

BayWAVE Sea Level Rise

MCCMC March 22, 2017

The goal of the BayWAVE project is to increase awareness and preparation for future SLR impacts by using this coordinated, multi-jurisdictional assessment.

The Issue

Marin is at risk today and in the future. We need to plan, coordinate and act to prepare for rising tides. Much of our infrastructure (transportation, utilities, our wetlands, and our community) is within the vulnerable shoreline. We've begun planning together and this was a first step. We will need to do much more...

Vulnerability Assessment

April 2017

Entire Marin Bay Shoreline from Sausalito to Novato (report complements SMART for the coast)
Report catalogs the impacts from sea level rise by asset and geography.

- land
- buildings
- roads and easements
- water, wastewater, stormwater, gas, electricity, and telecommunications
- agriculture
- habitat and wildlife
- recreation and public access
- emergency services
- cultural resources
- and by each incorporated and unincorporated community

Methods

Our Coast Our Future Viewer (Co2MoS)
BCDC's One Map Many Futures

Scenarios: 10 inches, 20 inches, 40 inches, plus each with the 100-year storm

GIS plus over 100 stakeholder interviews



Supporting Tools

- Project Talking points
- Presentation template
- Adaptation Fact Sheets
- Damaged/At-Risk Project summaries

Public Meetings and Next Phase

April 2017

Public meetings expected to share the results of the Vulnerability Assessment and to play the Game of Floods and share the process for planning.

April 19th 7-9 PM Pickleweed Park, San Rafael
April 25th 7-9 PM Mill Valley Community Center
April 29th 10-12 PM Novato City Hall

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Contact Chris Choo, principal planner and project manager with questions.



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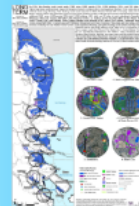
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Rise

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Methods

Our Coast Our Future V
BCDC's One Map Many

Scenarios: 10 inches, 20 inches

corporated

Methods

Our Coast Our Future Viewer (CoSMoS)
BCDC's One Map Many Futures

Scenarios: 10 inches, 20 inches, 60 inches,
plus each with the 100-year storm

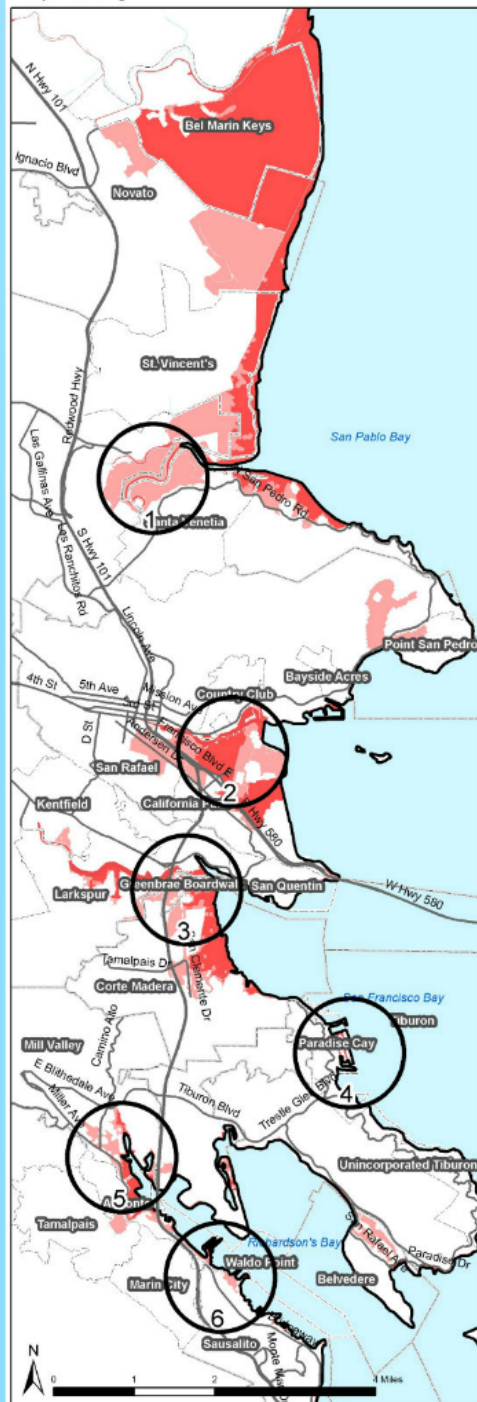
GIS plus over 100 stakeholder interviews

