

Fostering Climate Resiliency in Coastal Marin

CA Coastal Resilience Network, January 10, 2017

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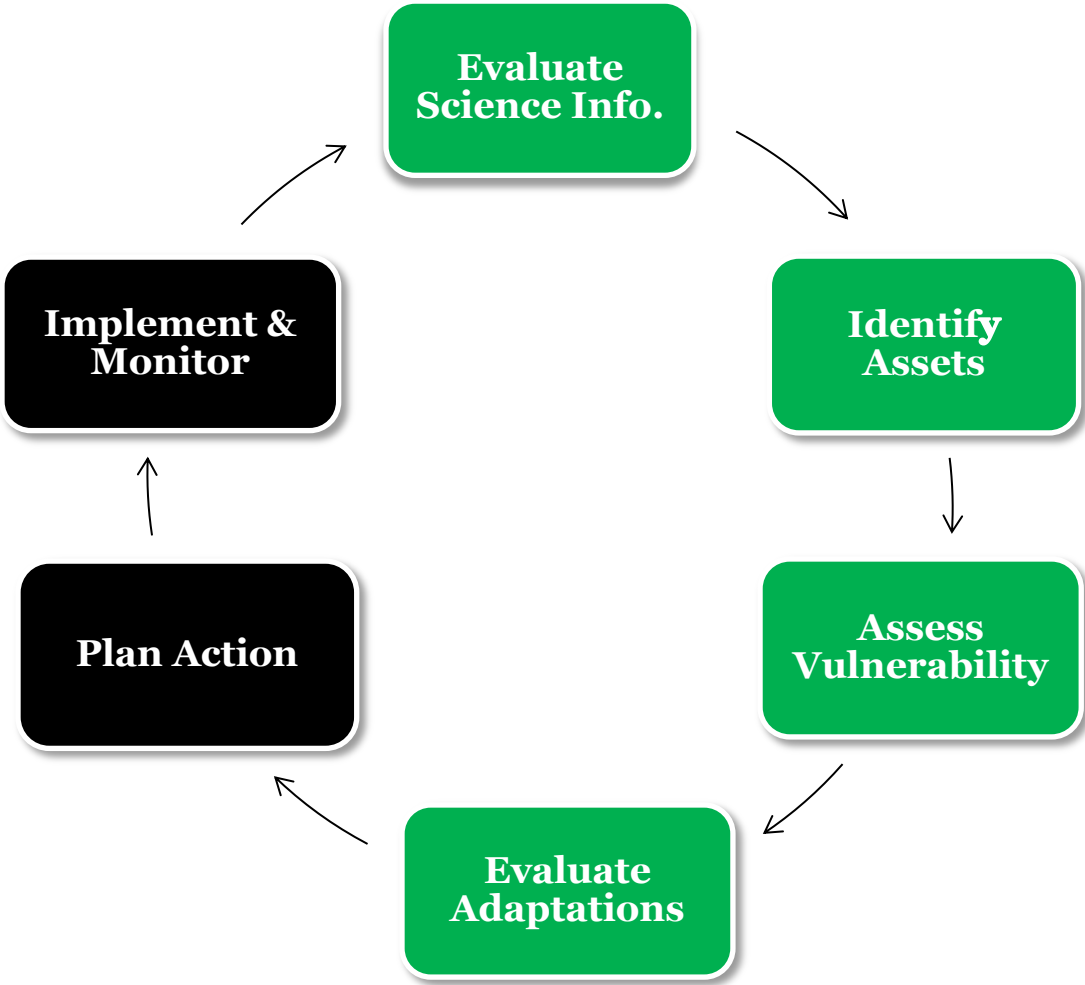


