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Safety First

Improving Hazard Resilience in the Bay Area

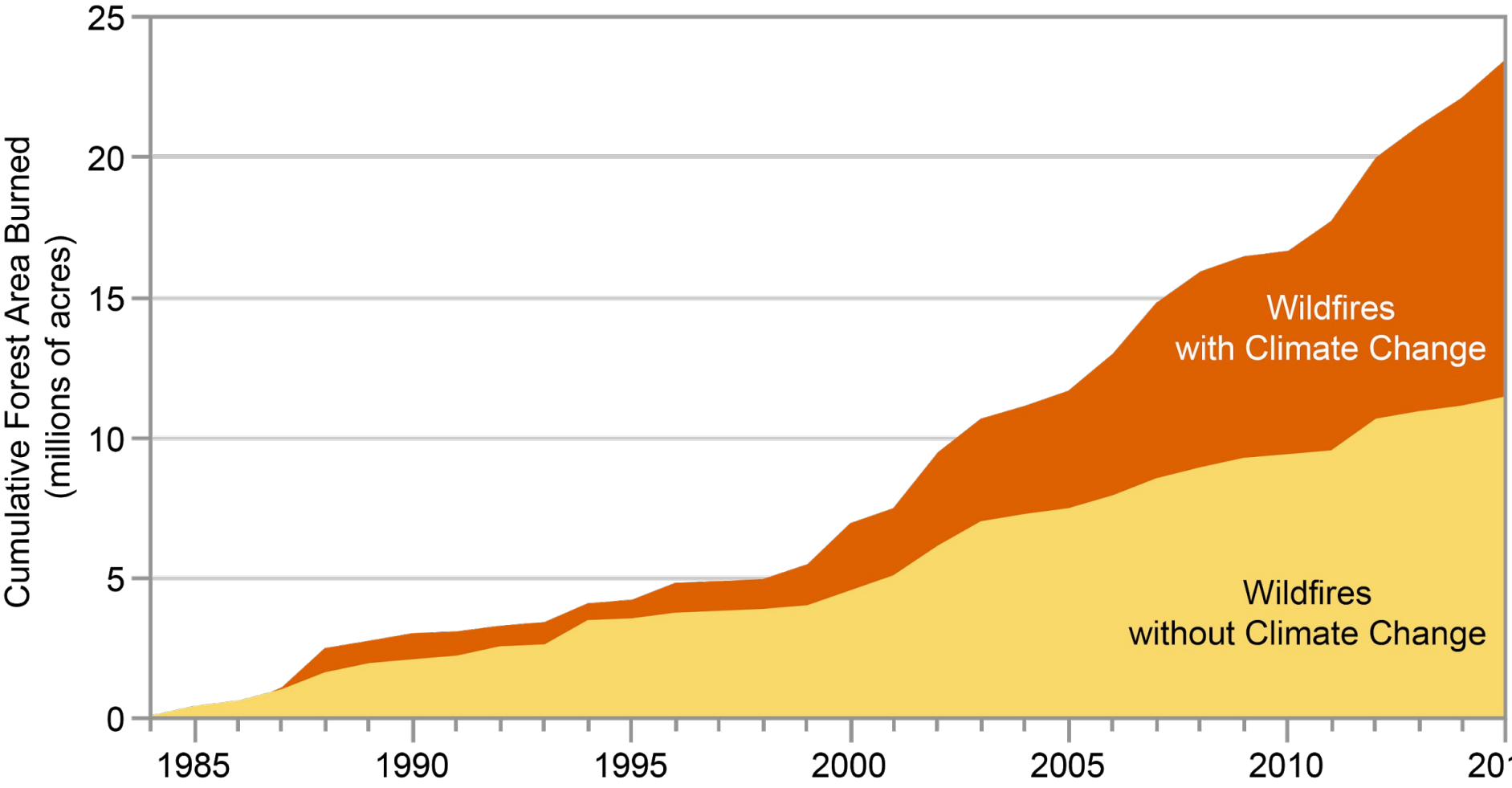
A white paper prepared for the SPUR Regional Strategy
Laura Tam & Laurie Johnson
January 2020



Key questions

1. What do we need to do to mitigate worsening hazards as the Bay Area adds people, jobs, and housing over the next 50 years?
2. As a region exposed to multiple natural hazards, what can we do together to improve community-wide resilience, that we cannot achieve acting alone as individual cities and counties?