NEAR TERM

Scenario 1:
10 in. Sea Level Rise

Scenario 2:
10 in. Sea Level Rise
+ 100-year storm surge

In 15 years, high tides could threaten Marin's shoreline buildings, roads, and original utility systems. Damage and breakdowns in road and utility networks would impact the entire County, especially Southern Marin. Tidal flooding (red) could reach 5,000 acres, 1,300 parcels, 700 buildings, and 8 miles of road in San Rafael east of State Route 101, bayfront Belvedere and Tiburon, Greenbrae Boardwalk, Waldo Point, and Paradise Cay. A 100-year storm surge (pink) would flood these areas with storm surge flooding, and flood an additional 3,000 acres, 2,500 parcels, 3,800 buildings, and 20 miles of road in North Novato, Black Point on the Petaluma River, lower Santa Venetia, Belvedere Lagoon, bayfront Corte Madera and Mill Valley, Marinship in Sausalito, Marin Lagoon in San Rafael, Tamalpais, and Almonte. Flooded ferry facilities would prevent commuters and visitors from traveling across the Bay. Boating facilities in Sausalito, Mill Valley, Strawberry, Tiburon, Belvedere, San Rafael, Bel Marin Keys, and Black Point may be inaccessible. This is especially a concern for marinas with residential boats and Southern Marin Fire and Sausalito Police boats. The Castro St. Fire Station in San Rafael is vulnerable to tidal flooding, though all emergency professionals would be denied vehicular access to people in vulnerable areas. Southern Marin marshlands would shift high marsh to low marsh to mud flat, and eelgrass beds could shrink under deeper darker waters. These habitat shifts would have significant repercussions for plant, insect, fish, and animal species.



1: Santa Venetia



2: Canal Area



3: Greenbrae Boardwalk/
Larkspur



4: Paradise Cay



5: Mill Valley



6: Waldo Point Harbor

Vulnerable Assets

Vulnerable Buildings

- Scenario 1: 10" SLR
- Scenario 2: 10" SLR + Storm Surge

Vulnerable Assets

- School
- Medical Facility
- Park
- Marin Transit Stop
- Golden Gate Transit Stop
- Park & Ride
- SMART Track
- Ferry
- Public Boat Launch
- Marina
- Fire Station
- Emergency Shelter
- Law Enforcement
- Fire Station
- District Office
- Gas Pipe
- Electrical Transmission Tower
- Substation
- PG&E Property
- Transmission Lines

Sea Level Rise Scenarios

- Scenario 1: 10" SLR
- Scenario 2: 10" SLR + Storm Surge

Location Indicators

- Unincorporated
- Municipality
- Road
- Bay

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.

EV3
DATE: 2/15/2011

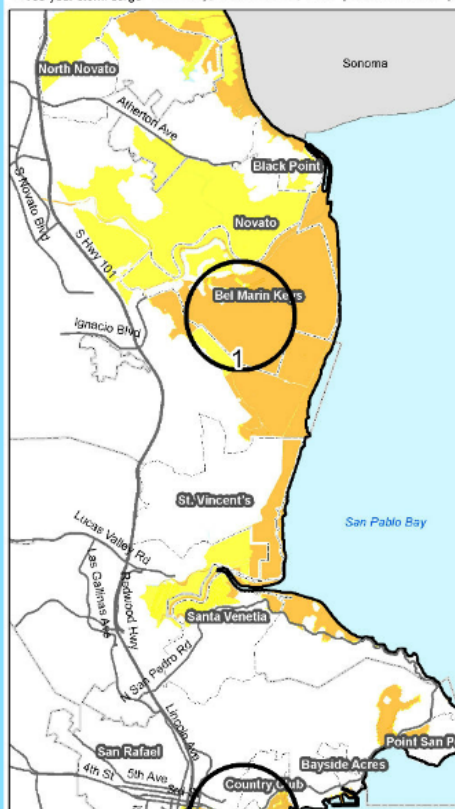
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DATE: 2/15/2011

MEDIUM TERM

Scenario 3:
20 in. Sea Level Rise

Scenario 4:
20 in. Sea Level Rise
+ 100-year storm surge

Tidal flooding could reach 7,000 acres, 3,000 parcels, 1,000 buildings, and 10 miles of road in the near-term, though more severely. With a 100-year storm surge (pink) flooding would extend further inland. Storm surge flooding would extend further inland in North Novato. Water travel could experience delays between rising groundwater and the road network. Sanitary, stormwater, and potable water pipes would cause even more damage than roads.

