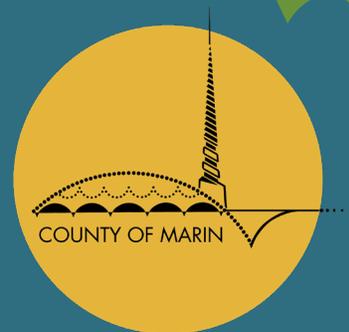




# ADAPTATION LAND USE PLANNING

Guidance for Marin County  
Local Governments





# ACKNOWLEDGEMENTS

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## INTRODUCTION

In May 2017, Marin County completed its BayWAVE Sea Level Rise Vulnerability Assessment (BVA) for the San Francisco Bay shoreline. The BVA evaluated future impacts on unincorporated county land and the eight cities that share the waterfront by assessing impacts to shoreline assets, including buildings, open space, agriculture, and infrastructure. The infrastructure assets included roads, pump stations, water treatment plants, and utilities, to name just a few.

As part of the BayWAVE program, this project explores appropriate adaptation land use planning for Marin County's bay shoreline based on the BVA and additional research. Adaptation planning identifies options for adapting to new situations brought on by climate change, such as rising sea level. Ideally, it involves plans, policies, and projects that are themselves easily adaptable to changing circumstances.

Other BayWAVE projects that address adaptation have been operating concurrently

with this project. The Capital Improvement Guidance provides online assistance to Marin County and other jurisdictions for incorporating adaptation into capital improvement projects. The Adaptation Framework project provides a step-by-step process for evaluating where nature-based or living shoreline infrastructure projects are most appropriate in Marin County. Adaptation projects are under way along the shoreline, restoring habitat that improves resiliency to future sea level rise. These include wetland restoration projects at Deer Island, Mcinnis, Tiscornia, and Bothin marshes. Additional work along beaches in Richardson Bay looks to improve response to near-term impacts of waves and erosion. The county is working to evaluate transportation and emergency services with sea level rise to identify possible improvements for the near- to medium-term. This project explores how land use planning tools can be used for adaptation and in concert with capital improvements, whether they are green or gray.

# WHY ADAPTATION PLANNING IS NEEDED

*Marin County already floods during King Tides or winter storms. Roads flood, disrupting traffic in some areas already suffering from congestion. Storm drains sit too low and fail to function. Homes and businesses sit on low-lying former baylands that were filled for development. Future flooding will worsen as sea level rises and both storm intensity and frequency increase as a result of climate change. Planning for future flooding now will increase the efficiency in which Marin County responds and adapts to these changes.*



BayWAVE examines future flooding under several scenarios of sea level rise based on guidance from the State of California. Six scenarios were used in the BVA: 10, 20 and 60 inches of sea level rise and then three more scenarios adding storm surge to the sea level rise, which resulted in 46, 56, and 96 inches. Ten inches is a near-term scenario and 56 and 96 inches are the mid-term and 2100 scenarios.

After the BVA was published, the State produced updated guidance on sea level rise that provides a strong case for early adaptation planning. The State recommends sea level rise scenarios that are similar to past State guidance and to those used in the BVA. Recognizing that sea level rise is occurring faster than scientist projected, the State also presented what it named the H++ scenario of 10 feet in 2100. The guidance essentially says, "Yes, plan for about five feet of sea level rise in 2100, but don't rule out ten." It examines sea level rise as it relates to global greenhouse gas emissions (GHGs) scenarios and does not examine flooding from

increased storm intensity and frequency. When storm surge (a temporary rising of the sea as a result of atmospheric pressure changes) occurs at a higher sea level, shorelines will be overtopped before a higher sea level alone reaches shoreline elevations. In other words, a 100-year flood has a probability of occurring once in 100 years. With sea level rise, a smaller storm surge would lead to coastal flood levels equivalent to that produced by a major storm today. The current 100-year flood return period would shorten dramatically. A [report](#) from the real estate firm Zillow estimates that in Marin County, nearly 10,000 homes valued at \$13 billion, could face persistent flooding by the year 2100. This underscores the need for early adaptation planning.

In 2018, Marin County worked with the National Research Center to conduct a resident survey. When asked about the importance of addressing climate change, 76 percent of respondents rated it as "essential" or "very important." When asked about the

importance of actions to address climate change, 81 percent rated protecting habitat, open spaces and marsh land as essential or very important. Seventy-nine percent rated upgrading infrastructure to be more resistant to impacts from climate change as essential or very important. Developing community-based programs and providing tools to assist landowners with long-term alternatives to flooding and heat waves was similarly ranked

by 66 percent of respondents. In general Marin County's natural environment is highly regarded and an important area of focus for the County ([Community Livability Report](#)) and respondents recognize that climate change threatens this environment. Adapting to climate change is more than protecting public safety, it is a necessary component of serving Marin County residents' values.

## METHODS

In adaptation planning, the first step is to assess vulnerabilities and risks. With this step accomplished in the BVA, this project began by identifying an adaptation approach. The County identified the adaptation pathways approach as a process that accommodates stakeholder engagement as well as cross-jurisdictional approaches to shared impacts. It further encourages integration of project planning and policy planning, in other words, capital planning and land use policies. Land use planning tools selected in conjunction with other planned shoreline projects will result in more effective adaptation.

Next, we identified cross-jurisdictional impacts to help develop the groundwork for a land use planning approach that could be considered by multiple local governments and emphasize the need for multi-jurisdictional cooperation. Preparing in advance for cross-jurisdictional impacts can help us develop common approaches so that one jurisdiction's approach does not adversely impact another. It can also help jurisdictions identify financing mechanisms that can enable cost sharing where possible.

We then identified a range of land use planning tools that can be used for sea level rise adaptation. We conducted interviews with Planning Directors from the eight shoreline cities about the land use planning tools they employ to address sea level rise and other planning issues. Not every approach requires inventing new tools. The interviews were broad in scope and considered the degree to which different tools

are already in use, whether or not they are used for adaptation.

Tools commonly used by local governments and planners are good candidates to be extended or adjusted to address sea level rise. We summarized our results in a discussion of the benefits of each tool and how commonly it was used.

Because adaptation planning is specific to the location and existing conditions, we selected a location on the shoreline where we could provide an example of how adaptation pathways and policies could be applied. We chose Tamalpais Valley because it is located entirely within unincorporated Marin County and there are projects currently planned in this location.



# HOW TO USE THIS GUIDANCE

The purpose of the report is to provide sea level rise adaptation planning guidance to the towns and cities in Marin County as well as in unincorporated Marin. Most of the report is written to inform all jurisdictions in the County. However, there are a few sections of the report specific to unincorporated Marin. The report in its entirety is usable by all jurisdictions. Recommendations are included throughout the report. Where a recommendation or section of the report is specific to unincorporated Marin, it is clearly labeled. The concluding section summarizes the recommendations and separates those specific to unincorporated Marin County.

This report includes a sample planning scenario in Tamalpais Valley. While the scenario is located in unincorporated Marin, it provides a sample overlay and a range of policies that could be used by any jurisdiction located on the bay shoreline. The overlay is not a proposal for specific policies in that area. Instead, it provides one possible example of the breadth and scope of a shoreline overlay and describes a process for connecting capital improvement and policy adaptation decisions.



## SHARED IMPACTS

Flooding from sea level rise does not respect jurisdictional boundaries. Finding common interests and coordinating planning timeframes between local governments is challenging under the best circumstances. Jurisdictions are at different places in their planning processes and are obligated to serve their communities' best interests, which may not be another jurisdiction's interest. However, the impacts from flooding effect many interests across the County's unincorporated areas, cities, and towns that require cooperation between them so that each jurisdiction benefits, and so that an adaptation action by one jurisdiction does not prevent the action of another jurisdiction. Such cooperation can also provide leverage when working with other agencies and special districts, such as Caltrans and utility districts.

The purpose of the maps in **Figures 1 through 9** is to show where flooding will occur under several scenarios of sea level rise and how the impacted areas compare to jurisdictional boundaries. They show the progression of sea level rise in areas with significant impacts that span multiple jurisdictions, using the following sea level rise scenarios: 24 inches, 48 inches, and 96 inches. The maps also show the depth of flooding in two-foot increments. To maintain a clear image of the flooding, the major assets included in the maps are limited to major roads and highways.

As an example of how to read the maps, Figures 1 - 3 show flooding in the City of San Rafael and unincorporated Marin. At 24 inches, significant areas within the City of San Rafael's downtown would be



flooded. Sections of I580 and Hwy 101 would be 2-4 feet underwater, impacting traffic and interrupting access within the City of San Rafael and across the entire County as well as the Richmond-San Rafael Bridge. The City of San Rafael would experience direct flooding of homes, businesses, streets, and public transportation in its busy downtown area. Downtown would be 2-4 feet underwater and more of the unincorporated areas surrounding San Rafael would begin flooding. One of the largest wetlands in the area would be flooded to a depth of 6-8 feet. The second largest wetland in the area is flooded to a depth of approximately 4 feet. At 48 inches, large segments of Second Street would be flooded, cutting off access to development along the unincorporated shoreline and to China Camp State Park. At 96

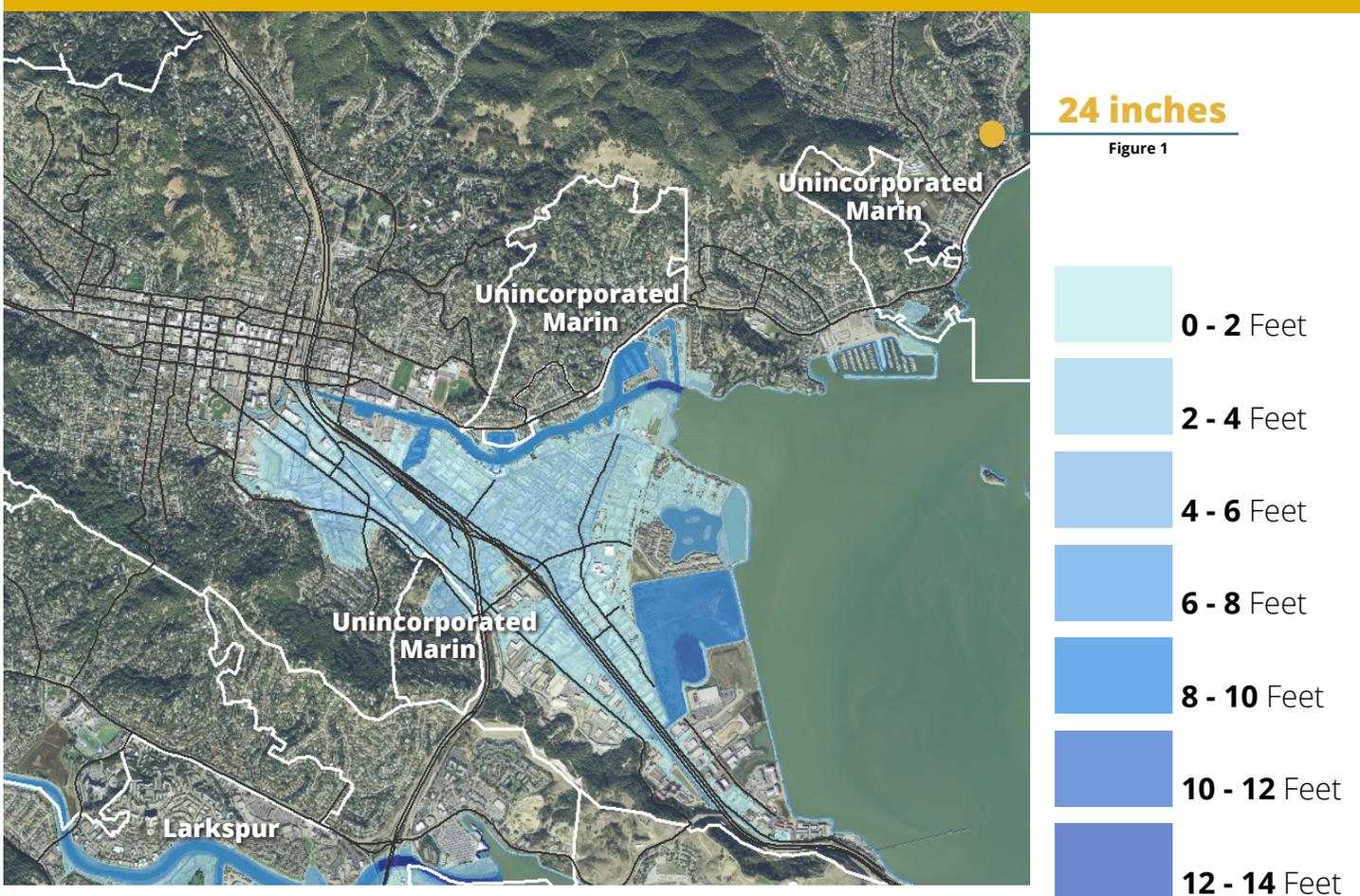
inches, the deepest flooding is 8-10 feet and most of downtown San Rafael would be under 4-6 feet of water. Figures 4 - 6 show the area near the mouth of Corte Madera Creek and the shared impacts between the jurisdictions of Corte Madera, Larkspur, and unincorporated Marin County. Figures 7 - 9 show the same in Richardson Bay, between unincorporated areas, Sausalito, and Mill Valley.

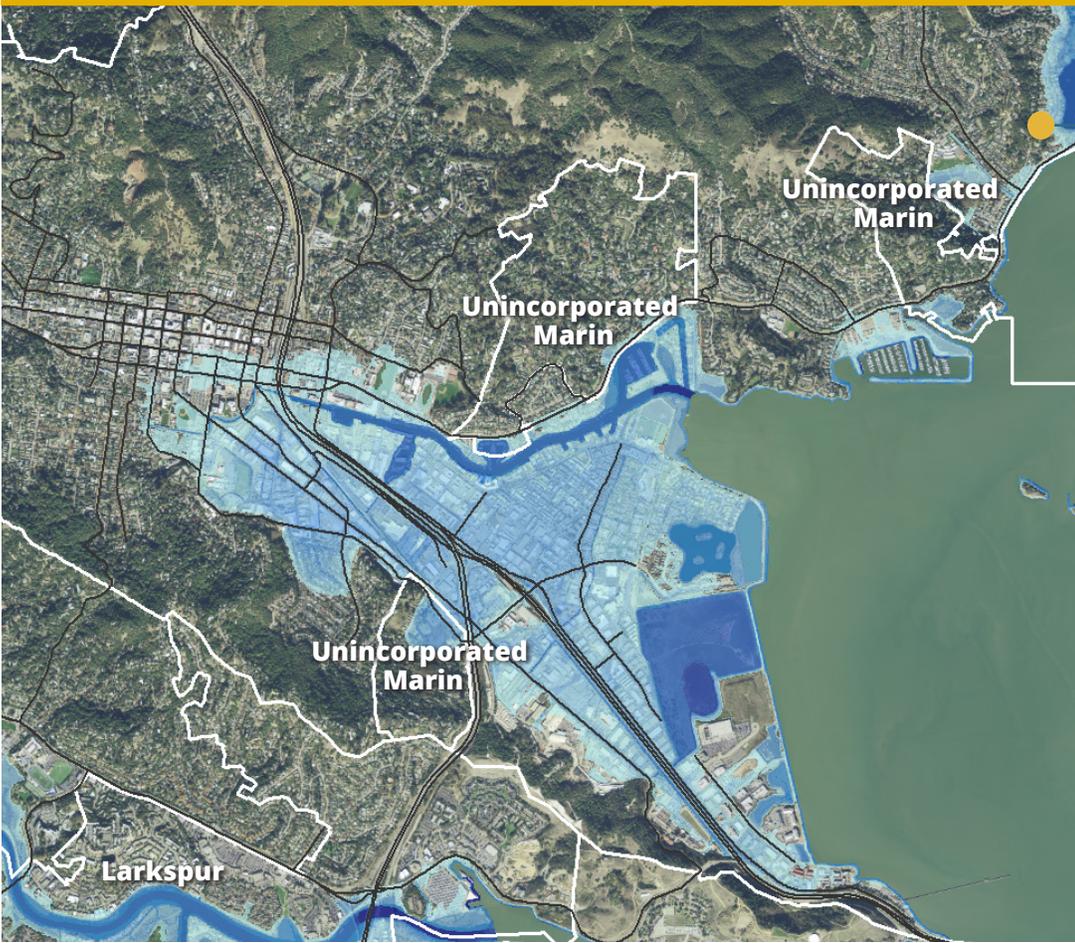
With some common sea level rise vulnerabilities identified across jurisdictions, the next steps are to identify land use planning tools that can be used for adaptation and how this might occur. The following section examines the range of land use planning tools available and then the policy guidance that proceeds provides some ideas to start multi-jurisdictional conversations.

## RECOMMENDATIONS

- ▶ Begin conversations between jurisdictions with shared sea level rise impacts. Perform in depth analysis of specific areas and/or impacts to identify common goals and possible strategies.

