



Adapting to Rising Tides

Bay Area Flood Explorer

July 16, 2018

Origins of ART mapping



- **2015 Alameda County** (ART Alameda County Vulnerability Assessment)
 - **2015 San Francisco** (San Francisco Public Utilities Commission)
 - **2016 Contra Costa County** (ART Contra Costa County Vulnerability Assessment)
 - **2016 San Mateo County** (San Mateo Sea Change Vulnerability Assessment)
 - **2016-2017 Remaining 5 counties** (BCDC, MTC, AECOM)
 - **2018 Build Flood Explorer to make maps easily accessible**
- 

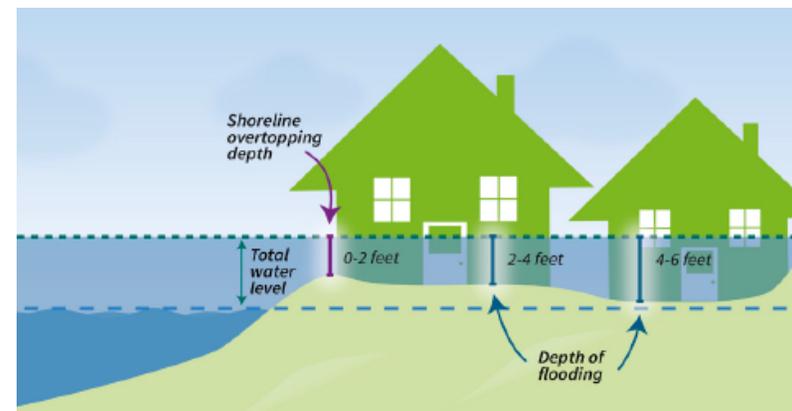
Why create the Flood Explorer?

MAPS UNIQUELY SUITED TO SUPPORT PLANNING:

#1. Stakeholder Review

#2. One Map, Many Futures

#3. Shoreline Overtopping



Audience and Goals

AUDIENCES:



Planning
Partners



Public
Agencies



Elected Officials
and their staff



General
Public

WHAT DOES THE FLOOD EXPLORER ACHIEVE?

- #1.** Enable users to **explore and interact** with maps
- #2. Educate** users about flooding from sea level rise and storms
- #3.** Describe **intended uses** for maps
- #4.** Data **download** for technical users
- #5. Connect** the public to existing adaptation efforts