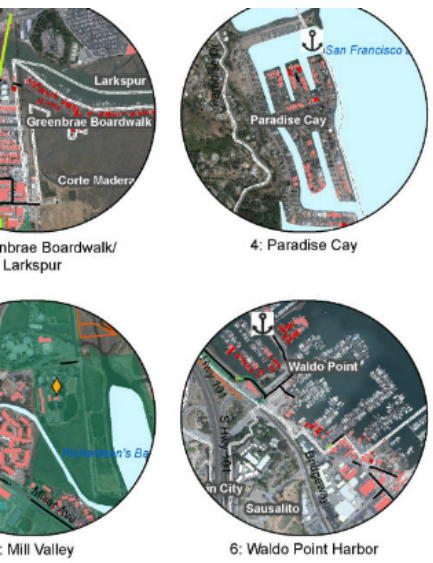


MEDIUM TERM

Scenario 3
20 in. Sea Level Rise

Scenario 4
20 in. Sea Level Rise
+ 100-year storm surge

Tidal flooding could reach 7,000 acres, 3,000 parcels, 2,000 buildings, and 18 miles of roadway in the same locations impacted in the near-term, though more severely. With a 100-year storm surge, the area vulnerable to tidal flooding would also experience storm surge flooding. An additional 7,000 acres, 2,200 parcels (8%), 3,600 buildings (7%), and 40 miles of roadway could anticipate storm surge flooding. Most levees south of Novato are not designed to withstand this level of flooding and would be overtopped. Storm surge flooding would extend further inland beyond the marshy areas of Mill Valley, Strawberry, San Rafael, St. Vincent's, and North Novato. Water travel could experience similar outcomes as in the near-term, though the highest high tides and storms surges would cause even more damage than weathered twenty years earlier. Pipelines beneath flooded roads could become squeezed between rising groundwater and the roadway, cause pipes to bend and break, and even damage roadways, this is true for sanitary, stormwater, and potable water pipes. PG&E substations, electrical transmission towers and lines, and natural gas pipelines could be bent or broken by flooding, subsidence, and erosion, with far reaching impacts on utilities, buildings, and transportation. This ten inch increase in sea level would continue to shrink trapped beach and marsh habitats in Southern Marin. Shoreline parks and pathways would flood often.



Vulnerable Assets

- Buildings Vulnerable to Storm Surges
- Park
- SMART Track
- Marin Transit Stop
- Golden Gate Transit Stop
- Park & Ride
- Ferry
- Airport
- Public Boat Launch
- Marine

Sea Level Rise (SLR) Scenarios

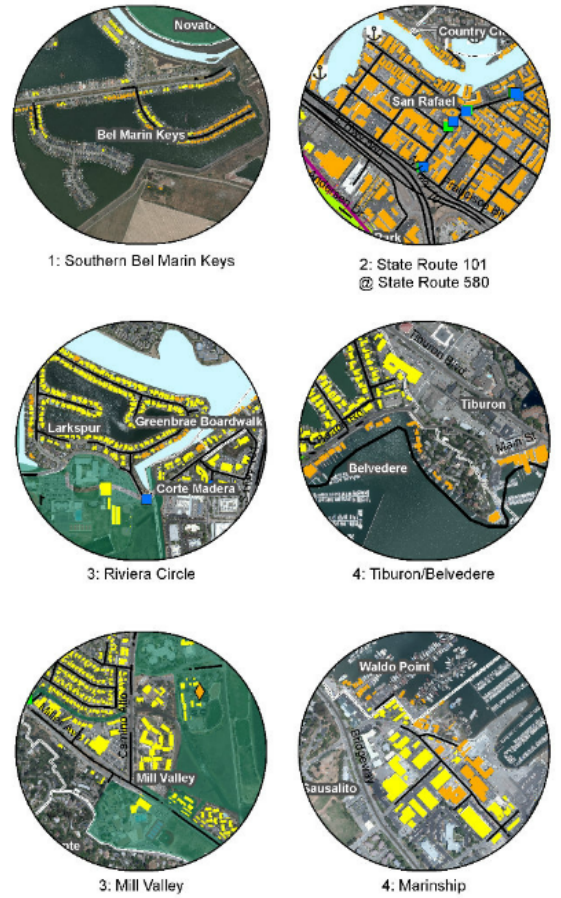
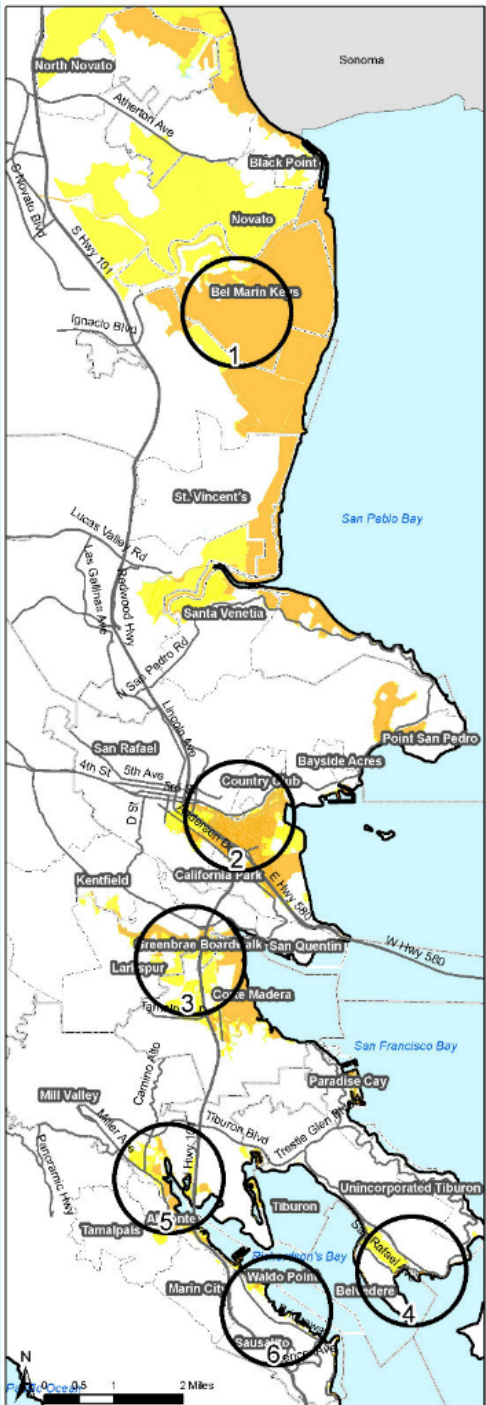
- Scenario 3: 20" SLR
- Scenario 4: 20" SLR + Storm Surge