## SAN RAFAEL

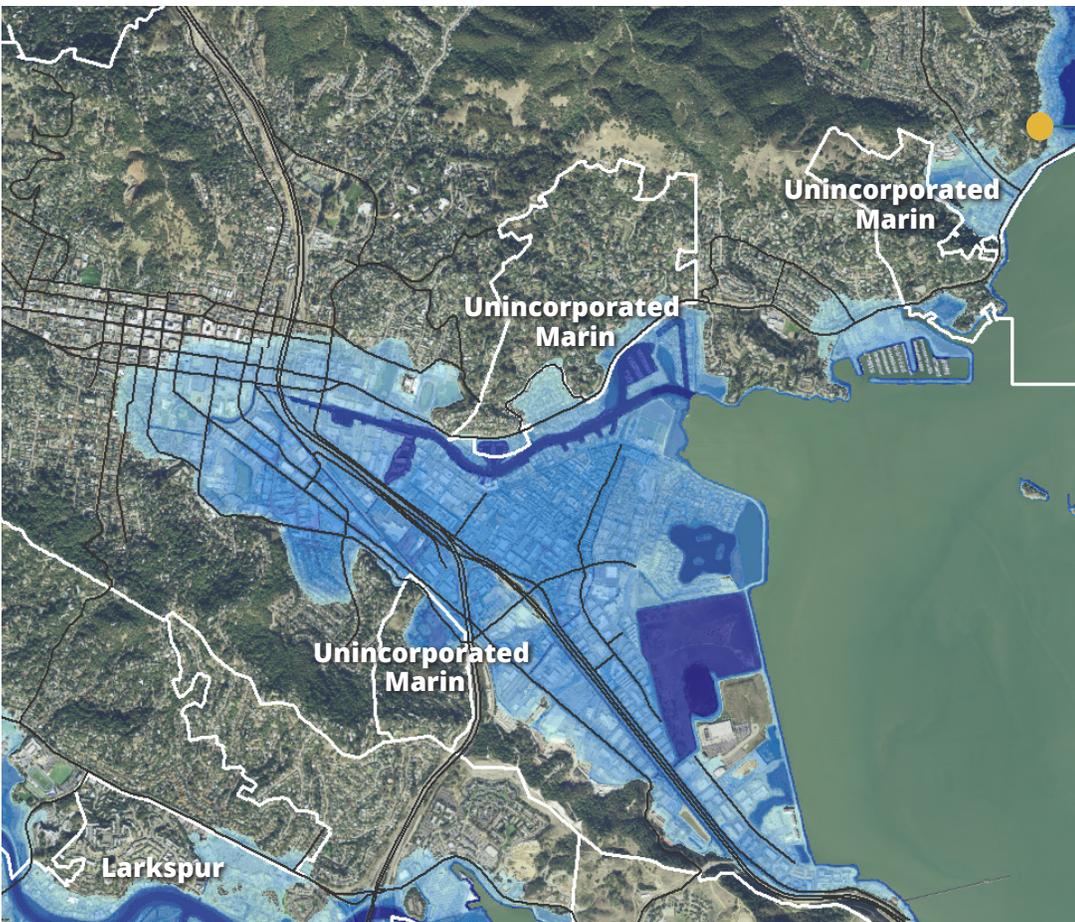




**48 inches**

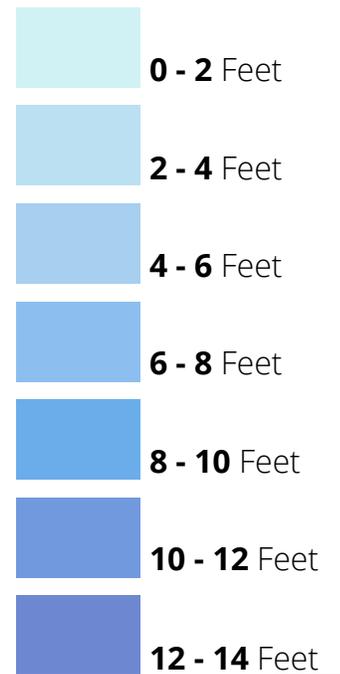
Figure 2

## Sea Level Rise Shared Impacts in the City of San Rafael and Unincorporated Marin County



**96 inches**

Figure 3



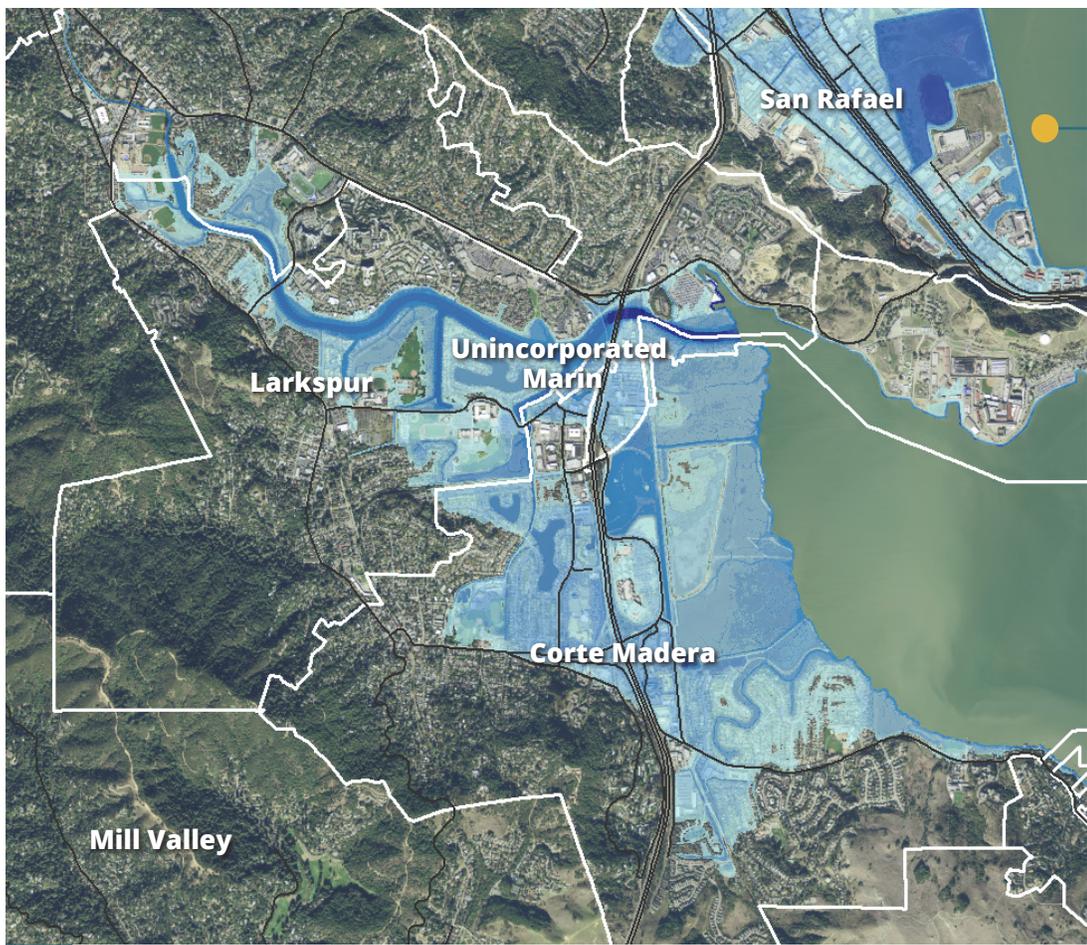
# LARKSPUR & CORTE MADERA



**24 inches**

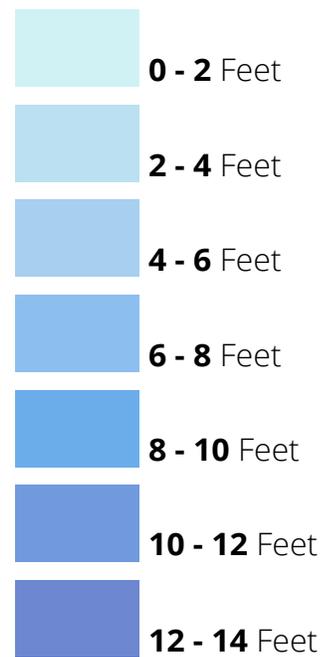
Figure 4

**Sea Level Rise**  
Shared Impacts in Larkspur, Corte Madera and Unincorporated Marin

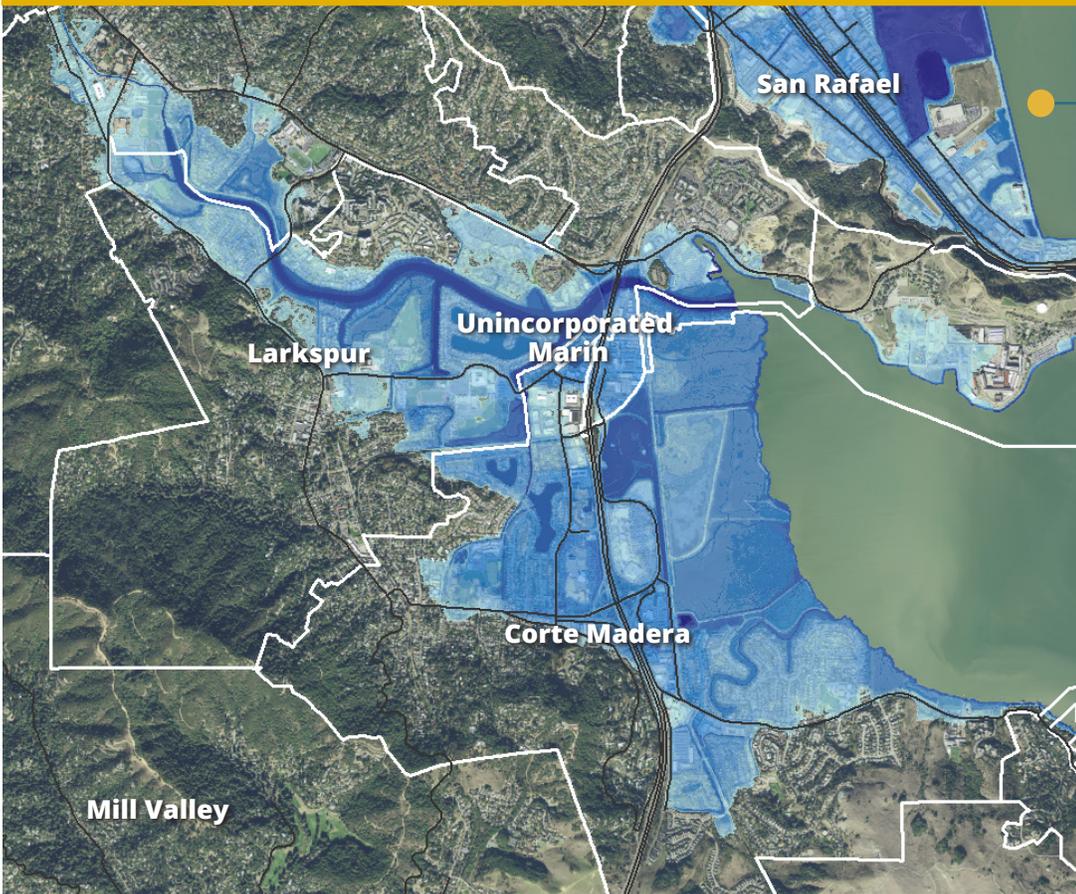


**48 inches**

Figure 5



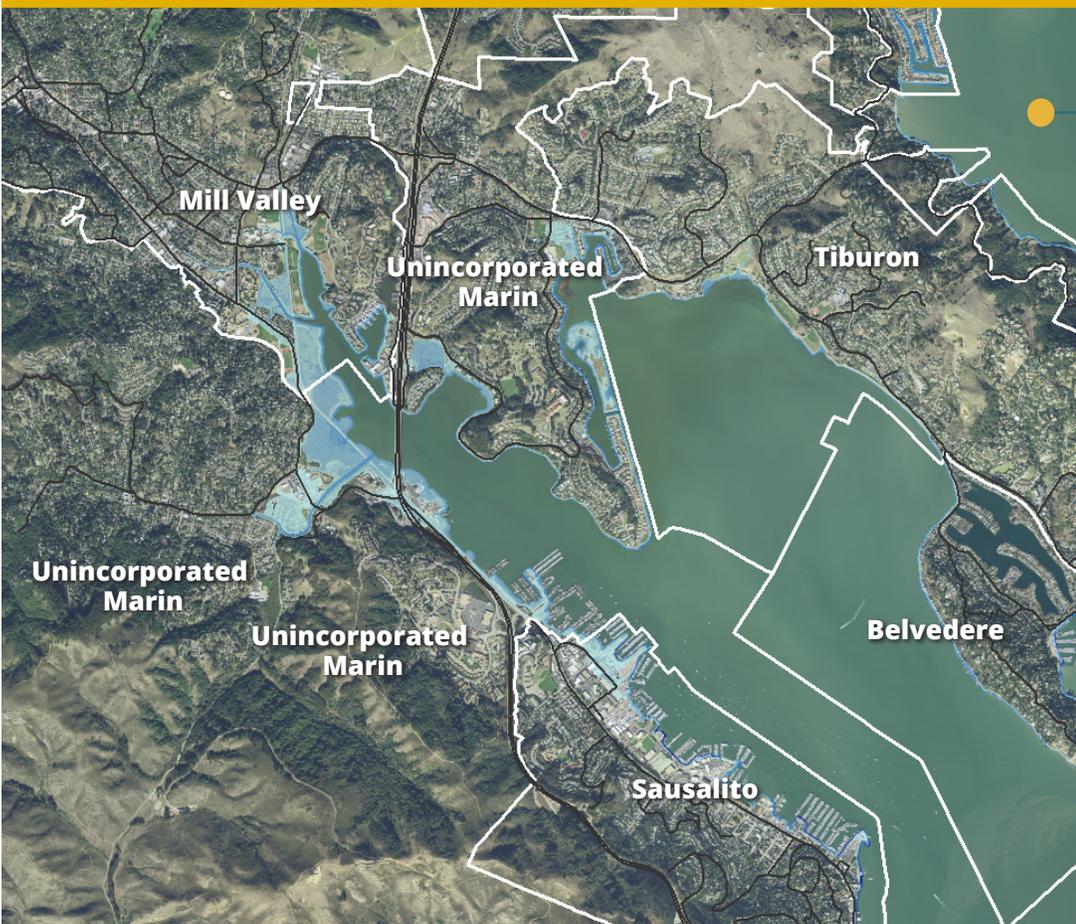
# LARKSPUR & CORTE MADERA



**96 inches**

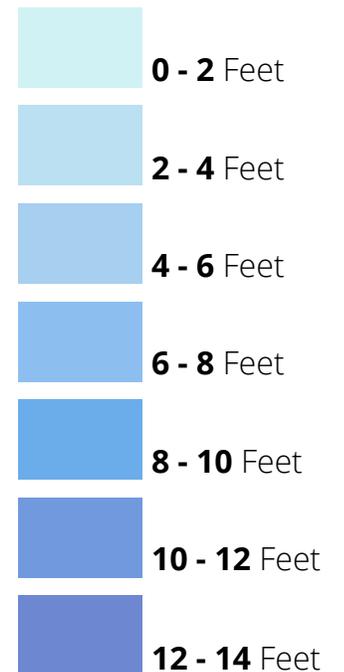
Figure 6

# RICHARDSON BAY

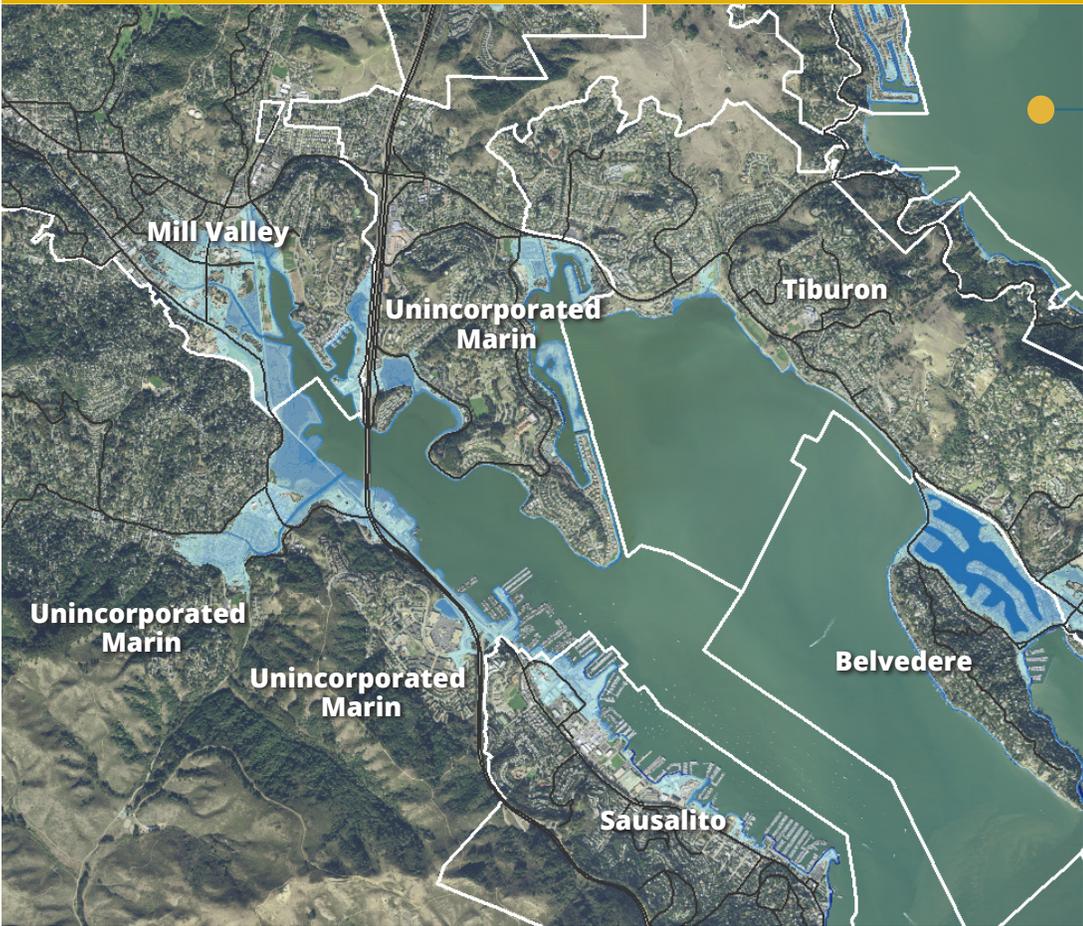


**24 inches**

Figure 7



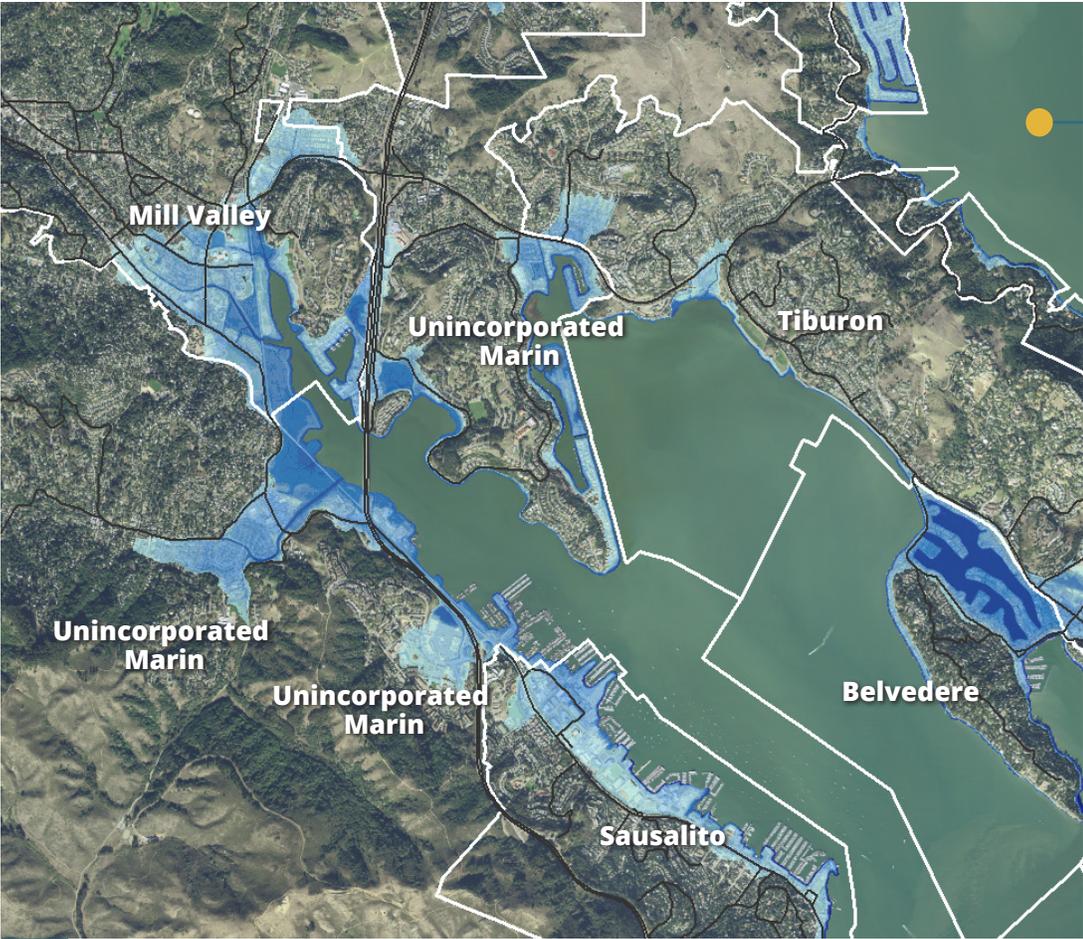
# RICHARDSON BAY



**48 inches**

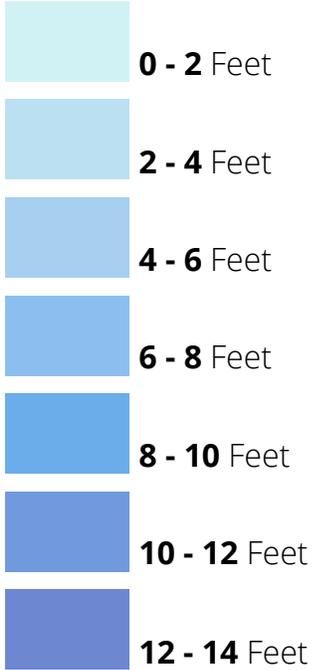
Figure 8

**Sea Level Rise**  
Shared Impacts  
in the City of  
Mill Valley, Town  
of Tiburon,  
Sausalito and  
Unincorporated  
Marin County



**96 inches**

Figure 9



# ADAPTATION CONSIDERATIONS

There are multiple reports describing the land use planning tools available for sea level rise adaptation and describing the legal framework in which they are used. Rather than repeat that research, links are provided to the most relevant and up-to-date reports. Of those reports, the State Coastal Conservancy's [Adaptation Tools Project](#) produced the most useful information for the San Francisco Bay shoreline in its Adaptation Tools Narrative and Adaptation Tools Spreadsheet, the latter of which includes an exhaustive list of land use planning tools. Appendix A from the Adaptation Tools Narrative, provides a description of each tool and how it is used and is included here also as Appendix A. The Georgetown Climate Center produced a report entitled [Adaptation Tool Kit: Sea Level Rise and Coastal Land Use](#), which provides information on how governments can use land use practices to adapt to sea level rise. The Georgetown Climate Center also produced [Zoning for Sea Level Rise](#), in which they developed a model ordinance and did a case study of implementation barriers in Maryland.

Most of the reports on land use planning tools categorized them by the type of authority exercised to implement them, such as planning, regulatory, or tax and market-based

tools. Another important consideration in analyzing the appropriate application of a tool includes its function; whether it facilitates protection, accommodation, retreat, and/or preservation. Adaptation land use measures will vary based on the location and whether flood protection projects are in place or are planned. A thoughtful approach will integrate public infrastructure and land use planning.

The legal framework for land use planning is an important consideration. Land use planning tools are tested through the courts and established case law on legal principles, such as takings, through torts, and by consistency with environmental laws. Land use planners must be familiar with these and whether and how the various tools they use are consistent with them. They often walk a fine line between regulating to implement communitywide goals and running afoul of private property rights. Tools that have proven to be feasible and effective are more reliable than those that have not. Avoiding legal challenges reflects good fiscal responsibility and governance. This project looks at ways to use tried and true land use planning tools in slightly different ways to address rising sea levels. Even so, one of the biggest hurdles in using land use planning tools may be avoiding “takings” challenges.

## Takings

The Fifth Amendment of the U.S. Constitution Takings Clause states that the government cannot take private property without providing just compensation. A taking without just compensation is also called “inverse condemnation.” A “physical taking” can occur when private property is directly appropriated without just compensation, such as when a flood protection structure is built on private property without the owner’s consent. A “regulatory taking” can occur when a regulation prevents a property owner from economic use of the property, such as a zoning policy that prevents all development without legal justification. A zoning policy can limit certain types of development resulting in a partial diminution in property value, in which case a balance of the economic impact, the reasonable investment-backed expectations, and

the purpose of the regulation must be considered.

Two case law rulings provide a test for implementing regulations in a manner that avoids a regulatory taking. The test requires exactions to have a nexus, or substantial relationship, and be roughly proportional to the impact of the development. Governments reduce legal risk when exactions are the same nature and extent as the impacts of the development. For more discussion of the legal framework of adaptation land use planning, see [Enabling and Limiting Conditions of Coastal Adaptation: Local Governments, Land Uses, and Legal Challenges](#), [Taking Background Principles Seriously in the Context of Sea-Level Rise](#), and [Legal Risk Analysis for Sea Level Rise Adaptation Strategies in San Diego](#).

## No Action

What are the consequences should a local government fail to act in the face of climate change? The San Diego Legal Risk Analysis mentioned above asks two related questions. The first is, “A local government fails to act, leading to flooding of private homes and property. Would the local government be liable for the damage? Failure to act in itself is unlikely to be sufficient grounds for a takings. However, a government’s failure to act may give rise to infrastructure failures that damage private property, in which case the government could be liable under takings law. As an example, a levee is overtopped, causing flooding and irreparably damaging private property.

The second question posed by San Diego, is “In the face of climate change, a city’s stormwater drainage system can no longer keep up with the stormwater, leading to flooding of private property. Would the city be liable for the damage?” A distinction must be made between maintenance and upgrades; however, there is little clarity on how to define maintenance in the face of climate change. San Diego concludes that “To the extent adaptation measures would be considered an upgrade to, as opposed to maintenance of, the current system, it

is unlikely a local government would be found liable for a takings claim.” Developing sea level rise policies that require property owners to record liability waivers and assume the risks of living in a hazard area can provide some protection from takings claims. Liability waivers and assumptions of risk are discussed in detail below.

Most of the reports on land use planning tools categorized them by the type of authority exercised to implement them, such as planning, regulatory, or tax and market-based tools. Another important consideration in analyzing the appropriate application of a tool includes its function; whether it facilitates protection, accommodation, retreat, and/or preservation. Adaptation land use measures will vary based on the location and whether flood protection projects are in place or are planned. A thoughtful approach will integrate public infrastructure and land use planning. Figure 16 depicts the types of projects that could be considered under each function, including living shorelines and hard shorelines. Appendix B includes additional detailed fact sheets for each type of adaptation project, including their pros and cons.

## Living Shorelines

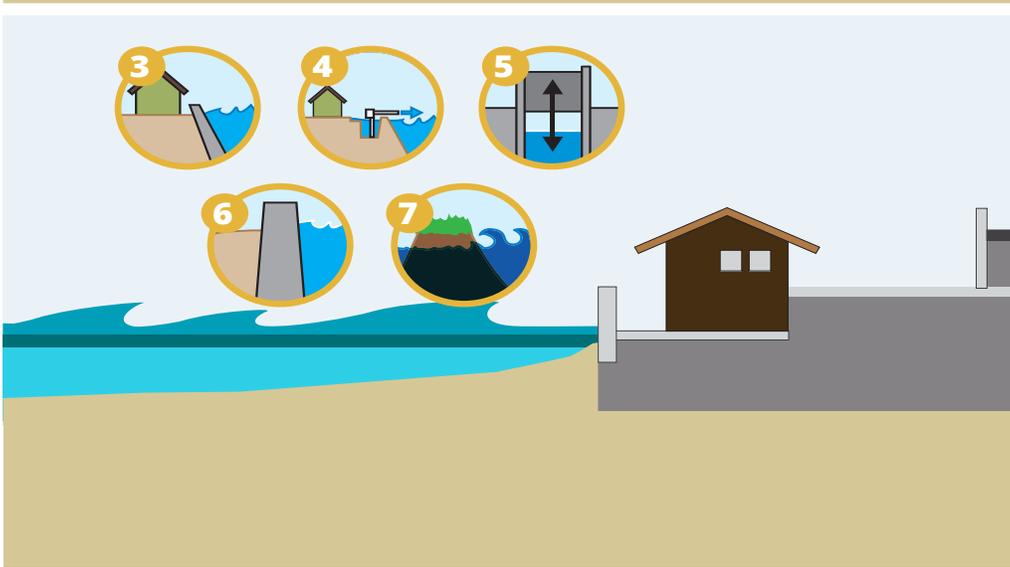
Some of the traditional adaptation measures presented in Figure 10 involve “gray” or hard infrastructure, such as seawalls, revetments, bulkheads, and levees. These measures fix the shoreline in a given location and involve substantial initial investments. Therefore, they lack the flexibility needed to adapt to changing bay conditions. They can also have significant site-specific and cumulative impacts on the bay. Hard shoreline structures cause increased erosion in nearby areas in two ways. They eliminate sediment sources that would otherwise be present with natural erosion. This causes increased erosion in adjacent areas and offshore areas. They also cause deflection of wave energy, which can accelerate erosion of nearby

sites, exacerbating the desire for shoreline armoring structures elsewhere. If shoreline protection fails, the consequences can be significant, especially in residential areas and if shoreline protection creates a false sense of security.

Hard, fixed shorelines may be necessary to protect major infrastructure or high-density land uses. For example, most of San Francisco’s shoreline is defined by shoreline armoring, which protects the City’s financial district, tourist areas, and transportation infrastructure. In contrast, the development on Marin County’s shoreline relative to San Francisco is low-density commercial or residential. In northern Marin County, much of the bay

# ADAPTATION MEASURES

Adaptation Measures are engineering and planning solutions designed to manage, mitigate, and avoid impacts from sea level rise and flooding. Depending on the location, single or hybrid adaptation measures can effectively address flooding.

	<h3>Accommodate</h3> <ol style="list-style-type: none"><li>1. Floating structures or floodable developments are designed to accommodate flooding.</li><li>2. Elevating buildings, roads, utilities, and grades provides near to medium-term flood protection.</li></ol>
	<h3>Protect: Engineered</h3> <ol style="list-style-type: none"><li>3. Seawalls, revetments, and bulkheads are vertical features that protect from wave action and erosion.</li><li>4. Pump stations move water to nearby retention basins or to outer water ways.</li><li>5. Tide gates span waterways to provide protection from high tides or storm surge.</li><li>6. Levees are vertical earthen structures that protect shorelines from flooding and wave action.</li><li>7. Breakwaters and artificial reefs are structures engineered for erosion control and wave energy reduction.</li></ol>
	<h3>Protect: Natural</h3> <ol style="list-style-type: none"><li>8. Bio-beds or near-shore habitat enhancements reduce small wave action and erosion.</li><li>9. Bay and beach nourishment protect inland structures and reduce erosion from flooding and wave action.</li><li>10. "Horizontal levees" combine marsh and transition zone habitat backed by a levee for dual protection benefits.</li></ol>
	<h3>Retreat</h3> <ol style="list-style-type: none"><li>11. Managed retreat accommodates flooding and shoreline migration by moving development out of harms way.</li></ol>

shoreline uses are agricultural, open space, or residential. In the southern half, the uses are primarily residential, commercial, and open space. Unlike many other communities bordering San Francisco Bay, there is not a predominant warehouse/light industrial use along Marin's shoreline. Recall that in 2018, Marin County worked with the National Research Center to conduct a resident survey. When asked about the importance of addressing climate change, 76 percent rated it as essential or very important. When asked about the importance of actions to address climate change, 81 percent rated protecting habitat, open spaces and marsh land as essential or very important. The residents' focus on the natural environment is apparent in Marin's history of preserving open space and natural lands. A living shorelines approach to adaptation may be more appropriate on much of Marin's shoreline and consistent with residents' values.

Living shorelines (also called nature-based adaptation) provide flood protection while maintaining shoreline habitat. Figure 10 presents a number of living shoreline measures, which are discussed in more detail in Appendix B. They include tidal marshes, oyster reefs, dune restoration, and combination strategies like horizontal levees, which mix green and gray infrastructure. These measures attenuate waves and hold excess water,

thereby reducing shoreline erosion and flooding. According to the National Oceanic Atmospheric Administration (NOAA Fisheries) fifteen feet of marsh can absorb fifty percent of incoming wave energy. They add attractive, low-maintenance green space and focal points for people to gather. They purify water, store carbon, provide important fisheries habitat, and attract wildlife to habitat. One square mile of salt marsh stores the carbon equivalent of 76,000 gallons of gas annually ([NOAA Fisheries](#)), making salt marsh restoration both an adaptation and carbon reduction measure.

Living shorelines tend to cost less than hard shorelines. NOAA Fisheries estimates installation fees vary from less than \$1,000 to \$5,000 per linear foot. Maintenance of living shorelines typically costs less than \$100 per linear foot annually. Marin County's C-SMART [Sea Level Rise Adaptation Report](#) (page 63) provides a cost comparison of adaptation strategies that shows the costs of living shorelines is generally less than shoreline armoring. In an analysis of sea level rise measures performed for Imperial Beach (and discussed here in the Acquisitions case study), the authors compared the costs of groins, retreat, beach nourishment, dunes, and shoreline armor. Groins and shoreline armoring had the highest costs ([2016 City of Imperial Beach Sea Level Rise Assessment](#)).

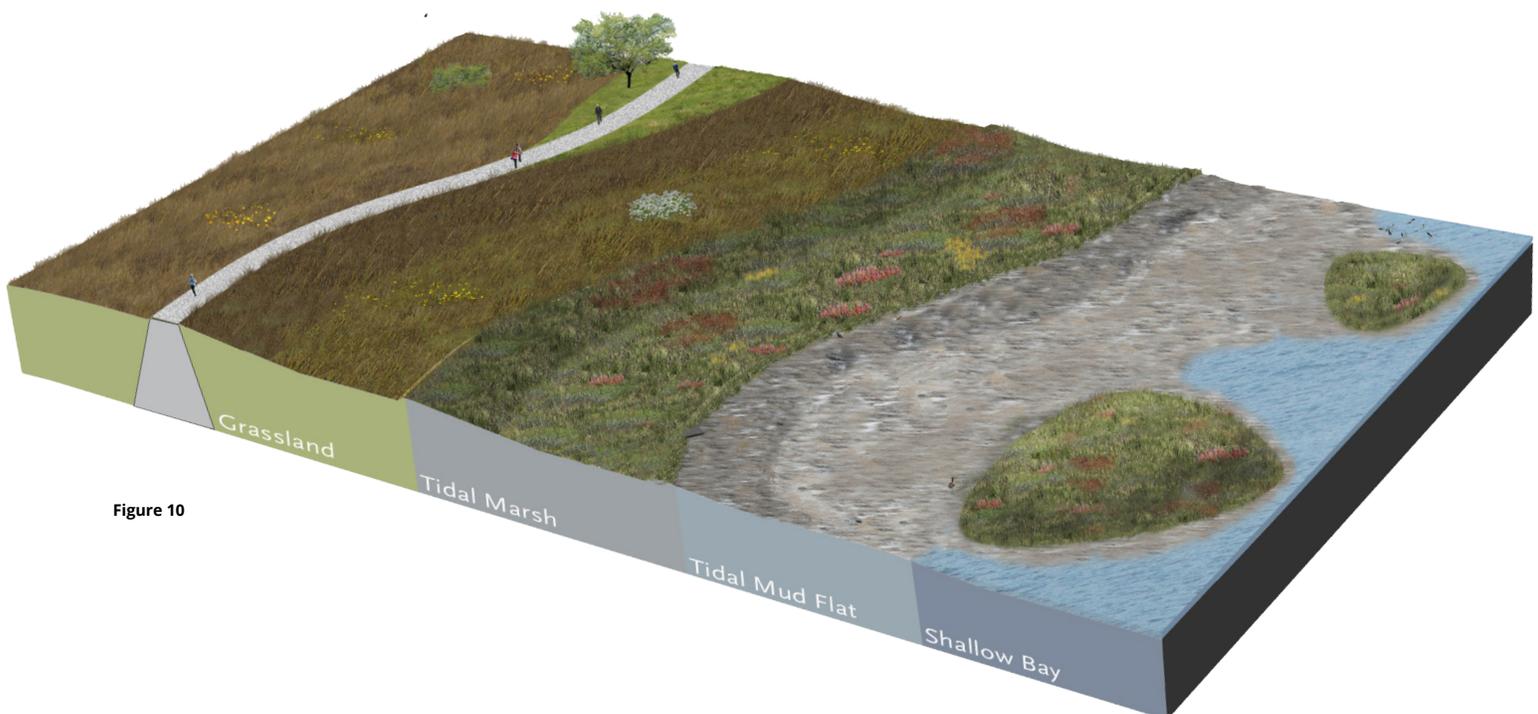


Figure 10

# RECOMMENDATIONS

- ▶ Develop policies that promote a living shorelines approach to adaptation.
- ▶ Continue to pursue living shorelines projects on the shoreline.
- ▶ Rule out a no action approach.

## TOOLS ASSESSMENT

To date, Marin County has not set any countywide policy objectives for addressing sea level rise, such as accommodation, protection, or retreat. Rather, the next steps in this project are to test ideas on particular areas of the shoreline, recognizing that objectives will vary based on the land uses, infrastructure, and topography of each location and they also might change over time. With no single objective in place, staff evaluated a wide range of tools, including regulatory, market-based, and a small set of planning tools, such as special area plans, formal and/or digital asset management programs, and the FEMA Community Rating System.

One of the products from the Coastal Conservancy's Adaptation Planning Project was a comprehensive spreadsheet ([Adaptation Tools Spreadsheet](#)) that describes 69 land use planning tools. Using that list, some tools were eliminated because of topographic, geologic, or governance structure conflicts that made them infeasible in Marin County. For example, using redevelopment agencies was listed as a tool, but we no longer have such agencies in California. Other tools were

so similar in nature and application that a single representative tool was chosen. Some tools on the list were removed because they are already mandated by the state, such as General Plans. The list was paired down to three programmatic tools or planning programs and 31 tools that are most applicable in Marin County. Those 31 tools were categorized as regulatory, market-based, or floodplain management tools. They are described in detail below and summarized in tables included as Appendix C.

Staff interviewed the Planning Directors from ten of the eleven cities in the County about the types of land use tools practiced in their respective city. Of those, eight cities have bay shoreline within their jurisdiction. The other three will also be impacted by the cascading impacts of sea level rise. For now, responses from the eight shoreline cities and the County are included here for a total of nine respondents. The interview questions focused on land use tools that could be used for sea level rise adaptation; however, respondents were asked whether they use the tools in any way, not solely for adaptation.

### *Planning Programs*

Planning programs provide a framework for the application of any number of land use tools. Respondents were asked about three planning programs: specific plans, the Community Rating System, and asset management programs. These programs were included in the interview questions because they are not required by law, like a General Plan, but they are useful in adaptation planning.

Respondents were asked if or how they use special area plans, which were defined broadly to include specific plans, community plans, or any land use document pertaining to a particular area and or responding to particular planning needs. Special area plans are used by 7 out of 9 jurisdictions. The City of Novato has the Downtown Specific Plan and the City of Sausalito has specific policies for Marinship that were developed based on

a study of the former ship building area near the shoreline. The County uses community plans for the neighborhoods spread throughout unincorporated Marin.