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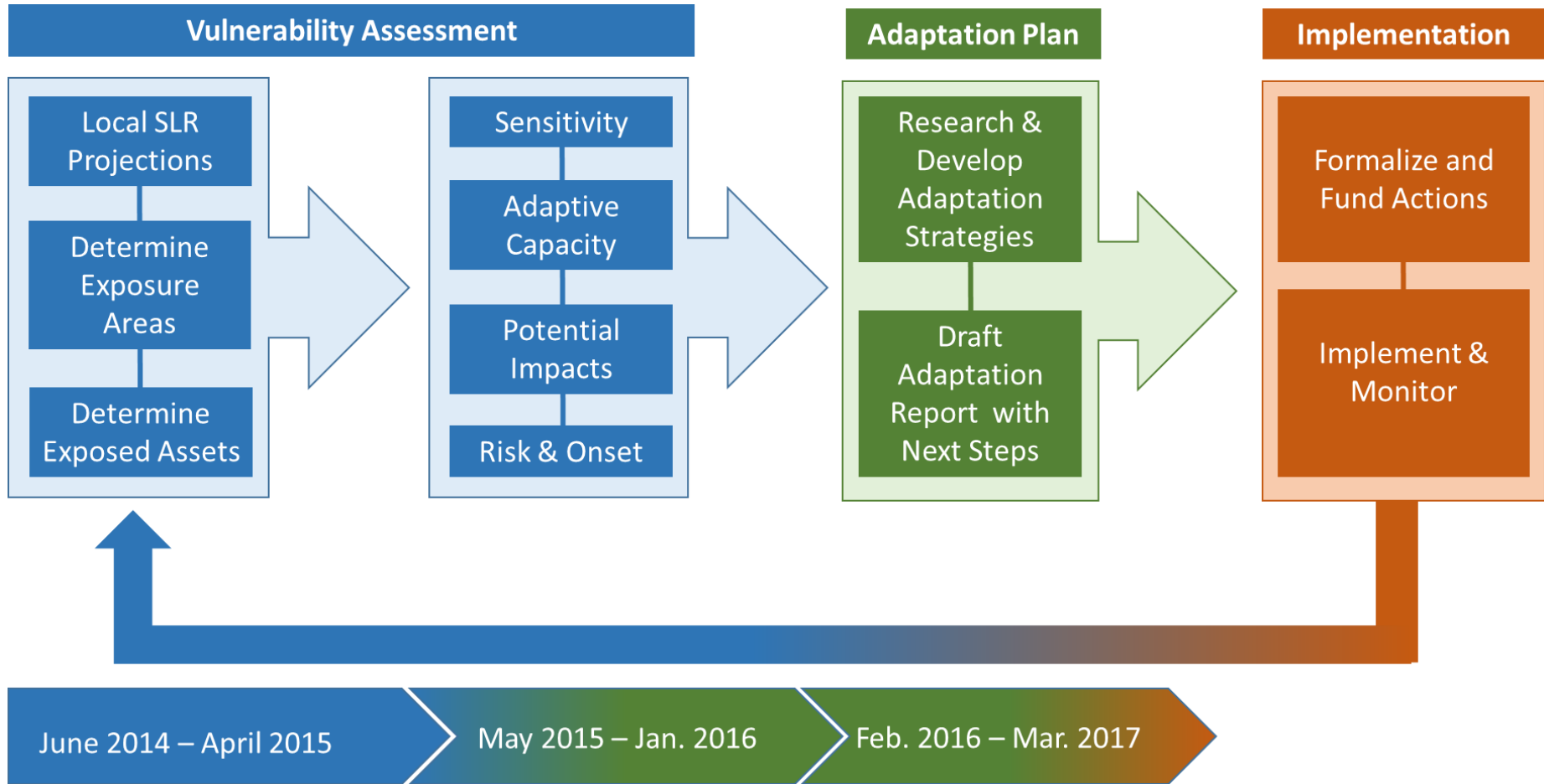
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Sea Level Rise Adaptation Process



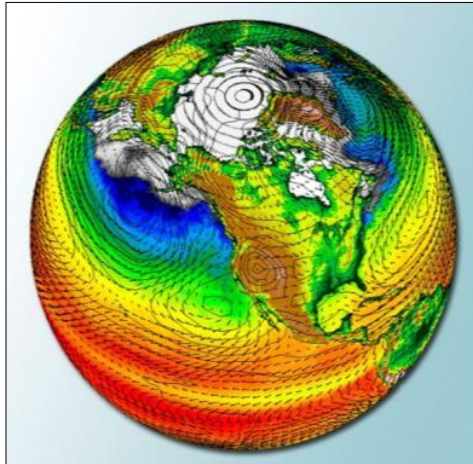
C-SMART

(Collaboration Sea Level Marin Adaptation Response Team)

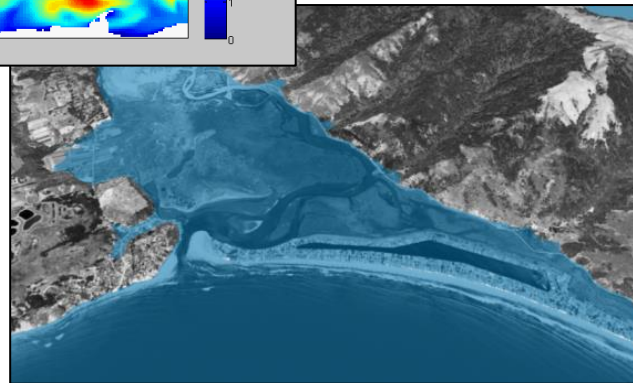
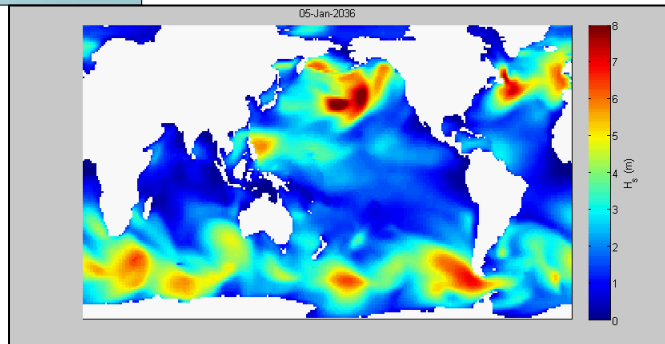


