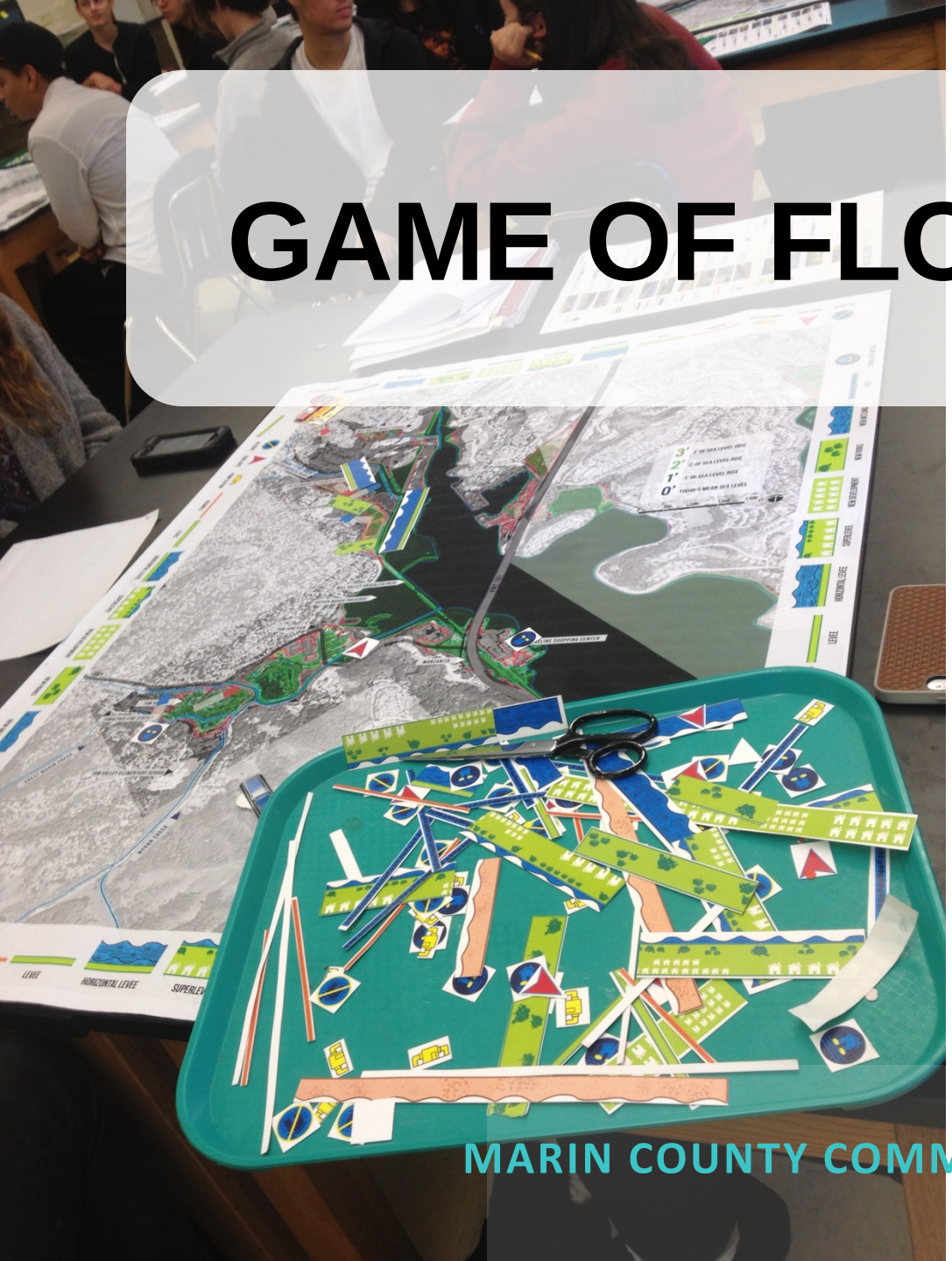
GAME OF FLOODS



COUNTY OF MARIN

MARIN COUNTY COMMUNITY DEVELOPMENT AGENCY

MARIN ACADEMY, 1/19/17

THE GAME OF FLOODS *Your Island*

START

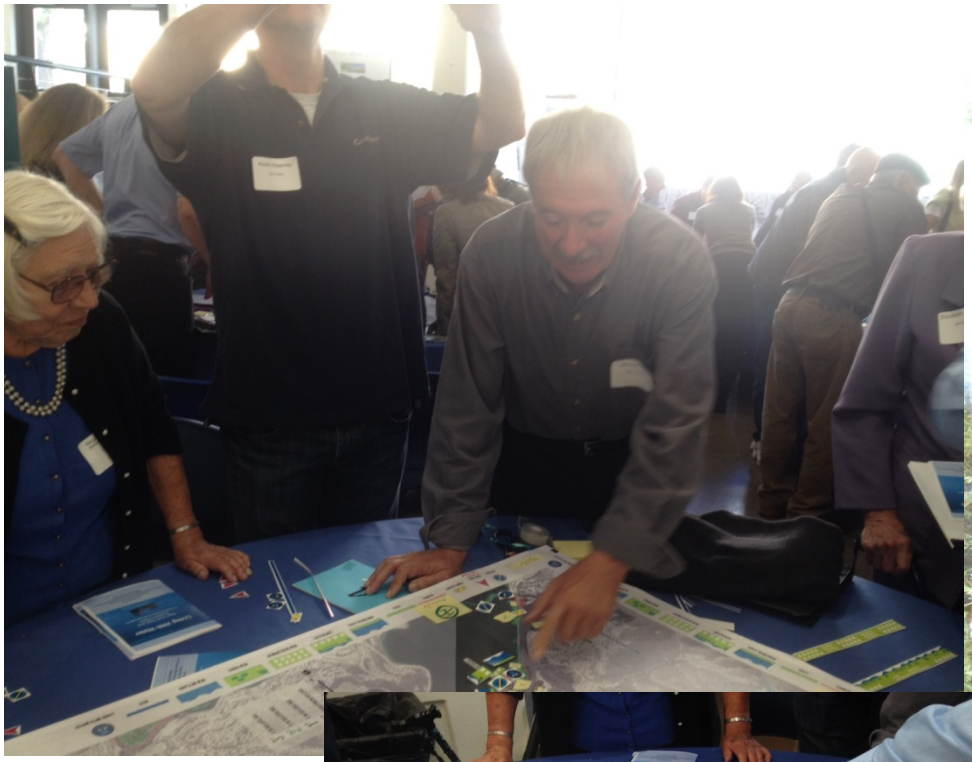
Sea levels are rising world-wide as warming oceans expand and melt glaciers and ice sheets. Stronger storms coupled with rising seas can significantly damage— even destroy— property, infrastructure, public facilities, natural habitats, and other resources we depend on. In the face of these threats, you are tasked with collaboratively developing a Sea Level Rise Adaptation Plan using the strategies (game pieces).