Timeline and Roll out

Dec 2017-Jan 2018

Collect feedback from external partners

May-July 2018

Collect and integrate feedback on beta site

2019

Update maps and add add site functionality

Aug-Sept 2018

Trainings to key stakeholders and general public

Jan-May 2018

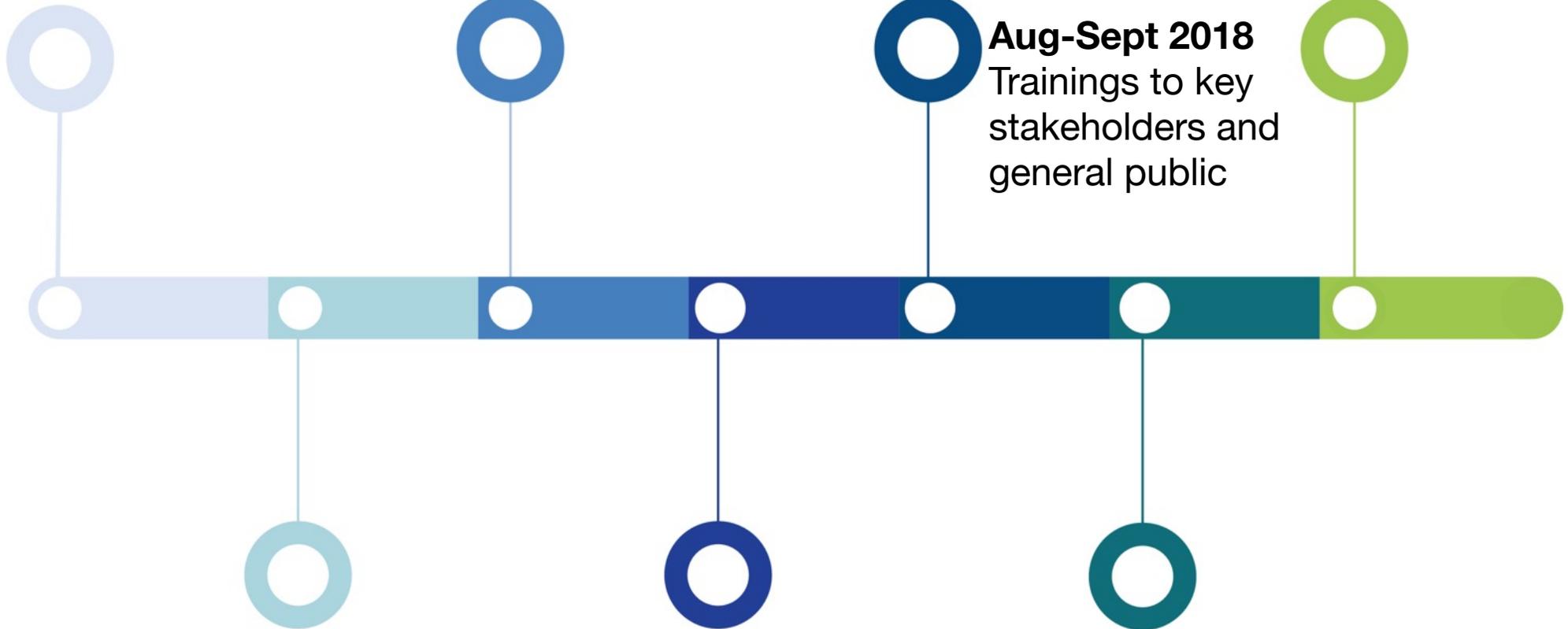
Beta Site Development

August 2018

Launch Site!

Fall 2018

Broader Public Outreach





Adapting to Rising Tides

Bay Area Flood Explorer

The Adapting to Rising Tides program has developed this tool to help Bay Area communities learn about current and future flooding due to sea level rise and storm surges by exploring local flood maps, identifying areas of greatest risk, and downloading the data for further analysis. These maps increase understanding of what could be at risk without future planning and adaptation, helping Bay communities, governments, and businesses to drive action.

LEARN

EXPLORE

DOWNLOAD

ABOUT



The Bay Area Flood Explorer is part of the San Francisco Bay Conservation and Development Commission's Adapting to Rising Tides Program. [Disclaimer](#)



Sea Level is Rising in the Bay

Sea level rise refers to the worldwide average increase in ocean water levels.

Unlike King Tides, which are *temporary*, sea level rise results in *permanent* increase in water levels. The latest science tells us the Bay should be prepared for:

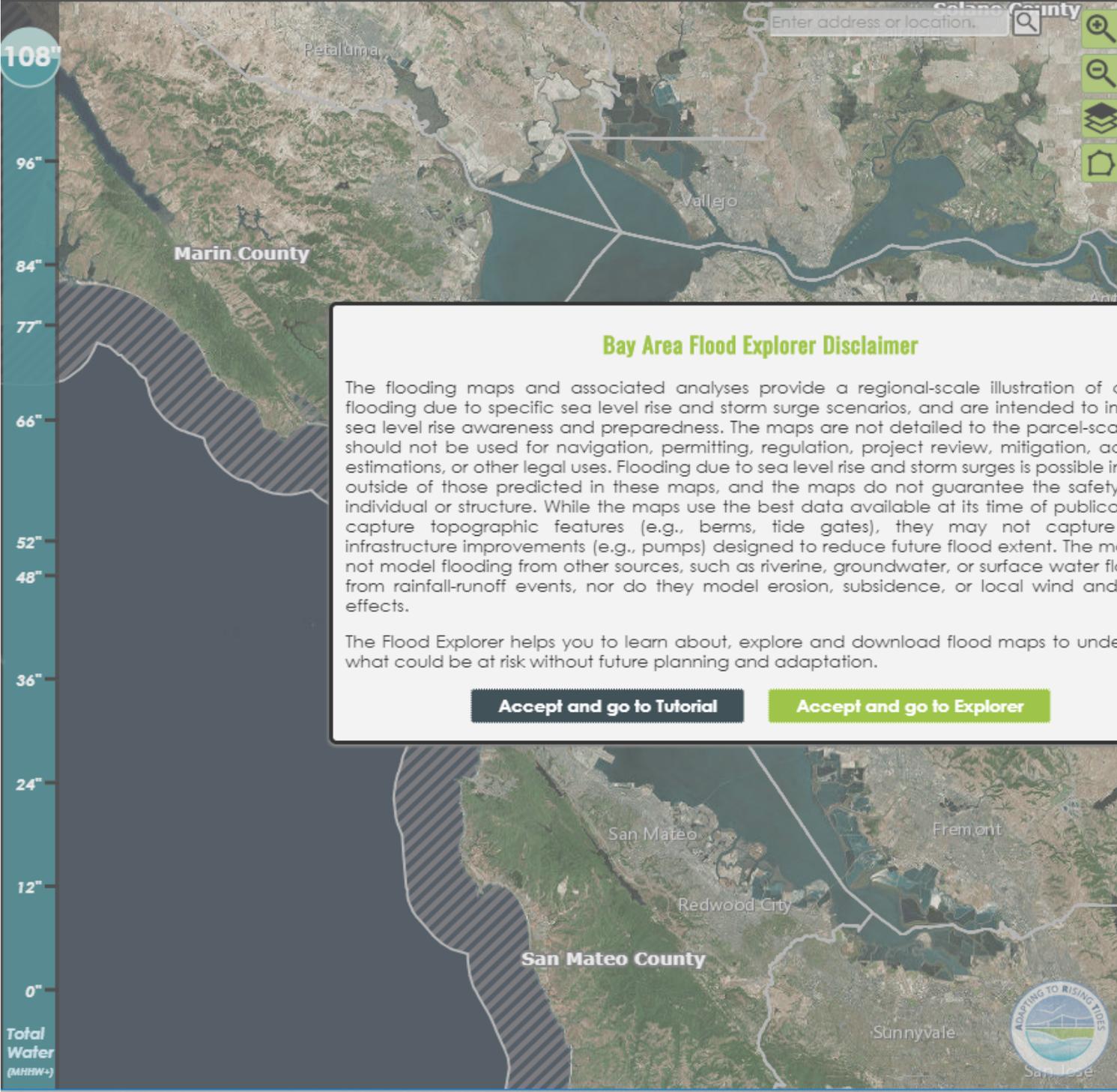
- 6- to 10-inches of sea level rise by 2030
- 13- to 23-inches of sea level rise by 2050

That is soon! It is challenging to predict the amount of sea level rise we may experience closer to the year 2100, in part because we can't be sure how quickly the world will cut greenhouse gas emissions. It is these heat-trapping gases from fossil fuels that drive global warming and thus sea level rise.

You read more about the science of sea level rise and the [State of California's sea level rise projections here](#).

+ SEA LEVEL RISE

HIGH TIDE



ONE MAP, MANY FUTURES ?

Total Water Level Choose a Scenario

No flooding condition selected. To change the Total Water Level, use the slider at the left of the screen.

Bay Area Flood Explorer Disclaimer

The flooding maps and associated analyses provide a regional-scale illustration of coastal flooding due to specific sea level rise and storm surge scenarios, and are intended to improve sea level rise awareness and preparedness. The maps are not detailed to the parcel-scale and should not be used for navigation, permitting, regulation, project review, mitigation, actuarial estimations, or other legal uses. Flooding due to sea level rise and storm surges is possible in areas outside of those predicted in these maps, and the maps do not guarantee the safety of an individual or structure. While the maps use the best data available at its time of publication to capture topographic features (e.g., berms, tide gates), they may not capture other infrastructure improvements (e.g., pumps) designed to reduce future flood extent. The maps do not model flooding from other sources, such as riverine, groundwater, or surface water flooding from rainfall-runoff events, nor do they model erosion, subsidence, or local wind and wave effects.

The Flood Explorer helps you to learn about, explore and download flood maps to understand what could be at risk without future planning and adaptation.

Accept and go to Tutorial

Accept and go to Explorer

LEGEND

Layers on/off and control transparency Use Slider at left to control Total Water Level.

Depth of Flooding ?

Transparency:

- 2+ feet
- 10 - 12 feet
- 6 - 10 feet
- 4 - 8 feet
- 2 - 6 feet
- 0 - 4 feet
- 0 - 2 feet

Shoreline Overtopping Depth ?