Identifying Future Risk with CoSMoS

1. Global forcing using the latest climate models



2. Drives global and regional wave models



3. Scaled down to local hazards projections

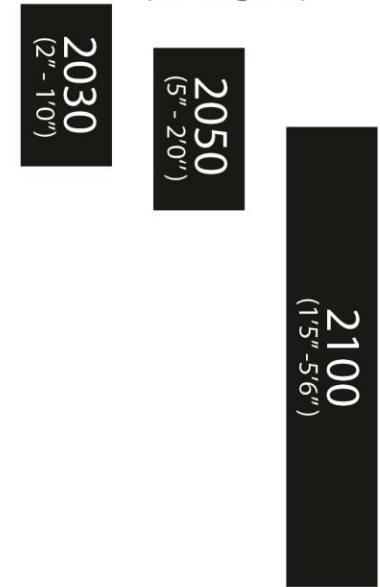


Sea Level Rise amount

	No storm	Annual storm	20-year storm	100-year storm
0'0" / 0 cm	Dark Blue	Red	Red	Orange
0'10" / 25 cm	Red	Orange with dot	Orange with dot	Yellow-Orange
1'8" / 50 cm	Red	Orange	Orange with dot	Yellow-Orange
2'6" / 75 cm	Orange	Orange	Yellow-Orange	Yellow-Orange
3'3" / 100 cm	Orange	Orange	Yellow-Orange	Yellow-Orange with dot
4'1" / 125 cm	Yellow-Orange	Yellow-Orange	Yellow-Orange	Yellow-Orange
4'11" / 150 cm	Yellow-Orange	Yellow-Orange	Yellow-Orange	Yellow
5'9" / 175 cm	Yellow-Orange	Yellow-Orange	Yellow-Orange	Yellow
6'7" / 200 cm	Yellow-Orange	Yellow-Orange	Yellow	Yellow with dot
16'5" / 500 cm	Yellow-Orange	Yellow	Yellow	Light Yellow

•C-SMART Scenario

NRC Sea-Level Projections* (SF Region)

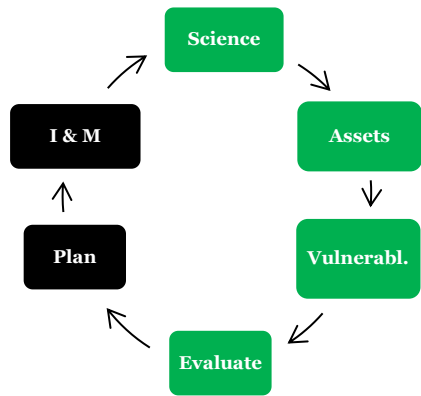


*NAS-NRC, 2012



Geomorphologic Change

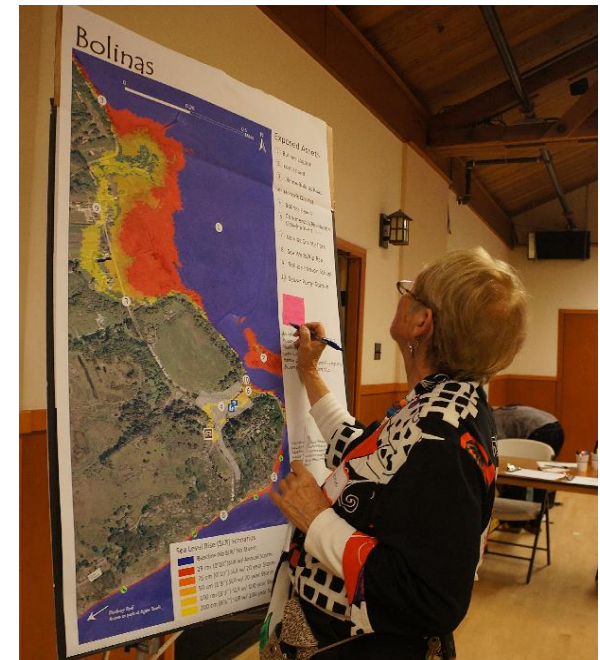




ASSET MAPPING & INVENTORYING

- Agricultural land
- Protected areas
- Public beaches and parks
- Dunes
- River & streams
- Wetland areas
- Habitat areas
- Oyster beds
- Sandspits
- Shorebirds

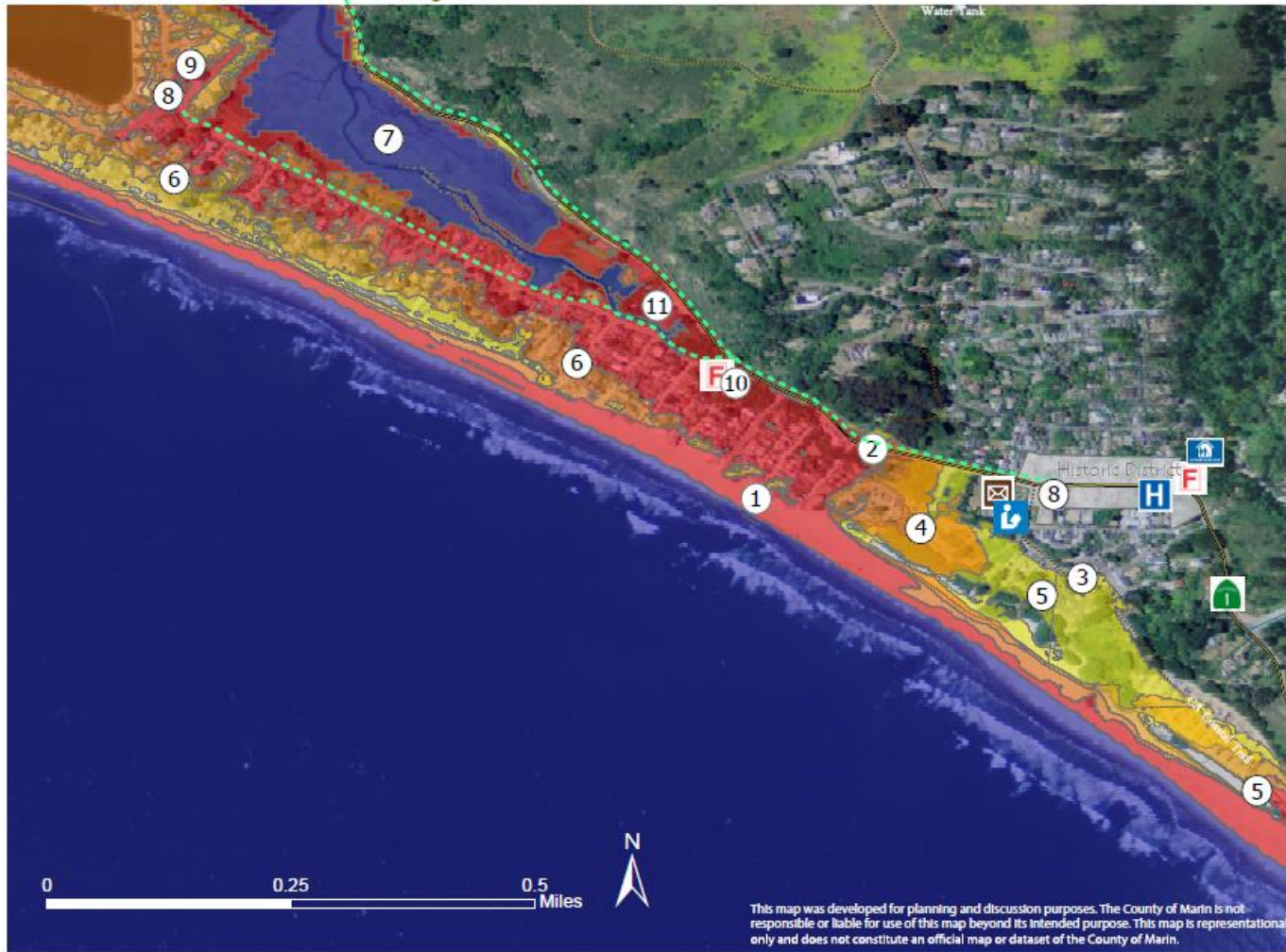
- Roads and transportation
- Trails
- Buildings
- Residential development
- Commercial buildings
- Schools
- Elderly/mobility limited facilities
- Hotels/Motels
- Harbors and marinas