1. To begin, one player reads the sea level rise scenario aloud.
2. Role the di to determine who goes first. The highest roll goes first. If a tie occurs, the tied players must re-roll. Players take turns in clockwise order.
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. Use the remaining time to finalize the group's proposal by resolving conflicts. Consider the following factors to inform the proposal: (1) Costs/funding, (2) Private property impacts, (3) Environmental impacts, (4) Equity/social justice concerns, (5) Others. Use your worksheet to take notes.

Sea Level Rise 2050 Scenario Key

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

C-SMART Program
May 2015




PUMP STATION
SEAWALL
LEVEE
HORIZONTAL LEVEE
SUPERLEVEE
NEW DEVELOPMENT
NEW PARKS
NEW WETLAND
REEF
LIVING WITH WATER


4
4
3' OF SEA LEVEL RISE
2' OF SEA LEVEL RISE
1' OF SEA LEVEL RISE
0' TODAY'S MEAN SEA LEVEL
PUMP STATION
SEAWALL
LEVEE
HORIZONTAL LEVEE
SUPERLEVEE
NEW DEVELOPMENT
NEW PARKS
NEW WETLAND
REEF
LIVING WITH WATER

GAME OF FLOODS: PT. REYES STATION

HIGH SCHOOLS

PRESERVATION EDITION

Advisory assistance provided by:

National Trust for Historic Preservation
Save the past. Enrich the future.™

Changes:

- More urban look and feel
- Increased assets of historical/cultural significance
- Integrity impacts
- Documentation

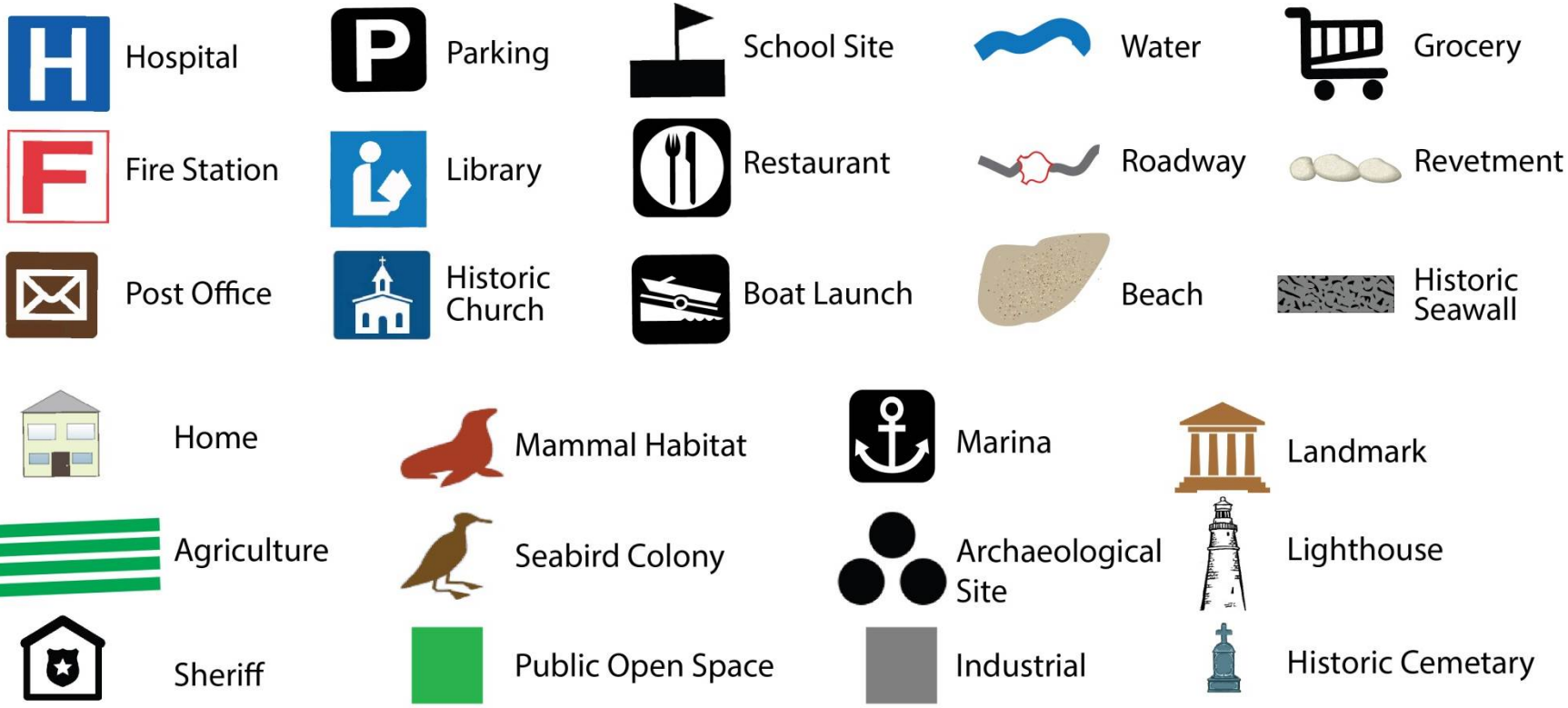
Developed for:

KEEPING HISTORY ABOVE WATER
APRIL 10-13, 2016 | NEWPORT, RI

CALIFORNIA PRESERVATION FOUNDATION

Asset Mapping & Inventory

Mapping people; livelihoods; infrastructure, environmental, and economic, social, & cultural assets