101 SOUTH
San Rafael
San Francisco

101 NORTH
Santa Rosa
Eureka
1/4 MILE

Hanna Ranch Rd
↗

SOUTH San Rafael
San Francisco

SOUTH MARIETTA
Boulevard
1/4 MILE

EXIT
↘



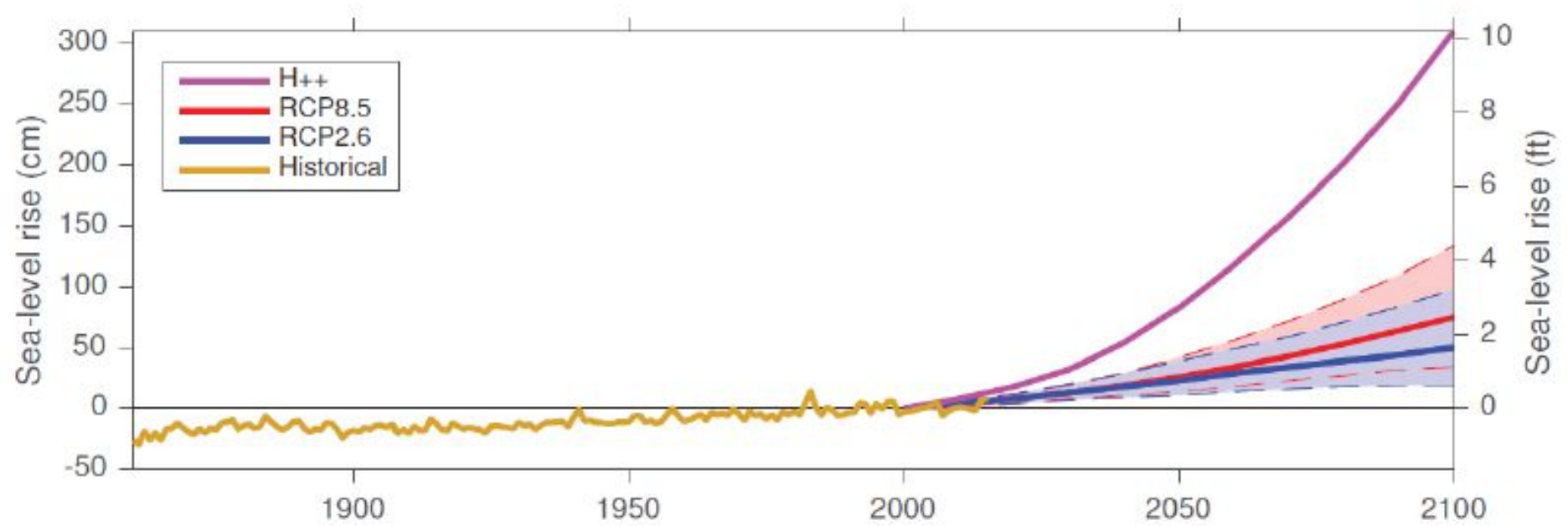
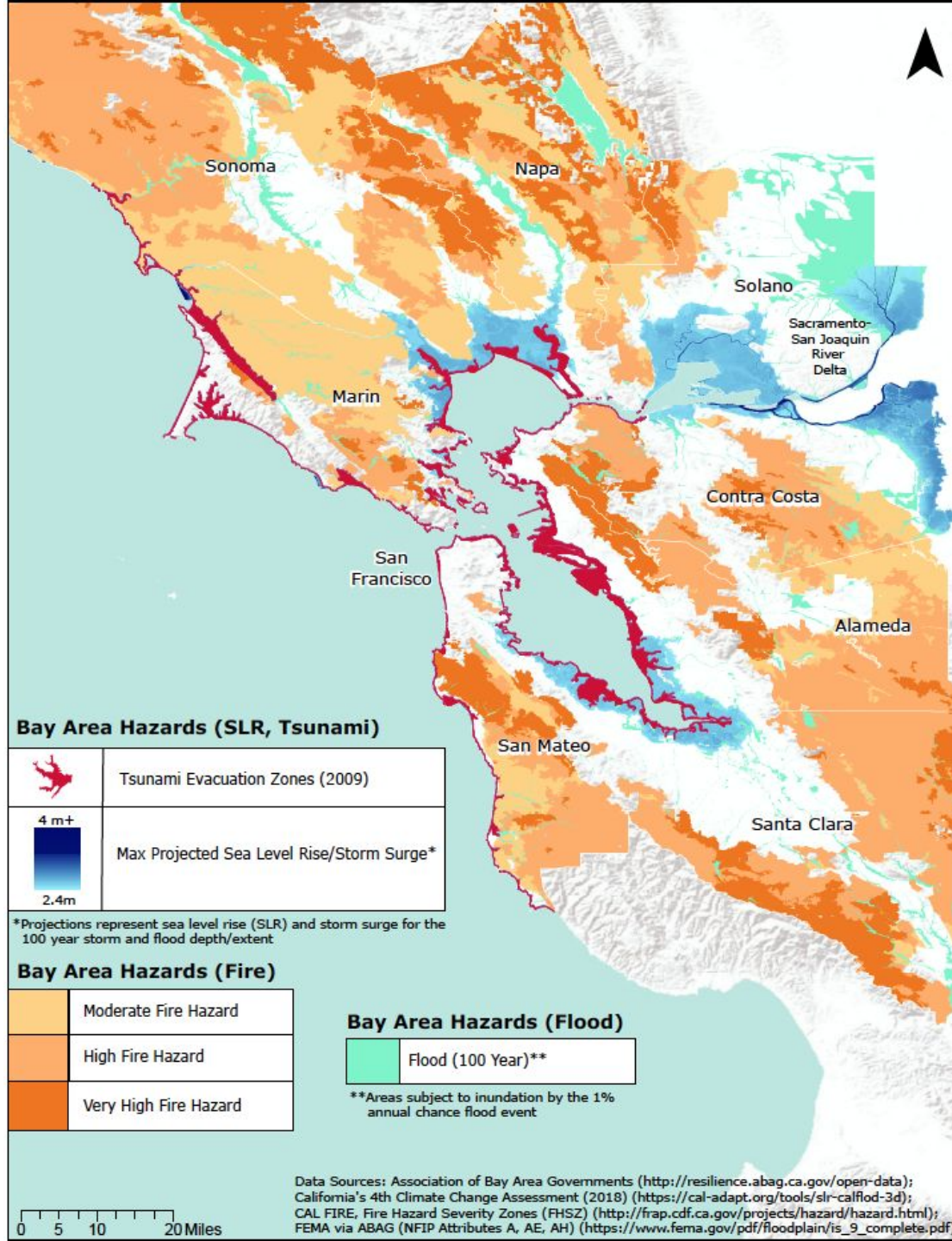