Transparency:

- Overtopping
- No Overtopping

Disconnected Low-lying Areas ?

Transparency:

- Disconnected Low-lying Area

San Francisco Bay Counties

- Counties

Total Water (MHW+)



Enter address or location. **ONE MAP, MANY FUTURES** **Total Water Level** Choose a Scenario



84" Total Water Level
represents similar flooding above MHHW in Contra Costa County under the following scenarios:

Sea Level Rise	Storm Surge
42"	100-year
48"	50-year

Explore different sea level rise and storm surge scenarios with similar flooding. You may enlarge the window by dragging the grey bar at bottom.

As a Total Water Level is chosen, the 'One Map, Many Futures' window (top right) changes to reflect about different scenarios of sea level rise and storm surge that can cause the same amount of flooding.

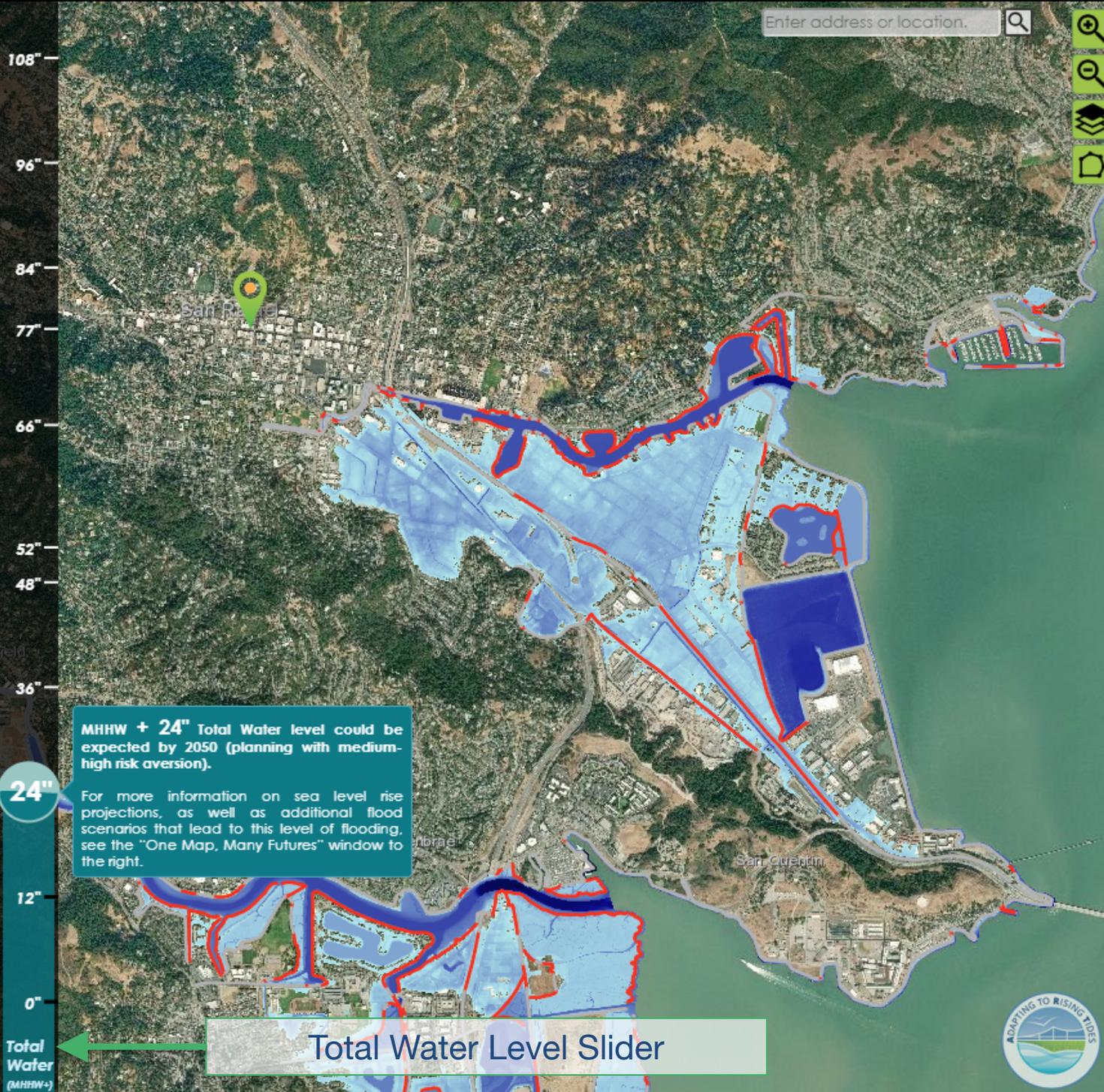


Close and go to Explorer

0" Total Water (MHHW+)

ADAPTING TO RISING TIDES

- Disconnected Low-lying Area
- San Francisco Bay Counties
- Counties



Enter address or location.