INTERVENTION OPTIONS

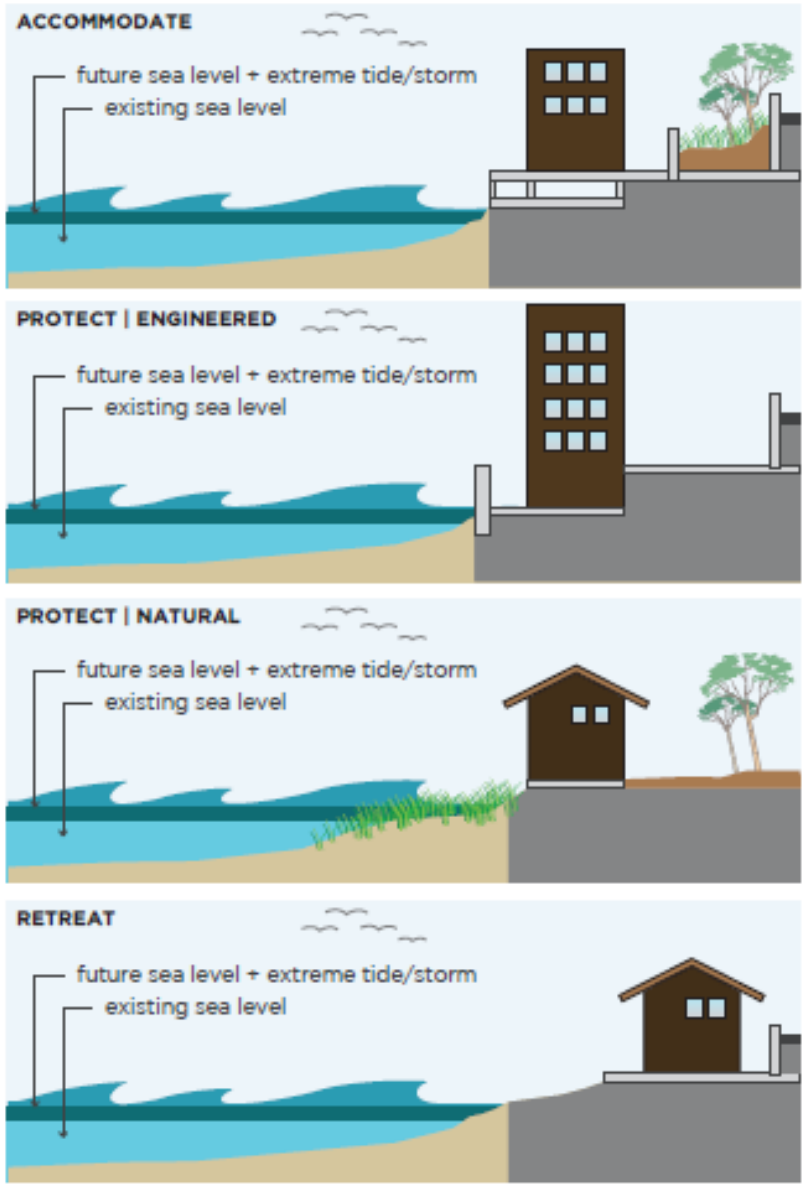
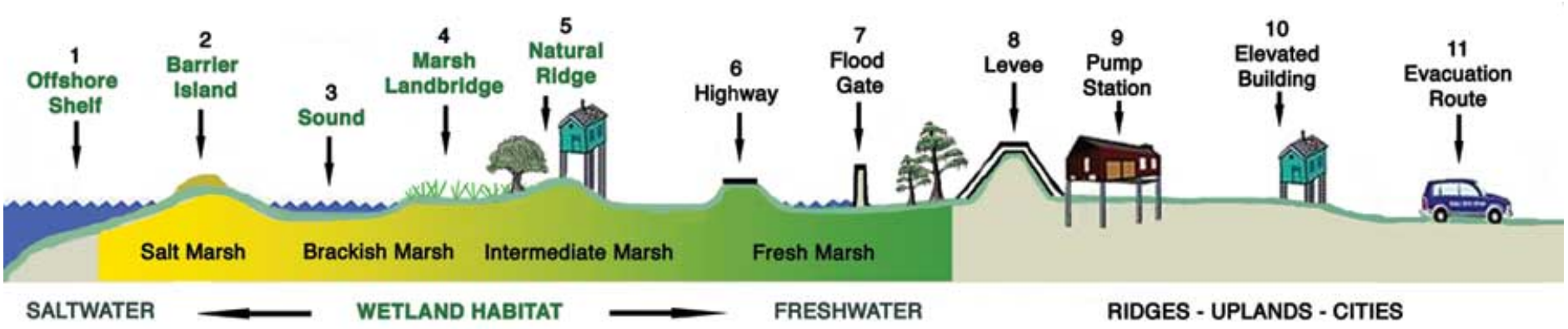


Image: SF Sea Level Rise Action Plan

Hybrid Strategies

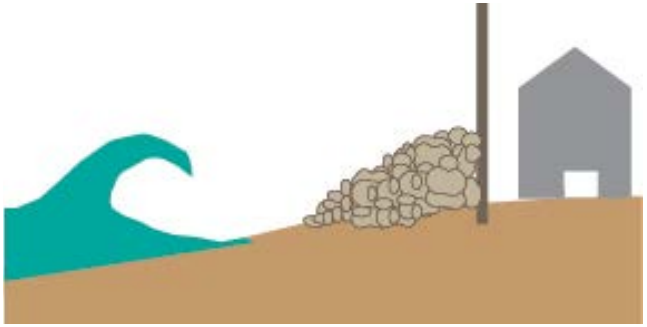


Lopez, John A., 2006, The Multiple Lines of Defense Strategy to Sustain Coastal Louisiana, Lake Pontchartrain Basin Foundation, Metairie, LA January 2006