- Fishing, aquaculture facilities
- Utilities & services
- Septic leach fields
- Water Supply wells
- Archeological/ Paleontological sites
- Historic sites



Stinson Beach



Exposed Assets

- ① Stinson Beach
- ② State Highway 1
- ③ California Coastal Trail
- ④ Picnic Area
- ⑤ Stinson Beach Parking Lots
- ⑥ Commercial/Residential Development
- ⑦ Bolinas Lagoon
- ⑧ Tsunami Evacuation Route
- ⑨ Emergency Generator
- ⑩ Fire Station
- ⑪ Water District Office

Additional Natural Resources include Steelhead Trout habitat, Harbor Seal Haul Outs, Brown Pelican Roosting Sites, Wetlands

Sea Level Rise (SLR) Scenarios

- Baseline No SLR/ No Storm
- 25 cm (0'10'') SLR w/ Annual Storm
- 25 cm (0'10'') SLR w/ 20 year Storm
- 50 cm (1'8'') SLR w/ 20 year Storm
- 100 cm (3'3'') SLR w/ 100 year Storm
- 200 cm (6'6'') SLR w/ 100 year Storm

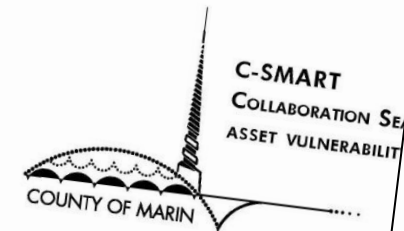
Properties Exposed

- 2
- 120
- 250
- 398
- 490



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The Vulnerability Assessment Tool



C-SMART COLLABORATION SEAL ASSET VULNERABILITY ASSESSMENT

COUNTY OF MARIN

INTERVIEWER: _____
 INTERVIEWEE: _____
 ASSET: _____

Instructions to CDA: Use this script to conduct interviews (in-person or virtual) with the asset manager and provide an overview of the asset and its vulnerability to sea level rise and storm surge. Maintain consistency across interviews.

CDA: Hello, my name is _____ from Marin County CDA. I am here today for an appointment to discuss how sea level rise can impact public assets.

CDA: Thank you for agreeing to this interview. We hope that this interview will help us understand the vulnerability of your assets. In particular, we have one/a few/several public assets related to your team. These assets are:

- _____
- _____
- _____

At most this process could take 30 minutes per asset, and answers to the questions will be short answer questions, followed by ranking degrees of sensitivity to sea level rise and storm surges. Completing this for each asset will enable us to create a vulnerability assessment plan.

Before I get started, do you have any questions? [Allow Q&A]

CDA: We will begin with the [insert asset] (if needed). The first step is to get us thinking about sea level rise and storm surge preparation.

- Are there efforts underway to address SLR/SS (emergency preparedness)?
 No Yes, _____
- What is your level awareness of sea level rise?
 None Low, heard/read of SLR
- What is your general workplace's awareness of sea level rise?
 None Low, heard/read of SLR

4. Please describe the current physical condition of the asset. Are there existing stresses, are they likely to improve/worsen?