ONE MAP, MANY FUTURES ?

Total Water Level Choose a Scenario

24" Total Water Level represents similar flooding above MHHW under the following scenarios:

Sea Level Rise ?	Storm Surge ?
0"	5-year
6"	2-year
12"	King Tide
24"	No Storm Surge

Marin County

LEGEND

Toggle layers on/off and control transparency below. Use Slider at left to control Total Water Level displayed.

Depth of Flooding ?

Transparency:

- 12+ feet
- 10 - 12 feet
- 8 - 10 feet
- 6 - 8 feet
- 4 - 6 feet
- 2 - 4 feet
- 0 - 2 feet

Shoreline Overtopping Depth ?

Transparency:

- Overtopping
- No Overtopping

Disconnected Low-lying Areas ?

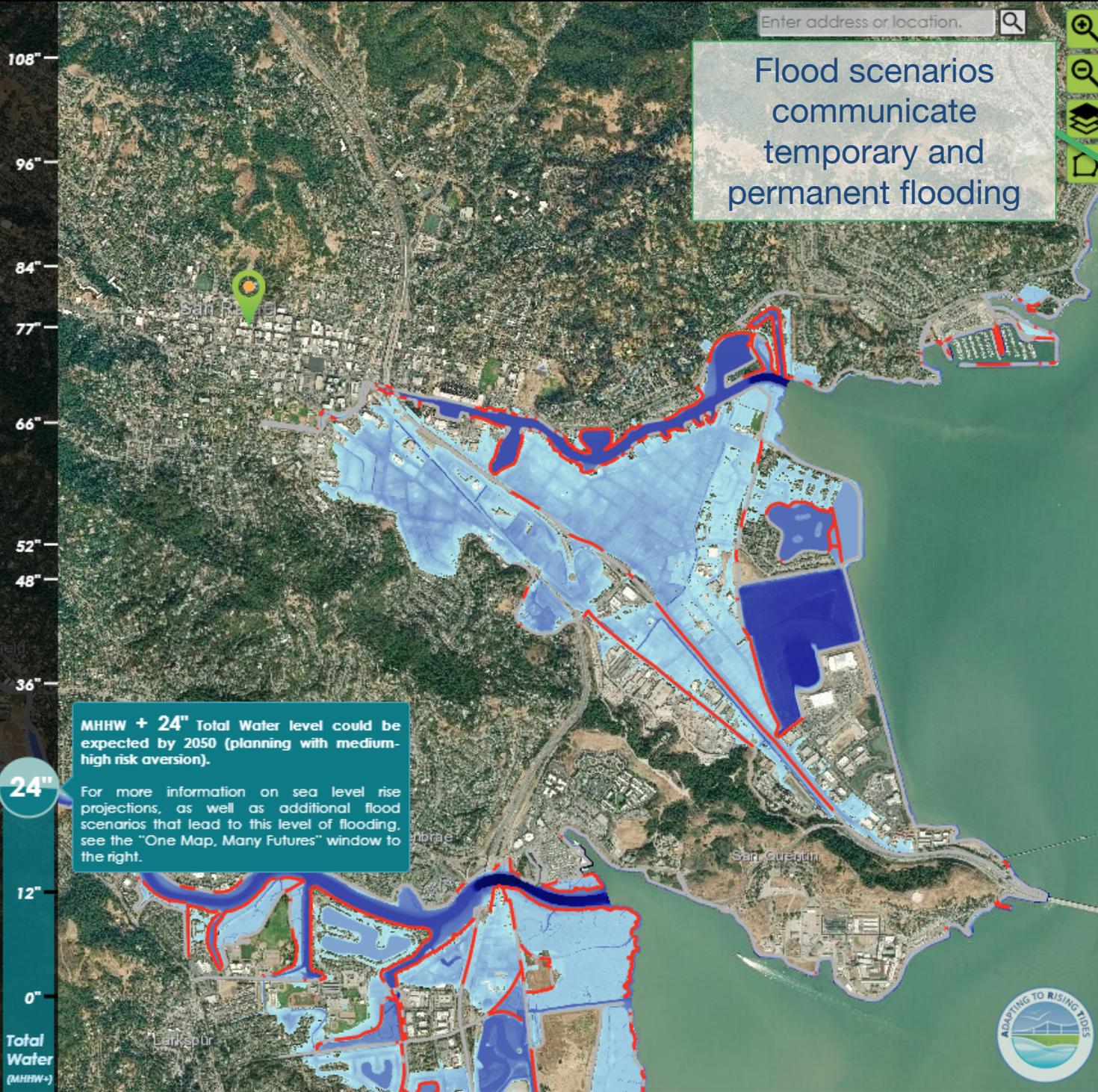
Transparency:

- Disconnected Low-lying Area

San Francisco Bay Counties

- Counties





Flood scenarios communicate temporary and permanent flooding

MHHW + 24" Total Water level could be expected by 2050 (planning with medium-high risk aversion). For more information on sea level rise projections, as well as additional flood scenarios that lead to this level of flooding, see the "One Map, Many Futures" window to the right.

ONE MAP, MANY FUTURES

Total Water Level Choose a Scenario

24" Total Water Level represents similar flooding above MHHW under the following scenarios:

Sea Level Rise	Storm Surge
0"	5-year
6"	2-year
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Marin County

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Shoreline Overtopping Depth

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Disconnected Low-lying Areas

Transparency:

- Disconnected Low-lying Area

San Francisco Bay Counties

Counties



Enter address or location.

User can "Choose the Scenario" of SLR and Storm Surge

ONE MAP, MANY FUTURES ?

Total Water Level Choose a Scenario

Select sea level rise and storm surge to see Total Water Level and compare permanent and temporary impacts.

1. Choose Sea Level Rise

No SLR	12"	24"	36"	48"
52"	66"	77"	84"	96"
				108"

2. Choose Storm Surge

No Storm Surge			King Tide		
2-yr	5-yr	10-yr	25-yr	50-yr	100-yr

66" Total Water Level
 Combination of 24-inches of sea level rise and a 100-year storm surge.

LEGEND

Toggle layers on/off and control transparency below. Use Slider at left to control Total Water Level displayed.

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108"
96"
84"
77"
66"
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36"
24"
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0"

Total Water (MHHW+)



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Shoreline Overtopping Depth ?

Transparency:

Overtopping

Depth of Flooding ✕

Depth: 7.58 feet

Shoreline Overtopping

Overtopping Depth: 3.82 feet
 Shoreline Type: [Embankment](#)