The Community Rating System is a program offered through the Federal Emergency Management Agency’s (FEMA) National Flood Insurance Program (NFIP) to encourage property owners to comply with FEMA standards. NFIP offers them discounts on flood insurance, which are determined by the level of participation within their local government. Five of 9 jurisdictions participate in the Community Rating System Program. Sausalito is updating its shoreline program. Tiburon does not participate, but it employs a two-foot freeboard requirement over water and a waterproof requirement where it’s feasible. The City of San Rafael is exploring future participation in the program.

Capital improvement and asset management programs refers to formal programs, usually relying on software tools, that inventory and track the status

infrastructure assets throughout their life cycle. They are important for maintaining and improving infrastructure as sea level rises. As the demands on infrastructure improvements grow, asset management programs may need to become more sophisticated. All nine jurisdictions have capital improvement and asset management programs that vary in formality based on the size of the jurisdiction. Novato and the Sausalito are working on acquiring asset management software or building computerized systems. Marin County is building a geographic information system-based asset management program.

Although planning programs are included in this report as tools, what they really do is provide a structure for the use of regulatory, market-based, and floodplain management tools. The following discussions on those tools are organized with definitions of each tool along with the pros and cons associated with its use. Following the pros and cons is a discussion of how various tools are used by jurisdictions in Marin.

## Regulatory Tools

Regulatory tools are the bulk of tools already in use by jurisdictions in Marin. The prevalence of regulatory tools in use is summarized in Table 1. Regulatory tools used for environmental hazards generally have some associated pros and cons. Regulatory tools can help implement community goals and objectives. They can protect recreational areas and open space as well as environmentally sensitive areas. They can discourage development in hazardous areas and they are enforceable. Conversely, they can limit property rights resulting in a “takings” and placing local governments at risk of legal action. Regulations can lower property values while, at the same time, making construction more expensive. It is highly likely that as sea level rises, property located in flood zones will lose value and insurance rates will rise, with or without regulations. It makes sense then

that regulations for sea level rise should be designed to protect public safety while also recognizing the impacts to owners of properties subject to flooding. The pros and cons associated with each tool are described below.

Regulatory Tools		# in Use
1.1	Zoning Overlays	9
1.2	Setbacks/Buffers	9
1.3	Substantial Improvement	8
1.4	Stormwater Management Measures	4
1.5	Dedications and Easements	7
1.6	Deed Restrictions	7
1.7	Site-Specific Capacity Standards	6
1.8	Rebuilding Limitations/Prohibitions	5
1.9	Development Moratoriums	5
1.10	Policies on Hard Shore Armoring	1
1.11	Policies on Nature-Based Infrastructure	1
1.12	Limitations on Nonconforming Structures	3

**Table 1.** Regulatory Tools in Use in Marin County

## 1.1 OVERLAY ZONES / DISTRICTS

Zoning designates areas for specific types of development and provides the legal framework for permitting allowable development in a zone. An overlay or combining district superimposes additional regulations or incentives based upon characteristics of that zone. Overlays can be used to designate sea level rise zones and develop policies consistent with the objectives for each zone. For example, a zoning overlay can require a sea level rise assessment and adaptation plan for certain types of development proposals based on the type and intensity of the project, the degree of flood hazard risk or environmental considerations.

PROS	CONS
<ul style="list-style-type: none"><li>• Different sea level rise overlays can have different objectives, such as a sea level rise protection zones, accommodation zones, retreat or preserve zones.</li><li>• An overlay acts as a home for regulations and incentives, thereby facilitating their use to meet specific objectives for the area.</li></ul>	<ul style="list-style-type: none"><li>• Overlays are created in the General Plan and developed further in code. Changes to the overlays require a process that can be lengthy compared to the time that may be available for adaptation.</li><li>• Zoning designations are often controversial because they effect the development type and developable area on private property.</li></ul>

## 1.2 SETBACKS / BUFFERS

Require that development is set back a distance from a baseline. Setbacks and buffers are typically used to set development back from a property line, a hazard, or to create a buffer between environmentally sensitive areas and development.

PROS	CONS
<ul style="list-style-type: none"><li>• Limits development in hazardous areas</li><li>• Protects environmentally sensitive areas from development</li><li>• Reduces density where the reduction is most impactful</li></ul>	<ul style="list-style-type: none"><li>• Lowers the developable area on a property, which can reduce property values</li><li>• Shoreline properties are often too small for a setback from the Mean High Tide Line to provide anything more than short-term protection</li></ul>

As might be expected, zoning overlays, setbacks/buffers, and substantial improvement regulations are employed by nearly all jurisdictions. Commonly used overlays were for historic districts and steep hillside areas. Notably, the Cities of Corte Madera, Novato and the County all employ overlays along the bay shoreline to address bay-related issues. Corte Madera has a Baylands Risk and Natural Habitat Area Zone that requires hazard assessment for building on bay mud, including settlement assessments. Novato's Baylands overlay requires a 50-foot setback from the bay. The County's Bayfront Conservation Area (BFC) includes a range of measures including setbacks and building restrictions on activities in wetlands. The BFC policies are reviewed herein under the Countywide Plan heading.

### 1.3 SUBSTANTIAL IMPROVEMENT

Calling a project a rebuild once the improvements involved in the proposal are substantial (substantial can be 50% of structure or other), thereby triggering compliance with new development standards and building codes.

PROS	CONS
<ul style="list-style-type: none"><li>• Brings older structures undergoing major improvements into compliance with modern safety standards.</li></ul>	<ul style="list-style-type: none"><li>• Increases project costs</li></ul>

All nine jurisdictions utilize a regulatory approach that triggers requirements based on a determination that the extent of proposed improvements constitute a “substantial improvement.” By way of example, new or remodeled buildings located in FEMA floodplains are required to be raised to a specified base flood elevation when the proposed construction meets or exceeds 50% of the structure’s valuation. Because substantial improvements can greatly extend the life of a structure, establishing a trigger can ensure that their future life is spent in compliance with updated regulations designed to protect health, safety, and welfare. Tracking improvements over time until the cumulative improvements reach the trigger can also bring structures into compliance. In flood zones and areas subject to future sea level rise, substantial improvements can trigger development standards for flood protection, such as relocating vulnerable utilities. Most jurisdictions employ some type of 50 percent trigger to call something a substantial improvement, but do not track accumulation of improvements over time. Mill Valley is the only jurisdiction that tracks improvements, but only for a 24-month period, until it reaches 50 percent of the structure.

### 1.4 STORMWATER-MANAGEMENT MEASURES

Prevent stormwater from flowing directly into storm drains by requiring measures, such as bioswales, retention basins, green streets and otherwise reducing impervious surfaces.

PROS	CONS
<ul style="list-style-type: none"><li>• Improved water quality, reduced urban heat island effects, and improved air quality.</li><li>• Increased walkability and public enjoyment of streets</li></ul>	<ul style="list-style-type: none"><li>• Increases project construction and maintenance costs</li><li>• Can be difficult to implement on some sites</li></ul>

Stormwater management measures that go beyond Marin County Stormwater Prevention Program requirements were used by several jurisdictions. The City of Larkspur recently updated its stormwater quality ordinance and Novato’s recently updated ordinance has wide applications to construction activities as well as pre and post-construction.

## 1.5/1.6 DEDICATIONS, EASEMENTS AND DEED RESTRICTIONS

A mechanism to preserve land for conservation or recreation purposes, which allows property owners to grant an easement restricting development on a portion of their land for compensation or tax benefits. Dedications and easements can be recorded as deed restrictions to ensure that they run with the land. Deed restrictions can also be used to record Assumptions of Risk and Liability Waivers for buildings in hazardous areas.

PROS	CONS
<ul style="list-style-type: none"><li>As shoreline property values drop with rising sea level, a shoreline easement can guarantee space for water to rise while providing a financial benefit in the way of tax cuts or development purchases.</li></ul>	<ul style="list-style-type: none"><li>The small size of many shoreline lots don't leave space for easements.</li></ul>

Deed restrictions, dedications and easements are widely used for a variety of purposes. Six jurisdictions use dedications and easements. The City of Mill Valley requires dedication of a public access easement when development occurs adjacent to a creek. Novato requires conservation easements on some projects as a condition of approval. Seven jurisdictions use deed restrictions. Belvedere employs them to ensure that certain units remain affordable. San Rafael uses them on accessory structures that can easily be converted to dwelling units to inform property owners that permits are required for such work. Novato employs deed restrictions at the Hamilton neighborhood to provide notice to property owners of toxins in nearby soils. Marin County uses them to record liability waiver. Marin County requires liability waivers for losses experienced due to geologic and hydrologic conditions and other natural hazards, which may be implemented through a deed restriction.

## 1.7 SITE-SPECIFIC CAPACITY STANDARDS

Based on the capacity of a site to sustain new development they require analysis of local site conditions on developable property to determine the extent of development the site can sustain. These standards are often used on lots with steep slopes to identify safe developable space.

PROS	CONS
<ul style="list-style-type: none"><li>The standards can decrease density in hazardous areas</li><li>Protect public safety</li></ul>	<ul style="list-style-type: none"><li>The standards can effectively downzone hazardous areas without going through a rezoning process.</li><li>Downzoning can result in lower property development value</li><li>May conflict with state housing requirements</li></ul>

Most site-specific capacity standards were used in tandem with an overlay district that includes an analysis process to determine the development capacity of individual lots within the district. It was most commonly used for areas with steep sloping lots. The

City of San Rafael uses a hillside overlay with a set of regulations that lay out a series of steps to determine where and how much development can occur on a specific property. The City of Larkspur’s design review standards identify slope use standards that reduce floor area on steeper sites and require slope analysis to move development away from potential slide paths. Marin County’s Local Coastal Program is structured with a series of steps for site analysis that require buffers in Environmentally Sensitive Habitat Areas (ESHA), setbacks from wells, protection of views, and other specific analysis, much of which is mandated through the California Coastal Act. The resulting outcome is a site-specific analysis that determines where, how much and under what performance conditions development can occur.

## 1.8 REBUILDING LIMITATIONS/PROHIBITIONS

Placing restrictions or prohibiting rebuilding after a natural disaster. For example, rebuilding limitations and prohibitions are used in repetitive loss areas where frequent storms have destroyed a home more than one time. This is more common on the Atlantic and Gulf shorelines. FEMA’s National Flood Insurance Program (NFIP) has a very specific definition of Repetitive Loss Properties, which applies to properties for which two or more claims of more than \$1,000 have been paid by the NFIP within any 10-year period since 1978 (e.g. 1978-1987, 1979-1988, etc.). Marin County’s Repetitive Loss Area Analysis, dated March 2015, identifies 78 Repetitive Loss Claims since 1978.

PROS	CONS
<ul style="list-style-type: none"> <li>Restricting development after a natural disaster avoids repetitive losses</li> <li>Protects public safety</li> </ul>	<ul style="list-style-type: none"> <li>Places additional financial and quality of life burdens on those who have already suffered a loss</li> </ul>

## 1.9 DEVELOPMENT MORATORIUMS

A hold on new development that can last up to two years

PROS	CONS
<ul style="list-style-type: none"> <li>Can give jurisdictions an opportunity to plan for adaptation while development is stopped</li> </ul>	<ul style="list-style-type: none"> <li>Although it is temporary, it deprives property owners full use of their land</li> </ul>

Five jurisdictions have used or are using development moratoriums. These can be useful while a local government determines the best way to address an issue or a specific area. Belvedere employed a total building moratorium after it incorporated and its government was getting started. Both Novato and Sausalito currently have moratoriums on cannabis-related businesses. Sausalito also has a use moratorium on office and financial uses in mixed-use commercial zones. Applying this tool to residential uses should be carefully considered in the context of recent State housing law (Senate Bill 330) that substantially restricts the use of housing moratoria.

## 1.10 POLICIES ON HARD SHORELINE ARMORING

For example, provisions to limit or facilitate armoring or guidelines to reduce adverse impacts of armoring.

PROS	CONS
<ul style="list-style-type: none"><li>• Reduces adverse impacts of hard shoreline armoring</li><li>• Can require investigation of softer, lower-cost shoreline protection measures</li></ul>	<ul style="list-style-type: none"><li>• Local governments are not the ultimate regulatory authority on development in the bay. State and federal resource agencies have that authority, unless the local government requires more stringent measures.</li></ul>

## 1.11 POLICIES ON NATURE-BASED INFRASTRUCTURE

For example, relaxing restrictions on soft infrastructure protection measures will make them more attractive alternatives.

PROS	CONS
<ul style="list-style-type: none"><li>• Nature-based shoreline protection is more cost-effective and has obvious environmental benefits</li><li>• Consistent with the values of Marin County residents per the Marin County Residents Survey</li><li>• Softer shorelines are less likely to cause erosion from wave activity on nearby properties</li></ul>	<ul style="list-style-type: none"><li>• Nature-based solutions typically address near-to-medium range sea level rise impacts only</li><li>• The success of nature-based solution requires robust monitoring</li><li>• stringent measures.</li></ul>

For shoreline protection structures, whether hard or nature-based, most jurisdictions relied on regulation through the resource agencies. Two cities and the County have bay shoreline overlays, but newer resource agency and CEQA requirements remain the most effective measures for protecting shoreline and water resources. Both the San Francisco Bay Conservation and Development Commission and the Regional Water Quality Control Board are updating policies on bay fill to address the increased demand to place fill for shoreline protection. Stakeholders have commented that revised policies should recognize the long-range habitat benefits of fill for nature-based projects.

Very few jurisdictions have policies on hard shoreline armoring, nature-based infrastructure, or limitation on nonconforming structures. Marin County has a policy in the BFC that limits hard shoreline structures in wetlands and it has policies that can be interpreted as encouraging nature-based infrastructure, but they were not developed with that intent. Similarly, San Rafael has policies that address nature-based adaptation in its general plan, even though they were not created for that purpose. Most jurisdictions rely on resource agencies to review projects in the bay.

Regarding limitations on nonconforming structures, FEMA requires that when

construction costs reach fifty percent of the market value of a structure, the structure must comply with FEMA standards. All local governments use these standards. Countywide, local governments have agreed to require fire safety upgrades using a fifty percent rule based on floor area. The fifty percent is calculated differently among jurisdictions, but when the trigger is reached the upgrades must be installed. Beyond those uniform codes, the City of San Rafael also requires seismic upgrades to non-conforming structures.

## 1.12 LIMITATIONS ON NONCONFORMING STRUCTURES

Putting restrictions in place that will limit the lifespan of a non-conformity, such as a non-conforming land use or a structure (by virtue of its size, location on the lot, or type of construction).

PROS	CONS
<ul style="list-style-type: none"> <li>As shoreline zoning changes to adapt to sea level rise, limits on non-conformities can ensure that existing structures and uses also adapt.</li> </ul>	<ul style="list-style-type: none"> <li>Limiting nonconforming structures increases construction costs</li> </ul>

Marin County and its eight local governments on the Bay shoreline generally hold back when CEQA, resource agencies, or existing programs, such as the Stormwater Management Protection Program, are already addressing issues. Otherwise, the jurisdictions are employing a wide range of regulatory tools in standard and creative ways to address existing land use issues. Their wide range of experience could be excellent preparation for addressing the challenges of sea level rise.

## Tax and Market-Based Tools

Most available types of tax and market-based tools were seldom employed with a few exceptions. Their use is summarized in Table 2. Notably, special assessment districts are used by eight of nine jurisdictions.

Market-Based Tools		# in Use
2.1	Tax Credit Programs	1
2.2	Tax Incentives for Siting Development	0
2.3	Relocation/Retrofit Tax Incentives	0
2.4	Geologic Hazard Abatement Districts	0
2.5	Other Special Assessment Districts	8
2.6	Development Impact Fees	4
2.7	Stormwater Management Fees	3
2.8	Transfer of Development Rights	3
2.9	Density Bonuses	5
2.10	Conservation Easements	4
2.11	Land Banking	0
2.12	Acquisitions	1
2.13	Real Estate Disclosures	1

Table 2. Market-Based Tools in Use in Marin County

## 2.4 GEOLOGIC HAZARD ABATEMENT DISTRICTS (GHAD)

An independent special district providing hazard prevention and mitigation within a defined area which could be well-suited to sea level rise protection.

PROS	CONS
<ul style="list-style-type: none"><li>• GHADs are easier to form than other special districts and can be formed by property owners</li><li>• GHADs are structured so they can continue raising funds for project maintenance, monitoring, and adaptation</li></ul>	<ul style="list-style-type: none"><li>• GHADs are only available to neighborhoods that can afford them</li><li>• Shoreline protection projects will increase with sea level rise. As GHADs and other special districts form to address them, their projects will need policy guidance to avoid a piecemeal approach to shoreline protection.</li></ul>

No jurisdiction in Marin County has a GHAD. However, there are GHADs throughout California, several of which exist to provide shoreline protection. (Further discussion of GHADs is included below under case studies).

## 2.5 SPECIAL ASSESSMENT DISTRICTS

For example, a Mello Roos bond-created district is a community facilities district formed when bonds are used to finance public improvements, which are then repaid by a special tax assessed on property owners within the district. Unlike Geologic Hazard Assessment Districts (GHADs), which are formed by property owners, Mello Roos districts are formed by a public agency.

PROS	CONS
<ul style="list-style-type: none"><li>• Special Assessment Districts make it possible for the communities that benefit from public improvements to pay for those improvements</li><li>• Because they are formed by public agencies, they can be more democratic than GHADs</li></ul>	<ul style="list-style-type: none"><li>• Though some properties may be at greater risk than others, the impacts of sea level rise go well beyond individual neighborhoods. It is unlikely that a shoreline protection project will protect only the neighborhood behind it and not the roads and infrastructure connecting the neighborhood to greater Marin. Upland neighborhoods located outside the Special Assessment District are likely to benefit as well; however, only those within the District pay for the benefits.</li></ul>

The districts had a variety of funding sources, mostly some sort of tax, such as Mello Roos: a taxing district established to underwrite public financing through the sale of bonds for certain public improvements and services.

## 2.6 DEVELOPMENT IMPACT FEES

For example, impact fees for siting development in flood zones

PROS	CONS
<ul style="list-style-type: none"><li>The higher cost discourages development in flood zones</li></ul>	<ul style="list-style-type: none"><li>There are few undeveloped lots in East Marin. Although, perhaps this issue could be remedied if impact fees are also applied to rebuilds or additions to existing development.</li></ul>

Development impact fees are employed by four jurisdictions to supplement funding for the impacts on schools, roads, affordable housing, drainage, traffic, and community facilities. Belvedere, Novato, and Tiburon also had stormwater management fees that are collected as development impact fees. The fee in Tiburon, is tied to new impervious surfaces, which has resulted in a marked reduction of impervious surfaces. Marin County assesses impact fees for road impacts and applies the fees to transportation facilities improvements. The County also assesses affordable housing impact fees on new single-family homes over 2,000 square feet and teardowns and major remodels that result in over 500 square feet of new enclosed floor space. The fees mitigate the impact of new development on the affordable housing stock in unincorporated Marin County.

## 2.8 TRANSFER OF DEVELOPMENT RIGHTS

Transfer of certain property rights from one lot to another

PROS	CONS
<ul style="list-style-type: none"><li>TDR programs can prevent a “takings” by affording property owners the ability to make use of property rights that may not be available due to regulations in an area</li></ul>	<ul style="list-style-type: none"><li>TDRs require a receiver site, which is exceedingly difficult to find</li><li>TDR programs are complicated, requiring a great deal of staff time</li></ul>

Mill Valley, Tiburon, and the County have Transfer of Development Rights programs in their general plans, but they are rarely used.

## 2.9 DENSITY BONUSES

Allow greater density to be built on a site than would otherwise be allowed through underlying zoning, commonly used where the development includes a higher percentage of affordable units or in some cases, where the density bonus is made up of Transferred Development Rights. Density bonuses, acquisition programs, and transfer of development rights can be used alone or combined to provide incentives to develop in specific places or retreat from hazardous areas.

PROS	CONS
<ul style="list-style-type: none"> <li>In built out areas increasing density in specific areas offers a means to support affordable housing or potentially accommodate retreat from sea level rise.</li> <li>Density bonuses have a proven track record, having been successful in supplying affordable housing</li> </ul>	<ul style="list-style-type: none"> <li>There are few places in Marin where residents want increased density</li> </ul>

Five out of nine jurisdictions used density bonuses for affordable housing, consistent with State law. The “built-out” jurisdictions face challenges complying with State affordable housing requirements. Tiburon is one such jurisdiction and it offers tax credits for affordable housing projects.

## 2.10 CONSERVATION EASEMENTS

A mechanism by which public entities can preserve land while allowing it to remain in private ownership. Landowners receive a tax deduction. Rolling easements could provide a rolling boundary as the shoreline migrates inland, but are largely untested.

PROS	CONS
<ul style="list-style-type: none"> <li>As shoreline property values drop with rising sea level, a conservation easement can preserve shoreline space for water to rise while providing a financial benefit in the way of tax cuts or development purchases.</li> </ul>	<ul style="list-style-type: none"> <li>On the bay side of Marin, much of the property appropriate for a conservation easement is already in public ownership; however, strategic connections can still be made</li> </ul>

## 2.11 LAND BANKING

Purchase of land at an alternate location for use later

PROS	CONS
<ul style="list-style-type: none"> <li>Funding could come from an impact fee or tax (e.g. Flood Tax/Impact Fee)</li> <li>Land banking can provide space for retreat from sea level rise at a later date. Purchasing land in advance ensures that it is available when needed and can be held as open space until that time.</li> </ul>	<ul style="list-style-type: none"> <li>Property values in Marin are high making land purchases expensive</li> <li>Finding land that does not increase exposure to a different hazard or reduce other community benefits is difficult; however, with some analysis it may be feasible</li> </ul>

Tax and Market-based tools can provide needed funds for flood protection projects implemented by local governments or by a special district. Some tools can provide incentives for locating new development away from hazards or relocating development out of hazardous areas. To date, this category of tools remains largely untapped by Marin County and its local governments.

## 2.12 ACQUISITIONS

Acquiring property from willing sellers to protect public safety

PROS	CONS
<ul style="list-style-type: none"><li>• Multiple sources of funding could assist property owners whose primary investment is their home or who are unduly burdened by leaving their home</li><li>• Funding could come from an impact fee or tax (e.g. Flood Tax/Impact Fee)</li></ul>	<ul style="list-style-type: none"><li>• Property is expensive and finding funding sources requires staff time and investment in an assistance program</li><li>• Benefits of acquisitions only go to property owners, which could raise equity issues</li></ul>

No jurisdictions had acquisition programs in place to buy out homeowners in hazardous areas. Marin County does have occasional policies in community plans that suggest acquisition of certain properties. Marin County Parks makes strategic purchases of properties for recreational and open space uses.

## 2.13 REAL ESTATE DISCLOSURES

Disclosure of hazards during transaction that could include an assumption of risk and/or waiver of liability.

PROS	CONS
<ul style="list-style-type: none"><li>• Disclosures provide a fair process of informing buyers of the risks to which they will be exposed</li><li>• Disclosures can be a form of public education about the impacts of sea level rise</li></ul>	<ul style="list-style-type: none"><li>• Disclosures can reduce property values</li></ul>

Standard real estate disclosures are required by the State for property resales. The Town of Tiburon requires additional disclosures focused on educating future buyers about town requirements. No other jurisdiction requires real estate disclosures that go beyond State requirements for addressing environmental hazards such as high fire hazard, Alquist-Priolo fault areas, and flood zones.

## FLOODPLAIN MANAGEMENT TOOLS

Most of the tools designated as floodplain management tools are not in use by the nine jurisdictions, except freeboard elevation requirements and requirements for flood-resistant designs. Within FEMA flood zones, all jurisdictions comply with FEMA elevation requirements. Marin County requires an additional foot above the FEMA-required

height. No jurisdiction requires elevation outside of flood zones, such as in future sea level rise inundation areas. Likewise, the California Building Code requires flood-resistant designs in flood zones, with which all jurisdictions comply, but none require flood-resistant designs outside of currently-designated flood zones.

## FREEBOARD/ELEVATION REQUIREMENT

Elevating an existing structure or constructing new structures so that the elevation of a building's lowest floor is above the minimum base flood elevation (BFE) established by FEMA. Minimum regulations on development in floodplains must be required by local governments to participate in the National Flood Insurance Program (NFIP). Adding height to the BFE to accommodate sea level rise is an additional measure that local governments can impose.

PROS	CONS
<ul style="list-style-type: none"><li>Where development in place is at risk of flooding, home elevation can protect a structure and those living in it.</li></ul>	<ul style="list-style-type: none"><li>Home elevation is a substantial investment. Increasing rates of sea level rise may surpass the FEMA-required elevation height in some areas.</li><li>To address sea level rise, as opposed to temporary flooding, management tools must be comprehensive by accounting for road access and utilities. Home elevation may not be appropriate without such access.</li></ul>

## RESTRICTING HAZARDOUS MATERIALS IN FLOODPLAINS

Such as an ordinance prohibiting ammonia, sulfur, and/or acetone in floodplains

PROS	CONS
<ul style="list-style-type: none"><li>As floods become more frequent, contaminants will become exposed and impact water quality. A prohibition on hazardous materials now will prevent future damage.</li></ul>	<ul style="list-style-type: none"><li>Difficult to enforce</li></ul>

## LIMITING FILL FOR ELEVATION

Limiting or prohibiting the use of fill to elevate structures

PROS	CONS
<ul style="list-style-type: none"><li>Limiting unnecessary fill or regulating the type of fill in areas outside the bay can preserve sediment for subtidal and tidal marsh habitat preservation.</li><li>Elevating structures on fill can create drainage issues that create flooding in other areas</li></ul>	<ul style="list-style-type: none"><li>State and federal resource agencies already regulate fill</li><li>More regulations make projects more expensive to construct</li></ul>

## POLICIES EXTENDING V-ZONES STANDARDS TO A-ZONES

Extending V-Zone (areas subject to additional damage from wave action in the 100-year floodplain) standards to the A-Zone (100-year floodplain)

PROS	CONS
<ul style="list-style-type: none"><li>NFIP-required regulations address greater flooding risk in V-zones than A-Zones. With increased sea level, the flooding risks will increase in A-zones, making V-zone regulations applicable in these areas</li></ul>	<ul style="list-style-type: none"><li>Increased flooding in A-zones will not occur in the same manner as the more exposed V-zones.</li><li>May require Rezoning or Height Variances</li><li>Increases costs without immediate benefit to homeowner.</li></ul>

## REQUIREMENTS FOR FLOOD-RESISTANT DESIGNS

Designing structures with flood resistant or flood-proof building materials to enable floodable designs (those that allow for a certain level of flooding with no or negligible damage)

PROS	CONS
<ul style="list-style-type: none"><li>Floodable designs protect structures from flooding and cost much less than elevating structures</li><li>Can complement a sister measure to allow buildings that are portable and can be removed, such as container homes or container swimming pools (modpools.com)</li></ul>	<ul style="list-style-type: none"><li>Floodable designs are a temporary solution</li></ul>

## FLOOD TAX/IMPACT FEE

A tax or fee paid when new development is located in a flood zone and will require public infrastructure to keep it safe.

PROS	CONS
<ul style="list-style-type: none"><li>The development pays to prevent the impacts to which it will be exposed</li></ul>	<ul style="list-style-type: none"><li>Encourages development in floodplains</li></ul>

Marin local governments have experience with overlays and accompanying policies. We have substantially less experience using tax and market-based incentives. Some programs that might be most useful to local governments in Marin are: GHADs to protect or accommodate development, acquisition programs coupled with TDRs to locate or relocate development, and flood taxes or special taxes designated for flood protection. Case studies for these strategies are presented here.

# SB 379

SB 379 is a California state law adopted October 8, 2015, that requires cities and counties to review and update the safety elements of their general plans to include climate adaptation and resiliency strategies for their localities. The requirement is tied to the next revision of their local hazard mitigation plan (LHMP), which must be adopted in accordance with the federal Disaster Mitigation Act of 2000. SB 379 took effect January 1, 2017, applying when a local government updates its LHMP. If a local jurisdiction has not adopted a LHMP or in the case of Marin County, the LHMP update began prior to January 1, 2017, the safety element update must commence by January 1, 2022.

