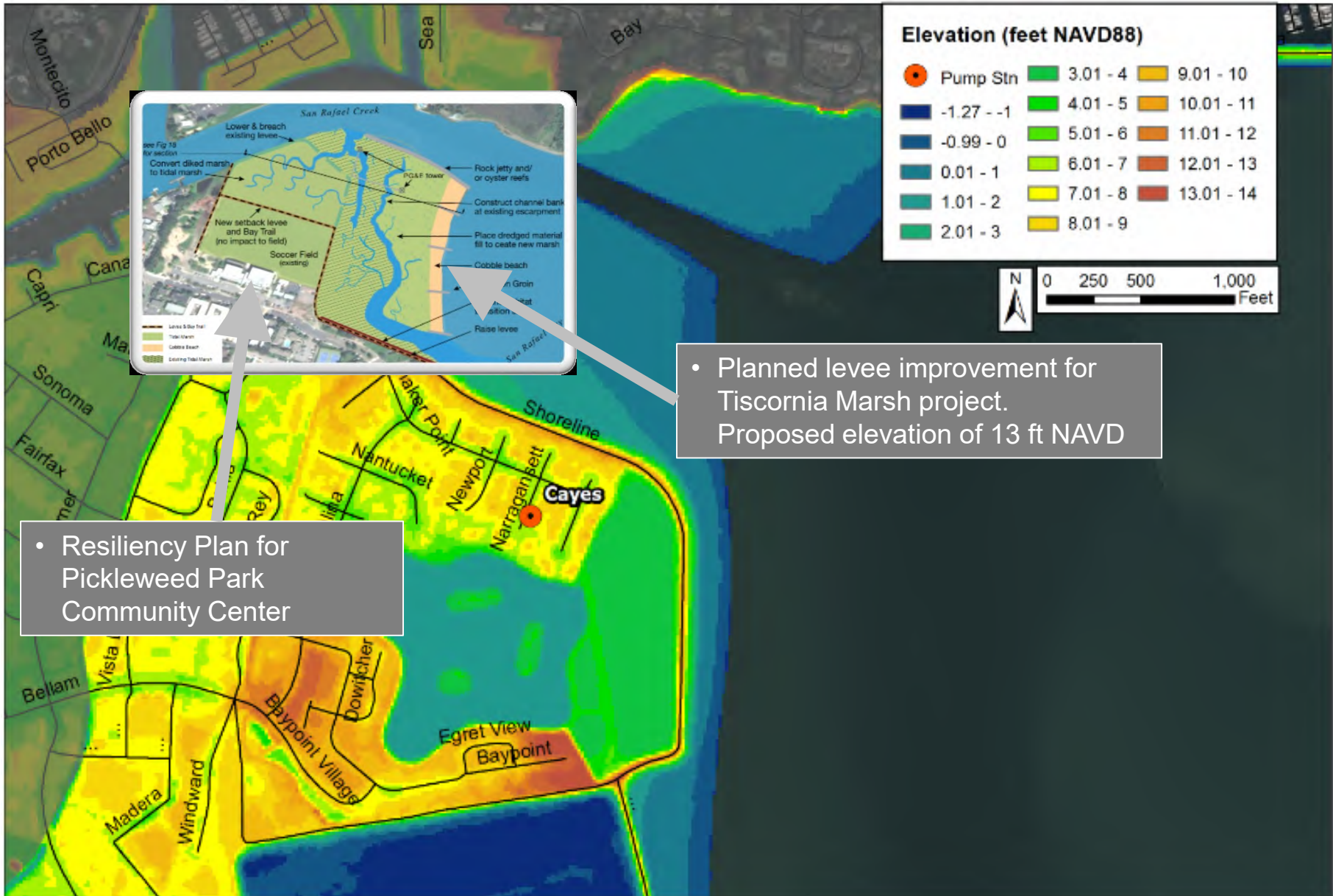
Water Levels Relative to Topography



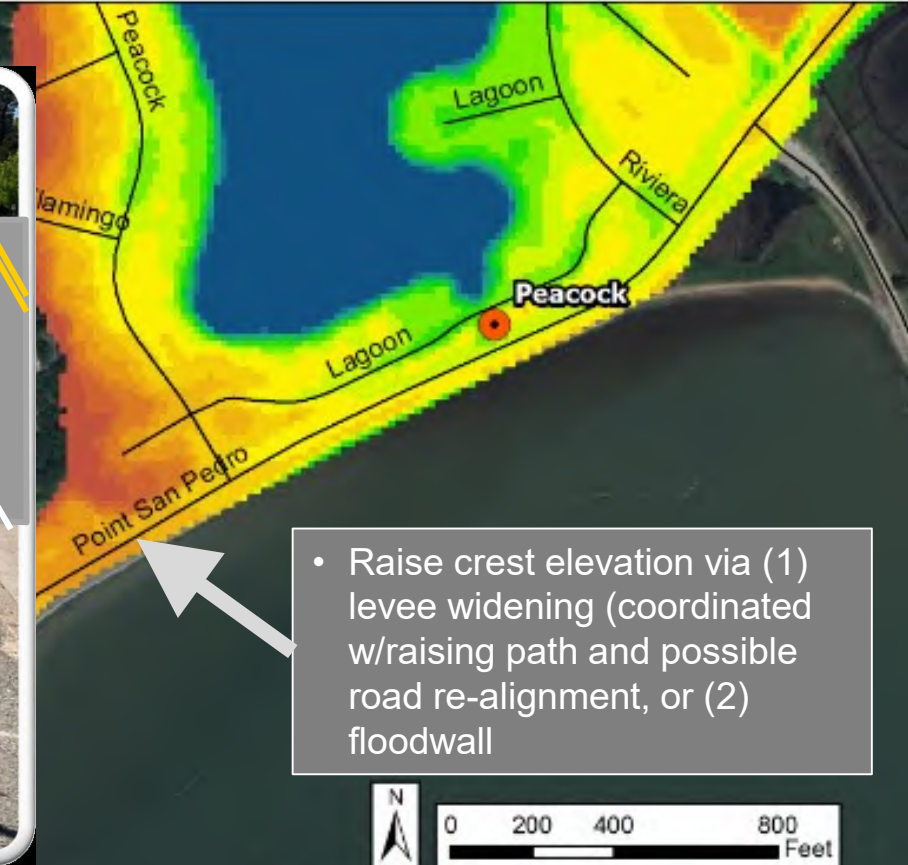
Shoreline Reaches & Elevations



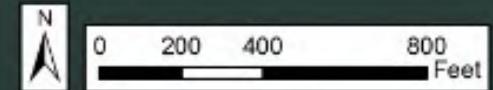