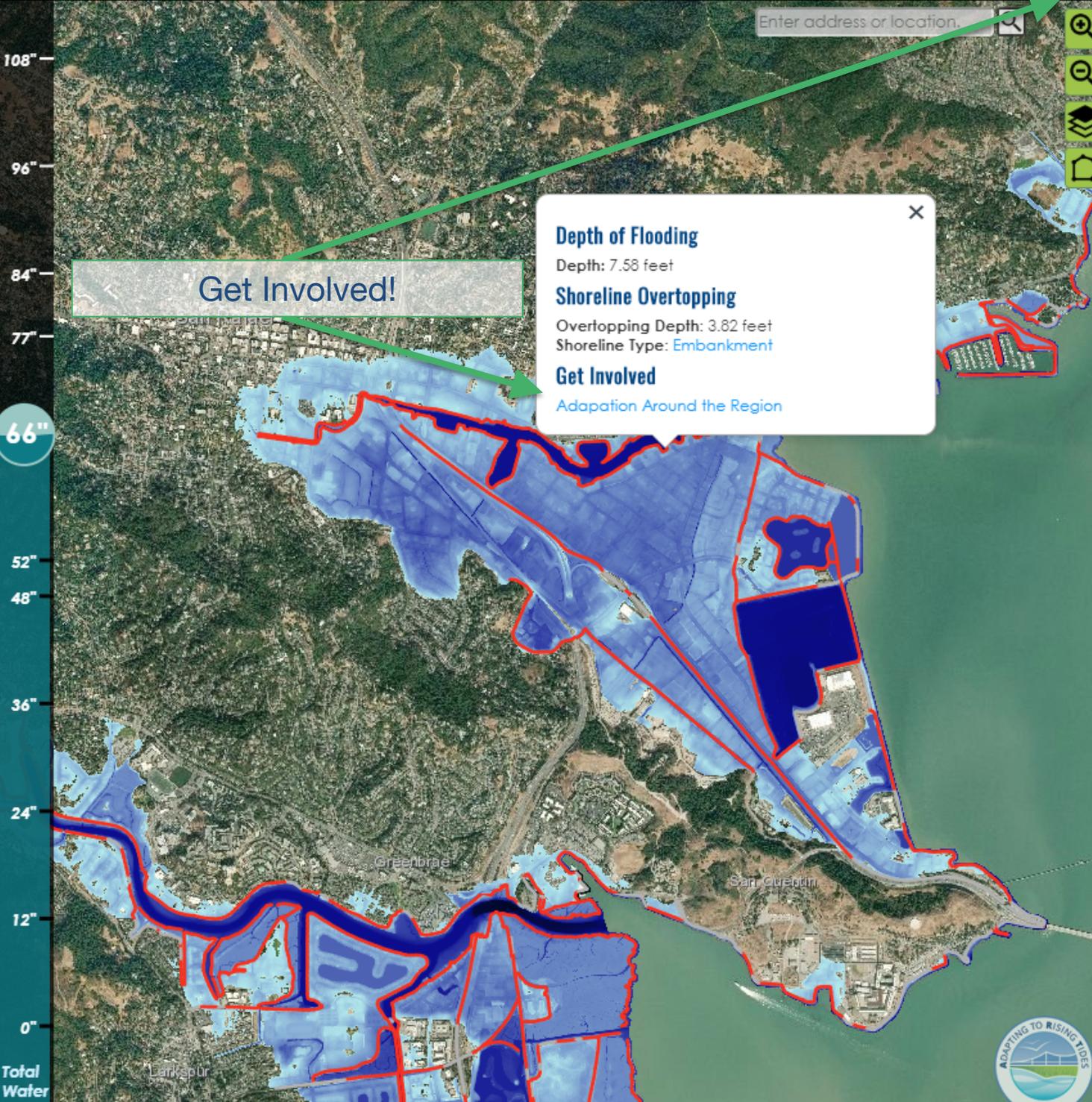
Get Involved

[Adaptation Around the Region](#)

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0"

Total Water





Depth of Flooding ✕

Depth: 7.58 feet

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Overtopping Depth: 3.82 feet

Shoreline Type: [Embankment](#)

Get Involved

[Adaptation Around the Region](#)

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Transparency:

Overtopping



Adapting to Rising Tides > GET INVOLVED WITH ADAPTION AROUND THE REGION

Findings +

Maps and Data Products >

Projects +

How-To +

Help Desk >

Adaptation Around the Region >

GET INVOLVED WITH ADAPTION AROUND THE REGION

Adapting to sea level rise and building regional resilience requires ongoing action at many scales and by numerous organizations, communities, and jurisdictions.

In order to ensure adaptation projects provide multiple benefits, are flexible to changing sea levels and science over time, and recognize impacts to neighboring communities and the region, successful adaptation efforts generally exhibit three key characteristics.



CONNECTED

As we consider which adaptation strategy best protects our shoreline from flooding, projects must be designed to account for the connectivity of public access, water, sediment, and wildlife between the uplands and the Bay. Connectivity must also be considered in terms of how changing the shoreline in one place may positively or negatively impact neighbors through increased erosion.



COMMUNITY, COLLABORATIVE ACTION

Given the complexity of our connected shorelines, successful adaptation strategies often require action by multiple jurisdictions or property owners. Adaptation planning is by its very nature a collaborative process that brings together community stakeholders to develop a shared vision of what their shoreline should look like. This is both a challenge and a strength of the process which results in beneficial outcomes not only for flood-resilience, but also for public health, the economy, the environment, social equity, and the community at large.

Enter address or location.