SB 379 requires a vulnerability assessment that identifies the risks of climate change effects on local jurisdictions and their geographic areas. It further requires the safety element updates to include a set of goals, policies, and objectives and specified feasible implementation measures related to each. The law builds on AB 162, which requires flood protection to be considered in the safety elements of general plans, SB 1241, which requires consideration of fire protection and SB 1000, which requires cities and counties that have disadvantaged communities to incorporate environmental justice (EJ) policies into their General Plans, either in a separate EJ element or by integrating related goals, policies, and objectives throughout the other elements.

During the staff's interviews with city planning directors, we asked whether they were

preparing to update their safety elements to comply with the new law. A few were already planning to update their general plans and include adaptation measures. The County's recent LHMP update aimed for a countywide, coordinated approach and included most of the cities within the County, which means those cities should also have until January 1, 2022 to begin their safety element updates. All jurisdictions involved in the countywide LHMP have now either adopted or are in the process of adopting it.

In the interviews, planning directors responded to questions about SB 379 and the status of their jurisdiction's General Plan. The questions were: "When was the last time your General Plan was updated?" and "Where is your city in its efforts to comply with SB 379?" Their responses are in Table 3. Generally, those cities that were already updating their General Plans were anticipating adding new adaptation measures in some form, but nobody was planning specifically to comply with SB 379 (The City of San Rafael is now complying with SB 379 in its update). One jurisdiction recently completed a General Plan update and two others had already begun General Plan updates. One city was planning for an anticipated update. If all the cities and the County comply with SB 379, we will have successive and simultaneous general plan updates commencing over the next three years, which provides a great opportunity to coordinate where feasible and learn from each other.

City or Town	When was the last time your GP was updated?
<b>Belvedere</b>	2010. Not due for an update until 2030
<b>Corte Madera</b>	2008. No plans now to update.
<b>Larkspur</b>	Updating now with adoption planned in 2020. Looking at some adaptation measures, both specific design standards and more general policy direction for greater coordination with other agencies.
<b>Mill Valley</b>	2013. The GP includes a small section on adaptation.
<b>Novato</b>	Finishing up a GP update at time of interview. Includes very limited policy direction for adaptation.
<b>San Rafael</b>	2012. GP 2040 planning is underway. Expecting adoption by 2020. Climate Action Plan is being updated. Expected adoption in 2018.
<b>Sausalito</b>	Started an update in Spring 2017. Sustainability Commission is working on goals and implementation measures for adaptation.
<b>Tiburon</b>	2005. Planning for a 2020 update.

**Table 3.** General Plan Updates

# THE COUNTYWIDE PLAN

Marin County's general plan, known as the Marin Countywide Plan (CWP), was adopted November 6, 2007. In accordance with SB 379, the County will commence an update to the Safety Element (named Environmental Hazards in the CWP) in 2021. Advanced planning to define a stakeholder-inclusive update process is underway. This discussion provides analysis of the CWP sections with policies that relate to sea level rise adaptation and some direction for the County's initial planning.

The Countywide Plan includes policies that address climate change impacts and specifically address sea level rise. The Biological

Resources (BIO) and Environmental Hazards (EH) sections are particularly pertinent to sea level rise. Policy BIO-5 establishes The Baylands Corridor, which provides direction for appropriate development near the shoreline. The set of BIO-5 policies encourage enhancement of baylands and ensure that baylands and large, adjacent essential uplands are protected. The policies further ensure that wetlands are hydrologically linked and that development is set back and limited to avoid areas with sensitive vegetation and habitat. Acquisition of essential baylands is encouraged.

## *Biological Resources*

Each section of the Countywide Plan includes a discussion of goals and objectives. The discussion of goals for Biological Resources includes direction to protect baylands, in part by reducing building intensity within the Baylands Corridor by calculating densities and commercial floor area ratios at the low end of the range established by the Countywide Plan land use designations (Policy CD-1.3). However, recently passed housing legislation (Senate Bill 330) may restrict or prohibit reducing densities for housing

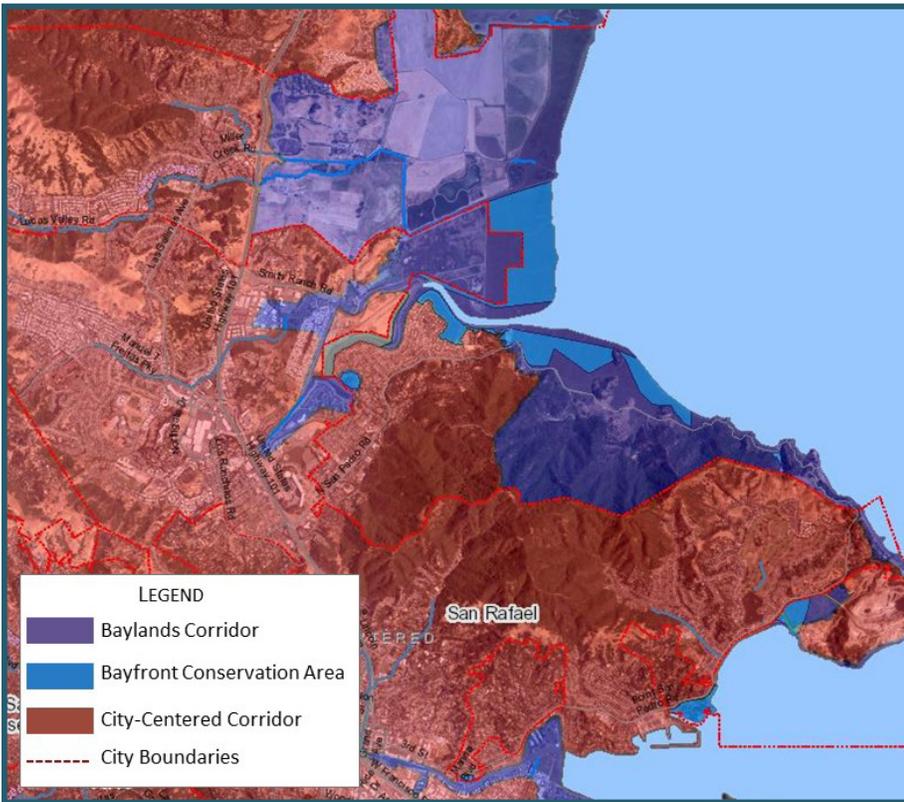
development projects. The implementation of this policy and consideration of adopting similar policies going forward should be carefully analyzed by legal staff. The Baylands Corridor policies also protect tidal marshes that line much of Marin's bay shoreline. Their dense vegetation and long shallow approach to the shore provide valuable habitat and promote their function as natural flood protection. Like sponges they soak up water and attenuate waves. Living shorelines adaptation projects can involve tidal marsh restoration that elevates

### **BIO-5.3**

Leave Tidelands in Their Natural State. Require that all tidelands be left in their natural state to respect their biological importance to the estuarine ecosystem. Any modifications should be limited to habitat restoration or enhancement plans approved by regulatory agencies.

### **BIO-5.8**

Control Shoreline Modification. Ensure that any modifications to the shoreline do not result in a loss of biodiversity or opportunities for wildlife movement. Possible modifications may include construction of revetments, sea walls, and groins, as permitted by State and federal agencies.



**Figure 12.** Baylands Corridor and Bayfront Conservation District

marshes to help them keep up with rising sea level. They might involve restoring marshes and acquiring adjacent uplands to accommodate marsh migration as sea level rises, also called marsh transgression. Some strategies involve raising marsh elevations and placing an inland barrier to transgression where development requires protection, which is commonly called a horizontal levee. Recall from the discussion of living shorelines above that protecting natural landscapes and addressing climate change are high priorities for the residents of Marin County. Living shorelines projects provide substantial water quality and

habitat benefits as well as flood protection.

It is possible to make the case that short-term impacts to tidal marsh or other wetland habitats from living shorelines projects will ultimately result in enhancement of the marsh; therefore protecting long-term biodiversity. Updating these policies to more explicitly integrate information on living shorelines adaptation and sea level rise projections may give the County more flexibility in accomplishing long-term goals. Notably, the County will only have as much flexibility as state and federal resources agencies provide; however, the County may advocate for similar flexibility in the regulations of those agencies.

Prior to creating the Baylands Corridor in the Countywide Plan, the Bayfront Conservation District (BFC) was created as a zoning overlay. It includes development standards that supersede the standards in other zoning areas where applicable.

However, the geographic areas covered by the BFC and the Baylands Corridor do not necessarily align (Figure 14). While many of the policies and standards are aimed at protecting the shoreline, as the shoreline changes with sea level rise, the geographic boundaries for both the Baylands Corridor and the BFC might be better placed to correspond to areas vulnerable to flooding. Similarly, the content of the Baylands Corridor policies could be updated to address expected changes in the shoreline and the BFC could be updated to align with policy updates.

## RECOMMENDATIONS

- ▶ Update Countywide Plan Bio-5 policies to better accommodate living shorelines adaptation projects.
- ▶ Advocate with state and federal resource agencies for new policies that make living shorelines projects more feasible by recognizing the long-term habitat and biodiversity benefits.
- ▶ Explore expanding and aligning the Baylands

Corridor and BFC area to align both the geographic extent and the policy direction. The geographic extent should include areas subject to future flooding and the policies should promote adaptation in those areas. Policies that may directly or indirectly result in reducing residential densities should be analyzed for consistency with State housing laws.

# Environmental Hazards

The Environmental Hazards section of the Countywide Plan focuses heavily on flooding, directing the County in EH-3 to protect people and property from risks associated with flooding and inundation. Other EH-3 policies call for a regulatory approach over the use of flood control projects when possible by regulating development in flood and inundation

areas. The EH-3 policies require periodic review and updates of flood maps and dam inundation maps, submission of hydrologic studies for new development, a considered expansion of Floodway Districts, and continued implementation of adopted flood control programs. A few policies apply directly to flooding from sea level rise.

## EH-3.A

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Regulate Development in Flood and Inundation Areas. Continue to require all improvement in Bayfront, Floodplain, Tidelands, and Coastal High Hazard Zones to be designed to be more resistant to damage from flooding, tsunamis, seiches, and related water-borne debris, and to be located so that buildings and features such as docks, decking, floats, and vessels would be more resistant to damage.

## EH-3.D

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Alert Property Owners. Notify owners of property in areas with inundation or flooding potential regarding those hazards when they seek development review or other related County services.

## EH-3.K

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Anticipate Climate Change Impacts, Sea Level Rise. Recent predictions of sea level rise for the San Francisco Bay region by BCDC and USGS based on climate models and hydrodynamic modeling of the San Francisco Bay Estuary Institute indicate 16 inches of rise by mid-century and 55 inches by 2100. Cooperate with the U.S. Geological Survey, the San Francisco Bay Conservation and Development Commission, the California Landscape Cooperative's Climate Commons project and other monitoring agencies to track bay and ocean levels and share baseline topographic and resource data obtained by the County in implementing its own projects to enhance hydrodynamic and ecosystem modeling efforts and assessment of regional climate change impacts. Use official estimates for mean sea level rise and topographic data for environmental review. Environmental review for development applications and County infrastructure shall incorporate official mid-century sea level rise estimates, and require adaptive strategies for end-of-century sea level rise for any such project with expected lifetimes beyond 2050.

## EH-3.N

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Plan for Sea Level Rise. Consider sea level rise in future countywide and community plan efforts. Consider revising Marin County Development Code standards for new construction and substantial remodels to limit building or require elevated buildings and infrastructure or other applicable mitigations in areas that may be threatened by future sea level rise as shown on maps released by the San Francisco Bay Conservation and Development Commission in February 2007.

The EH-3 policies provide a broad mandate to plan for sea level rise, particularly through regulating development in a manner that protects the public from flooding. Climate change science and projections for future sea level rise have advanced substantially since 2007. For example, in 2007 the State of California projected three feet of sea level rise in 2100. The BCDC maps referred to in EH-3.n used that projection. In 2017, California projected five feet in 2100 and included the possibility that sea level could rise by ten feet. This policy does not provide the flexibility required to accommodate changes in sea level rise projections. Most local governments have the ability now to map sea level rise flooding scenarios using a variety of tools. Updated policies can provide direction to be consistent with state guidance or simply to update maps on a regular basis using the best available science. To comply with new state-imposed housing mandates, policy updates may also require removing language that intends to limit building, even in areas subject to flooding.

Policy EH-3.k could be updated to guide the County's monitoring efforts in a manner more consistent with current State efforts. Since the policy was written, the State has implemented a highly organized climate change and sea level rise approach structured to address varied impacts of

climate change. The Governor's Ocean Protection Council is currently responsible for funding and overseeing sea level rise science updates and producing guidance on how to incorporate the science in adaptation planning. The second half of this policy recommends incorporating mid-century sea level rise estimates into environmental review of projects and requiring adaptive strategies. However, without a broader strategy in place to adapt to sea level rise, implementing this policy could result in maladaptive construction projects.

Policy EH-3.d requires informing a limited number of property owners about the hazards of future sea level rise: those that submit permit applications. The County is not doing this now and it would be a relatively easy, though possibly controversial, task to implement. However, all property owners and residents living in areas at risk of flooding from sea level rise should be informed, whether or not they require County services. This could be accomplished by mailing a notice to all property owners. Again, this could raise controversy because it may affect property values. This policy could be updated to inform all property owners at risk of flooding from sea level rise. Either way, the County has a clear mandate to inform those property owners who require County services.

## RECOMMENDATIONS



► Update policies to be adaptive to future sea level rise projections, to require broad public education about future sea level rise, and to include policies specific to Marin County that also conform to the

State sea level rise guidelines issued through the Ocean Protection Council.

- Explore changes to the BFC overlay that correspond in area to sea level rise flooding scenarios and include flexible policies that allow area-specific adaptation strategies, which consider topography, existing adaptation measures, and other specific conditions.
- Update policy Eh-3.k to guide the County's monitoring efforts in a manner more consistent with current efforts and to require more specific adaptation measures that will not conflict with more comprehensive adaptation strategies.
- Implement Policy EH-3.d as it now reads and consider expanding the notification requirements.

# CASE STUDIES

A number of local and state jurisdictions have developed unique methods to adapt to sea level rise. The methods range from state-sanctioned special districts to tax programs to overlays like those described above. Some of those methods have been analyzed and

executed. Some of them are still underway. Below is a discussion of several case studies involving parties that have implemented or are in the process of implementing adaptation measures that could be useful in Marin County.

## Acquisition Programs

Flooding from rising sea level will decrease the value of shoreline homes in Marin County and increase the cost of flood insurance. Many homeowners will suffer substantial financial losses and may not necessarily have the resources to relocate, if necessary. Commercial property owners may lose their income and be similarly financially strapped. Acquisition or assistance programs may be necessary.

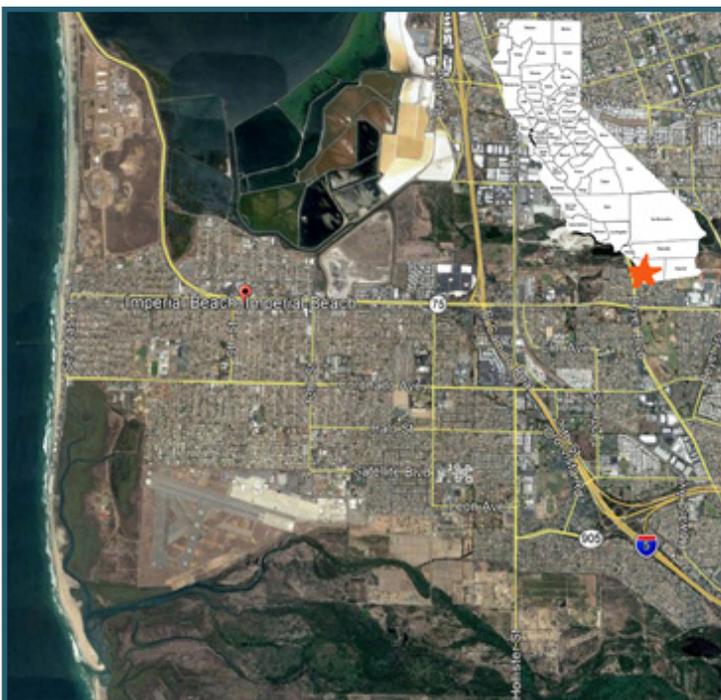
However, all level of government will also suffer increased costs for infrastructure improvements, health and human services, fire protection, and emergency services. Thoughtful planning should include financial analysis of potential losses and adaptation measures. The analysis performed for Imperial Beach is a good start.

## LESSONS FROM IMPERIAL BEACH

The City of Imperial Beach, one of the only blue-collar coastal areas in Southern California, is planning to adapt to sea level rise through a variety of strategies that includes retreat. Imperial Beach is the only city located south of San Diego (Figure 12). It is surrounded by water on three sides: San Diego Bay to the North; The Pacific Ocean to the West; and the Tijuana River and National Estuarine Wildlife Refuge to the South (Figure 13). The City is developing a plan to move residential structures off of the shoreline using two possible methods. First, it examined acquiring the properties and renting them back to homeowners. Second, it is exploring a Transfer of Development Rights program

involving a donation of land to which residents would move. The second plan is an outgrowth of the first plan and is less developed. The plans are explored in the [2016 City of Imperial Beach Sea Level Rise Assessment](#).

Prior to considering the option of retreat, planners at the City of Imperial Beach began with an economic analysis to determine the costs to the City of various adaptation approaches. They started with the assessed property values in the San Diego County parcel data and adjusted them to current market values. Then, they analyzed how public and private property values change as the beach changes. They applied a model developed by the California Coastal Sediment Management Workgroup in 2008 called the Coastal Sediment Benefits Analysis Tool (CSBAT). The CSBAT model evaluates the recreational value of beaches based on beach width: the wider the beach, the greater the recreational value up to about 250 feet. They conducted a sensitivity analysis in which they added ecological benefits. They conducted a vulnerability assessment in which they focused on beach erosion,



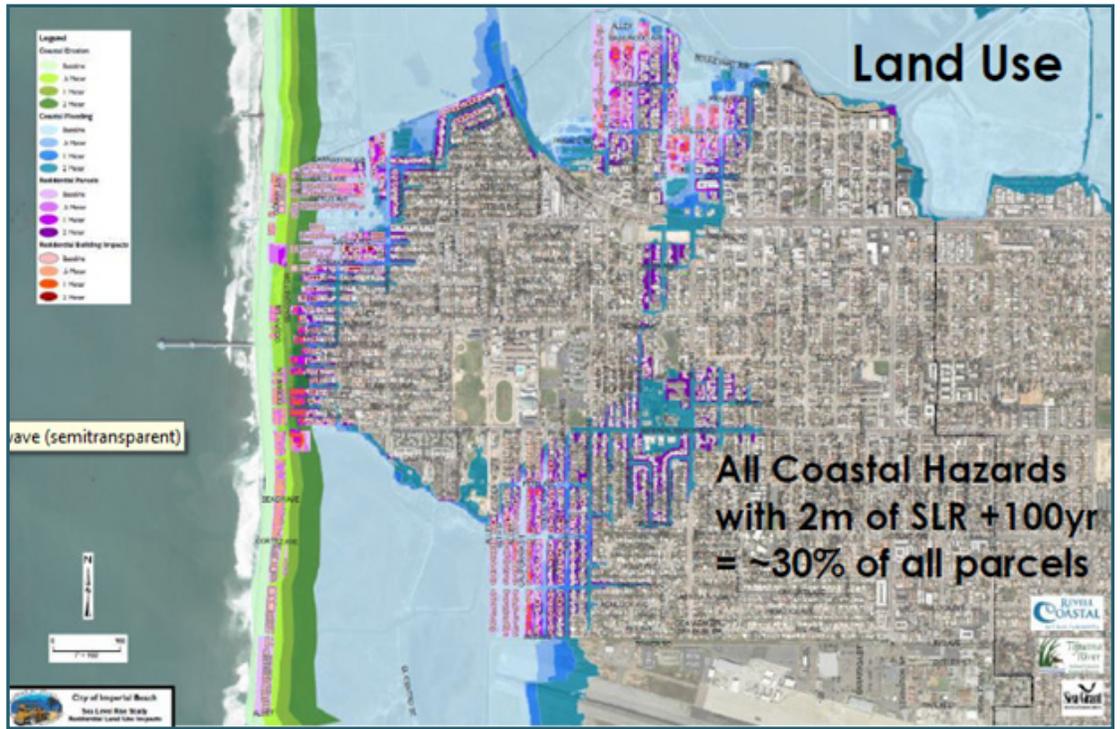


Figure 14. City of Imperial Beach Vicinity Map

tidal flooding and event flooding using the following scenarios: year 2047 (0.5 meters); year 2069 (1 meter); and year 2100 (2 meters). Losses from erosion were most significant with \$43 million at 0.5 m, \$74 million at 1.0 m, and \$92 million at 2.0 m. Losses from event flooding were \$14, \$25, and \$41 million respectively. Tidal flooding is a nuisance to homeowners now and will become a problem, but not on the same scale as erosion and event flooding: \$4, \$7, and \$36 million respectively. With all of this information and additional information on implementation costs for various adaptation strategies, they ran a benefit cost analysis of adaptation approaches.

They found that retreat has the highest net benefit through 2100. In Figure 17, the green bar on the right represents what happens by 2100, the red bar represents 2069, and the blue bar represents 2047. The costs and benefits of other approaches, such as armoring, balance out near 2069. The choice of approaches depends largely on community

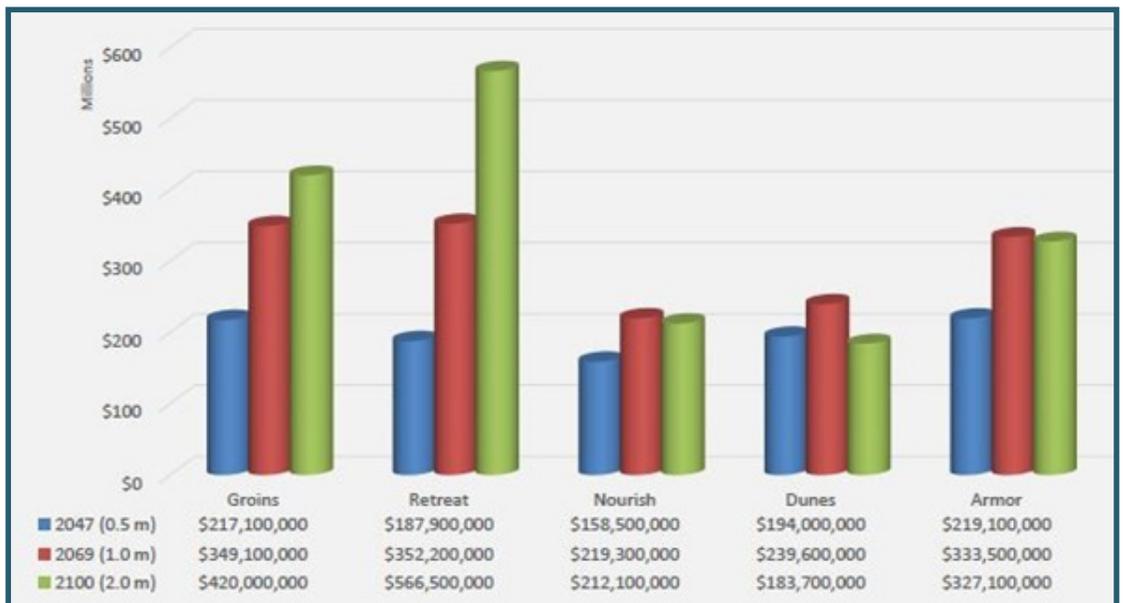


Figure 15. Flooding Projection in the City of Imperial Beach

values. For example, the analysis shows that the benefits of dune restoration and beach nourishment are relatively similar. The community must decide where they want to put their resources. The City of Imperial Beach planners examined an acquisition program they called a lease/buyback program, which is essentially a fee-simple payback program.

Their analysis showed if the City or a nonprofit purchased vulnerable properties with a property tax exemption, the purchasing entity could recover its investment in about 30 years—a typical mortgage. The line graph in Figure 16 shows how long it would take to payback a property if the local government or a nonprofit bought them out and rented it back at current market rates to the current owner or someone else (the presumption would be that the current owner has first rights of refusal). In 48 years you can pay off 90% of the value of the property. If the purchase is exempt from property tax, then the blue line shows that the payoff of 100% is just 31 years. Since this analysis was performed, loan interest rates have risen, putting the outcome closer to the grey line again. The City of Imperial beach is now exploring a transfer of development rights program with a public subsidy and or land donation.

The important lesson from the City of Imperial Beach’s approach is that acquisition programs can create a net benefit over time, especially when natural resource values are considered in a benefit-cost analysis and especially as sea level rise reaches higher levels, like Imperial Beach’s 2.0m scenario. The City is searching for an approach where they provide assistance to those at risk rather than leaving people to devise individual, possibly competing, strategies to address sea level rise or to do nothing, possibly putting themselves or others at risk. Where acquisition strategies fail to balance out, additional money might be found through grant programs. High property values across Marin County would likely necessitate an additional influx of money to prevent major losses to a local government or nonprofit taking on such a program.

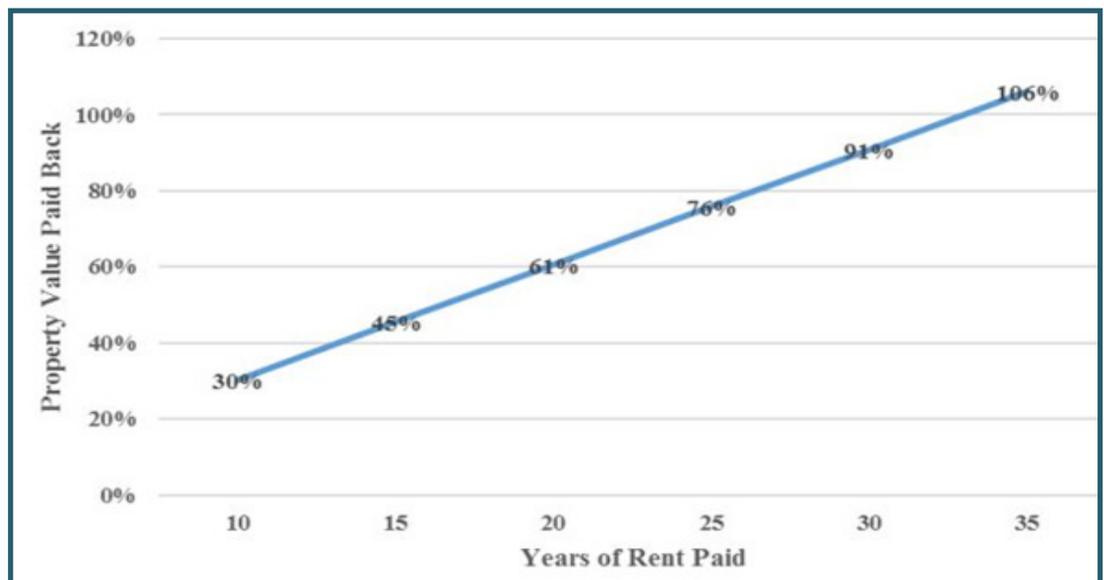


Figure 16. Net Benefits of Adaptation Strategies through 2100

## BLUE ACRES ACQUISITION PROGRAM

New Jersey’s Blue Acres Floodplain Acquisitions Program was created through two separate bond measures passed by voters in 2007 and 2009 to fund \$36 million for acquisition of lands in the floodways of three major rivers and their tributaries. Properties and structures that have been damaged by or may be prone to incurring damage cause by storms or storm-related flooding, or that buffer or protect other lands from such damage are eligible for acquisition. All Blue Acres acquisitions must be from willing sellers and most are from properties subject to repetitive loss by flooding. The program existed prior to Hurricane Sandy and changed substantially after the hurricane when large sums of money poured in to buy out property owners from large swaths of coastal land. Marin County has not experienced a storm that has caused the kind of

damage that could be considered a national disaster. Acquisition efforts here would be preventative as opposed to post-disaster. Therefore, the pre-Hurricane Sandy program is described below.

Under the Blue Acres model, local governments partner with the Federal Emergency Management Agency (FEMA) to purchase parcels and/or structures identified as repetitive loss properties. The FEMA funding process is complex and the Blue Acres staff has expertise in working through the process that they offer to local governments. Plus, they can rely on the expertise of their predecessor acquisition program called Green Acres, which is dedicated to purchasing lands for open space. As an example of an acquisition, the Harmony Township in Warren County received assistance from Blue Acres to create a buy-out of six parcels that were destroyed in two successive flooding disasters along the Delaware River. As a result of those flood events, certain properties qualified for FEMA disaster relief funding. FEMA provided 75% of the land acquisition and demolition costs and Green Acres provided the 25% match. These former at-risk residential properties are now access points to the river for all the residents of New Jersey.