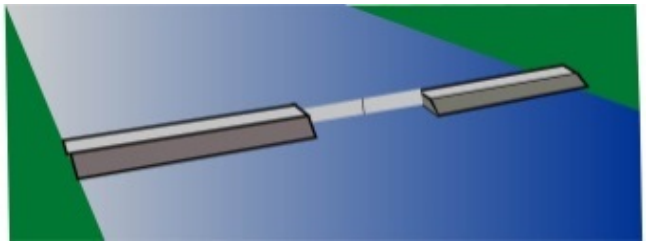
1. PROTECT

Hard (Traditional) Engineering

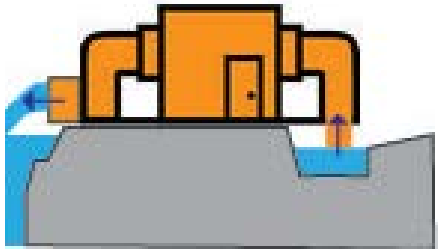
Traditional levee



Seawall/Revetment

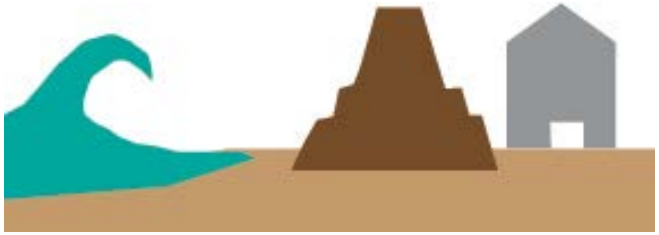


Tidal gate



Wall & Pump Station

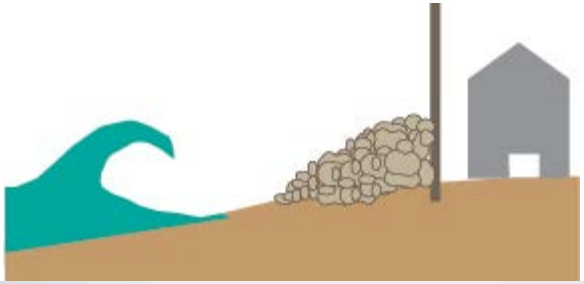
Levee



Costs: High
Environmental Impacts: High
Effectiveness: Medium to Long Term

Sacramento-San Joaquin Delta/ Locke

Seawall



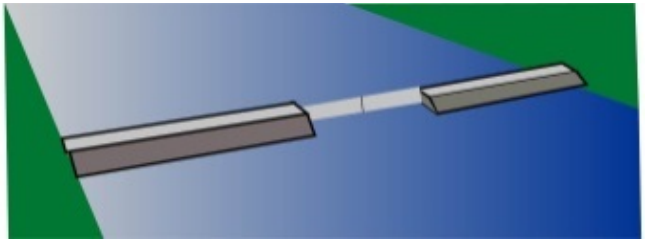
Costs: High
Environmental Impacts: High
Effectiveness: Medium to Long Term

St. Augustine, FL

Jones Point, Washington D.C.