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0"

Total Water (MHW+)

Feedback



ART Bay Area Sea Level Rise and Shoreline Analysis Maps

The ART Bay Area Sea Level Rise and Shoreline Analysis maps are robust and accurate mapping products that leverage the latest LiDAR topographic data sets, the [FEMA San Francisco Bay Area Coastal Study and San Francisco Tidal Datums Study](#), and the [regional shoreline delineation developed by the San Francisco Estuary Institute](#). The county maps are available to download as .pdf or a geodatabase (.gdb) for all ten water levels including:

- Depth of Flooding (polygon and raster)
- Shoreline Overtopping Depth
- Disconnected Low-Lying Areas

You can read more about the [mapping methodology](#) and [GIS data catalog](#).

County	Mapbook (PDF)	Geodatabase (Download)
Alameda		
Contra Costa		
Marin		
Napa		
San Francisco		
San Mateo		
Santa Clara		
Solano		
Sonoma		

scenario. The table also shows what temporary water levels may occur due to storms in each future scenario.

Using the Flood Explorer to Visualize Sea Level Rise Scenarios (State Guidance, Griggs et al, 2017)

- Navigation**
- Planning Support
 - Sea Level Rise Projections
 - Planning Across Scales
 - County-based Planning
 - Regional Planning
 - Local Planning
 - Disclaimer
 - Maps
 - Description
 - Technical Report
 - Glossary
 - FAQ
 - Program
 - BCDC
 - Adapting to Rising Tides Website
 - County Assessments
 - Adaptation Projects Around the Region
 - Funding + Partners

Comparing the California State Guidance on Sea Level Rise to the Bay Area Flood Explorer		Likely range (high end of the 67% probability range)		1-in-200 Chance	H++
		Low-Risk Aversion	Medium-High Risk Aversion	Extreme Risk Aversion	
2030	State Guidance (High emissions)		6"	9.6"	12"
	ART Maps Equivalent	MHHW+	**	12"	12"
	Sea Level Rise + 5-Year Storm	MHHW+	**	36"	36"
	Sea Level Rise + 50-Year Storm	MHHW+	**	48"	48"
	Sea Level Rise + 100-Year Storm	MHHW+	48"	52"	52"
2040	State Guidance (High emissions)		9.6"	15.6"	21.6"
	ART Maps Equivalent	MHHW+	12"	**	24"
	Sea Level Rise + 5-Year Storm	MHHW+	36"	36"	48"
	Sea Level Rise + 50-Year Storm	MHHW+	48"	52"	**
	Sea Level Rise + 100-Year Storm	MHHW+	52"	**	66"
2050	State Guidance (High emissions)		13.2"	22.8"	32.4"
	ART Maps Equivalent	MHHW+	12"	24"	36"
	Sea Level Rise + 5-Year Storm	MHHW+	36"	48"	**
	Sea Level Rise + 50-Year Storm	MHHW+	48"	**	**
	Sea Level Rise + 100-Year Storm	MHHW+	52"	66"	77"
2060	State Guidance (High emissions)		18"	31.2"	46.8"
	ART Maps Equivalent	MHHW+	**	**	48"
	Sea Level Rise + 5-Year Storm	MHHW+	**	52"	**
	Sea Level Rise + 50-Year Storm	MHHW+	52"	66"	84"
	Sea Level Rise + 100-Year Storm	MHHW+	**	**	**
2070	State Guidance (High emissions)		22.8"	42"	62.4"
	ART Maps Equivalent	MHHW+	24"	**	66"
	Sea Level Rise + 5-Year Storm	MHHW+	48"	66"	84"
	Sea Level Rise + 50-Year Storm	MHHW+	**	77"	96"
	Sea Level Rise + 100-Year Storm	MHHW+	66"	84"	108"
2100	State Guidance (High emissions)		40.8"	82.8"	122.4"
	ART Maps Equivalent	MHHW+	**	84"	**
	Sea Level Rise + 5-Year Storm	MHHW+	66"	108"	**
	Sea Level Rise + 50-Year Storm	MHHW+	77"	**	**
	Sea Level Rise + 100-Year Storm	MHHW+	84"	**	**

**No corresponding ART Sea Level Rise and Shoreline Analysis map in the Flood Explorer.

The California State Guidance recommends that jurisdictions and developers decide which of these sea level rise projections to select



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