In the past, the Blue Acres Program applied for and received FEMA Flood Mitigation Assistance (FMA) grants and FEMA Severe Repetitive Loss Pilot (SRL) grant funds for acquisitions. The cost share is determined through a set of complex measures, differs by grant program, and depends on the type of structures to be acquired. (Under Sandy/HMGP 4086, Blue Acres was also awarded HUD Community Development Block Grant disaster (CDBG-DR) funds for buyouts.) Pre-Superstorm Sandy, the Blue Acres Program applied for and was awarded seven (7) distinct FEMA mitigation grants totaling \$35 million. (\$26.2m Federal & \$8.8m state cost share). These grants covered 149 properties, at an average cost of \$235,000 per property. Blue Acres has acquired 110 properties and demolished the structures on those properties. The average cost of a single-family home in Marin County is \$1,525,000 (Market Reports), which makes acquisitions here more challenging. However, FEMA does not cap the dollar amount it will grant for property acquisitions. Rather, it requires a cost benefit analysis to ensure that the acquisition will ultimately create a net benefit.

FEMA's FMA grants are awarded to states and tribes. Funds are then awarded from the state to local governments and from there are distributed to property owners. California Office of Emergency Services (CalOES) participates in and receives grants from both the FMA and SRL programs. FEMA's SRL grants can be awarded directly to local governments, provided that they have prepared a report following FEMA guidelines for detailing number and location of repetitive loss properties in their jurisdiction. However, in California, those grants are first reviewed by CalOES and, if approved, sent on to FEMA.

The FEMA programs are completely voluntary; no homeowner is required to sell their property or is forced to move because their home is located in an area subject to repetitive flooding. Homes that are determined to be eligible for buyouts are purchased at the fair market value of the property. The fair market value is determined as the result of an appraisal conducted by a certified appraiser using sales of comparable homes sold. Once a property has been purchased through the Blue Acres program, the home is demolished and the land becomes public property, designated via deed-restriction as open space. FEMA does not place a cap on the total cost of acquiring a property per se, but it does require a cost benefit analysis that must show a clear benefit from the acquisition.

Implementation of an acquisition/grant project is institutionally dependent. Blue Acres' implementation costs run at roughly 5% of the grant award. The evolution of their buyout program out of a highly successful open space program (Green Acres) has allowed them to draw on in-house, existing real estate expertise. In many ways, Blue Acres didn't have to "build a buyout team" from scratch. It can safely be assumed that any new program, "starting from scratch," would have higher implementation costs. On the east side of Marin County, homes already located in flood zones are generally

less expensive than other homes in the County. Many of those were purchased before people knew about the potential increase in flooding risks. For many middle-income people, their home is the single largest component of their net worth (Campbell, 2015). Flooding from rising sea level will decrease the value of shoreline homes in Marin County, just as it has already done along the Atlantic and Gulf coasts. The cost of flood insurance will increase, as it already has in flood zones here in California. The County is already exploring grant programs to provide financial assistance for home elevations. It is worth exploring the long-term costs and benefits associated with both options for assisting homeowners.

## RECOMMENDATIONS

► Retain a financial analyst to explore the financial viability of an acquisition program that would use a variety of funding resources and tools for buyouts, including eminent domain, the significant repetitive loss program, conservation easements, and other voluntary programs.

► Explore and identify Countywide potential receiver sites for Transfer of Development Rights (TDR) programs. TDR programs are complex and require significant staff time to implement. Pursuing a TDR program should be done only where receiver sites are feasible.

## *Tax Programs and Impact Fees*

The bay shoreline of Marin County is not facing pressures for new development. Most of the shoreline is already developed or in public ownership. If the County pursues a strategy that relies primarily on shoreline protection, the costs of

constructing and maintaining the protection infrastructure and access to the areas protected will require additional sources of revenue. Several initiatives are already in use elsewhere.

## FLOOD IMPACT FEES IN SACRAMENTO

The Sacramento Area Flood Control Agency Act of 1990 (SAFCA) gives the SAFCA Board of Directors (the Board) the authority to “prescribe, revise, and collect fees as a condition of development of land.” The resolution adopting the fee program must describe the following: (1) the specific flood control projects that are needed so the areas proposed for development meet the flood protection standards determined by the Board; (2) the estimated cost of these projects; (3) a tentative time schedule for their implementation; and (4) the reasonable portion of the cost to be apportioned to new development.

The program was developed to ensure that new structures placed in the 200-year floodplain do not increase Sacramento’s exposure to flood damages and the governmental costs associated therewith. To measure this exposure, the Board used the expected annual damages (EAD), which integrates the probability of an uncontrolled flood and the resulting property damage. New development could significantly increase EAD by increasing the economic consequences of an uncontrolled flood. The fee program would mitigate this impact by funding a series of flood risk reduction projects identified under step one of the Board’s mandate. The Fee Program would provide a portion of the local share of the cost of achieving at least a 200-year level of protection. This increased protection would offset the additional property damage exposure created by new development in the program area and avoid any substantial increase in EAD.

There are communities in Marin that have voted down impact taxes to pay for flood infrastructure projects aimed at protecting their communities. Where development in flood zones becomes a public safety hazard along Marin County's developed shoreline, an impact fee ordinance could rely on a substantial cumulative development program that tracks construction on existing structures to the point where the life of the structure is extended substantially enough to warrant assessment of an impact fee that will help pay for the flood protection measures required to protect it. Careful documentation would be necessary to show the nexus between substantially extending the life of an existing structure in a flood zone that is subject to increased frequency and severity of flooding and the flood protection measures required to protect public safety.

There are scale and timing differences between the Sacramento program and what could occur in Marin. The Sacramento program applies to large tracts of land being developed, which would generate fees for an entire tract. On the largely developed Marin shoreline, a much smaller number of homes would be likely to reach the cumulative trigger and, since it would be an incremental approach, the timeframe would be longer. Ultimately, the fees generated would be lower than a full tract of land.

## CORTE MADERA SALES TAX

The Town of Corte Madera is host to one of the finest shopping areas in all of Marin County. People drive from surrounding towns to shop at the auto dealerships, "The Village" and the "Town Center," located in close proximity to one another and both located in the 100-year floodplain. As their host, Corte Madera benefits from the tax revenues and faces the potential costs of protecting them, but it also provides a service to people well outside of its town boundaries.



In 2018, Corte Madera placed a referendum on the ballot (Measure F), which was passed by voters, to raise sales tax in the area. Measure F increased the town's sales tax from a half-cent tax to a three-quarters cent and eliminated a \$98 special property tax for flood control. With the quarter-cent increase, the town's sales tax will be 9 percent. The tax is expected to generate \$3.5 million annually for flood protection and disaster preparedness. By using a sales tax, those who benefit from shopping in Corte Madera pay for the cost of protecting that benefit.

## RECOMMENDATIONS

► Explore a sales tax to provide flood protection in lieu of a special property tax. In areas where businesses generate substantial sales, a sales tax

can ensure that flood protection is paid for by the users of those services who may live outside the city or town providing them.

# Geologic Hazard Abatement Districts

Geologic Hazard Abatement Districts (GHAD) can be a useful tool in protecting property owners from sea level rise. California Public Resources Code (PRC) Division 17 prescribes requirements for their formation and describes their rights and responsibilities. Pursuant to Division 17, GHADs are independent, public agencies that operate similarly to special districts to oversee geologic hazard prevention, mitigation, abatement, and control within a defined area. They are authorized by State law and established by resolution of the local government jurisdiction in which they reside. They finance their hazard response and maintenance work through assessments of property owners within the boundaries of the designated district. GHADs can also issue and service bonds. They must form a Board of Directors that

oversees the assessments and financing of GHAD improvements.

PRC Division 17 defines a “geologic hazard” as an “actual or threatened landslide, land subsidence, soil erosion, earthquake, fault movement or any other natural or unnatural movement of land or earth [emphasis added].” Flooding can have serious consequences of erosion or sediment deposition in low-lying areas. Typical wave action can generally degrade or affect the structural integrity of waterside flood control structures, such as seawalls, levees, or berms, reducing their efficacy and possibly leading to failure. The GHAD’s single focus and ability to hold financial resources in reserve, make it a potentially successful alternative to construction and maintenance of flood

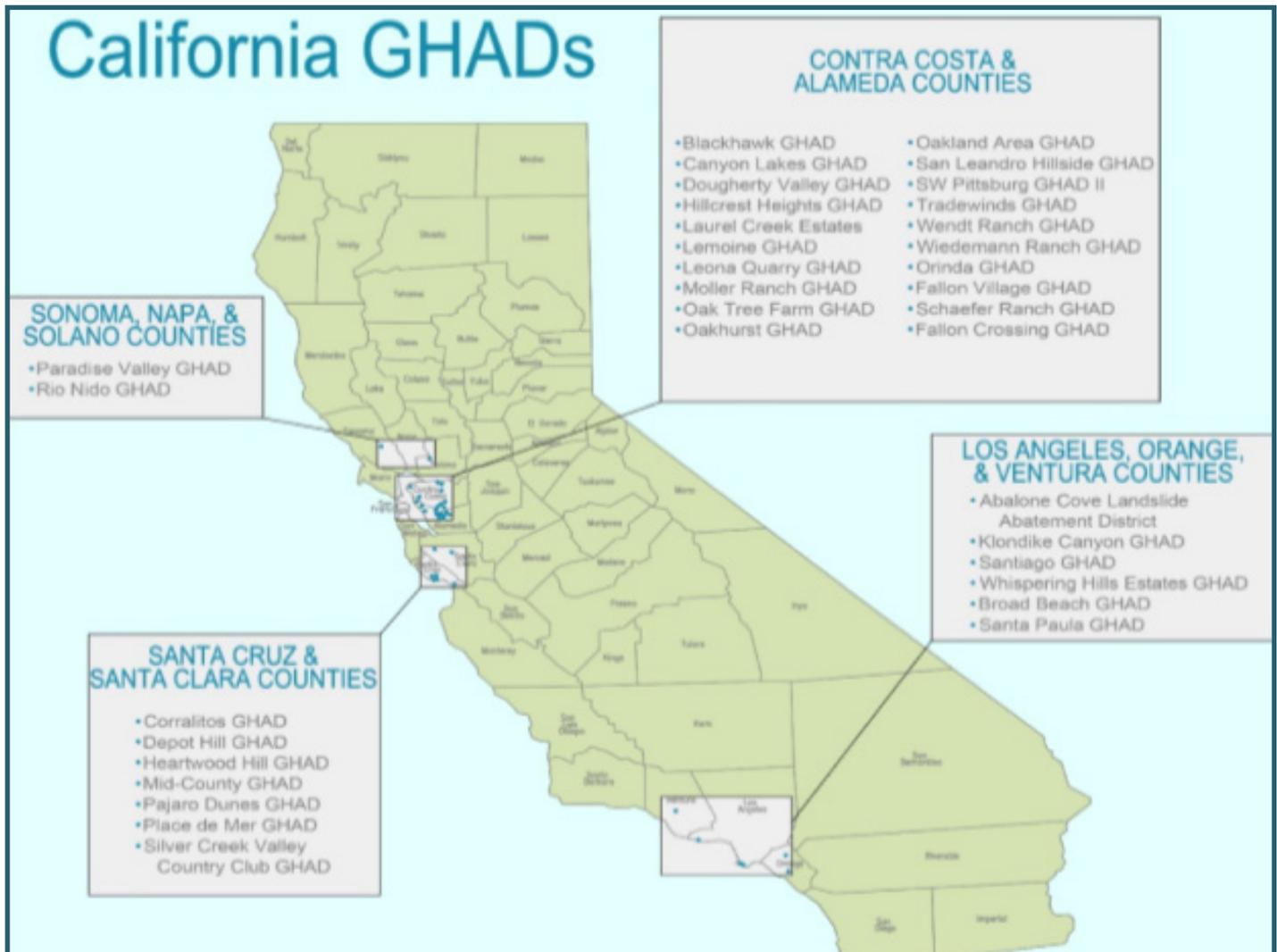


Figure 17. Geologic Hazard Abatement Districts in California

control structures by local governments. GHADs can monitor impacts over time and respond quickly when needed to provide technical assessments and maintenance or construction measures that avoid failure of flood control measures. Approximately 40 GHADs exist in California (Figure 17) with approximately 4 of these formed to address coastal erosion issues.

[The California Association of GHADs](#) identifies additional benefits of GHADs evaluated against other funding

alternatives, such as Community Facilities Districts (CFD). For example, CFDs are usually tied to repayment of infrastructure bonds as the terminus of their functions. GHADs can be created with continual funding streams that correspond to long-term operations and maintenance responsibilities. GHADs can also own and acquire land, focus on hazard prevention, quickly respond to new land stability circumstances, form and manage with less complicated requirements, and endure for an unlimited amount of time.

The same website also breaks down the formation of GHADs into steps as shown here.



The City of Malibu approved the formation of the [Broad Beach GHAD](#) in September 2011 (Figure 18). The Broad Beach GHAD spans the entirety of Broad Beach and a portion of Victoria Point, from Trancas Creek at the east to Lechuza Pont at the west.

GHADs finance their response and maintenance work through assessments of property owners who own real estate within the boundaries of the designated district. State law authorizes GHADs to issue and service bonds. The assessments and associated financing of the GHAD improvements are overseen entirely by

the GHADs Board of Directors. The Broad Beach GHAD Board approved and passed a resolution accepting the Plan of Control and a resolution adopting the Engineer’s Report, which specifies the work to be completed and financing for the same. The manner in which assessments are calculated is based upon the amount of linear beach frontage owned by each GHAD member. All GHAD projects remain subject to required regulatory agencies, including for the Broad Beach GHAD, the California Coastal Commission (CCC), State Lands Commission (SLC), Army Corps, Regional Water Quality Control Board, and the City of Malibu.



Figure 18. Broad Beach Vicinity Map



Figure 19. Photo Simulation of Broad Beach Dune Restoration

In response to decades of beach erosion, the Broad Beach GHADs Plan of Control seeks to implement a long-term shoreline protection plan to return Broad Beach to its historical proportions. The project is estimated to cost

\$15 million, which includes the following costs: performing the necessary legal, biological and engineering work; securing permits; constructing the dune; and maintaining the beach. The project consists of:

- *sand nourishment*
- *dune restoration*
- *sand backpassing (moving sand from wider reaches of the beach to narrower reaches of the beach when objective triggers are reached) designed to prolong nourishment, and*
- *retaining existing rock revetment seaward of certain Board Beach properties as a permanent protective structure buried under both the restored beach and dune.*



This, privately funded project will create an approximate 65'-75' wide dry sand beach and 40'-60' wide restored dune system for all to enjoy. It will also provide long-desired protection to private property immediately inland of the sand and dunes. The GHAD has committed to conducting and maintaining this beach restoration and preservation project for decades into the future, complete with sand sourced from inland locations.

GHADs are used for steep hillsides and coastal beaches with aggressive wave activity. How can they be used on the San Francisco Bay Shoreline? There are locations all over the bay shoreline that receive wave action and consequent erosion, such as small sandy beaches, tidal marshes that would otherwise provide flood protection, and shorelines where creeks meet the bay (for example Corte Madera Creek).

SLC is the lead agency. To date, the GHAD received a consolidated Coastal Development Permit from the CCC (October 2015) and approval from the State Lands Commission (August 2016). The property owners are working out some of the public access requirements in their CCC permit before they can start construction.

Provisions can be included in a bay shoreline overlay to promote the formation of GHADs in critical erosion and flooding areas. Local governments should consider carefully the implications of encouraging GHADs. While they provide an effective way to finance shoreline protection, they are only available to those who can afford to pay the fees.

A bay shoreline overlay can also support GHADs and provide direction towards nature-based protection measures. An overlay can include provisions to change the burden of proof or create exemptions for permitting of nature-based flood protection measures, such as marsh restoration, horizontal levees, and various wave attenuation strategies that GHADs can undertake. While local ordinances have no bearing on decisions of state and federal resource agencies, they provide a clear process for at least the local permit. For example, provisions in Marin County's Development Code regarding the

Bayfront Conservation Zone overlay (Section 22.14.060.F.6) prohibit diking, filling or dredging in areas subject to tidal action, with some exceptions granted for emergency or precautionary measures in the public interest (e.g. protection from flood or other natural hazards). An additional policy could provide clear direction that nature-based flood protection measures are preferred to gray infrastructure by asking applicants to show that a nature-based solution is not possible before allowing the construction of gray infrastructure.

## RECOMMENDATIONS

GHADs may form to take on shoreline projects. Develop policies that do the following:

► Provide clear direction that living shorelines flood protection measures are preferred to gray infrastructure for protecting from medium-range sea level rise scenarios.

► Provide permit exemptions for marsh restoration projects that qualify for a CEQA Categorical Exemption subject to CEQA Guidelines 15333, Class 33, which applies to small habitat restoration project not to exceed five acres in size and provides an exemption for "restoration, enhancement, or protection of habitat for fish,

plants, or wildlife." Examples of small restoration projects may include..."wetland restoration, the primary purpose of which is to improve conditions for waterfowl or other species that rely on wetland habitat."

► Recognize that marsh restoration projects may involve temporary impacts to marsh habitat that are necessary to sustain the marsh over the long term. Healthy marshes grow at specific tidal elevations and marsh accretion must keep pace with sea level rise to endure over the long term.

## THE ADAPTATION PATHWAYS APPROACH

Adaptation planning can be accomplished by identifying multiple planning options or pathways and decision points that indicate when a different pathway is needed to adapt to changing conditions. In land use planning, the pathways can be plans and ordinances that move us toward solutions and are designed to be modified as conditions change. In capital planning, the pathways can be infrastructure projects that protect public safety (Figure 20). Identifying in advance the relationship between capital improvements and policy modifications and their respective decisions points promotes integration of capital and land use planning. One pathway may be an infrastructure project and another may be a new ordinance. When the adaptation threshold is reached on one, then the other may become necessary or they may run on parallel courses. Because most local governments have separate land use planning and public works departments, using a process that integrates planning

across departments is critical. Ideally, when a decision point is reached, the current pathway is designed to fold into the next pathway. These ideas have been captured several ways, including the graphic from Deltares created for the Netherlands' Delta Works project in Figure 20. It shows several key points in the planning process. The circle represents the point at which a new adaptation measure is set in place. The vertical line represents the adaptation threshold or the point at which an adaptation measure is no longer viable, such as the point when flooding becomes so serious in a neighborhood that public safety is at risk. This has also been called an adaptation tipping point. The colored horizontal lines represent an adaptation action that is in effect and the triangle represents the point at which a decision must be made to move to another adaptation option before the adaptation threshold is reached.

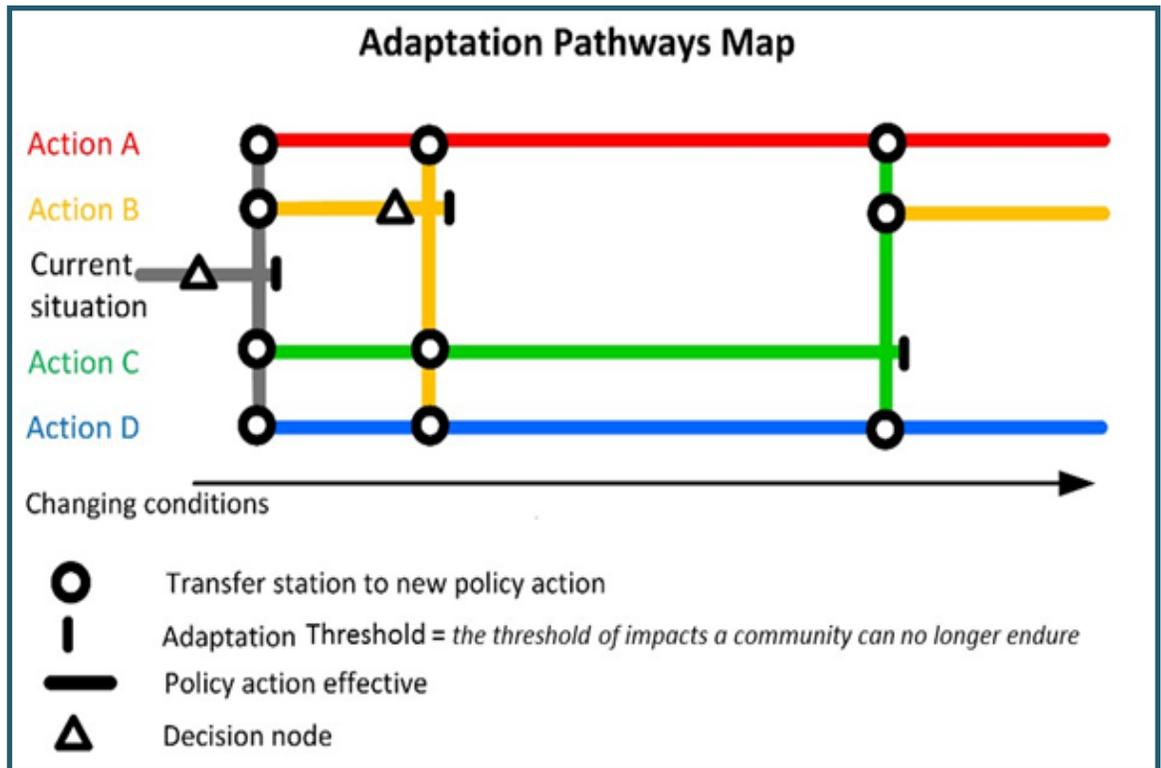


Figure 20. Adaptation Pathways

An adaptation approach with decision points and pathways identified in advanced has become widely accepted. Generally, the approach is used for capital projects, but it can also be applied to land use policies that state goals and guide how projects can attain those goals. Land use policies are often implemented slowly, on a project-by-project basis. If a sea level rise policy aimed at protecting public safety is adaptive, the decision point for taking another path must occur before floods are anticipated in an area.

By adding some lead time before a decision must be made, planners have time to consider policy options as well as capital improvements. Identifying warnings or signals (not included in Figure 20) to prepare for the decision point is one way to provide lead time. A signal can be the number of days an area floods per year as long as it provides ample time to engage stakeholders in a decision-making process before the decision point. In Figure 2, the triangle changes from a decision point to an adaptation signal. It becomes the point at which a decision-making process is employed. The decision point is represented by the rectangle and placed to allow time for implementation before the adaptation threshold is reached.

For example, where a shoreline has development located behind a levee, the adaptation threshold (AT) would be when the

levee is overtopped and assets are flooded. The signal to avoid reaching the AT could use Mean Sea Level plus storm surge (MSL+SS). When MSL+SS reaches an identified height on the levee, a stakeholder engagement process ensues to inform the decision making that must occur at the decision point. The decision point is determined by a higher point on the levee than the signal, and it that marks the point at which there is ample time left to implement an adaptation measure before the AT is reached. Figure 21 shows how this adaptive planning could function. Adaptation measures undertaken prior to the signal could also be incorporated as a factor in determining the decision point. For example, a pre-determined percentage of development located behind the seawall has already been elevated.

Whether local governments use overlays or other tools, monitoring sea level rise is an essential component of adaptation. Identifying signals and decision points will determine the type of monitoring that will be needed. Budgets will need adjusting to pay for staff time and equipment to monitor. In another example, a developed low-lying area already floods. The signal could be a pre-determined increase in frequency of smaller storm-tides and the decision point could be an even higher increased frequency. Incorporated into the decision point would be any adaptation measures taken prior to

reaching the signal. For example, an existing tidal marsh has been elevated and restored, which changes the frequency of flooding in relation to smaller storm-tides. Alternatively, CalTrans has determined that it can no longer maintain a Highway that leads to the development because the cost of protecting it from rising water is too great. Now the signal has been reached and it may be necessary to consider pathways that were previously considered only in a longer-term scenario.

Because the adaptation pathways approach identifies multiple paths forward, providing some flexibility to change with conditions, it may also be a useful tool for situations where jurisdictions share impacts from sea level rise. Multiple pathways means multiple options where jurisdictions might agree or where they may agree on an initial path with an understand that their paths may diverge at a later point. The pathways approach gives jurisdictions time to plan for that divergence.

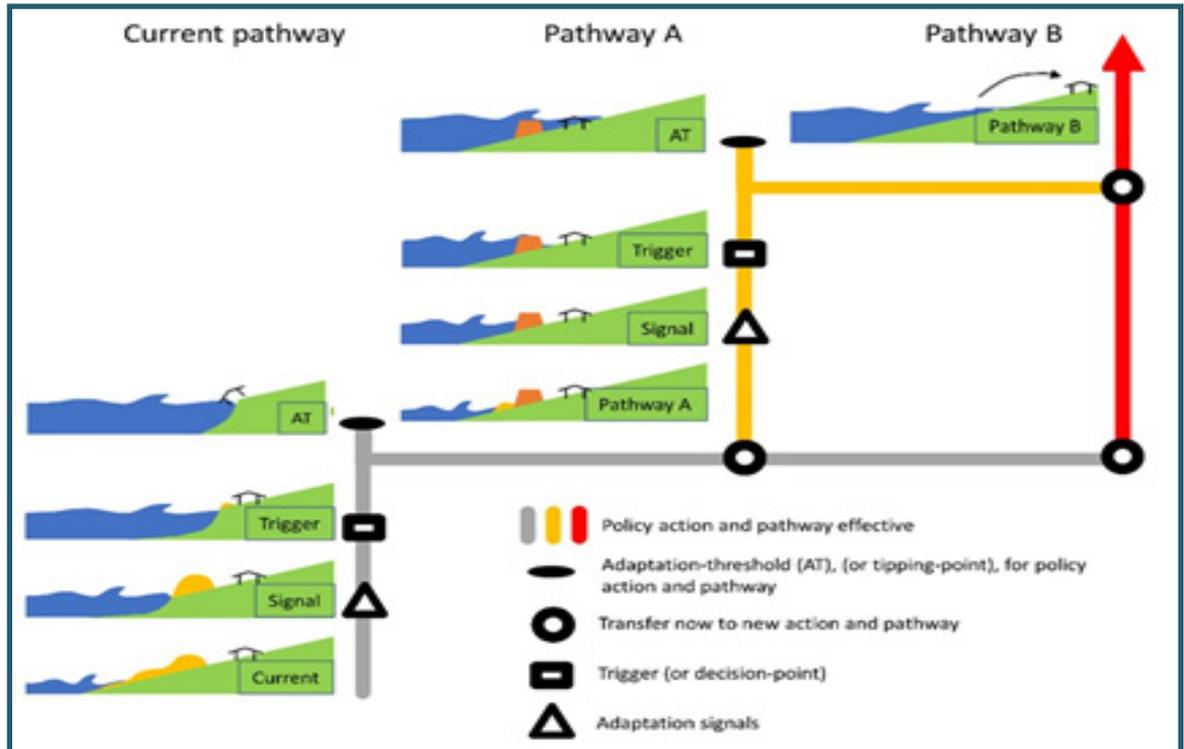


Figure 21. Policy Adaptation Pathways

## RECOMMENDATIONS

- Use a modified adaptive pathways approach to coordinate capital and land use sea level rise planning and coordinate planning where impacts are shared by jurisdictions.

## POLICY GUIDANCE

This report described some of the future impacts of rising bay water in Marin County and how they may change over time. Adaptive planning to prepare for these changes is necessary and required by state law. The report evaluated a number of land use planning tools that can be adapted to address sea level rise. Many of the regulatory tools are already used by local governments throughout Marin County,

though for different purposes. Their use implies that local governments are having some land use planning success with those tools. Market-based tools remain largely untapped. The guidance below provides a sample adaptation policy framework for a segment of Marin County's shoreline in Tamalpais Valley.

There is some adaptation planning already

underway in the Tam Valley area, including restoration at Bothin Marsh that will also include improvements to the bike path. Funding for adaptation planning along the shoreline from Manzanita Park and Ride through Tam Valley has been secured and planning is beginning. Although these projects are real, the policy planning process below is merely an example of how land use planning policies can be tied to project-specific planning and the types of policies that may be appropriate as well as the types of policies that can be included in a zoning overlay.

Shoreline protection overlays have been used successfully here in Marin County, in Monterey County with special setback zones, and in East Hampton New York. In Maryland, a sea level rise overlay protects public safety and habitat in the Chesapeake Bay Area. A policy framework based on an overlay is useful for sea level rise because the overlay area can be directly associated with the projected flood area for a sea level rise scenario. Using an adaptation pathways approach ties the overlay and associated policies to other adaptation projects that may impact the policy approach. Figure 22 shows two potential overlays associated with two scenarios of sea level rise: 24 inches and 48 inches, or near-term and medium-term scenarios. The overlay could cover the area in the near-term scenario. If needed, at a later date, it could expand to include a greater area.