Figure 2
Relative sea level in San Francisco (from Griggs et al. 2017)






Bay Area Hazards (SLR, Tsunami)


	Tsunami Evacuation Zones (2009)
	Max Projected Sea Level Rise/Storm Surge*

*Projections represent sea level rise (SLR) and storm surge for the 100 year storm and flood depth/extent

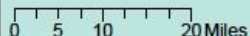
Bay Area Hazards (Fire)

	Moderate Fire Hazard
	High Fire Hazard
	Very High Fire Hazard

Bay Area Hazards (Flood)

	Flood (100 Year)**
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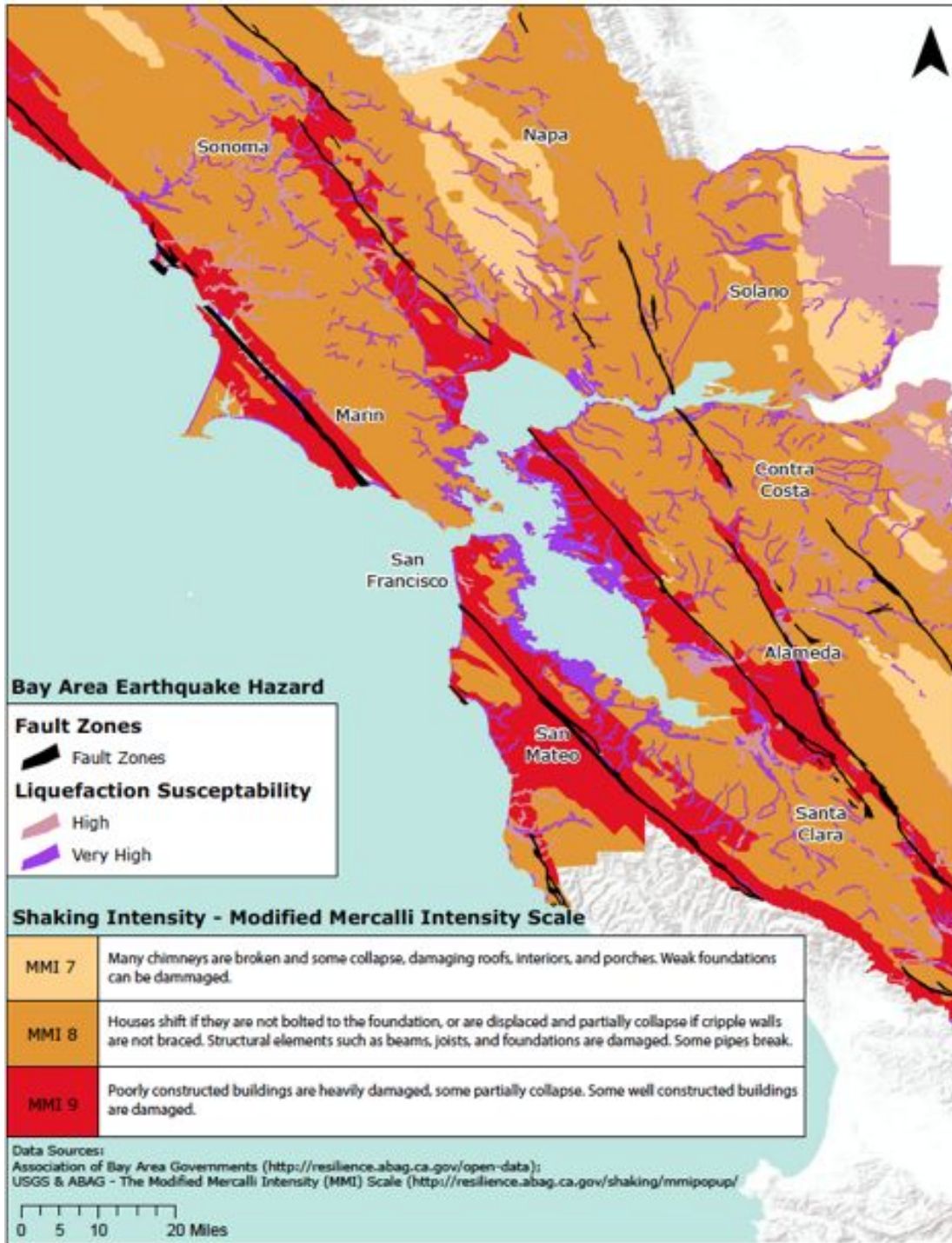
**Areas subject to inundation by the 1% annual chance flood event



Data Sources: Association of Bay Area Governments (<http://resilience.abag.ca.gov/open-data>); California's 4th Climate Change Assessment (2018) (<https://cal-adapt.org/tools/slr-calflod-3d>); CAL FIRE, Fire Hazard Severity Zones (FHSZ) (<http://frap.cdf.ca.gov/projects/hazard/hazard.html>); FEMA via ABAG (NFIP Attributes A, AE, AH) (https://www.fema.gov/pdf/floodplain/is_9_complete.pdf)







Risks vs. Hazards

The presence of natural hazards is only one part of understanding risk

Risk is a function of

Hazards (fires, floods, earthquakes)