Location Indicators

- Unincorporated
- Municipality
- Road
- Bay

Other Assets

- School
- Medical Facility
- Law Enforcement
- Emergency Shelter
- Fire Station
- District Office
- Gas Pipe
- Electrical Transmission Tower
- Substation
- PG&E Property
- Transmission Lines



Vulnerable Assets

- Buildings Vulnerable to Storm Surges
- Park
- SMART Track
- Marin Transit Stop
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- Ferry
- Airport
- Public Boat Launch
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Sea Level Rise (SLR) Scenarios

- Scenario 3: 20" SLR
- Scenario 4: 20" SLR + Storm Surge

Location Indicators

- Unincorporated
- Municipality
- Road
- Bay

Other Assets

- School
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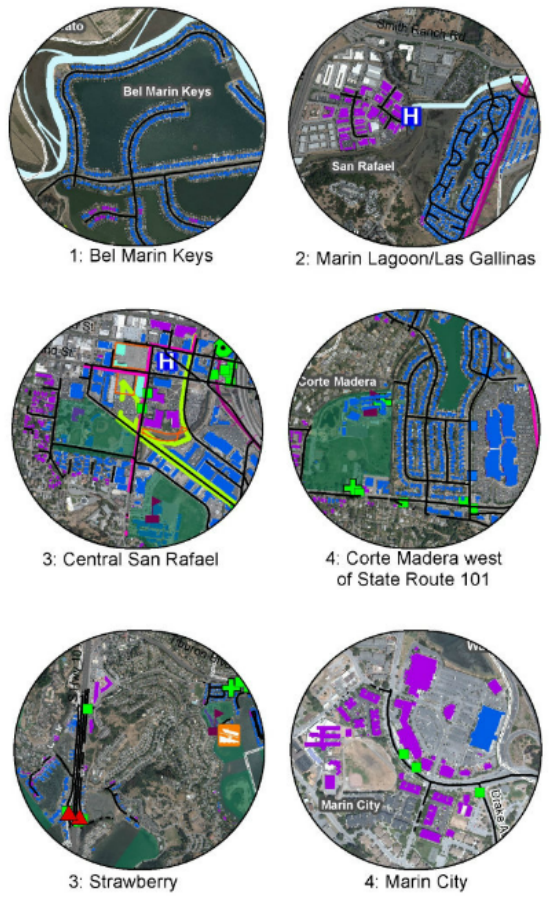
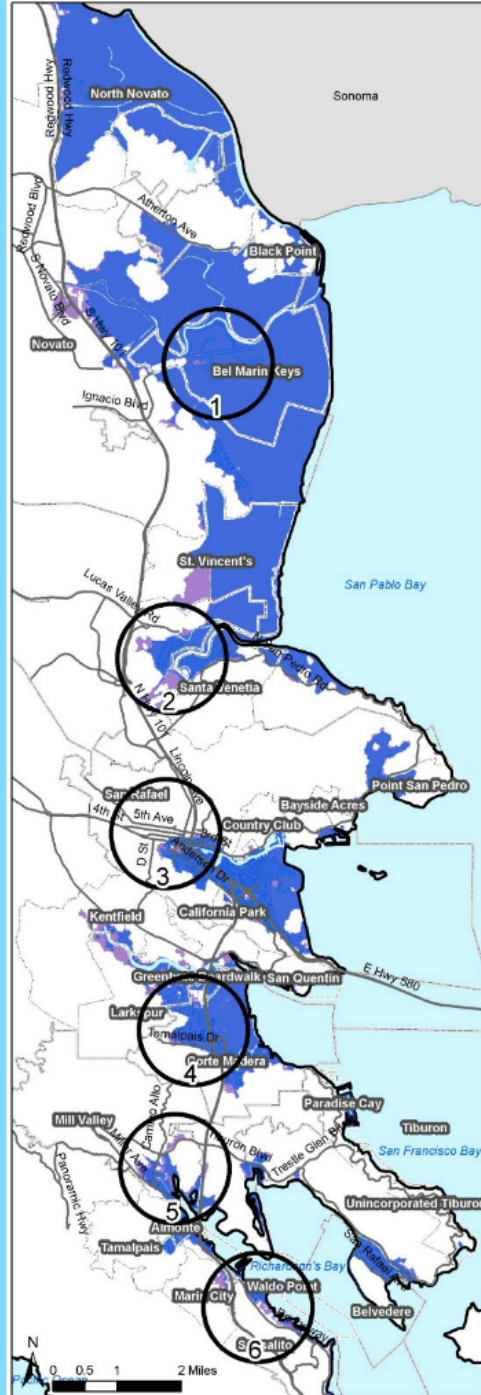


LONG TERM

Scenario 5:
60 in. Sea Level Rise

Scenario 6:
60 in. Sea Level Rise
+ 100-year storm surge

By 2100, tidal flooding could reach nearly 7,000 acres, 8,000 parcels (13%), 9,000 buildings (12%), and 100 miles of road. Higher high tides could adversely impact the locations flooded in medium-terms, and significant portions of the areas that previously suffered storm surge flooding. Tidal flooding would reach beyond the State Routes 101 and 580 in low-lying areas, into Southern Marin's narrow valleys and creek sides, and over every levee in Marin County. A 100-year storm surge could flood these areas, and an additional 6,500 acres, 4,600 parcels (20% total), 3,000 buildings (15% total), and 30 miles of road, extending to Sausalito west of Bridgeway, Marin City housing, Mill Valley's