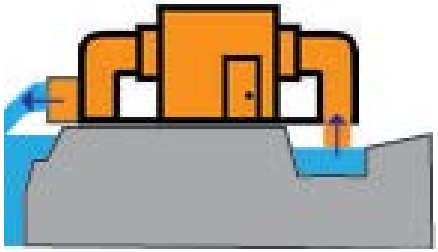
Images: Ann Horowitz

Tidal gate



Costs: Extreme
Environmental Impacts: High
Effectiveness: Long Term

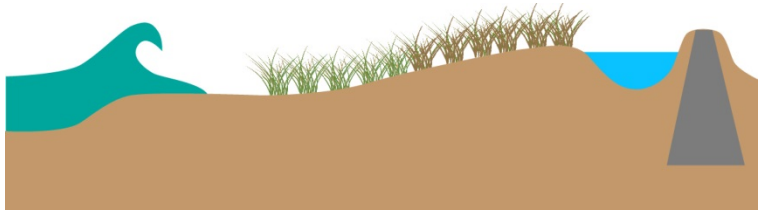
Pump station



Costs: High
Environmental Impacts: High
Effectiveness: Medium Term

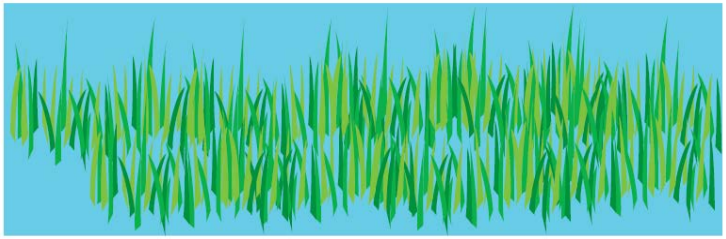
1. PROTECT

Soft (Nature-based) Engineering

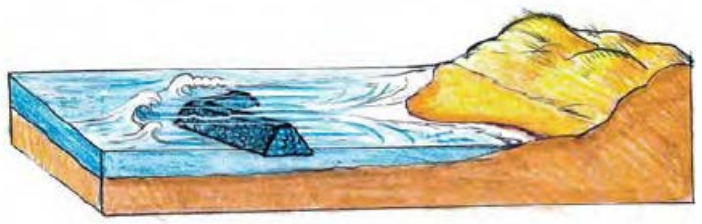


Horizontal levee

Dune restoration &
Beach maintenance

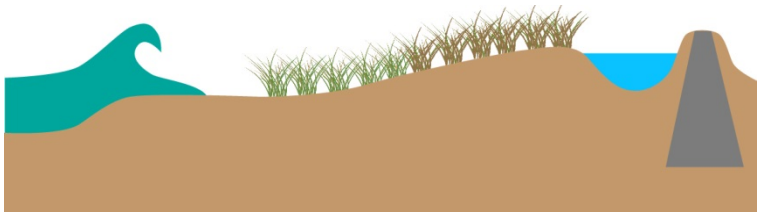


Wetland/ shoreline
vegetation

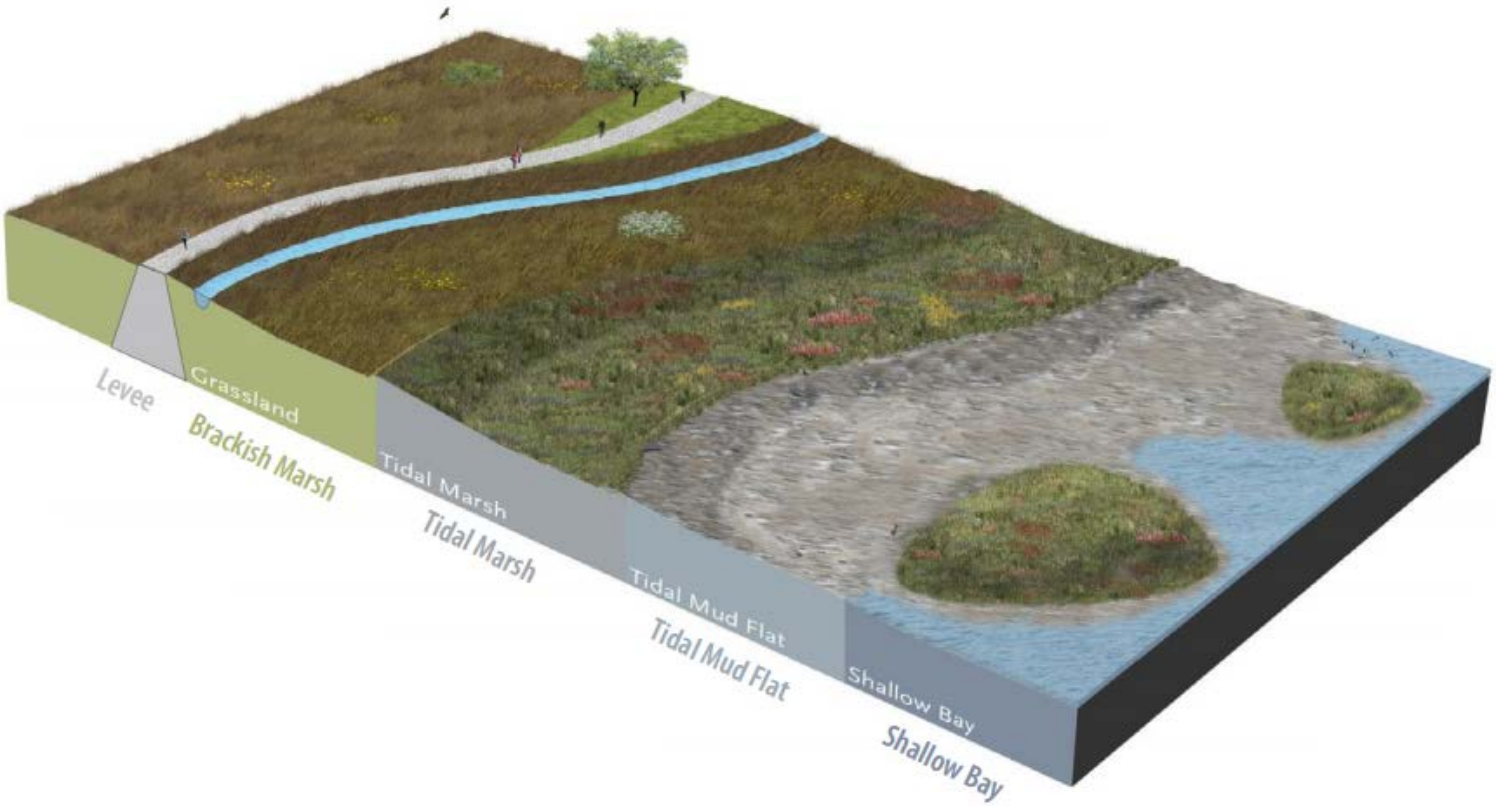


Offshore
structure

Horizontal levee



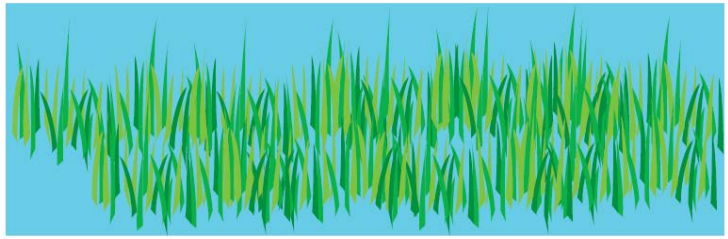
Costs: High
Environmental Impacts: Positive
Effectiveness: Long Term (waves and sea level rise)



Safesfbay.org

Wetland/ Living Shorelines

Costs: Medium
Environmental Impacts: Positive
Effectivenes: Medium Term (Wave Attenuation)



Giacomini Wetland Restoration, 2008

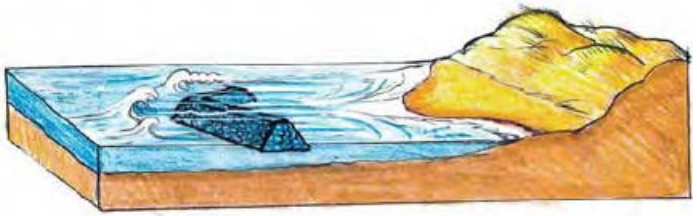
Beach Maintenance

Costs: Medium to High
Environmental Impacts: Negative to Positive
Effectiveness: Medium Term (Wave Attenuation)

Venetian Court Apartments. Capitola, CA

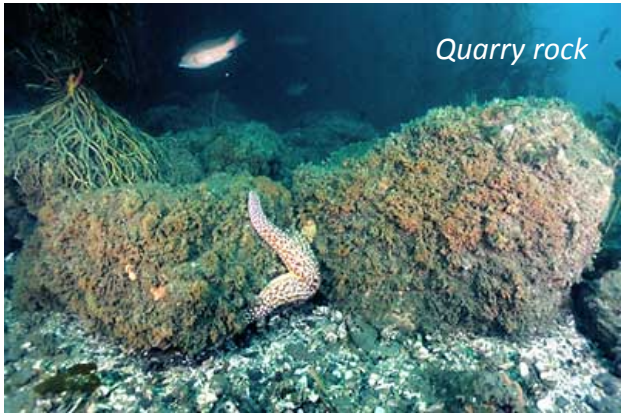
Offshore structures

Costs: Medium to High
Environmental Impacts: Positive
Effectiveness: Medium Term (Wave Attenuation)



San Clemente artificial reef experiment


Concrete


Quarry rock

2. ACCOMMODATE

Elevate buildings

Floodable Development

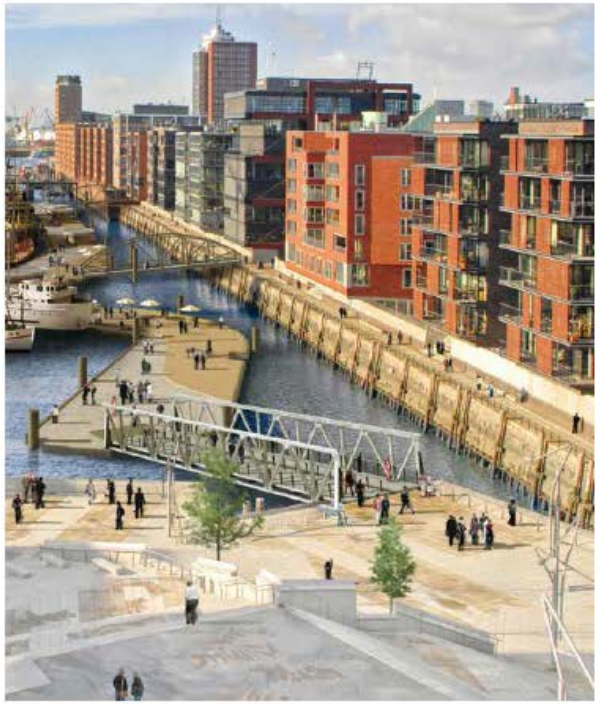
Elevate/New Road

Elevate buildings

Costs: Medium to High
Environmental Impacts: Neutral
Effectiveness: Medium Term

FLOODABLE DEVELOPMENT

Costs: High
Environmental Impacts: Medium
Effectiveness: Medium Term



New/elevate road

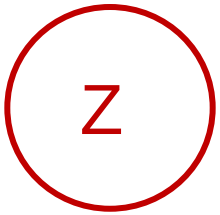
Costs: High
Environmental Impacts: High
Effectiveness: Long Term