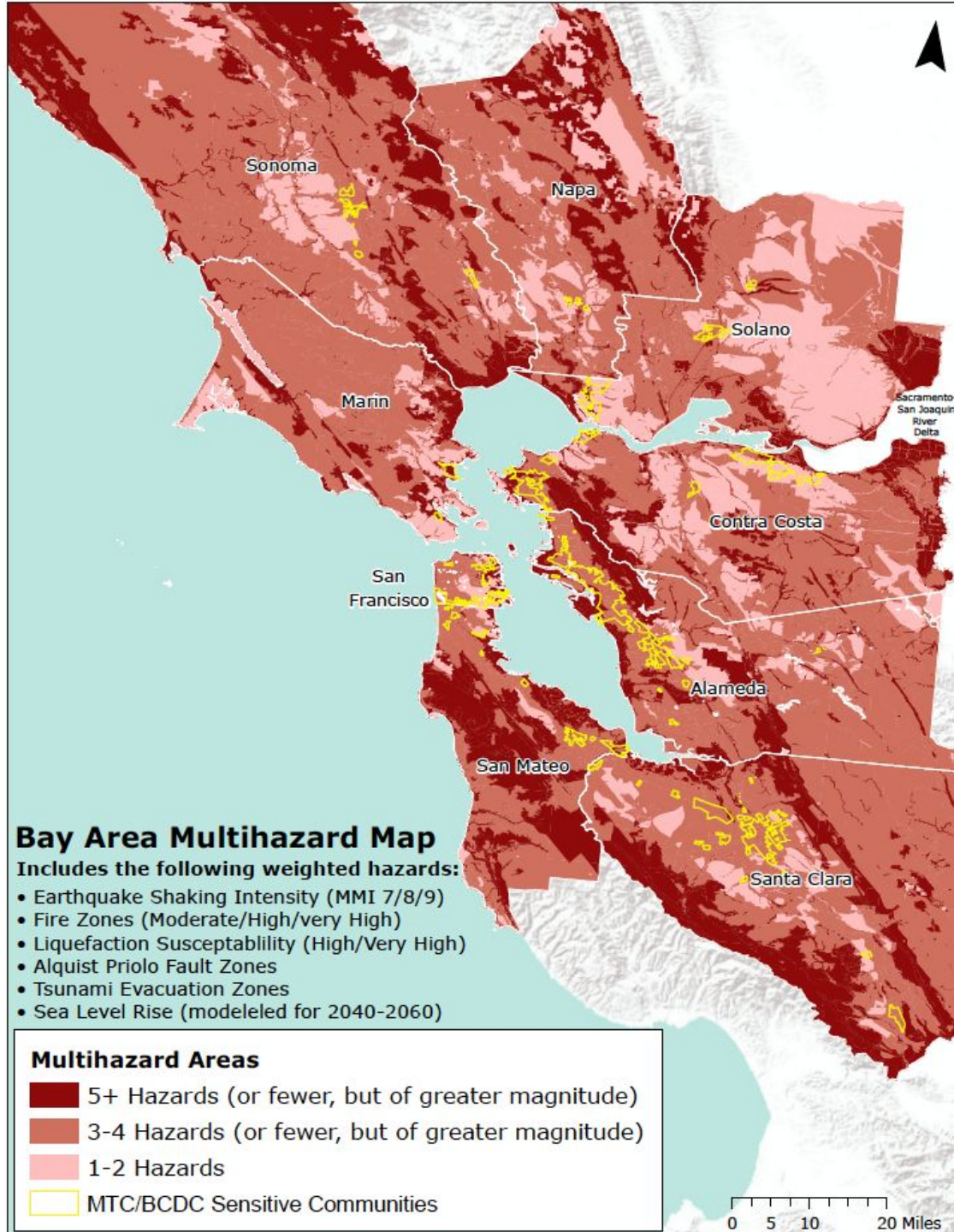
Exposure to a particular hazard (people, buildings, and infrastructure)