5. Has the asset been disrupted in the past due to an unplanned stress e.g., weather-related closure, emergency repair, strike?
 No Yes. How long did disruption last? _____

7a. Was the asset able to continue functioning? No Partially Yes

6. When was the last repair or update? _____

7. Is any major maintenance or repair planned? No Yes, when _____

CDA: Thank you. Please consider how the following sea level rise and storm surge exposures could impact [insert asset]. The exposures include:

- Rising water table
- Saltwater intrusion
- Permanent flooding
- Temporary flooding
- Wave impacts
- High winds impacts
- Beach/cliff erosion
- Habitat shifts

Do you have any questions about what any of these exposures are? [Allow response, and clarify if needed]

First we will address sensitivity, then adaptive capacity, adaptation ideas, and risk for each. For the sensitivity assessment, sensitivity is defined as the degree an asset could be damaged or the service it provides disrupted. Please indicate if [insert asset] will be sensitive for each exposure according to these levels:

No Sensitivity: Not impaired, damaged, or disrupted
 Low Sensitivity: Minimally impaired, damaged, or disrupted. The asset may require minor repairs or suffer minimal disruption.
 Medium Sensitivity: Somewhat impaired, damaged, or disrupted. The asset may require repairs and able to maintain most functions.
 High Sensitivity: Greatly impaired, damaged, or disrupted with complete loss or shut-down. The asset will require significant repairs and disruption could impact public health and safety.
 Maximum Sensitivity: Permanent loss or disruption.
 Unknown

Do these rankings make sense? Do you have any questions about sensitivity? [Allow response, and clarify if needed]

How sensitive is [insert asset] to:

8. Temporary flooding? No Low Med High Max
9. Permanent flooding? No Low Med High Max
10. Cliff/beach erosion? No Low Med High Max
11. Water table rising? No Low Med High Max
12. Saltwater intrusion? No Low Med High Max
13. Wave surge? No Low Med High Max
14. High winds? No Low Med High Max
15. Habitat shifts? No Low Med High Max

moderately, highly, or maximally sensitive to [name asset]. Please ask the asset manager what the impact of the exposure could be and what is the NATURE of the sensitivity).

the adaptive capacity of the asset for each exposure you rated as the ability of an asset to recover from the damage or disruption. Do you have any questions about adaptive capacity? [Allow for Q & A]

these categories:

• need for intervention.
 • moderate, high, and maximum sensitivity exposures. [insert asset]
 • low, moderate, high, and maximum sensitivity exposures. [insert asset]
 • elevated structure). Could be easily replaced, repaired, and cope with the consequences with significant impact], and cope with the consequences with significant impact], and cope with the consequences (no alternative routes, or repairs.
 • repairable or replaceable in current location

ation planning, the next phase of analysis and exploration.

r your agency incorporated into managing the asset in times of emergency.

adaptation or preparation actions that will ensure the asset/structure is resilient to storm scenarios?

Vulnerability Assessment

- Executive Summary
- Introduction
- Methods
- Asset Profiles
 - Parcels & Buildings
 - Transportation
 - Utilities
 - Working Lands: Agriculture & Aquaculture
 - Natural Resources
 - Recreation
 - Emergency Services
 - Historic & Archeological Resources
- Coastal Zone Community Profiles
 - Muir Beach
 - Stinson Beach
 - Bolinas
 - Inverness
 - Point Reyes Station
 - East Shore
 - Dillon Beach
- Conclusion
- Append A: Workshop Summary
- Append B: Exposed Asset Tables
- Append C: Vulnerability Assessment Interview Tool
- Appendix D: ESA Memorandum on Marsh and Beach Shifts



Combined Riverine and SLR Flooding



THE GAME OF FLOODS

North Bay Island

Sea levels are rising world-wide as warming oceans expand and melt glaciers and ice sheets. Stronger storms coupled with rising seas can significantly damage—even destroy—property, infrastructure, public facilities, natural habitats, and other resources we depend on. At the base of these threats, you are tasked with collaboratively developing a sea level rise adaptation plan using the strategies (green pieces).

To begin, one player reads the sea level rise scenario aloud.

1. Players must roll. Players take turns in clockwise order.
- 2.
3. In turn, each player selects an asset to accommodate, defend, or retreat from. No need to duplicate assets. Use the worksheet provided to record your choice, costs, and pros and cons.
4. Next, in turn, each player places and states aloud their preferred adaptation strategies on or around the island. Conflicting strategies are allowed.
5. Consider the following factors to inform the proposal: (1) Cost/financing, (2) Private property impacts, (3) Environmental impacts, (4) Equity/social justice concerns, (5) Other. Use your worksheet to take notes.

Sea Level Rise 2050 Scenario Key

RED AREA = Permanent Sea Level Rise Flooding
ORANGE AREA = Temporary Storm Storm Flooding
YELLOW AREA = Temporary 100 Year Storm Flooding