Alto Shopping Center, Las Gallinas and N. San Pedro Blvd. in San Rafael, Bayside Acres, Country Club, and Kentfield. Minor building damage could amount to \$61 million (2016 dollars). Vulnerable single family homes exceed \$20 billion in market value (2016 dollars). Several park and rides, hundreds of bus stops, and bus routes, and SMART rail track, including the San Rafael Transit Center, could experience flooding. Disruptive flooding at the SASM and NSD wastewater treatment plants and pump stations would affect tens of thousands of people. Storm surges could flood Tiburon Fire Station No. 1, Corte Madera Fire Station No. 13, and Novato Atherton Ave. Fire Station. A few emergency shelters in Southern Marin flood at high tide, and many more could be closed during a storm. The Central Marin Police Department may have to navigate deep water to reach Larkspur and Corte Madera shoreline residents. In Southern Marin, mud flats and water would dominate existing marshes. In the north, tidal marshes could expand.



Vulnerable Assets

Vulnerable Buildings @60" Sea Level Rise	Vulnerable Buildings @100-Year Storm Surge	@60"-Storm Surge	SMART Station	SMART Track	School	Medical Facility	Emergency Shelter	Golden Gate Transit Stop	Public Boat Launch	Transmission Lines
Park	Park & Ride	Marin Transit Stop	Sea Level Rise (SLR) Scenarios	Scen 5: 60" SLR	Scen 6: 60"SLR+Storm Surge	Location Indicators	Unincorporated	Municipality	Road	Bay

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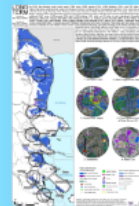
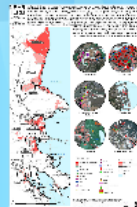
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