Bayfront South – Adaptation Measures



Point San Pedro Road – Adaptation Measures



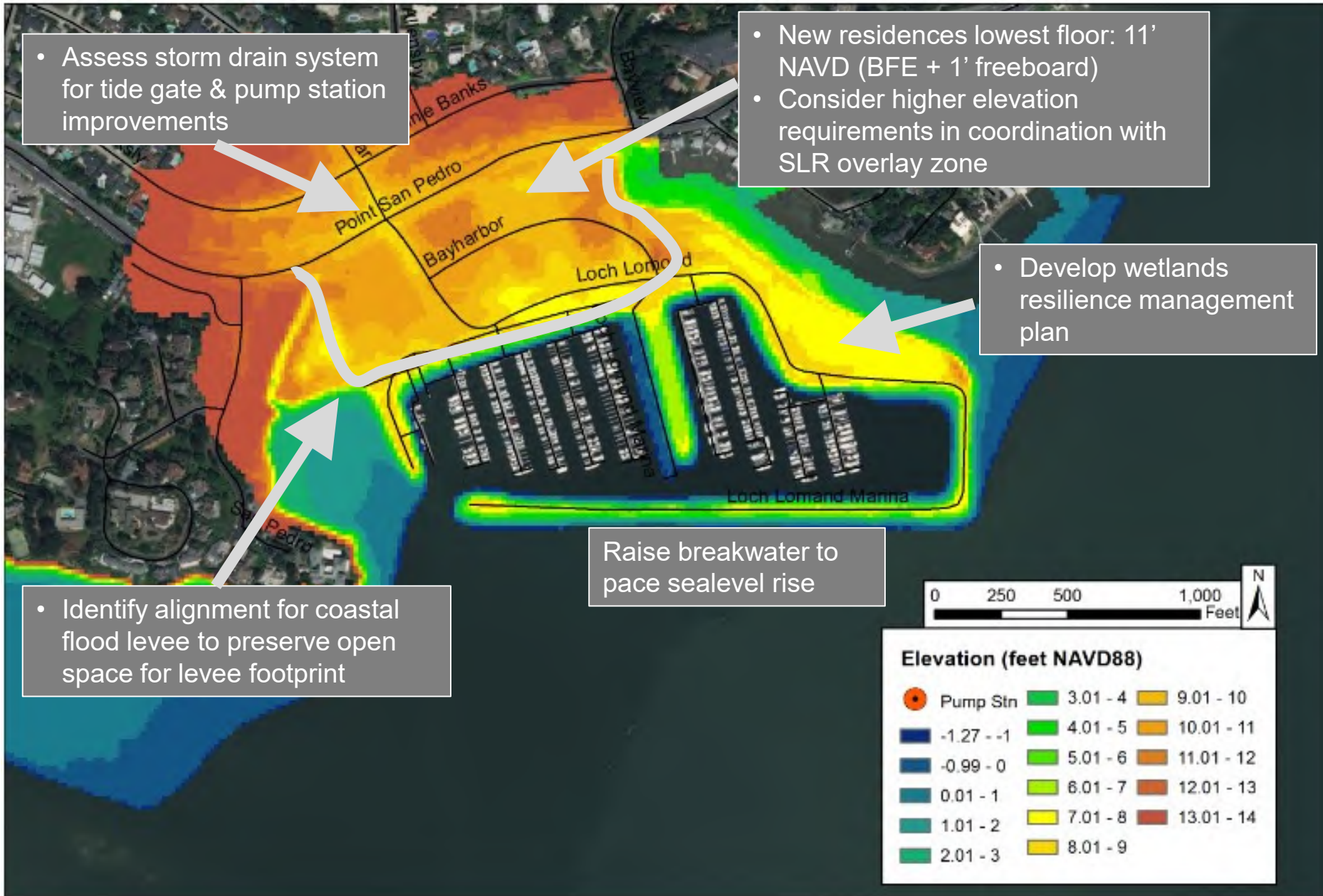
- Raise crest elevation via (1) levee widening (coordinated w/raising path and possible road re-alignment, or (2) floodwall



Elevation (feet NAVD88)

● Pump Stn	3.01 - 4	9.01 - 10
< -1	4.01 - 5	10.01 - 11
-0.99 - 0	5.01 - 6	11.01 - 12
0.01 - 1	6.01 - 7	12.01 - 13
1.01 - 2	7.01 - 8	13.01 - 14
2.01 - 3	8.01 - 9	