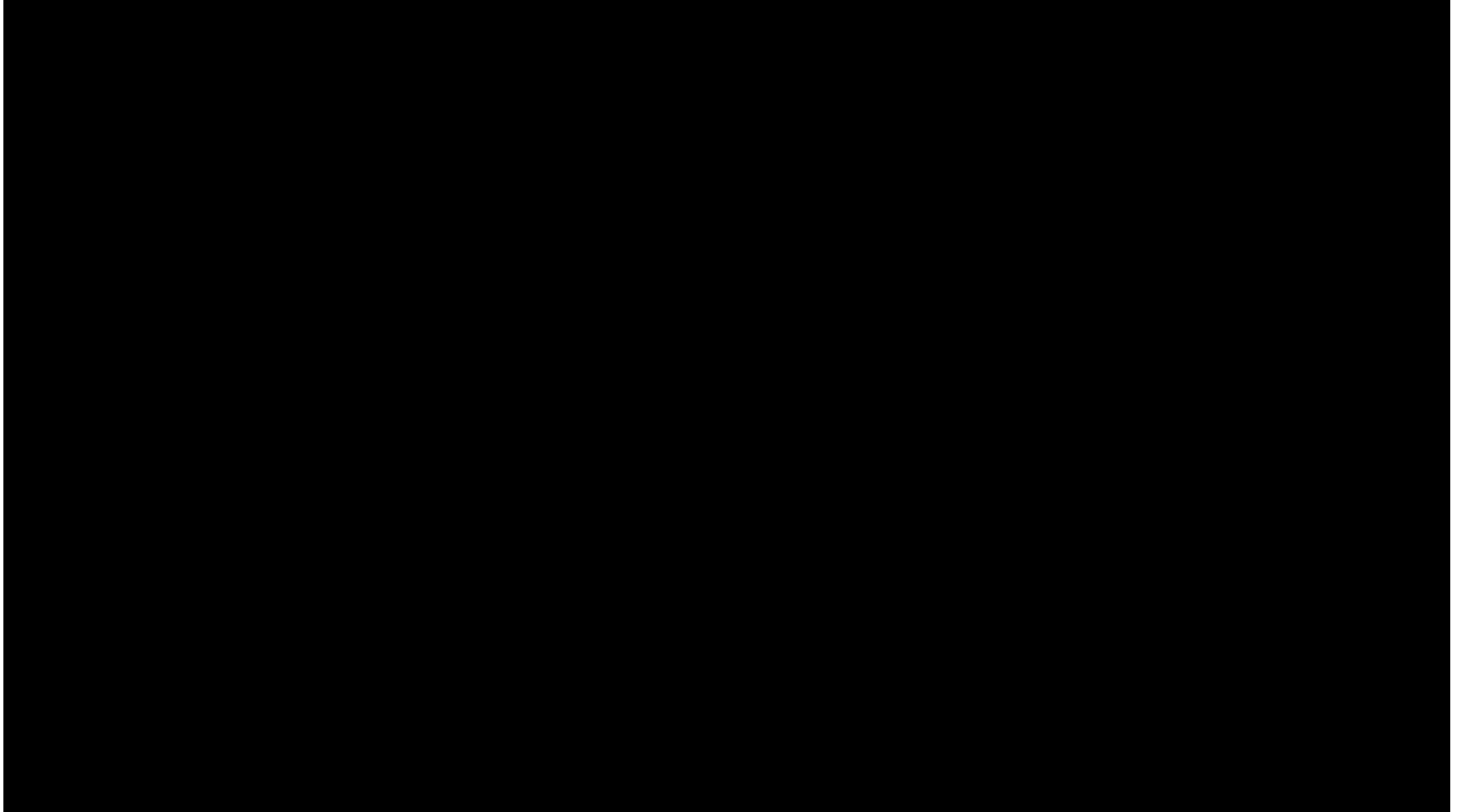
Evacuation Route	Marina	Mammal Habitat	Ranch	Grocery	Water	School Site	Parking	Hospital
Storm Shelter	Gas Station	Seabird Colony	Agriculture	Public Well	Roadway	Restaurant	Library	Fire Station
Electrical Sub-Station	Sewage Lift Station	Aquaculture	Sheriff	Home	Beach	Boat Launch	Historic Church	Post Office

LEGEND

GAME PIECES

<p>Managed Retreat</p> <ul style="list-style-type: none"> Retreat Move here Post-storm prohibitions Stricter land use zoning 	<p>Accommodate Water</p> <ul style="list-style-type: none"> Elevate Buildings Floodable Buildings Elevate/New Road 	<p>Hard Engineering</p> <ul style="list-style-type: none"> Revetment/Seawall Traditional Levee Tide Gate Wall & Pump Station 	<p>Soft Engineering</p> <ul style="list-style-type: none"> Horizontal Levee Wetland/shoreline vegetation Offshore Structure Beach Maintenance
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Game of Floods : Pt. Reyes Station



LCP Response to Sea Level Rise

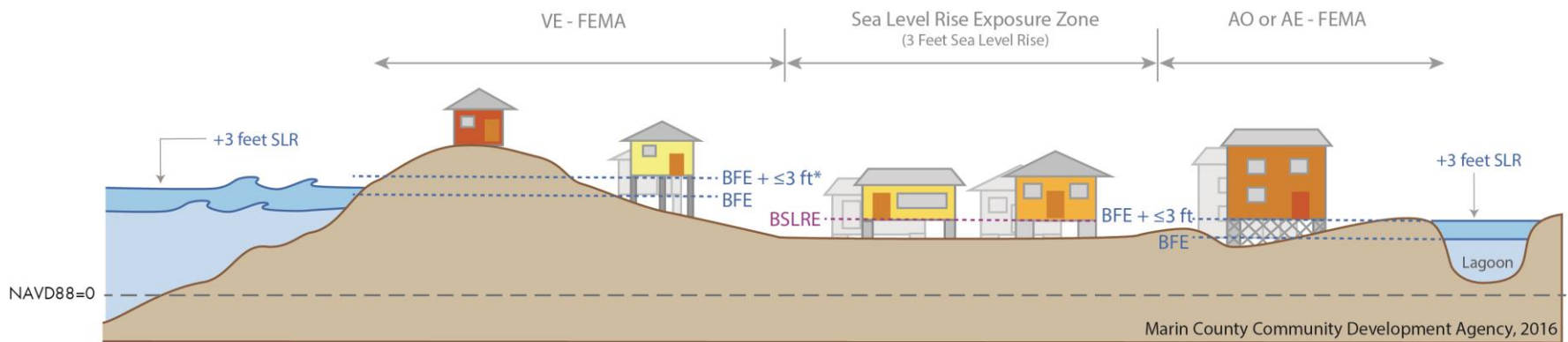
County Proposal

Facilitates adaptive management approach to address Sea Level Rise

Elevates structures 3 feet above FEMA based on best available science

Provides flexibility to raise existing homes to meet FEMA and Sea Level Rise projections