In Figure 23, Action A involves “holding the line” at Hwy 101 and Hwy 1 to Almonte Blvd. using shoreline armoring to either elevate or protect these main roadways. This measure would require substantial public investment and long-term maintenance costs. Once in progress, it would be difficult to undue in favor of another measure, which is why it is shown as a continuing line across the graphic. Action D, to retreat, would require substantial private, and potentially public, investments and could have rippling social impacts. It would provide the greatest reduction of risk from flooding. Therefore, it is also included here as a continuing line across the graphic.

Action B is restoration of Bothin Marsh to provide protection from sea level rise. This is a County Parks project that is already underway. The project to date includes historic, geomorphic, and vegetation assessments as well as preliminary design ideas from the project consultants. There has been extensive outreach and consultation with regulatory agencies and other stakeholders that has to date culminated in a vision document for the Bothin Marsh restoration. As the project proceeds, more information will be available about the degree to which it will provide flood protection and the duration of protection with continuing sea level rise. This action is shown with a line that stops, in theory, when the duration of protection ceases and the adaptation threshold is reached.

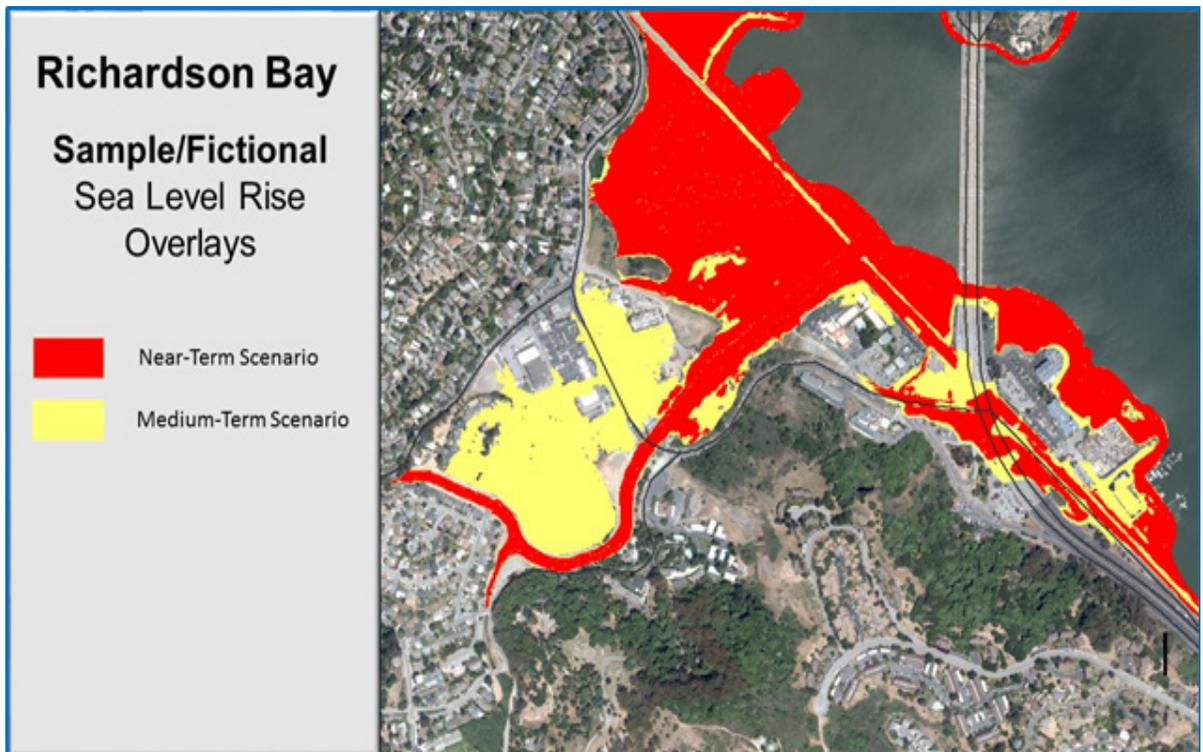


Figure 22. Fictional Overlays Based on Sea Level Rise

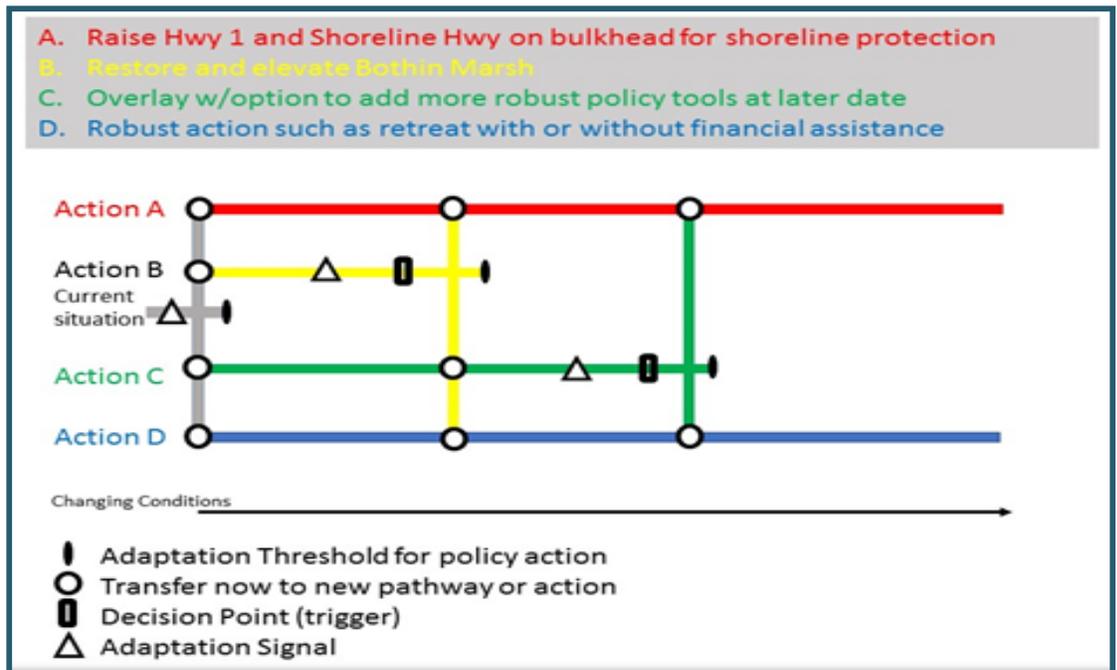


Figure 23. Tam Valley Sample Adaptation Pathways

Without moving the development existing upland of the marsh and leaving space for transgression, rising sea level would eventually drown the marsh. At the decision point, the next action could be Action D, to retreat, and leave space for marsh transgression and continued sea level rise protection upland of the marsh. Alternatively, the next action could be Action A, to hold the line at the major roadways. In this case, retreat might be necessary on the bay side of the roadways. Policies can be created to support the chosen action.

Action C is the zoning overlay and associated policies. The purpose of the overlay would be to protect shoreline habitat, as the BFC currently does, and to protect public safety. The overlay could include policies to encourage living shoreline measures as well as policies to decrease densities. It could include policies that require home elevation that is additive to what FEMA already requires, in height and possibly in areas subject to future flooding, but not within the FEMA floodplain. While not all areas of the shoreline are appropriate places to encourage home elevation, some areas may be. Home elevation requires a substantial investment from the property owner and may trigger other building code updates that further increase the building

costs. In an area where it may not be possible to upgrade roads to withstand sea level rise, the investment would hardly be worth it. Policies that could be appropriate for this Tam Valley sample overlay are discussed further below.

Whether local governments use overlays or other tools, public engagement in adaptation planning and monitoring of sea level rise are essential components of adaptation. Identifying signals and decision points will determine the type of monitoring that will be needed. Budgets will have to be adjusted to pay for staff time and equipment to monitor. At each signal, the public engagement will ensue again. Rather than depict each pathway as a straight line, another graphic might depict the public participation aspect of this iterative process as in Figure 26.

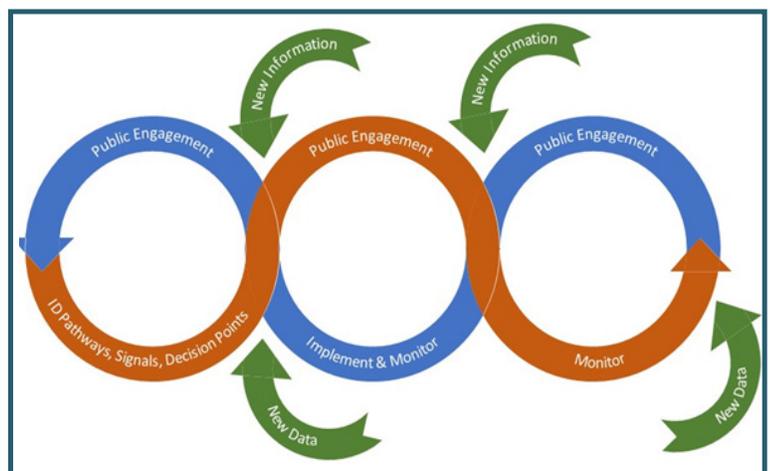


Figure 24. Public Participation in Adaptation Planning

## Sample Overlay and Policies

For this example, the medium-term scenario, shown in Figure 22 as both red and yellow, will delineate the area for the zoning overlay. The zoning area will be referred to herein as Tam Valley Sea Level Rise Zone (TVSLR Zone). The area includes both residential and commercial development, and the major throughways leading to nearby shopping and residential

areas, as well as the Hwy leading to everything north. Assuming that the County continues planning for restoration of Bothin Marsh, Action B from Figure 23, is a chosen pathway and the overlay policies presented here recognize that pathway. Some of the policies would apply to all areas of the shoreline impacted by sea level rise.

### SEA LEVEL RISE MONITORING

Monitoring sea level rise must take place on several levels. Sea level rise scenarios have changed considerably since 2008, when the state's highest scenario for 2100 was three feet of sea level rise. The highest 2017 scenarios for 2100 are five to 10 feet. The state and federal agencies monitor current trends and model scenarios then provide guidance based on those efforts. In addition to monitoring scenarios, an adaptation pathways approach requires monitoring to determine when indicators are triggered, such as signals and decision points. Policies should be included to direct local governments to follow updated state guidance and monitor local conditions. Specific language for monitoring indicators would depend on the type of indicator selected for a given overlay area. Direction for monitoring sea level rise guidance could read as follows:

*Marin County [or other local government] shall consider the best available and most recent scientific information with respect to the effects of long-range sea level rise when establishing sea level rise maps, scenarios, signals, and decision points. The County shall also support scientific studies that increase and refine the body of knowledge regarding potential sea level rise in Marin, and possible responses to it. Policies related to sea level rise should be reevaluated and modified as necessary.*

### WAIVER OF LIABILITY AND ASSUMPTION OF RISK

This provision would require a property owner who receives planning permit approval to record a document on behalf of themselves and successors and assigns assuming the risks associated with building in a flood area. The document is required as a condition of approval and best recorded as a deed restriction. It could acknowledge that:

- *The site is subject to flooding from a 100-year flood and/or sea level rise [attach a map showing overlay district flooding];*
- *Sea level rise may increase over time and compliance of the authorized development is based on current knowledge. Science suggests that increasing risk is likely;*
- *All risks from flooding are assumed by the property owner and any claim of damage or liability against the local government for personal or property damage resulting from such hazards are waived;*
- *Roadways and infrastructure that are damaged may be infeasible to repair or maintain and could be closed or abandoned, which may prevent continued habitation;*
- *Housing Code provisions prohibit the occupancy of structures where sewage disposal or water systems are rendered inoperable; and*
- *The applicant and assigns bear all responsibility for removing structures deemed and posted by the County [or other local government] as a public nuisance or dangerous pursuant to [cite the local government building code].*

## LAND DIVISIONS

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Land divisions generally must create developable lots and encourage development. Ensure that proposed residential lots include development envelopes that are sited outside of sea level rise overlay areas.

## ACQUISITION PROGRAM

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The recommendation from the acquisition case study recognizes that an acquisition program or financial assistance program of some sort may be feasible, given the existing resources and variety of methods for securing them. Since this example includes possible retreat at a later date, a policy could be worded as follows, but could be applicable countywide:

*Explore [or work with cities and towns to explore] the financial viability of an acquisition program that would use a variety of funding resources and tools for buyouts from willing sellers in TVSLR Zone. Seek funding to prepare a feasibility study to include, but not be limited to the following:*

- *Evaluate the potential for acquisition sites with willing sellers within unincorporated Marin as well as potential sites within cities and towns in Marin.*
- *Identify possible criteria for selecting acquisition sites.*
- *Identify possible funding sources for acquisitions, their reliability, and the resources required to receive such funding.*
- *Evaluate the feasibility of a nonprofit entity to administer or participate in an acquisition program.*
- *Evaluate appropriate uses of acquisitions sites, such as uses for open space, restoration, or rental use where such a use is safe a helps finance the acquisition.*

A policy like this can stand alone or be combined with a TDR policy, such as the policy in the current Countywide Plan. Another possibility is to combine acquisitions with a density bonus program. Note, however, that both programs are complex, requiring a great deal of staff time to implement. Furthermore, lack of available receiver sites will make the program infeasible. Marin County is already challenged to meet affordable housing requirements and density bonuses for sea level rise adaptation may place an additional burden on affordable housing stock. Before investing in either a density bonus or TDR program, it is necessary to identify and assess possible receiver sites to ensure the program's success and limit interference with other high-priority programs.

## SHORELINE PROTECTION

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With the likely formation of GHADs and the greater need for shoreline protection, the earlier recommendation in the GHAD case study called for clear direction that living shoreline flood protection measures are preferred to gray infrastructure for protection from near to medium-range sea level rise scenarios. Policies could simplify permitting for tidal marsh restoration, to the extent the local government review would be the cumbersome part of the approval process. They could include the following:

- *Require applicants for hard shoreline protection projects to demonstrate that nature-based alternatives are not available or will not provide the desired protection. Applicants should submit engineering reports and analysis of a range of living shoreline protection strategies that explains why a living shoreline approach is infeasible at the project location.*
- *Marsh restoration projects under five acres that qualify for a CEQA Categorical Exemption subject to CEQA Guidelines 15333, Class 33, are exempt from permitting.*

## REASONABLE INTERIM USE OF PROPERTY

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The City of San Rafael is in the process of updating its General Plan and looking at adaptation policies. This policy comes from one of their early drafts and serves to allow landowners reasonable interim use of property in areas where development is presently constrained by factors such as circulation system capacity, infrastructure, and natural hazards, such as flooding.

*Ensure that zoning regulations include provisions for reasonable interim uses for properties where the highest and best use allowed by zoning is not presently attainable due to traffic capacity, infrastructure, natural hazards (including sea level rise), and other factors. Examples of reasonable interim uses include contractor's yards, modular office and storage, new car storage, and outdoor recreation.*

## DEVELOPMENT GUIDELINES

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The guidelines here are divided by two possible paths: adapt in place and/or regulate existing development to protect public safety. The first assumes that there will be substantial redesign of developed areas to accommodate flooding. The second is a more standard regulatory approach focused on requirements that ensure development is safe from flooding to the maximum extent given current development patterns and constraints.

**1. Adapting in place** strategies might include redesigning entire elevated or floating neighborhoods surrounded by tidal marsh and tidal sloughs. Marin County already has examples of floating houseboat marinas and elevated homes on boardwalks. While those marshes might not be pristine, they might provide a much better alternative than hard shoreline protection. In the TVSLR Zone, what happens to the development on the bayside of the major roadways when the marsh can no longer migrate inland? One option might be to create a floating neighborhood. This policy is meant to provide big-picture guidelines and start early planning so that, where it is appropriate, a redesign can actually happen.

- Host a design competition for the Tam Valley neighborhood on the bay side of Hwy 101, Hwy 1, and Altamont Blvd., from Waldo Point Harbor to the area where the bike trail meets Altamont Blvd. Encourage affordable designs, such as modular construction or co-housing, provided that density is consistent with the TVSLR Zone.
- Explore regulatory barriers for innovative neighborhood designs, such as floating or elevated neighborhoods that accommodate flooding. Examine barriers for transforming shorelines from intermittently flooded to fully flooded and creating future marsh habitat in areas that are currently dry.

**2. Regulate existing development** by requiring applicants to demonstrate that structures will minimize risks to life and property [using one or all of the following guidelines]:

- New structures on undeveloped lots will be sited to reduce flood risk to the maximum extent feasible. Where siting options are limited, applicants are encouraged to explore other forms of development that respond to changing conditions, such as mobile structures that can be removed more easily before or after a flood, elevated structures, tiny homes, or structures that can float.
- Structures will be designed to withstand flooding by elevating so that the minimum floor elevation incorporates additional freeboard comparable to one foot above the projected flood depth under 42 inches of sea level rise (the medium-term scenario). (This standard could be included in areas where elevation is determined appropriate. It would be used with the maximum height policy below.)
- The development will provide for adequate ingress/egress for all applicable service connections (e.g., for water, wastewater, electricity, gas, or private roads, etc.), all of which shall be sited and designed to minimize impacts from flooding.
- The development will not have an adverse impact on public access to or along the shoreline.



## MAXIMUM BUILDING HEIGHTS

This policy would be for use in areas where building elevation is required and resulting building heights don't conflict with existing planning documents.

*New development that is elevated on an undeveloped lot may build above the height limitation of the existing zoning district by a distance comparable to the elevation distance above Base Flood Elevation. Existing development may build above the height limitation of the existing zoning district by a distance comparable to the elevation distance above Base Flood Elevation or, where necessary, can receive a height exemption where meeting the height limit would require removing part of the roof.*

The TVSLR Zone policies presented here provide an example of how an overlay can consider capital projects and location to create opportunities for adaptation. Some of the policies selected came directly from the tools discussed with local planning directors in Marin, some came from recommendations included in the report, and others were specific to the location and area. Likewise, some of the policies included in the overlay could apply across the entire bay shoreline in an expanded SLR overlay. Others are more specific to the sample TVSLR Zone.

## RECOMMENDATIONS

- ▶ Consider a shoreline overlay and policies similar to those herein that corresponds geographically to future flooding, provides guidance for adaptation, and uses an adaptation pathways approach to tie capital improvement decisions to policy decisions.



## CONCLUSION AND RECOMMENDATIONS

Adaptation land use planning requires developing policies that anticipate future impacts without placing an undue burden on property owners before impacts occur. The adaptation pathways approach sets out a process with multiple pathways, provides signals to prepare for decisions points, and provides options for new paths forward to avoid reaching the adaptation threshold. Identifying signals ahead of time provides time to engage the public in decision-making on the next path forward. Multiple pathways also allow multiple jurisdictions more options for coordinating approaches to shared sea level rise impacts. By including flood protection projects and infrastructure in signals and decision points, land use policies are also tied to capital planning.

Included in this report is a series of recommendations, which are included below. The Countywide Plan recommendations are specific to unincorporated Marin. The other recommendations are for local governments to consider and/or to begin

conversations about how we consider them together.

The overlay policies are options for consideration in a specific shoreline area as an example of how an adaptation pathways approach can lead to policy development. The size and reach of each shoreline area considered for adaptation should be determined by the sea level rise scenario, the topography, impacts, and the communities affected.

The next steps are to pursue the recommendations in this report. For unincorporated Marin, some recommendations will help in planning to update the Countywide Plan and some will be pursued as part of that update. An additional next step may be to identify more potential overlay areas and adaptation pathways them with actual signals, decisions points, and thresholds. This requires a deeper analysis of risks, shoreline protection options in that area, and community engagement.

## **Countywide Plan, Biological Resources Recommendations:**

- Update Countywide Plan Bio-5 policies to better accommodate living shorelines adaptation projects.
- Advocate with state and federal resource agencies for new policies that make living shorelines projects more feasible by recognizing the long-term habitat and biodiversity benefits.
- Explore expanding and aligning the Baylands Corridor in the Countywide Plan and Bayfront Conservation Area (BFC) in the Development Code to align both the geographic extent and the policy direction. The geographic extent should include areas subject to future flooding and the policies should promote adaptation in those areas.
- Advocate with state and federal resource agencies for new policies that make living shorelines projects more feasible by recognizing the long-term habitat and biodiversity benefits.

## **Countywide Plan, Environmental Hazards Recommendations:**

- Update policies to be adaptive to future sea level rise projections, to require broad public education about future sea level rise, and to include policies specific to Marin County that also conform to the State sea level rise guidelines issued through the Ocean Protection Council.
- Explore changes to the BFC overlay that correspond in area to sea level rise flooding scenarios and include flexible policies that allow area-specific adaptation strategies, which consider topography, existing adaptation measures, and other specific conditions.
- Update policy Eh-3.k to guide the County's monitoring efforts in a manner more consistent with current efforts and to require more specific adaptation measures that will not conflict with more comprehensive adaptation strategies.
- Implement Policy EH-3.d as it now reads and consider expanding the notification requirements.

## **Shared Impacts Recommendation:**

Begin conversations between jurisdictions with shared sea level rise impacts. Perform in depth analysis of specific areas and/or impacts to identify common goals and possible strategies.

## **Living Shorelines Recommendations:**

- Develop policies that promote a living shorelines approach to adaptation.
- Continue to pursue living shorelines projects on the shoreline.
- Rule out a no action approach.

## **Acquisition Program Recommendations:**

- Retain a financial analyst to explore the financial viability of an acquisition program that would use a variety of funding resources and tools for buyouts, including eminent domain, the Severe Repetitive Loss program, conservation easements, and other voluntary programs.
- Explore and identify Countywide potential receiver sites for Transfer of Development Rights (TDR) programs. TDR programs are complex and require significant staff time to implement. Pursuing a TDR program should be done only where receiver sites are feasible.

## **Tax Program Recommendation:**

Explore a sales tax to provide flood protection in lieu of a special property tax. In areas where businesses generate substantial sales, a sales tax can ensure that flood protection is paid for by the users of those services who may live outside the city or town providing them.

## **GHAD Recommendations:**

GHADs may form to take on shoreline projects. Develop policies that do the following:

- Provide clear direction that living shorelines flood protection measures are preferred to gray infrastructure for protecting from medium-range sea level rise scenarios.
- Provide permit exemptions for marsh restoration projects that qualify for a CEQA Categorical Exemption subject to CEQA Guidelines 15333, Class 33, which applies to small habitat restoration project not to exceed five acres in size and provides an exemption for "restoration, enhancement, or protection of habitat for fish, plants, or wildlife." Examples of small restoration projects may include... "wetland restoration, the primary purpose of which is to improve conditions for waterfowl or other species that rely on wetland habitat."



- Recognize that marsh restoration projects may involve temporary impacts to marsh habitat that are necessary to sustain the marsh over the long term. Healthy marshes grow at specific tidal elevations and marsh accretion must keep pace with sea level rise to endure over the long term.

### **Adaptation Planning Recommendation:**

Use a modified adaptation pathways approach to coordinate capital and land use sea level rise planning and coordinate planning where impacts are shared by jurisdictions.

### **Sample Overlay Recommendation:**

Consider a shoreline overlay and policies similar to those herein that corresponds geographically to future flooding, provides guidance for adaptation, and uses an adaptation pathways approach to tie capital improvement decisions to policy decisions.

### **Concluding Recommendations:**

- In addition to the recommendations above, sea

level rise outreach and education should continue in Marin. Neighborhoods should be informed of their risks and of their options. They should receive information about GHADs and/or special districts so they can begin planning at the neighborhood level. To increase awareness, the County could sponsor a design competition for adapting in place as described in the “Adapt in Place” policy in the overlay.

- Engage with the community to develop a process for setting sea level rise adaptation goals, which can provide direction for future projects. Examples of such goals could include the following: (1) promote in-place adaptation; (2) facilitate community-based financing of adaptation improvements; (3) prevent substantial housing loss from sea level rise; (4) encourage living shorelines; and (5) support community design innovation.
- From the Adapt in Place policy in the TVSLR Zone, explore regulatory barriers for innovative neighborhood redesigns and new designs, such as floating or elevated neighborhoods that accommodate flooding. Examine barriers for transforming shorelines from intermittently flooded to fully flooded and creating future marsh habitat in areas that are currently dry.
- Coordinate on an approach to planning that integrates the impacts of climate change.

# **APPENDIX A**

## LOCAL SEA LEVEL RISE ADAPTATION

TOOLS, DESCRIPTIONS, AND CAVEATS

\*\*Caveats and other notes are found in the footnotes

## Planning Tools

- ▶ **Plans**<sup>19</sup> – used by governments to manage a defined area’s future, particularly in terms of development.
  - **General (or Comprehensive) Plan**<sup>20</sup> – “The General Plan sets forth the goals, policies and directions the City will take in managing its future. The General Plan is the citizens’ ‘blueprint’ for development; the guide to achieving [the] vision. California law requires each local government to adopt a local General Plan, which must contain at least seven elements: Land Use, Transportation, Housing, Conservation, Noise, Open Space and Safety,” (Long Beach Planning).
  - **Local Coastal Program** (comprised of the Land Use Plan (LUP) and the Implementation Plan (IP)) – “...basic planning tools used by local governments to guide development in the coastal zone, in partnership with the [California] Coastal Commission,” (California Coastal Commission).
  - **Metropolitan Transportation Plan** – “Each metropolitan planning organization (MPO) must prepare a Metropolitan Transportation Plan (MTP), in accordance with 49 USC 5303(i), to accomplish the objectives outlined by the MPO, the state, and the public transportation providers with respect to the development of the metropolitan area’s transportation network,” (Federal Transit Administration 2015).
  - **Hazard Mitigation Plan** – “...allows a locality to identify policies and actions to reduce the risks from hazards. To be eligible for federal disaster and flood insurance, localities must have a regularly updated hazard mitigation plan,” (Wetlands Watch).
  - **Capital Improvement Program (CIP)**<sup>21</sup> – “Guide future investments in public infrastructure based upon projections of the community’s growth,” (Grannis 2011).

## Regulatory Tools

- ▶ **Zoning**<sup>22</sup> – “Provide the legal framework that governs the use and development of land in a community. Zoning maps divide the community into different districts based upon the types of uses that are permitted,” (Grannis 2011).
  - **Overlay Zones/Districts**<sup>23</sup> – “Overlay zones superimpose additional regulations on an existing zone based upon special characteristics of that zone,” (Grannis 2011).
    1. **Sea Level Rise Zone** – areas that will be inundated by sea level rise (based on agreed upon models and scenarios).
    2. **Protection Zone** – “areas with critical infrastructure and dense urban development, where the locality will permit coastal armoring; local governments could require soft-armoring techniques be employed where feasible,” (Grannis 2011).
    3. **Accommodation Zone** – “areas where local governments will allow new development but may limit the intensity and density of new development, limit hard shoreline armoring, and require that structures be designed or retrofitted to be more resilient to flood impacts,” (Grannis 2011).
    4. **Retreat Zone** – “area where local governments will prohibit hard armoring, will limit or prohibit rebuilding of damaged structures, or require the removal or relocation of structures that become inundated,” (Grannis 2011).
    5. **Preserve Zone** – “areas where local governments will seek to preserve and enhance important natural resources, ecosystems, habitats, or flood buffers,” (Grannis 2011).

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<sup>19</sup> Often, including sea level rise in these types of plans are the first steps local jurisdictions can take. These plans can become a “home” for many of the other tools below. Adding sea level rise to various plans allows for public engagement, (Wetlands Watch).

<sup>20</sup> SB379 requires local governments to address climate change adaptation and resilience in the Safety Element of the General Plan, (CA SB. 379 2015).

<sup>21</sup> One tradeoff is that CIPs that limit development in certain areas can lead to decreased tax revenue, (Grannis 2011).

<sup>22</sup> Local governments often will need to adopt a zoning ordinance in order to regulate land use, (Grannis 2011).

<sup>23</sup> Overlay zones/districts are flexible tools that can facilitate other tools, such as rebuilding/redevelopment restrictions, transfer of development credits (or rights) programs, building codes, etc.