Loch Lomond – Adaptation Measures



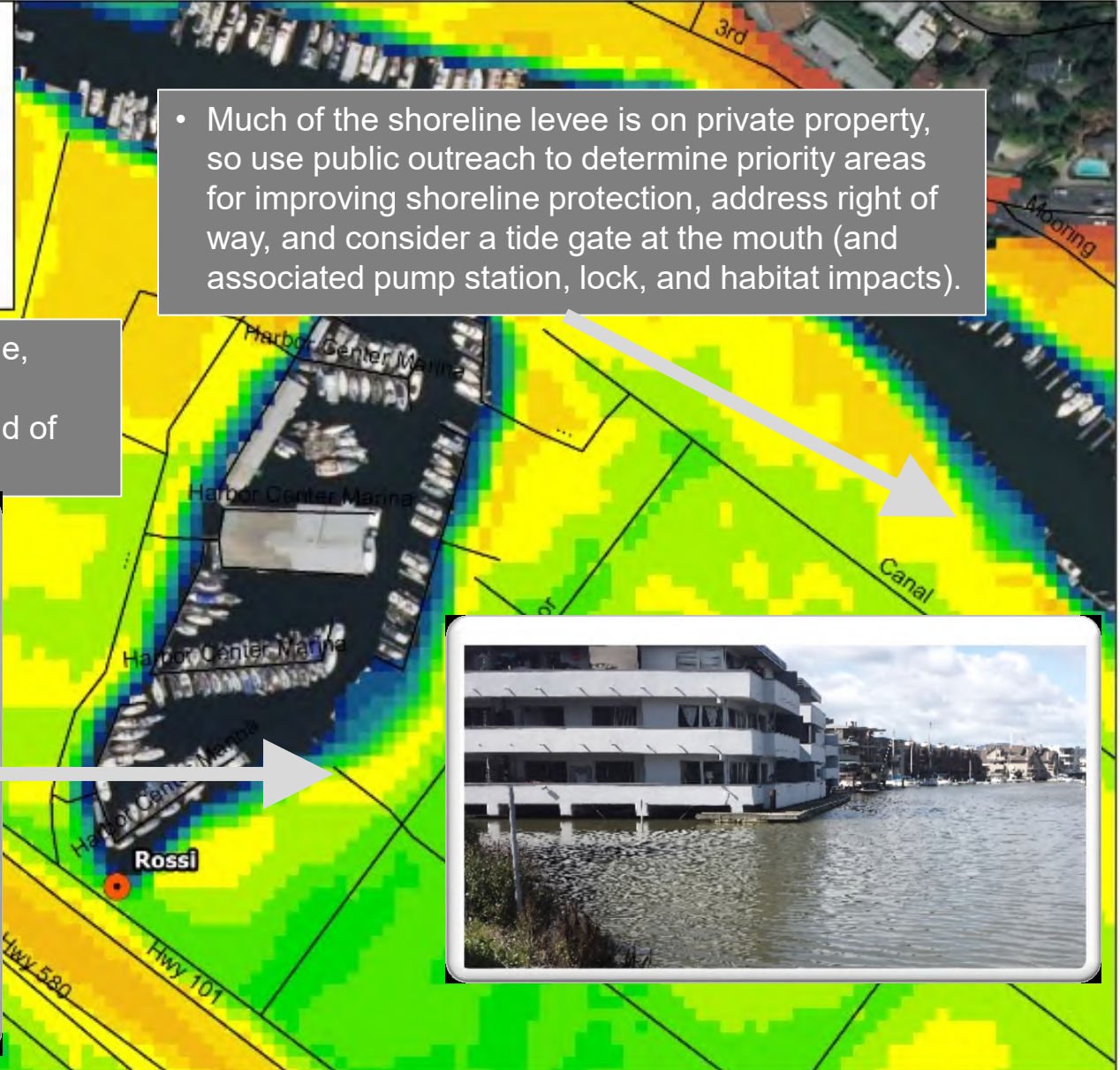
Canal South – Adaptation Measures

Elevation (feet NAVD88)

● Pump Stn	3.01 - 4	9.01 - 10
-1.27 - -1	4.01 - 5	10.01 - 11
-0.99 - 0	5.01 - 6	11.01 - 12
0.01 - 1	6.01 - 7	12.01 - 13
1.01 - 2	7.01 - 8	13.01 - 14
2.01 - 3	8.01 - 9	

- Much of the shoreline levee is on private property, so use public outreach to determine priority areas for improving shoreline protection, address right of way, and consider a tide gate at the mouth (and associated pump station, lock, and habitat impacts).

- Raise low point along shoreline, likely with earth fill at end of roadway, sheet pile around end of building



Summary: Develop Flood Management Plan for Sea Level Rise