Example of Future Building Elevation with 3 feet of Sea Level Rise

BSLRE = Base Sea Level Rise Elevation

BFEs are based on high-intensity storm floodwater elevations that have a projected 1% chance to occur in any given year (commonly referred to as the "100-year flood")

*Plus additional analysis required to address erosion and flooding hazard for projected 3 feet of Sea Level Rise



Stinson Beach: FEMA Velocity (VE) Zone



Existing: 14' BFE



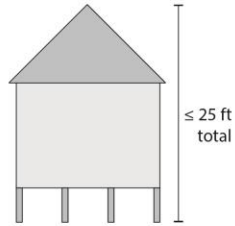
County Proposal
New: 7' BFE



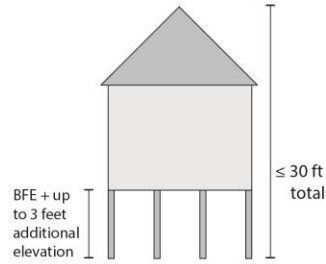
Development Requirements

22.68.060
Improvements to existing structures. Exempt if NOT in an appeal zone & NOT on a beach; in a wetland, stream or lake; seaward of the mean high tide line; in an ESHA; within 50 feet of the edge of a coastal bluff; or additions resulting in an increase of less than 10 percent of the floor area.

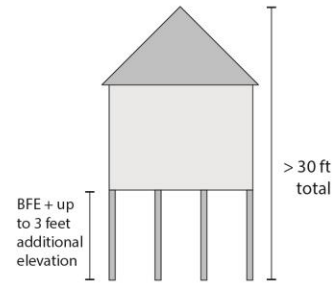
Exempt



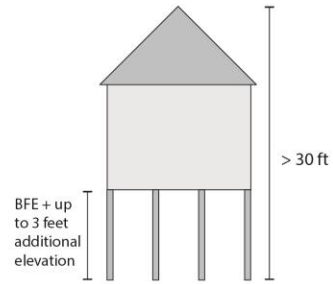
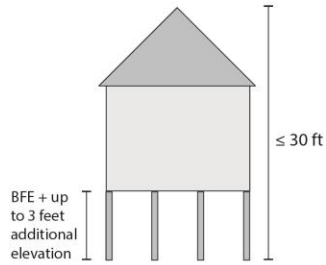
Coastal Permit (Standard Findings)



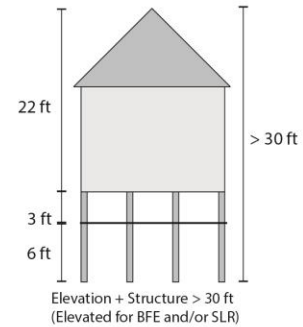
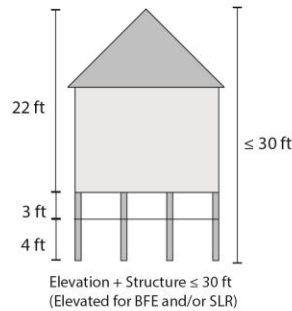
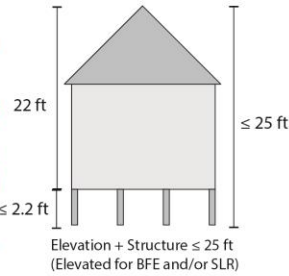
Coastal Permit



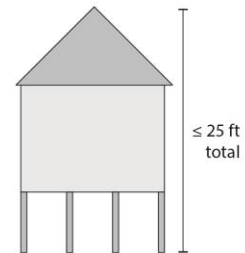
ON a beach; IN a wetland, stream or lake; seaward of the mean high tide line; IN an ESHA; or within 50 feet of the edge of a coastal bluff



IN APPEAL ZONE property that is located between the ocean and the first public road. Increase of no more than 10% of floor area of existing structure increase in height of no more than 10% of an existing structure.



New Development on Vacant Lot or Non-Exempt, Non-Excluded Expansion.



Redevelopment

1. alteration (including interior and/or exterior remodeling and renovations, demolition or partial demolition, etc.) of 50% or more of **major structural components** (including exterior walls, floor and roof structure, and foundation) considered individually;
2. additions and alterations to such development that lead to a 50% or more increase in **floor area** for the development; and/or
3. additions and alterations to such development that costs 50% or more of the **market value** of the existing structure before construction



Adaptation Report Major Sections

- Executive Summary
- Introduction
- Methods
- Adaptation Framework
- Asset Adaptation
 - Parcels & Buildings
 - Transportation
 - Utilities
 - Working Lands
 - Natural Resources
 - Recreation
 - Emergency Services
 - Historic & Archeological
- Community Alternatives
 - Muir Beach
 - Stinson Beach
 - Bolinas
 - Inverness
 - Point Reyes Station
 - East Shore
 - Dillon Beach
- Conclusions
 - Next Steps
 - Lessons Learned