RETREAT

Retreat

Rebuild here

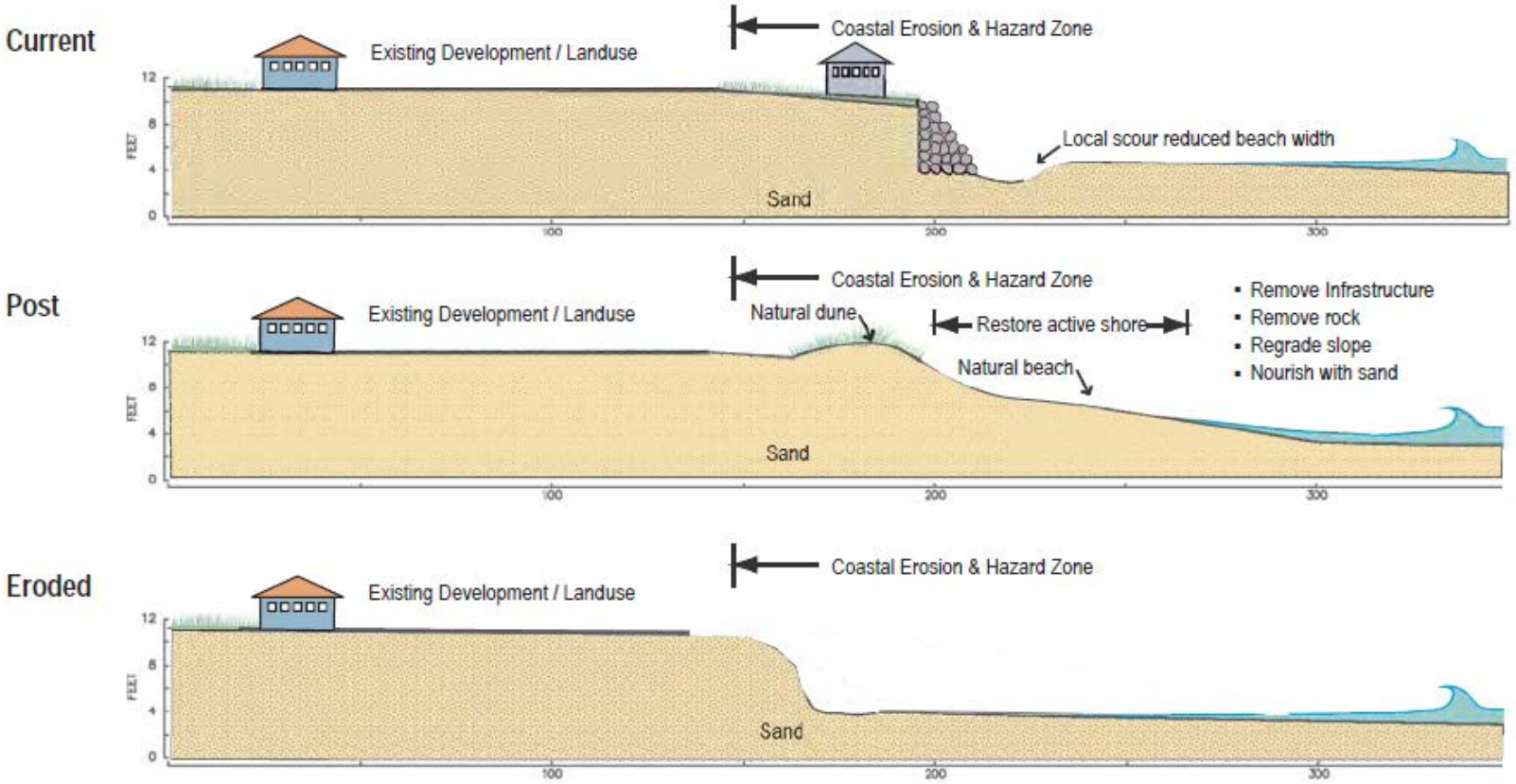
Post-storm prohibitions



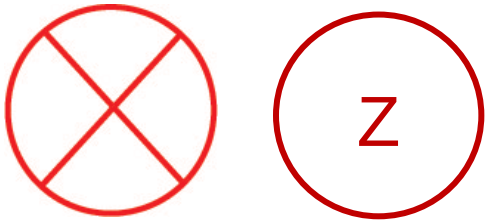
Stricter land use zoning

MANAGED RETREAT

Costs: High
Environmental Impacts: Low to Medium
Effectiveness: Long Term



POST STORM RESTRICTIONS AND STRICTER LAND USE ZONING



- **No or restricted rebuilding after storms?**
- **Rolling easements**
- **Extra technical studies**
- **Use of stricter codes (FEMA V)**

BLANK

Communities of North Bay Island

- Downtown Norbay
- Eroding Cliff Heights
- Mudflat Manors
- Desolation Court
- Shoreline Marina
- Twig Cove
- Seaspray Homes

Downtown Norbay

- Commercial hub of the island
- Protected by undersize levees and vulnerable to both riverine and tidal flooding