Vulnerability of that exposure to damage or harm

Federally-declared disasters, last 50 years

Name of Disaster	Event Category	Date(s)	Jurisdictions Involved	Damage (USD)	Damage (structures)	Death Toll
Russian River Flood	Flood	May, 2019	Sonoma	\$155 million	1,900	1
Tubbs, Nunn, Atlas & Wine Country Fires	Fire	Oct. 2017	Sonoma, Napa, Solano,	\$18 billion	18,600	87
South Napa Earthquake	Earthquake	Sep. 2014	Napa, Solano	\$300 million	2,000	2
Northern California Flood	Flood	Feb. 2006 - Feb. 2005	Contra Costa, Marin, Napa, Solano, Sonoma	\$300 million	1000	
Winter Storms and Mudslides	Severe Storms	Jan -Mar. 1995	Statewide	\$1.8 billion	10,300	28
Oakland Hills Fire	Fire	Oct. 1991	Alameda	\$1.5 billion	3,000	25
Loma Prieta Earthquake	Earthquake	Oct. 1989	Alameda, San Mateo, Santa Clara, San Benito, Santa Cruz and Monterey	\$6.9 billion	12,000	63
Northern California Flood	Flood	Jan. 1982	Santa Cruz, Contra Costa, Sonoma	\$280 million		25 - 32
El Nino	Severe Storms and Floods	1982-83	40 coastal counties	\$800 million	7,800	33





Bay Area Multihazard Map

Includes the following weighted hazards:

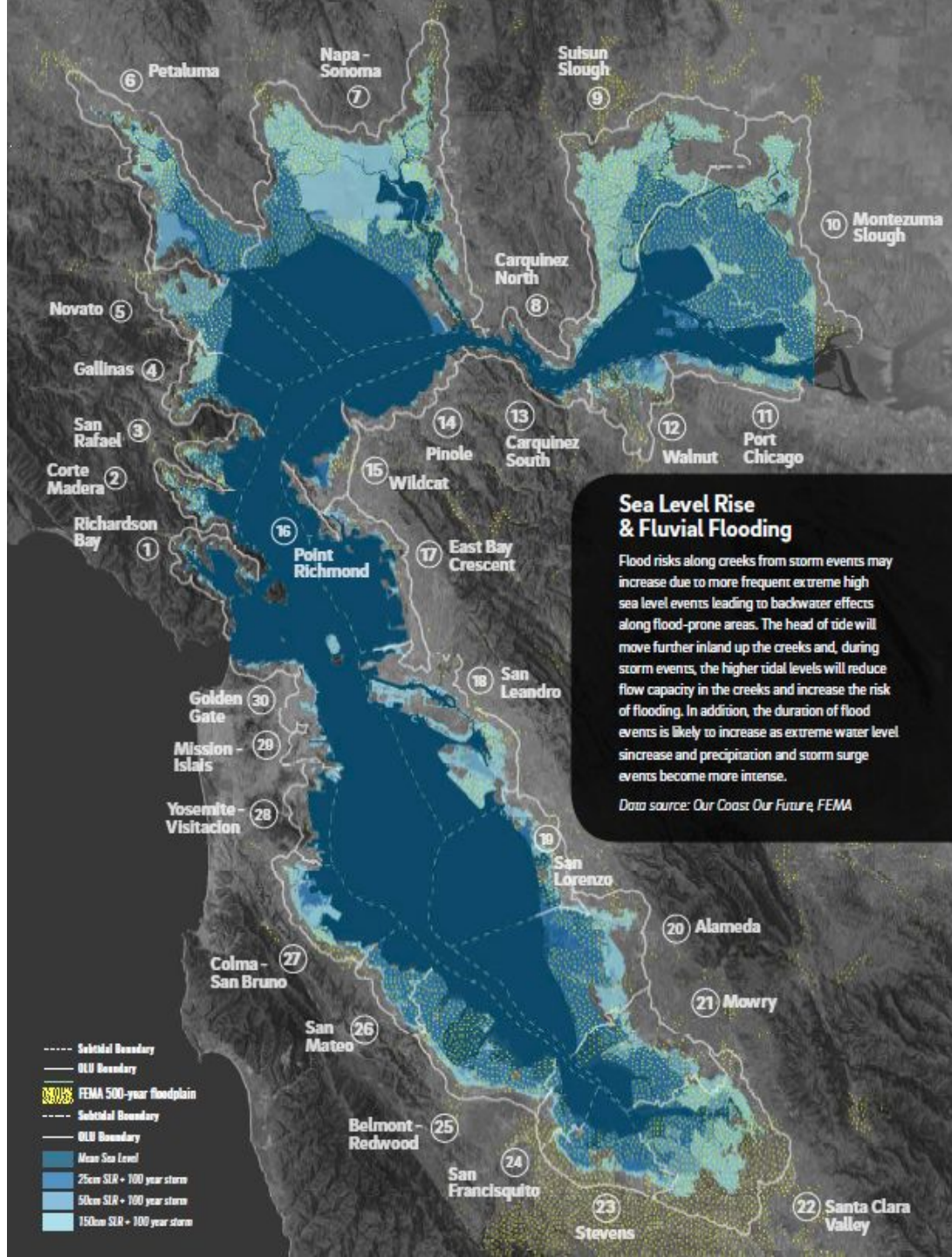
- Earthquake Shaking Intensity (MMI 7/8/9)
- Fire Zones (Moderate/High/very High)
- Liquefaction Susceptibility (High/Very High)
- Alquist Priolo Fault Zones
- Tsunami Evacuation Zones
- Sea Level Rise (modeled for 2040-2060)