- **Special Districts** – “A governmental entity formed to deliver a specific service, like fire protection, water service, recreation or the maintenance of open space,” (Institution for Local Governments 2010).
- **Subdivision Ordinances** – “The division of a tract of land into defined lots, either improved or unimproved, which can be separately conveyed by sale or lease, and which can be altered or developed. The process often includes setting aside land for streets, sidewalks, parks, public areas, and other infrastructure needs, including the designation of the location of utilities,” (Institution for Local Governments 2010). They can be used to concentrate development in desirable areas.
- **Cluster Development**<sup>24</sup> – Used to concentrate development in desirable areas. “These programs allow developers to increase densities in specified areas in exchange for the developer’s agreement to designate open space,” (Grannis 2011).
- **Downzoning**<sup>25</sup> – changing zoning to reduce density.
- **Setbacks/Buffers**<sup>26</sup> – “Require that development be set back a distance from a baseline [...]. Require landowners to leave, in their natural state, portions of property that support natural and beneficial functions,” (Grannis 2011).
  1. **Fixed Mandatory Setbacks** – “require that all structures, including sea walls, be set back a specific distance from a predetermined point,” (Grannis 2011).
  2. **Erosion-Based Setbacks**<sup>27</sup> – “are determined by a projected shoreline position that assumes a specific increase in sea level and erosion rates over a specific time frame such as the life of the structure,” (Grannis 2011).
  3. **Tiered Setbacks** – “require a lesser setback or buffer for smaller structures and a greater setback for larger structures that are more difficult to move if they become damaged and put more people at risk,” (Grannis 2011).
  4. **Buffer Zones for Vulnerable Areas** – “An area of land separating two distinct land uses that softens or mitigates the effects of one land use on the other,” (Institute for Local Government 2010).
  5. **Wetland Buffers** – “...a setback area between a stream, river, or wetland and any upland development. It maintains the natural vegetation cover along the waterway, which is an essential part of the aquatic ecosystem,” (City of Portsmouth).
  6. **Vegetation Preservation Ordinance** – preserving existing vegetation to reduce the threat of erosion.
- **Density Zoning/Transfer**<sup>28</sup> – “A way of retaining open space by concentrating densities—usually in compact areas adjacent to existing urbanization and utilities—while leaving unchanged historic, sensitive, or hazardous areas. In some jurisdictions, for example, developers can buy development rights of properties targeted for public open space and transfer the additional density to the base number of units permitted in the zone in which they propose to develop,” (Institute for Local Government 2010).

► **Floodplain Management**<sup>29</sup> – “As a requirement to participate in the National Flood Insurance Program (NFIP), local governments must impose minimum regulations on development in floodplains. [...] Governments could impose additional restrictions on development in floodplains above NFIP minimum standards,” (Grannis 2011).

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<sup>24</sup> Cluster development can also be categorized under building codes/design standards. Cluster development requires substantial open space. It may be of limited use in already highly developed areas, (Grannis 2011).

<sup>25</sup> Downzoning (and low-density zoning) can reduce intensity of development but can also lead to sprawling land use, (Wetlands Watch).

<sup>26</sup> Setbacks/buffers can also be categorized under floodplain management and building codes/design standards. Although similar in design, setbacks and buffers often have different goals. While setbacks are commonly used to protect the built environment, buffers are typically used to protect the natural environment, (NOAA Office of Ocean and Coastal Resource Management 2010). Setbacks/buffers limit the amount of development on a property which can, in some cases, reduce the developmental value of the property. They may be a short-term solution depending on the long-term effects of sea level rise to a parcel, (Grannis 2011). Setbacks/buffers can help reduce repetitive loss by requiring them after a damaging event, (Reiblich, Wedding, Hartge 2017).

<sup>27</sup> Maui, Hawai'i has adopted a strict erosion based setback in order to avoid future potential takings claims. Erosion-based setbacks can be difficult for local jurisdictions to implement because they require scientific data, (Grannis 2011).

<sup>28</sup> Density Zoning/Transfer can be used to facilitate transfer of development credits (or rights) programs or the purchase of development rights.

<sup>29</sup> Most floodplain management tools can earn communities points under FEMA's CRS program.

- **Restricting/Reducing Development** – restricting or reducing allowable uses of land.
- **Open Space Regulations** – incentivizing open space through floodplain regulations.
- **Cumulative Substantial Improvement Ordinances**<sup>30</sup> - improvements, modifications, additions, and rebuilds are built to specific floodplain regulations.
- **Freeboard/Elevation Requirement**<sup>31</sup> - “...the elevation of a building’s lowest floor to a height above the minimum base flood elevation (BFE) during the initial construction process,” (Wetlands Watch).
- **Policy Prohibiting Hazardous Materials in the Floodplain** – ordinance prohibiting specific hazardous materials (i.e. ammonia, sulfur, acetone, etc.) in the floodplain, (FEMA).
- **Prohibiting/Limiting Enclosures** – prohibiting or limiting enclosure uses under an elevated structure.
- **Community Rating System (CRS) Program Participation**<sup>32</sup> - participation in FEMA’s CRS program entails going above and beyond NFIP requirements for floodplain management. Participation also affords landowners reduced flood insurance rates.
- **Limiting/Prohibiting Fill for Elevation** – prohibiting or limiting using fill for structure elevation.
- **Policy for Protection of Critical Infrastructure** – policy ensuring the protection of infrastructure that is critical to health and safety before, during, and after a flood, including hospitals, emergency response, nursing homes, shelters, and infrastructure that could worsen impacts such as hazardous materials facilities, power generation facilities, wastewater treatment plants, etc., (FEMA 2017).
- **Extending V-Zone Standards to A-Zone**<sup>33</sup> - extending V-Zone (areas subject to additional damage from wave action in the 100-year floodplain) standards to the A-Zone (100-year floodplain), (FEMA 2017).

► **Building Codes/Design Standards**<sup>34</sup> – “Establish requirements for building construction to maximize protection from flooding,” (Grannis 2011).

- **Compact Development/Designs**<sup>35</sup> – The intent is... “To encourage development in existing areas to conserve land and protect farmland and wildlife habitat. To promote livability, walkability, and transportation efficiency, including reduced vehicle distance traveled,” (U.S. Green Building Council).
- **Flood-Resistant Building Materials** - using flood resistant or flood-proof building materials in construction or renovation to enable floodable designs.
- **Floodable Designs** – building designs (including the use of flood-resistant building materials) that allow for a certain level of flooding with no or negligible damage.
- **Low Impact Development**<sup>36</sup> – “...systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat,” (EPA Jun 2017).

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<sup>30</sup> Cumulative Substantial Improvement Ordinances can also be categorized under rebuilding/redevelopment restrictions and in building codes/design standards.

<sup>31</sup> Freeboard/elevation requirements can also be categorized under building codes/design standards. These requirements are a “band-aid” short-term solution that do not move structures out of vulnerable areas. They can significantly increase building costs and can reduce or remove ADA access of structures. They may be constrained by height limitations. Although structures are elevated, floors, piles, and wiring are still subject to issues caused by flooding, such as rot, (Wetlands Watch). As sea levels rise and elevated houses are in the public trust, public access can be impeded.

<sup>32</sup> CRS program participation can also be categorized under building codes/design standards. Participation in the CRS program and using future projected flood rates (going beyond the base requirements of the NFIP) will be important as sea levels rise as the NFIP’s flood insurance rate maps (FIRMs) are based on historical data, (Grannis 2011). Many of the other tools in this document are included in CRS program participation, such as: freeboard/elevation requirement, prohibiting/limiting enclosures, limiting/prohibiting fill for elevation, policy for protection of critical infrastructure, extending V-Zone standards to A-Zone, flood-resistant building materials, and more. Participation in the CRS program lowers flood insurance costs for landowners which can increase its political support and implementation, (Grannis 2011).

<sup>33</sup> Extending V-Zone Standards to A-Zone can also be categorized under building codes/design standards.

<sup>34</sup> Building code and design standard enforcement is critical to their success. This can be achieved through permit approval, design and plan review, site visits, and continual training and education, (NOAA Office of Ocean and Coastal Resource Management 2010).

<sup>35</sup> Compact development/design is best paired with zoning that regulates development in the floodplain and other building codes. However, design can be difficult to implement in areas already heavily developed, (NOAA Office of Ocean and Coastal Resource Management 2010).

<sup>36</sup> Low impact development can also be categorized under urban greening for stormwater management.

► **Special Conditions/Conditional Development**<sup>37</sup> – “[Local governments can] impose special conditions as a condition of a development permit. Conditions can be designed to mitigate the impacts of development...” (Grannis 2011).

- **Impact Fees**<sup>38</sup> – “The developer is required to pay a fee to cover the costs of potential emergency response, future armoring, to mitigate impacts to natural resources from future armoring, to flood proof infrastructure that services the new development, [or other adaptation activities]” (Grannis 2011).
- **Exactions**<sup>39</sup> – “A contribution or payment required as an authorized precondition for receiving a development permit; usually refers to mandatory dedication (or fee in lieu of dedication) requirements found in many subdivision regulations,” (Institute for Local Governments 2010).
- **Land Use Restrictions** – land is restricted to specific (less intensive) uses.
- **Dedications** – “The landowner dedicates an easement to preserve natural buffers, floodways, or to provide public access,” (Grannis 2011).
- **Deed Restrictions** – “A private legal restriction on the use of land recorded in the deed. The restriction burdens or limits the use of the property in some way,” (Institute for Local Governments 2010).
- **Site Capacity/Performance Standards** - “...are based on the capacity of a site to sustain new development. Local municipalities may analyze local site conditions on developable property to determine the extent and type of development the site can or should sustain based on its unique conditions,” (Land Use Law Center, Pace University School of Law 2008).
- **Special Area Ordinances** – “...adopted to protect sensitive resources facing development pressures or risks from threats including sea level rise. Regulations governing such areas may require that proposed development undergo scrutinized environmental impact assessments; may prohibit uses other than non-intensive recreational ones; or may divide land within the critical area into classifications supporting development, limited development, and strict resource conservation,” (Land Use Law Center, Pace University School of Law 2008).

► **Rebuilding/Redevelopment Restrictions**<sup>40</sup> – “Limit a property owner’s ability to rebuild structures destroyed by natural hazards...” (Grannis 2011).

- **Limited Rebuilding** – “Landowners are allowed to build smaller, more resilient structures to replace older, damaged structures; or landowners could be required to provide for additional setbacks,” (Grannis 2011).
- **Prohibited Rebuilding** – “Landowners are prohibited from rebuilding destroyed properties when they are located in identified flood- or erosion-prone areas; or landowners are prohibited from rebuilding structures that have been repetitively damaged,” (Grannis 2011).
- **Conditional Rebuilding** – “Landowners are allowed to rebuild properties largely as they were but with the condition that they will not build protective armoring or that they will remove structures when threatened by erosion or inundation,” (Grannis 2011).

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<sup>37</sup> Special conditions/conditional development can be politically unpopular as they can increase development costs, reduce the structure’s life, or decrease the amount of space for development. Since conditions are often negotiated between landowners and regulators, inconsistencies can occur. Zoning ordinances must include the consideration of sea level rise or other relevant criteria for regulators to exact conditions, (Grannis 2010). Several special conditions/conditional development tools present a takings risk. Governments can prevent a takings challenge here by articulating essential nexus + rough proportionality, (Wolf 2013).

<sup>38</sup> Impact fees can also be categorized under adaptation funding mechanisms.

<sup>39</sup> Exactions can also be categorized under market-based tools as a way of acquiring property.

<sup>40</sup> Rebuilding/redevelopment restrictions are not proactive and therefore may not reduce risk immediately. They require a structure to be significantly damaged before implementation. They can be politically unpopular, especially in large-scale rebuilding periods (post disastrous events). Restrictions for repetitive-loss structures can be more feasible, (Grannis 2011).

- **Non-Conformities** – “A use that was valid when brought into existence, but by subsequent regulation becomes no longer conforming. It is a generic term and includes (1) non-conforming structures (by virtue of size, type of construction, location on land, or proximity to other structures), (2) non-conforming use of a conforming building, (3) non-conforming use of a non-conforming building, and (4) non-conforming use of land. Thus, any use lawfully existing on any piece of property that is inconsistent with a new or amended general plan, and that in turn is a violation of a zoning ordinance amendment subsequently adopted in conformance with the general plan, will be a non-conforming use. Typically, non-conforming uses are permitted to continue for a designated period of time, subject to certain restrictions,” (Institute for Local Governments 2010). Reconstruction or improvements made to non-conforming structures can require the structure to come into conformity with various zoning regulations.
- **Development/Redevelopment Moratorium**<sup>41</sup> – “...a local law or ordinance that suspends the right of property owners to obtain development approvals while the community takes time to consider, draft, and adopt land use plans or rules to respond to new or changing circumstances not adequately covered by its current laws...” (Land Use Law Center, Pace University School of Law 2008).
- **Protection Permitting/Prohibition** – a policy to regulate or facilitate shoreline protection.
  1. **Hard-Armoring Permitting Policy** - “Using permitting processes to regulate the construction of hard-engineered structures that provide flood and erosion control,” (Grannis 2011).
  2. **Time Limited Hard-Armoring** – setting time limits on the life of hard- armoring structures
  3. **Natural or Nature-Based (or Green/Soft) Infrastructure Permitting Policy** – A policy to, “[f]acilitate ‘soft’ coastal protection projects that replenish or mimic natural buffers...” (Grannis 2011).
  4. **Prohibition of Hard-Armoring**<sup>42</sup> – the prohibition or restriction of hard-armoring as flood protection.
  5. **Assumption of Risk** – landowner assumes the risk (of flooding, sea level rise, wave action, erosion, etc.) as well as the injury and damage from such risks.
  6. **Waiver of Liability** – landowner waves any claim or liability.
  7. **Indemnity** – permitting authority will be exempt from any and all damages or losses.

## Market-Based Tools

► **Tax and Other Development Incentives**<sup>43</sup> – Encourage preferred patterns of development with mostly monetary incentives.

- **Tax Abatement (or Deferral) Programs** – “[Programs] freeze, for a specified period of time, increases in property taxes if the property is used for a specific purpose,” (Grannis 2011).
- **Tax Credit Programs**<sup>44</sup> – “[Programs] provide a one-time credit against business, personal income, or property tax,” (Grannis 2011).
- **Relocation/Retrofit Tax Incentives** – tax incentives for relocation away from vulnerable areas or for retrofitting development to accommodate flooding.
- **Siting Incentives** – tax incentives to site development in a certain location.
- **Land Use Value (or Preferential) Assessments**<sup>45</sup> – “...lower tax assessments to landowners who agree to preserve their property... Taxes are assessed based upon the property’s current use value, not its potential use value. In this way...assessment programs remove the incentive of property owners to develop property to keep pace with property tax increases,” (Grannis 2011).

<sup>41</sup> Development/redevelopment moratoriums are often used after a large disaster to allow government officials time to evaluate and plan redevelopment in devastated areas, (Grannis 2011).

<sup>42</sup> The prohibition of new hard-armoring presents a takings risk but can be avoided by identifying background principles, (Wolf 2013).

<sup>43</sup> Tax incentives can lead to a loss in tax revenue and to an expectation that compensation comes with all development restrictions, (Grannis 2011).

<sup>44</sup> Tax credit programs are often used to encourage redevelopment in blighted areas, (Grannis 2011).

<sup>45</sup> In land use value assessments, development is not restricted in perpetuity which may increase social acceptability but also may deem them temporary solutions. Additional parcels can be easily added to land use value assessment districts, (Wetlands Watch).

- **Transferable Development Credits (or Rights) Programs**<sup>46</sup> – “Restrict development in one area and allow for the transfer of development rights to another area more appropriate for intense use.” Includes the creation of a development rights bank and identification of “sending and receiving” areas, (Grannis 2011).

► **Adaptation Funding Mechanisms** – mechanisms used to fund sea level rise adaptation.

- **Special Assessments** – “...charges levied on property to pay for benefits received from some local improvement,” (Reiblich, Wedding, Hartge 2017).
- **Geological Hazard Abatement Districts (GHADs)**<sup>47</sup> – “...a special district formed to prevent, mitigate, abate, or control some geologic hazard,” (Reiblich, Wedding, Hartge 2017).
- **County Service Areas**<sup>48</sup> – “A type of special district that may provide any service that a county may provide in unincorporated areas. The service must not be one that the county already provides to the same extent on a countywide basis. County Service Areas are commonly used for road and drainage maintenance in new subdivisions. The basic premise of a County Service Area is to fund a service that the county would not otherwise be able to fund through traditional sources, like property tax or sales tax. County Service Areas are governed by the county board of supervisors and funded by a direct assessment paid by property owners who benefit from the services provided,” (Institutional for Local Governments 2010).
- **Redevelopment Agencies**<sup>49</sup> – “A local agency created by a city or county to promote the redevelopment of blighted areas. Redevelopment agencies identify blighted areas, then create and implement plans to redevelop those areas. They may work with other public agencies or private partners in implementing redevelopment plans. Redevelopment agencies have authority to acquire real property, the power of eminent domain, authority to develop and sell property without bidding, and the authority and obligation to relocate persons displaced by redevelopment. Redevelopment agencies can use a variety of financing tools, including Tax Increment Financing, selling bonds, and borrowing from federal or state governments, or private sources,” (Institute for Local Governments 2010).
- **Catastrophe Bonds**<sup>50</sup> – “...insurance schemes that offer more risk-bearing capacity than traditional insurance policies. These bonds are a mechanism for creating reinsurance for a set time period in a specific location,” (Reiblich, Wedding, Hartge 2017).
- **Mello-Roos Bonds** – “Locally issued bonds that are repaid by a special tax imposed on property owners within a community facilities district established by a public agency. The bond proceeds can be used for public improvements and for a limited number of services,” (Institute for Local Governments 2010).
- **Community Preservation Funds** – “Community preservation monies are raised locally through the imposition of a surcharge of not more than 3% of the tax levy against real property, and municipalities must adopt [the Community Preservation Act] by ballot referendum,” (Community Preservation Coalition).
- **Stormwater Management Fees** – a fee (often based on the amount of impervious area on a parcel or other base amounts) to fund stormwater management activities (Storm Water Management Program, City of Palo Alto 2016).
- **Environmental Impact Bond** – a bond to help finance natural (or green) infrastructure to manage stormwater runoff (DC Water, Goldman Sachs, Calvert Foundation 2016).

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<sup>46</sup> Transferable development credits (or rights) programs are not widely implemented because of the difficulty in correctly calibrating the market as well as their volunteer nature. Often, both the sending and receiving areas need to be downzoned, (Grannis 2011). They can also be administratively complex, (Wetlands Watch). These programs are also a zoning tool and can be paired with overlay zones to identify sending and receiving areas. To ensure that sending areas are preserved, sending landowners should execute a permanent conservation easement, (Herzog and Hecht 2013). These programs may give the perception of an economic loss, (Wetlands Watch).

<sup>47</sup> Although GHADs have freedom and power, they are not democratic and can be expensive to form and maintain, (Reiblich, Wedding, Hartge 2017). GHADs are a type of special district and can also be categorized under zoning tools.

<sup>48</sup> County Service Areas can also be categorized under zoning tools as a type of special district.

<sup>49</sup> Redevelopment Agencies have since been dissolved in CA but have been replaced by Community Revitalization and Investment Authorities with similar objectives (CA AB. 2 2015).

<sup>50</sup> If multiple catastrophic events occur unexpectedly, catastrophe bonds may end up losing money, (Reiblich, Wedding, Hartge 2017).

► **Spending Tools** – sea level rise adaptation tools requiring spending.

- **Acquisitions**<sup>51</sup> – “Acquire property at risk from flooding or other hazards,” (Grannis 2011).
  1. **Buyouts**<sup>52</sup> – purchasing of private property.
  2. **Eminent Domain** – “The power of the government to take private property and convert it into public use. The Fifth Amendment provides that the government may only exercise this power if they provide just compensation to the property owners,” (Cornell Law School Legal Information Institute 2007).
  3. **Conservation Easements**<sup>53</sup> – “Provide a flexible mechanism by which public entities can preserve land in its natural state while allowing land to remain in private ownership. Landowners grant an easement agreeing to restrict development of the land often for compensation or tax benefits,” (Grannis 2011).
  4. **Rolling Conservation Easements**<sup>54</sup> – “[Local governments can] adapt conservation easements to provide a rolling boundary that is designed to preserve the ability of the shoreline to migrate inland,” (Grannis 2011).
  5. **Land Banking** – “The purchase of land by a local government for use or resale at a later date,” (Institution for Local Governments 2010).
  6. **Purchase of Development Rights**<sup>55</sup> – “...similar to a [transfer of development rights program], without the created market to facilitate the transfer of development rights. Localities preserve open space by purchasing future development rights...” (Wetlands Watch).

► **Other Market-Based Tools**

- **Real Estate Disclosures**<sup>56</sup> – “Require sellers of real estate to disclose certain property defects to prospective buyers prior to close,” (Grannis 2011).

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<sup>51</sup> Lack of full buyout program participation in an area can lead to a “checkerboard” effect that can lead to decreased property value, blight, and increased vulnerability, (Grannis 2011). Particular attention needs to be paid as to where residents are relocated to avoid increasing overall vulnerability of relocated residents, (McGhee 2017).

<sup>52</sup> Buyouts can have high up-front costs and can result in loss of tax revenue, (Grannis 2011).

<sup>53</sup> Conservation easements are also a tax incentive as the federal government provides a tax deduction to landowners who donate an easement exclusively for conservation, (Grannis 2011). They can occur on the subdivision or regional scale for a more coordinated approach to shoreline management, (NOAA Office of Ocean and Coastal Resource Management 2010). Partnerships with land trusts or other conservation entities is essential for maintaining stewardship of land, (Wetlands Watch).

<sup>54</sup> Rolling conservation easements can reduce property value in the short-term but overall is less costly than total prohibition of development. They will also require removal and prohibition of hard coastal armoring to allow coastal habitats to migrate in-land. They only bind the specific property so as that property is inundated, the easement would terminate. Rolling conservation easements are largely untested. Legal challenges may be brought forward by several different owners as properties are inundated over time. To ensure their success, terms need to be crafted carefully, (Grannis 2011). It is currently unclear how rolling conservation easements will be applied in relation to the CA Coastal Act, (Reiblich, Wedding, Hartge 2017). The CA Climate Adaptation Strategy encourages local jurisdictions to explore rolling development restrictions for sea level rise adaptation, (Herzog and Hecht 2013).

<sup>55</sup> Purchase of development rights is an appropriate tool for localities facing development pressures. Communities with strong tourism industries benefitting from open space preservation have had success with purchasing development rights, (Wetlands Watch).

<sup>56</sup> Real estate disclosures can decrease the value (and tax revenue) of a property, (Grannis 2011).

## Engineering Tools<sup>57</sup>

### ► **Hard-Armoring<sup>58</sup>** – traditional engineering approach of physical shoreline protection.

- **Shore Parallel** – hard-armoring parallel to the physical shoreline. “These structures help hold the land back from the sea and the sea back from the land and/or dissipate wave energy,” (NOAA Office of Ocean and Coastal Resource Management 2010).
  1. **Seawalls** – “...a type of built structure designed to protect against encroaching seas. [...] They are built parallel to the shoreline and usually consist of concrete, wood, steel, or a mixture of these materials,” (Reiblich, Wedding, Hartge 2017).
  2. **Bulkheads** – retaining wall to protect against wave action (U.S. Army Corps of Engineers 1995).
  3. **Revetments** – “...a shoreline protection structure compromised of large rocks atop a durable cloth,” (Reiblich, Wedding, Hartge 2017).
  4. **Breakwaters** – “...hard engineered structures designed to impede swells from reaching the shore,” (Reiblich, Wedding, Hartge 2017).
  5. **Riprap** – rock or other rubble used to protect the shoreline.
- **Shore Perpendicular** – hard-armoring perpendicular to the physical shoreline. “These structures interrupt sediment transport and trap sediment to build/rebuild beaches and/or stabilize navigational channels and inlets, (NOAA Office of Ocean and Coastal Resource Management 2010).
  1. **Jetties** – “...a long, narrow structure that protects a coastline from the currents and tides,” (National Geographic Society 2012).
  2. **Groins** – “...a structure that is perpendicular to the shoreline and extends into the water. They function in trapping sand moving in the along-shore currents,” (Center for Coastal Resources Management at the Virginia Institute of Marine Science).
- **Large Flood Control Structures** – large engineered structures used to control flood waters.
  1. **Tide-Gates** – large gate that allows tide to flow in one direction and closes in the other to prevent large scale flooding.
  2. **Levees** – embankment to control the flow and direction of a river.
  3. **Dikes** – large-scale wall to prevent flooding.
- **Traditional Stormwater Management<sup>59</sup>** - used to reduce runoff and improve water quality (EPA Mar 2017).
  1. **Wider Drainage Ditches** - can allow for more flow.
  2. **Updating/Adding Pumps** – can prevent drainage systems from becoming overwhelmed.
  3. **Larger Pipes/Culverts** - can allow for more flow.
  4. **Converting Culverts to Bridges** – can allow for more flow.

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<sup>58</sup> There are many hard-armoring adaptation options. Some of the most common are listed here. Hard-armoring has several negative impacts. It can cause erosion, increased flooding (and therefore, decreased property value) of neighboring properties. It can prevent the upland migration of wetlands and beaches, causing them to drown. It can lead to a false sense of security and increase development in vulnerable areas. It can impede public access and destroy recreation and aesthetic values, (Grannis 2011). Hard-armoring devices can be expensive to build, maintain, and repair, (Wetlands Watch). Where hard-armoring is allowed, an exaction can be used to maximize public access, aesthetic value, and ecological protection. If a hard-armoring structure causes permanent flooding to a neighboring property, a takings challenge may be made, (Herzog and Hecht 2013).

<sup>59</sup> There are many traditional stormwater management tools. Some of the most common are listed here.

► **Natural or Nature-Based (or Green/Soft) Infrastructure**<sup>60</sup> – “...using natural ecological systems or processes to reduce vulnerability to climate change related hazards while increasing the long-term adaptive capacity of coastal areas by perpetuating or restoring ecosystem services,” (California 4th Climate Assessment).

- **Living Shorelines**<sup>61</sup> – “Any shoreline management system that is designed to protect or restore natural shoreline ecosystems through the use of natural elements and, if appropriate, manmade elements. Any elements used must not interrupt the natural water/land continuum to the detriment of the natural shoreline ecosystem,” (Restore America’s Estuaries 2015).
  1. **Wetland Restoration**<sup>62</sup> – “...allow[s] tidal wetlands to proliferate in areas that have been diked or otherwise altered from their original conditions,” (Reiblich, Wedding, Hartge 2017).
  2. **Beach Nourishment/Replenishment**<sup>63</sup> – “...the artificial placing of sand on a beach to replace eroded sand or to protect against future erosion,” (Reiblich, Wedding, Hartge 2017).
  3. **Dune Management/Restoration** – “...an engineered project to restore eroded dune systems,” (Reiblich, Wedding, Hartge 2017).
  4. **Sediment Management**<sup>64</sup> – “A systems approach to deliberately manage sediments in a manner that maximizes natural and economic efficiencies to contribute to sustainable water resource projects, environments, and communities,” (U.S. Army Corps of Engineers).
- **Urban Greening for Stormwater Management**<sup>65</sup> - the creation or improvement of green space in urban areas that increases groundwater recharge, reduces runoff, and improves urban watershed health.
  1. **Limiting/Prohibiting/Removing Impervious Surfaces**<sup>66</sup> – “In developed areas, impervious surfaces such as pavement and roofs prevent precipitation from naturally soaking into the ground. Instead, water runs rapidly into storm drains, sewer systems and drainage ditches and can cause: downstream flooding; stream bank erosion; increased turbidity from erosion; habitat destruction, combined storm and sanitary sewer system overflows; infrastructure damage; and contaminated streams, rivers and coastal water,” (EPA Mar 2017). Limiting or prohibiting impervious surfaces (i.e. traditional parking spaces) can reduce run-off.
  2. **Bioswales** – “...are storm water runoff conveyance systems that provide an alternative to storm sewers. They can absorb low flows or carry runoff from heavy rains to storm sewer inlets or directly to surface waters,” (Natural Resources Conservation Service 2005).
  3. **Rain Gardens** – “a depressed area in the landscape that collects rain water from a roof, driveway or street and allows it to soak into the ground. Planted with grasses and flowering perennials, rain gardens can be a cost effective and beautiful way to reduce runoff...” (EPA Jan 2017).