Eroding Cliff Heights

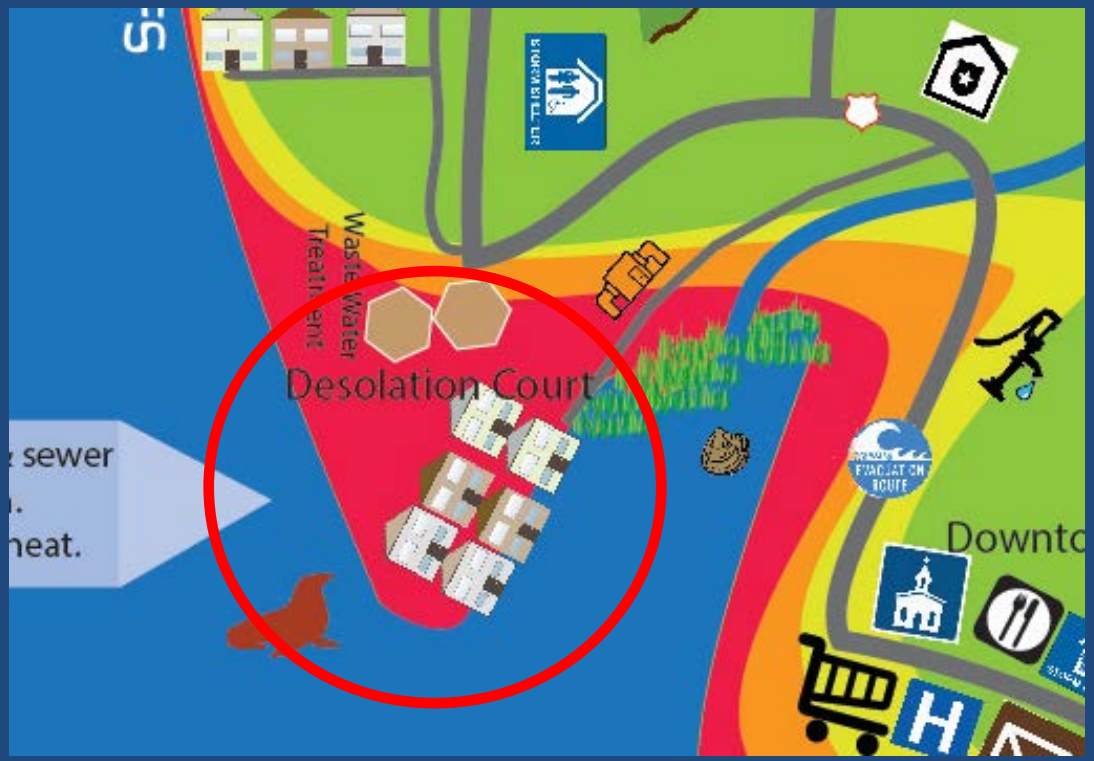
- Residential community threatened by cliff erosion
- Zoning and shoreline protection challenges

Mudflat Manor

- Large residential community threatened by SLR
- Vocal community of property owners demanding protection

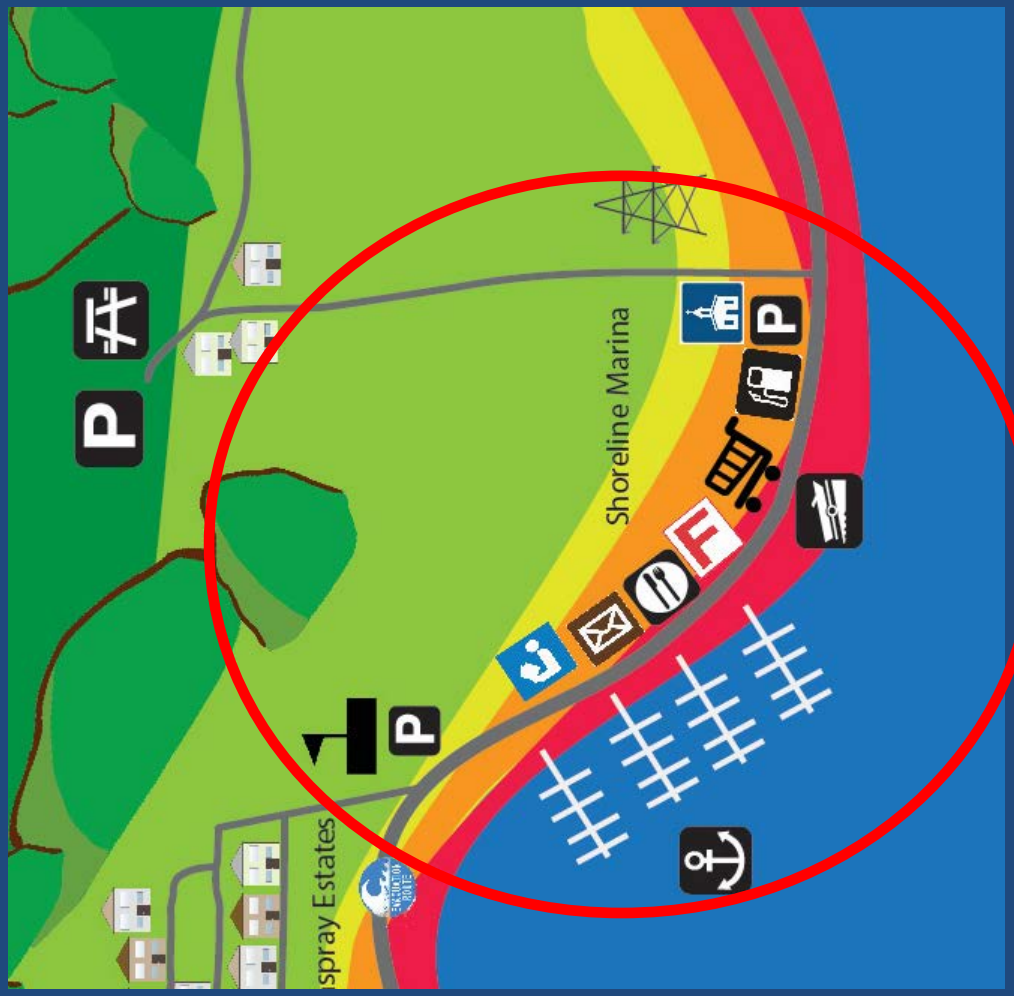
Desolation Court

- Small poor isolated community threatened by SLR
- In danger of being cut-off from services