Multihazard Areas

- 5+ Hazards (or fewer, but of greater magnitude)
- 3-4 Hazards (or fewer, but of greater magnitude)
- 1-2 Hazards
- MTC/BCDC Sensitive Communities

Pathways for hazards resilience management and governance in California

- Community planning: General Plans, Safety Element
- Disaster/emergency management: Hazard Mitigation Plans
- Building and lifeline codes and standards: state and local
- Voluntary programs: Community Wildfire Protection Plans, Firesafe Councils, NFIP
- Insurance: fire, flood, earthquake



Sea Level Rise & Fluvial Flooding

Flood risks along creeks from storm events may increase due to more frequent extreme high sea level events leading to backwater effects along flood-prone areas. The head of tide will move further inland up the creeks and, during storm events, the higher tidal levels will reduce flow capacity in the creeks and increase the risk of flooding. In addition, the duration of flood events is likely to increase as extreme water level increase and precipitation and storm surge events become more intense.

Data source: Our Coast Our Future, FEMA

- Subtidal Boundary
- OLU Boundary
- FEMA 500-year floodplain
- Subtidal Boundary
- OLU Boundary
- Mean Sea Level
- 25cm SLR + 100 year storm
- 50cm SLR + 100 year storm
- 150cm SLR + 100 year storm

Four Categories of Recommendations

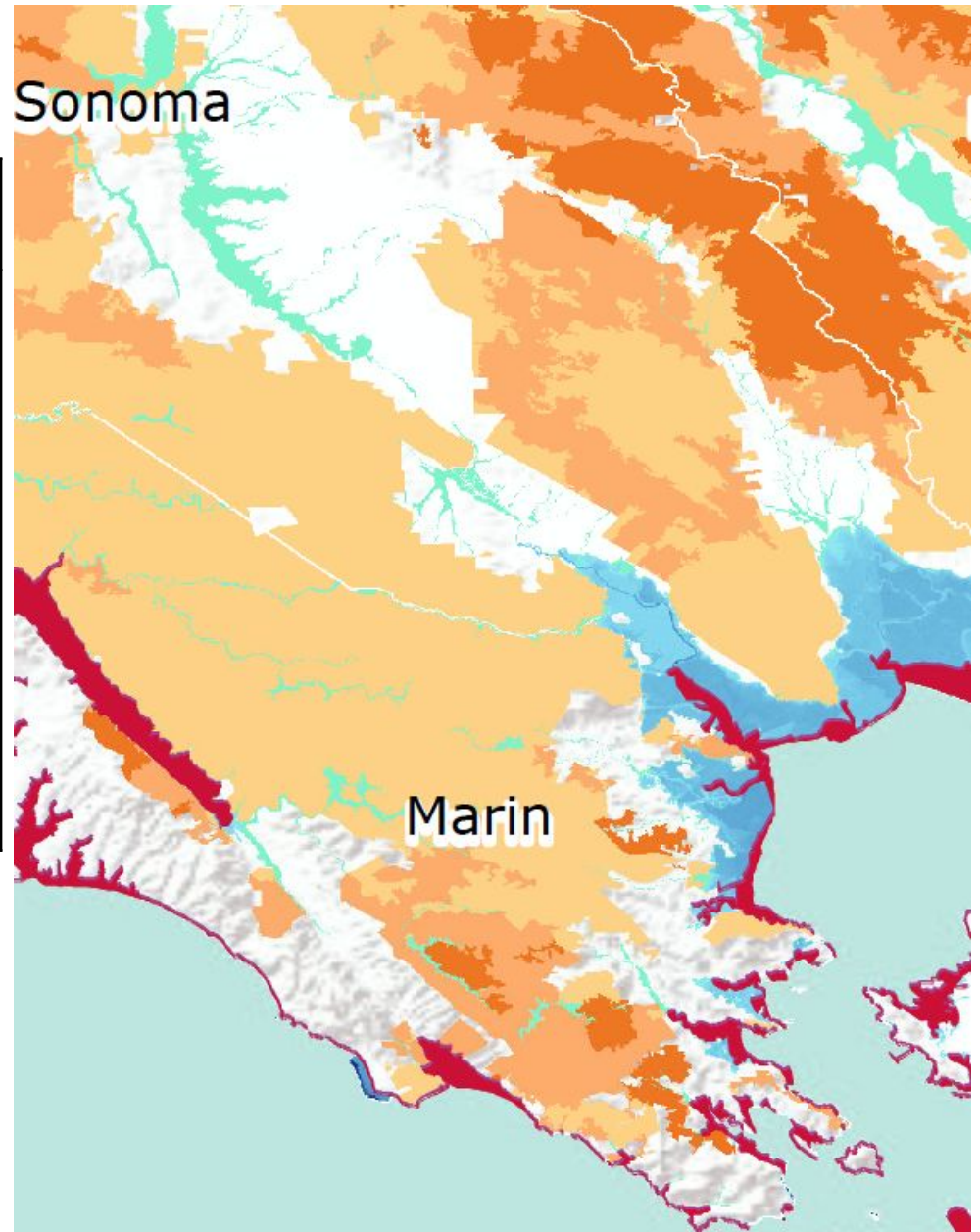
1. Data and information
2. Building and lifeline codes and standards
3. Community planning
4. Funding