Next Steps

- Community Plans for Adaptation to Coastal Hazards (PATCHs)
- West Marin Interagency Sea Level Rise Task force
- Formalize relationships with local/state/federal agencies who oversee transportation, utilities, parks/open space, emergency services, etc.
- Accommodate Sea Level Rise in capital improvement projects
- Establish a citizen's advisory committee with citizen science monitoring program
- Establish/formalize a sea level rise public education program
- Network with other agencies planning for sea level rise to evaluate adaptation strategies
- Continue to work with the Greater Farallones National Marine Sanctuary on natural resources strategy implementation

STAFF RECOMMENDATIONS ONLY, HAVE NOT BEEN VETTED WITH CDA MANAGEMENT OR BOARD OF SUPERVISORS



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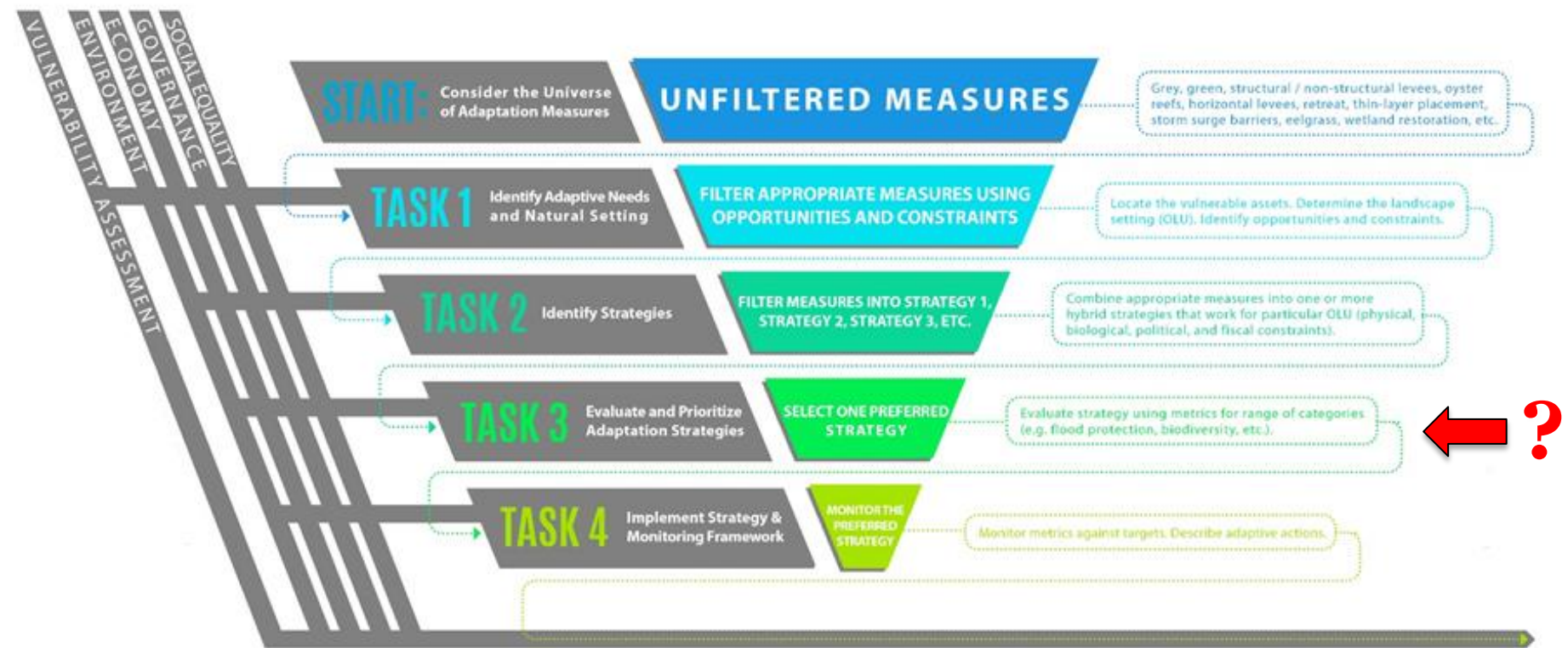
Community PATCHs

PLANS FOR ADAPTATION TO COASTAL HAZARDS

- 1) ID vulnerable infrastructure assets of community wide importance for each community.
- 2) Determine flooding frequency, intensity, and duration for the identified assets under different future scenarios.
- 3) Survey community members to determine 'trigger points' for vulnerable infrastructure. Link trigger points to specific timeframes (e.g., 2030, 2050)
- 4) With community members and asset managers initiate PATCHs around the identified timeframe to implement prior to nuisance flooding
- 5) Develop adaptation alternatives for evaluation (e.g., elevation, relocation, alignment). Populate matrices with information including costs, impacts and benefits. The matrices would guide the determination of a preferred alternative based on maximizing public benefits while minimizing costs and negative impacts.
- 6) Collaborate with partners on implementation of the preferred alternative through capital improvement programs.



Adaptation Processes?



Graphic Credit: San Francisco Estuary Institute



WHAT KIND OF COMMUNITY IS YOURS?

WE WANT TO TALK MORE!

a) Beach/Sandspit?

b) Urban?

c) Eroding Bluffs?

d) Sheltered Bay?





SEA LEVEL
2050

SEA LEVEL
2100
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SAVE THE DATE!

World Ocean Day • 6-8-17

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