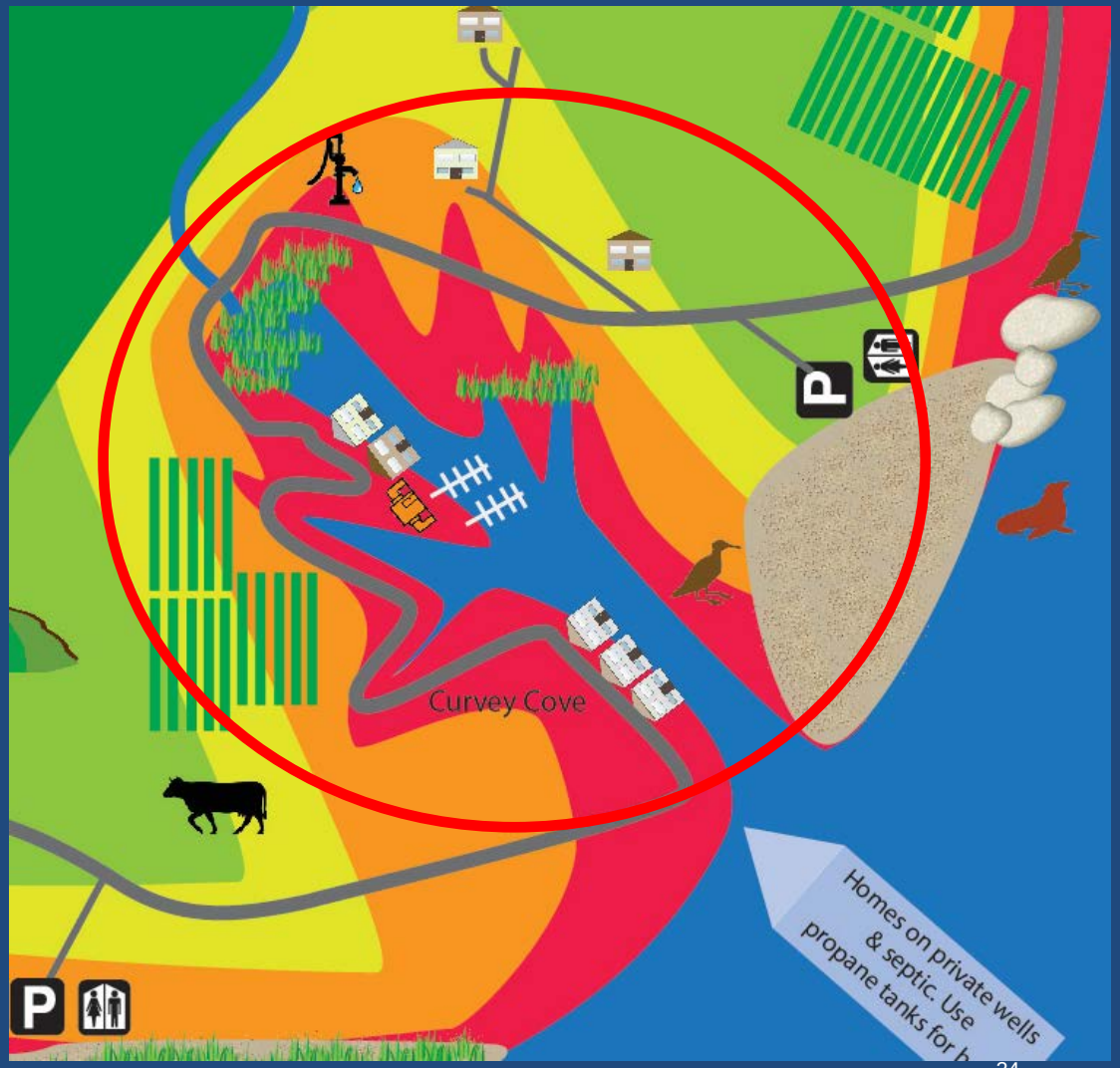
Shoreline Marina

- Water-based commercial business and associated businesses threatened by SLR
- In danger of being cut-off from road access at high tides



Curvey Cove

- Historic Ag based community with access and crops threatened by SLR
- In danger of being cut-off from road access at high tides



Seaspray Estates

- Large vacation and second home community with access and homes threatened by SLR
- In danger of being cut-off from road access at high tides

Costs $$$

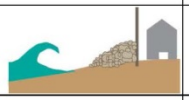
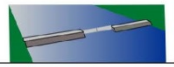
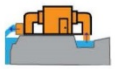
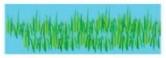
Real World – costs are messy and depend on many factors

+ planning & engineering
+ permitting
+ mitigation
+ maintenance & repair

Game World – costs are simpler one-time costs and given to you per unit (i.e. mile or # of buildings)

Game of Floods Marin Island

Adaptation Game Piece Reference Sheet

Name	Piece	Units	Cost ($)	Env. Impact EEE or EE or E	Flood Protection Short, med, or long-term	Uses and Notes
Hard (Traditional) Engineering						
Traditional Levee		Mile	$$$$	EEE	med	Protects against temporary flooding, storm surge and some sea level rise. • Can increase wave run-up and overtopping. • In high wave energy environment on coast, need to armor levee slope.
Seawall/Revetment		Mile	$$$	EEE	med	Protects against erosion. • Can increase wave run-up and overtopping. • Increase erosion in adjacent areas.
Tidal Gate		Feet	$$$$$	EEE	med	Protects against temporary flooding, storm surge and some sea level rise. • High environmental impacts to hydrology. • Viable in sheltered estuaries and lagoons.
Flood wall & pump station		Mile	$$$	EEE	short	Protects against temporary flooding, storm surge and some sea level rise. • Can increase wave run-up and overtopping. • Require electricity and maintenance.
Soft Engineering						
"Horizontal" Levee		Mile	$$$$	E	med/long	Protects against temporary flooding, storm surge, some sea level rise, and wave impacts. • Viable in sheltered estuaries and lagoons.
Wetland/shoreline vegetation		Acre	$$$	E	short-med	Protects against temporary flooding, storm surge, and wave impacts. • Viable in sheltered estuaries and lagoons.
Dune Restoration and Beach Maintenance (nourishment & groins)		Mile	$$$	EE	short/med	Protects against temporary flooding and storm surge. • Even nourished beaches can erode and expose infrastructure to wave damage.

1

Suggestions for the game

- Start with one community: what's at risk and what infrastructure is essential?
- What must be protected to allow the community to function. What other options exist?
- Adaptation options: discuss pros and cons of measures alone and combined - phasing
- Consider: mitigation, permits, and funding; options that span more than one community
- Add up the costs and stick your group's measures on the board

Game over?

1) Who in your organization is planning/strategizing around sea level rise?
2) What other organizations are also planning/strategizing that you may need to coordinate with?
3) What are the benefits or drawbacks of interagency discussion/planning/ strategizing?
4) Any improvements or suggestions?

THANK YOU!