12 Recommendations

State, Region, and Local scales

Data and information

Scale	Recommendation
State	Create dynamic multi-hazard maps that reflect property risk across multiple hazards.



Building and lifeline codes and standards

Scale	Recommendation
State	Adopt a statewide functional recovery building standard so that more buildings will be usable and easily repaired after a disaster.
State, region and local	Require a regional inventory and local screening by building type for vulnerabilities to wildfires, flooding, and earthquakes in areas of known risk - and require certain mandatory retrofits within 20 years. Exempt such improvements from property tax reassessment.
Region	Create a Regional Lifelines Council to identify interdependencies, assess vulnerability to hazards, set region-wide mitigation priorities, and identify ways to fund critical upgrades within the next ten years.
Local	Consolidate and expand certain special districts that serve a single purpose (fire, flood) into multi-hazard resilience districts.
Local	Develop local disaster recovery frameworks in every city and county to help ensure that they are ready to organizationally manage recovery following a major disaster.

Community Planning

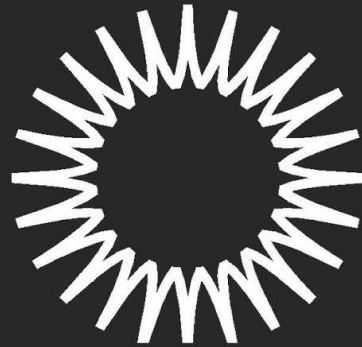
Scale	Recommendation
Local	Rezone high-hazard areas to prevent further expansion of development, particularly into the Wildland-Urban Interface, or in areas significantly vulnerable to liquefaction and sea level rise - with priority consideration in those areas where multiple hazards overlap. Ensure no net loss of planned housing by upzoning or transferring development rights to existing urbanized areas instead.
Local	Acquire undeveloped hazard-prone lands for public ownership and use.

Funding

Scale	Recommendation
State or region	Develop a regional or state buyout program for repeat-disaster properties affected by wildfire, flooding, or other hazard impacts.
State	Ensure that insurance for fire, earthquake and flood hazards remains available and affordable for residents and businesses. Ensure that state policy encourages and appropriately prices smarter land use, new construction, and retrofit practices.
Region	Establish a region-wide or series of county-wide Geological Hazard Abatement Districts to pool resources to fund regional resilience projects.
Region	Establish a Regional Resilience Trust Fund for future climate adaptation and hazard management needs.

Thank you





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