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<sup>60</sup> There are many natural or nature-based (or green/soft) infrastructure options. Some of the most common are listed here. See more examples here. Natural or nature-based (or green/soft) infrastructure can be less expensive than hard-armoring but needs regular maintenance and monitoring. It has many benefits beyond sea level rise (and flood) protection. It can provide critical habitat, filter runoff, and preserve recreation opportunities and aesthetic value, (Grannis 2011). It may not be appropriate in areas with high wave energy, (Wetlands Watch).

<sup>61</sup> For further clarity, NOAA defines living shorelines as, “... a broad term that encompasses a range of shoreline stabilization techniques along estuarine coasts, bays, sheltered coastlines, and tributaries. A living shoreline has a footprint that is made up mostly of native material. It incorporates vegetation or other living, natural “soft” elements alone or in combination with some type of harder shoreline structure (e.g., oyster reefs or rock sills) for added stability. Living shorelines maintain continuity of the natural land–water interface and reduce erosion while providing habitat value and enhancing coastal resilience,” (NOAA 2015).

<sup>62</sup> Several other adaptation tools are typically used in conjunction with wetland restoration. These include: removing or prohibiting hard-coastal armoring, acquisition of land, creation of buffer zones or setbacks, and cluster development or compact development/design, (NOAA Office of Ocean and Coastal Resource Management 2010).

<sup>63</sup> Beach nourishment/replenishment requires regular nourishment and may have negative environmental impacts depending on the removal and replacement methods, (Grannis 2011). It can increase property values of beachfront properties and increase recreational areas, (Herzog and Hecht 2013; Wetlands Watch). It is a “band-aid,” short-term strategy and can encourage development in hazardous areas. Nourished/replenished beaches can erode 2-3 times quicker than natural beaches, (Wetlands Watch).

<sup>64</sup> Successful sediment management includes all levels of government and impacted stakeholders, (NOAA Office of Ocean and Coastal Resource Management 2010).

<sup>65</sup> There are many urban greening for stormwater management tools. Some of the most common are listed here. Urban greening projects have many benefits other than stormwater management and climate adaptation. These can include: improved water quality, reduced urban heat island effects, improved air quality, increased walkability, and increased neighborhood safety.

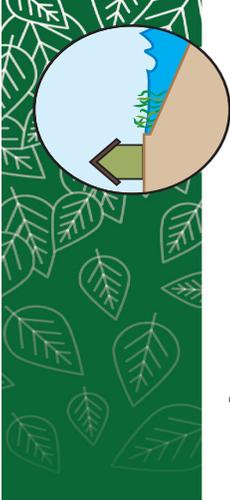
<sup>66</sup> Limiting/prohibiting impervious surfaces can also be categorized under building codes/design standards.

# **APPENDIX B**

# ADAPTATION MEASURES:

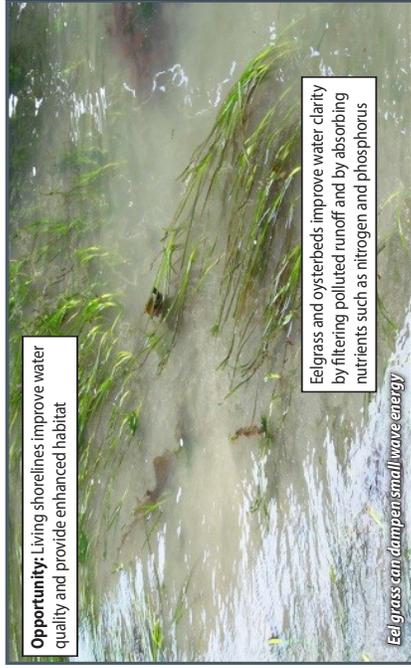
ACCOMMODATE, PROTECT, OR RETREAT  
FROM RISING SEA LEVEL

# Living Shoreline: Near Shore Biological Habitat



Living Shorelines projects use habitat restoration techniques to manage the shoreline, reduce coastal erosion, and maintain ecological processes while protecting, restoring, and creating natural habitat for aquatic flora and fauna. These techniques enhance habitat values and increase connectivity of wetlands and deeper intertidal and subtidal lands, while providing some amount of shoreline protection.

Eelgrass is most viable in estuarine areas such Tomales Bay, Bolinas Lagoon, and other shallow, low energy shoreline areas.

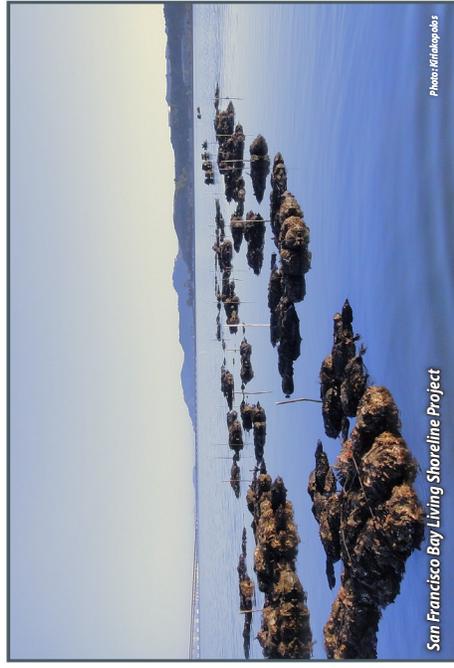


**Opportunity:** Living shorelines improve water quality and provide enhanced habitat

Eelgrass and oysterbeds improve water clarity by filtering polluted runoff and by absorbing nutrients such as nitrogen and phosphorus

*Eel grass can dampen small wave energy*

Living reefs can provide erosion and flood reduction in settings where waves are small and weak enough to be dissipated by the limited reef structures.



**San Francisco Bay Living Shoreline Project**

*Photo: Kitchygoats*

"Bio beds" is a term sometimes used to describe a group or cluster of living organisms designed to help improve water clarity and quality. They can be pre-assembled and constructed into the wetland, or grown through plantings.



*Photo: eelgrassbeds*

Oyster beds consist of a hard oyster settlement substrate of some type placed onto a supporting structure. Oyster bag mounds are placed on the base as an oyster recruitment structure. Treatment plots may be constructed parallel to shore with eelgrass beds later planted between the oyster structures.



**Oyster Reefs**

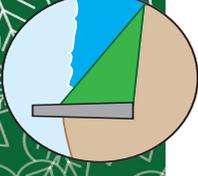
*Photo: External reefs*

## At a Glance

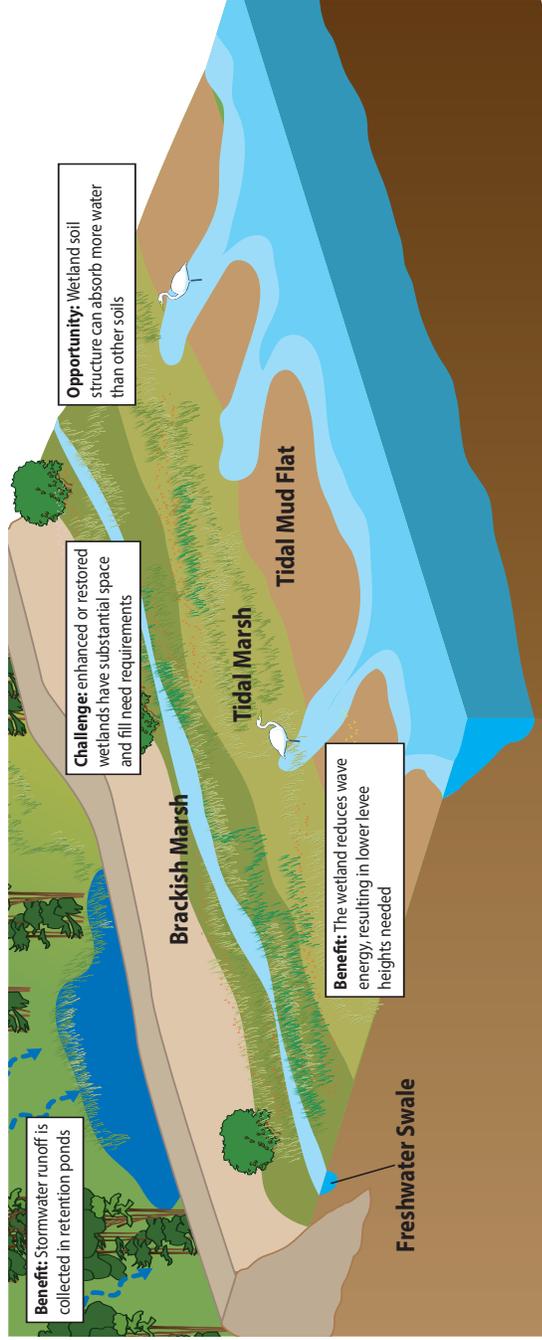
<b>Uses</b>	Near shoreline environments with low wave energy
<b>Things to Consider</b>	Help protect shoreline from wave action but do not address sea level rise
<b>Works best with</b>	Measures that lessen wave erosion or allow water flow
<b>Constructability</b>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Complex         </div> <div style="text-align: center;">  Medium         </div> <div style="text-align: center;">  Simple         </div> </div>
<b>Ecological Impacts:</b>	Access to habitat, habitat quality, and water quality
<b>Costs</b>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Negative         </div> <div style="text-align: center;">  Neutral         </div> <div style="text-align: center;">  Positive         </div> </div> <p>\$\$\$\$\$</p>
<b>Visual Changes and Appeal</b>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Negative         </div> <div style="text-align: center;">  Neutral         </div> <div style="text-align: center;">  Positive         </div> </div>
<b>Changes to Public Access</b>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Negative         </div> <div style="text-align: center;">  Neutral         </div> <div style="text-align: center;">  Positive         </div> </div>
<b>How it works</b>	<ul style="list-style-type: none"> <li>Living flora and fauna can provide protection to the shoreline by dampening small wave energy</li> <li>The right species are identified based on the local ecosystem</li> <li>Species can be incubated prior to placement or planted directly to the waterway</li> <li>While some initial upkeep and maintenance is required, ultimately the living shoreline is self-sufficient</li> </ul>

Technical information and costs detailed in Draft: Marin Ocean Coast Sea Level Rise Adaptation Report, July 2017

# Barrier and Living Shoreline: Horizontal Levee®



Horizontal levees® have gentle slopes facing a new or enhanced wetland, resulting in lower wave energy from the shoreline. Horizontal levees® also improve flood protection through the creation of storm water retention areas on the inboard side.

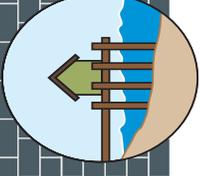


## At a Glance

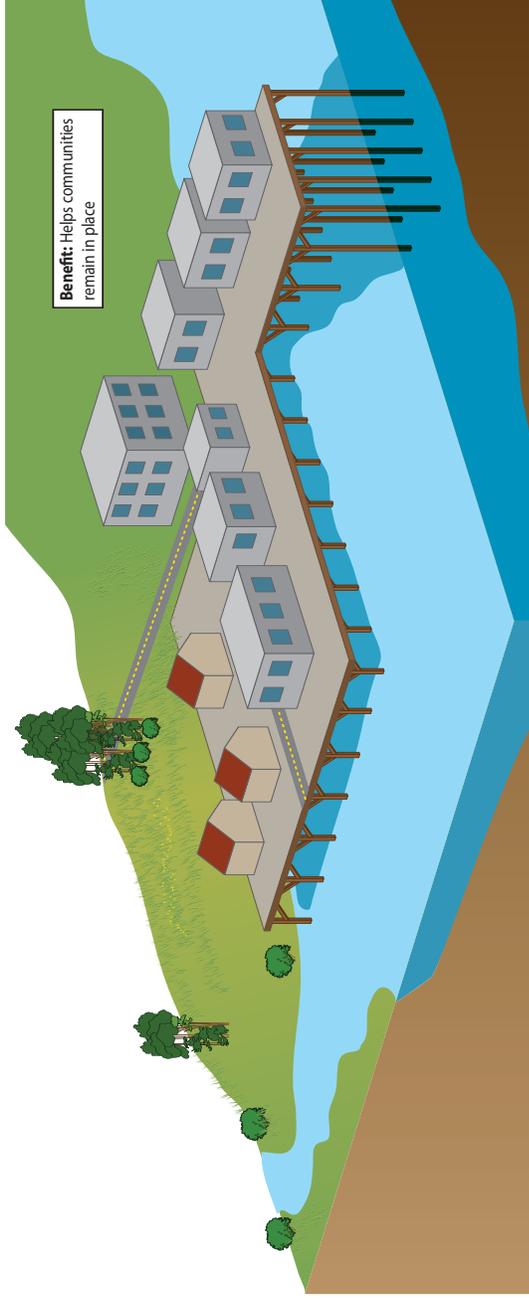
<b>Uses</b>	Combines flood protection benefits with habitat benefits, as well as stormwater flood control on inland side. Viewed as "gold standard" to multi-objective flood protection				
<b>Things to Consider</b>	Requires significant space, more than traditional levees, to allow wave attenuation across tidal marsh				
<b>Works best with</b>	SWALLE POND NO BAYS LEVEE TIDE GATE BARRIER	Measures that lessen wave erosion or control the movement of water			
<b>Constructability</b>	Complex Medium Simple				
<b>Ecological Impacts:</b>	Access to habitat, habitat quality, and water quality				
<b>Costs</b>	\$\$\$\$\$				
<b>Visual Changes and Appeal</b>	Negative Neutral Positive				
<b>Changes to Public Access</b>	Negative Neutral Positive				
<b>How it works</b>	<ul style="list-style-type: none"> <li>Creation of marsh dampens wave action while providing excellent habitat.</li> <li>Levee provides some protection from sea level rise and separates baywater from stormwater retention ponds.</li> <li>Retention ponds can be used to help irrigate freshwater habitat on landward side</li> </ul>				

Technical information and costs detailed in Draft Marin Ocean Coast Sea Level Rise Adaptation Report, July 2017

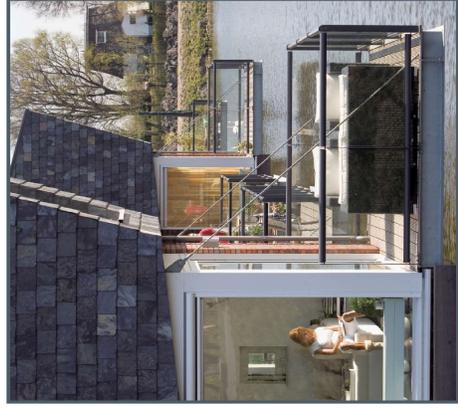
# New Development Strategies: Floating Structures and Floodable Property



Floodable developments and structures involve rebuilding structures and associated infrastructure – entire developments or communities – to adapt to sea level rise. Designs allow housing structures and communities to withstand elevated water levels without other measures.



Homes on piers example in the Netherlands



Elevated beach homes with open foundations



Design concept by Keith Oldhuis

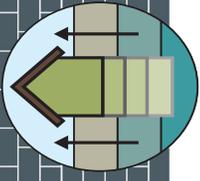


## At a Glance

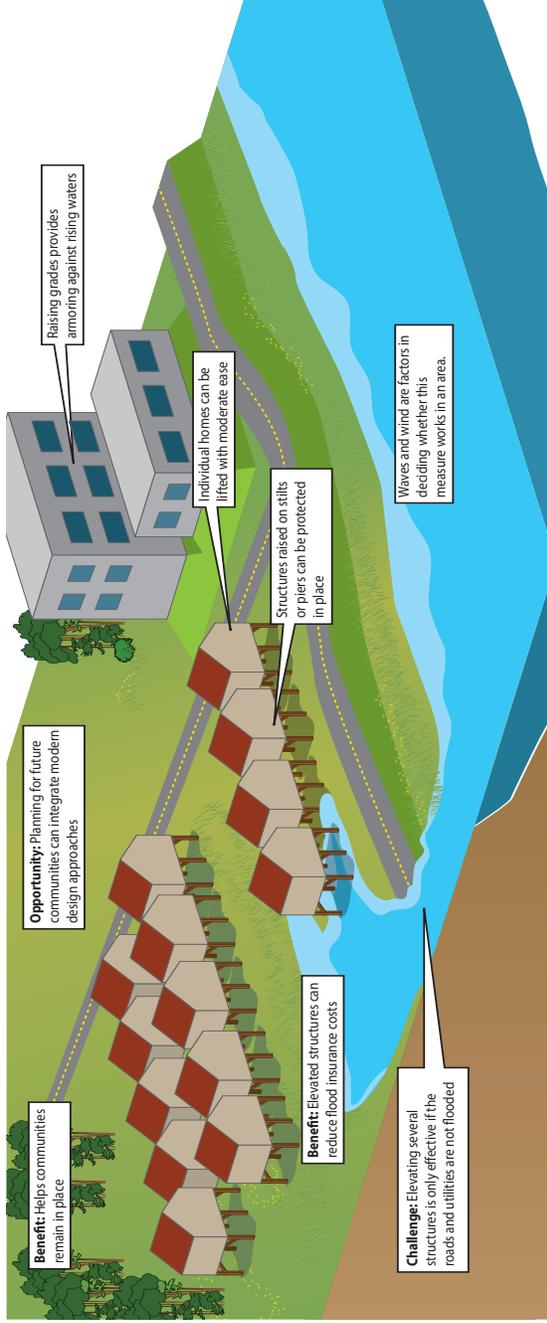
<b>Uses</b>	Effective in highly populated areas near waterfronts. Floating homes or communities are an option in areas with frequent flooding.
<b>Things to Consider</b>	Requires rethinking shoreline planning and density limitation
<b>Works best with</b>	Measures that allow water flow or large-scale planning
<b>Constructability</b>	 Complex  Medium  Simple
<b>Ecological Impacts:</b>	Access to habitat, habitat quality, and water quality  Negative  Neutral  Positive
<b>Costs</b>	\$\$\$\$\$
<b>Visual Changes and Appeal</b>	 Negative  Neutral  Positive
<b>Changes to Public Access</b>	 Negative  Neutral  Positive
<b>How it works</b>	<ul style="list-style-type: none"> <li>Rather than retrofitting, this measure is implemented as new housing or buildings are constructed, incorporating options to elevate and allow for water to flow beneath and around.</li> <li>Requires large scale planning to incorporate surrounding infrastructure and utilities.</li> <li>Floodproofing involves employing designs and materials which make buildings more resilient to water damage and flooding. An advantage to floodproofing is that it does not require additional land to implement</li> </ul>

Technical information and costs detailed in Draft Marin Ocean Coast Sea Level Rise Adaptation Report, July 2017

# Protect in Place: Elevate Buildings, Roads, and Grades



Elevating buildings and infrastructure is an effective measure which can be scaled to a range of options. Floodproofing, living with water, or floodable buildings allow communities to coexist in otherwise flooded areas. The benefits of raising homes or infrastructure is largely dependent on the needs or conditions of the nearby community. For example, while individual properties can be raised, underground utilities, roadways, and even yards may not be accessible during flooding.



Raised home on left is only noticeable by extended baseboards and higher roofline.



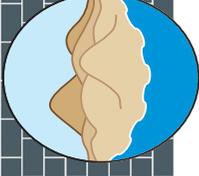
Roadways can be elevated over flooded areas

## At a Glance

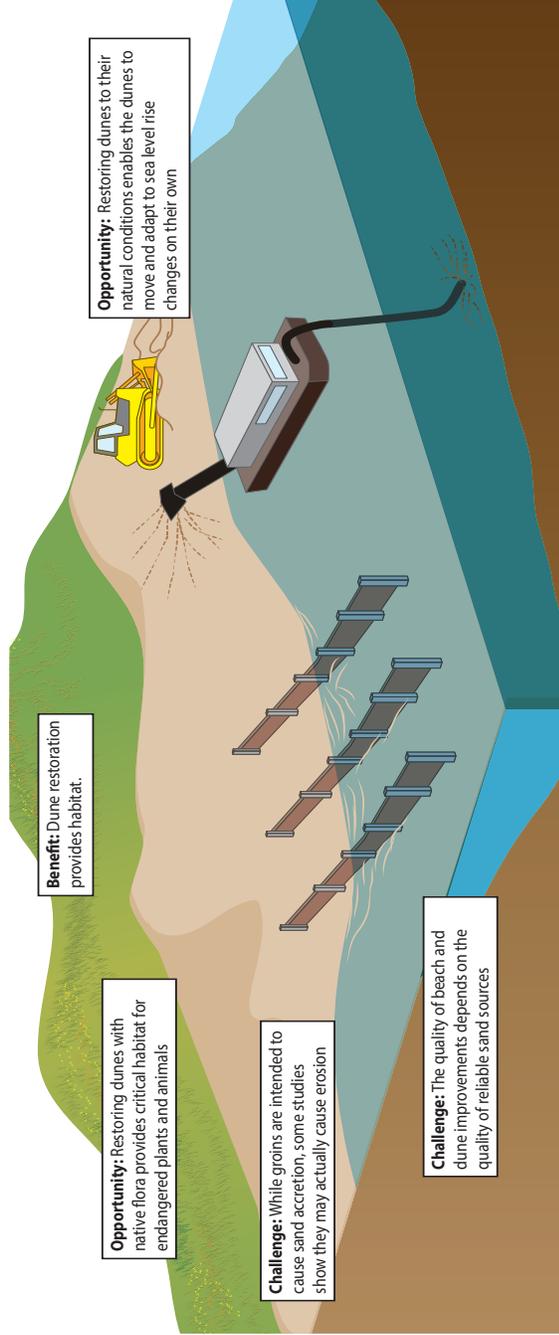
<b>Uses</b>	Effective protection for existing structures or planned developments; requires planning and large capital costs
<b>Things to Consider</b>	Elevation is only effective when all features are considered: structures, roadways, and utilities
<b>Works best with</b>	Measures that control movement of water or large-scale planning
<b>Constructability</b>	<ul style="list-style-type: none"> <li>Complex (Red circle with slash)</li> <li>Medium (Grey circle)</li> <li>Simple (Green circle)</li> </ul>
<b>Ecological Impacts:</b>	Access to habitat, habitat quality, and water quality <ul style="list-style-type: none"> <li>Negative (Red circle)</li> <li>Neutral (Blue circle with slash)</li> <li>Positive (Green circle)</li> </ul>
<b>Costs</b>	\$\$\$\$
<b>Visual Changes and Appeal</b>	<ul style="list-style-type: none"> <li>Negative (Red circle)</li> <li>Neutral (Blue circle with slash)</li> <li>Positive (Green circle)</li> </ul>
<b>Changes to Public Access</b>	<ul style="list-style-type: none"> <li>Negative (Red circle)</li> <li>Neutral (Blue circle with slash)</li> <li>Positive (Green circle)</li> </ul>
<b>How it works</b>	<ul style="list-style-type: none"> <li>Existing structures can be raised individually, depending on foundation type.</li> <li>New developments would require imported soil to raise the ground elevation.</li> <li>Roads can be raised during major renovations or new construction.</li> <li>Utilities can also be raised or waterproofed. Gravity-based waste water treatment plants cause significant challenges.</li> </ul>

Technical information and costs detailed in Draft Marin Ocean Coast Sea Level Rise Adaptation Report, July 2017

# Soft Armoring: Dune Restoration and Beach Nourishment



Beach nourishment is the placement of sand on beaches or dunes to replace sand lost to storms. Dune restoration involves adding and improving sand quality and often new native flora to existing dunes.



Need new text

text needed



**Challenge:** Beach nourishment can be more ecologically damaging than dune restoration; however, can provide some erosion protection

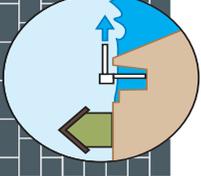


Technical information and costs detailed in Draft: Marin Ocean Coast Sea Level Rise Adaptation Report, July 2017

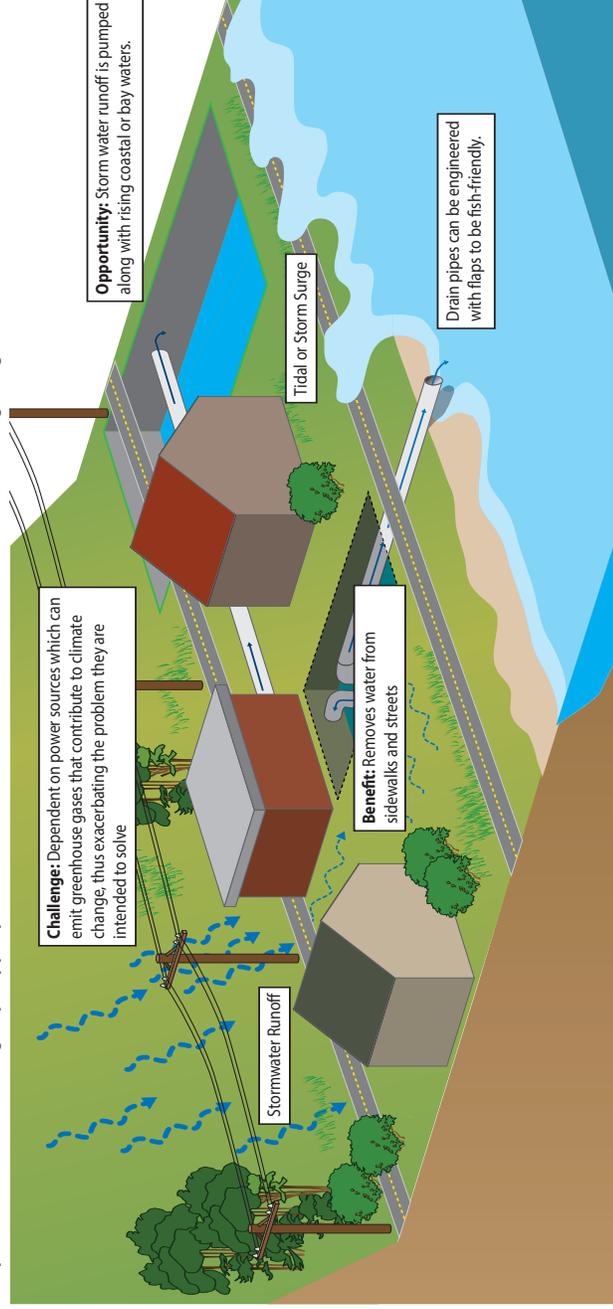
## At a Glance

<b>Uses</b> Primarily associated with coastal improvements, but has been demonstrated as effective within the bay shoreline.			
<b>Things to Consider</b> Dunes will continue to diminish with time and as sea levels rise, the frequency of nourishment must increase. It does not protect against permanent sea level rise.			
<b>Works best with</b> Measures that lessen wave erosion or allow water flow			
<b>Constructability</b>			
<b>Ecological Impacts:</b> Access to habitat, habitat quality, and water quality			
<b>Costs</b>	\$\$\$\$\$		
<b>Visual Changes and Appeal</b>			
<b>Changes to Public Access</b>			
<b>How it works</b>	<ul style="list-style-type: none"> <li>Dune restoration involves improving existing coastal shorelines which have become barren with increased sand quantities and improved habitat. It often involves the removal of invasive species to allow native species an opportunity to reestablish themselves.</li> <li>Beach nourishment moves sand, silt, or other material such as oyster shells that are extracted from nearby channels or other sources to eroded shorelines.</li> <li>These materials are placed on top of existing dunes or erosional areas.</li> <li>Shoreline plants can be established in the area to provide additional measure against erosion.</li> </ul>		

# Protect in Place: Pump Stations



Pump stations use one or more large capacity pumps to move floodwater from storm drains or behind shoreline armoring to larger bodies of water.



## At a Glance

<b>Uses</b>	Provides effective, immediate removal and management of stormwater and baywater		
<b>Things to Consider</b>	Can be very expensive to maintain and subject to power outages		
<b>Works best with</b>	Small Level Small Surge Small Tidal	Small Runoff Small Storm Small Surge Small Tidal	Small Level Small Surge Small Tidal
<b>Constructability</b>	Complex Medium Simple	Complex Medium Simple	Complex Medium Simple
<b>Ecological impacts:</b> Access to habitat, habitat quality, and water quality	Negative Neutral Positive	Negative Neutral Positive	Negative Neutral Positive
<b>Costs</b>	\$\$\$\$\$		
<b>Visual Changes and Appeal</b>	Negative Neutral Positive	Negative Neutral Positive	Negative Neutral Positive
<b>Changes to Public Access</b>	Negative Neutral Positive	Negative Neutral Positive	Negative Neutral Positive
<b>How it works</b>	<p>Runoff from upland stormwater</p> <p>Hydraulic pump action moves water collected from drainage pipes along roadways to areas not impacting human use</p> <p>Tidal or storm surge from waterway</p>		

Engineered drainage brings water from the street to the pump station.



Small pump stations can be placed to minimize visual impacts

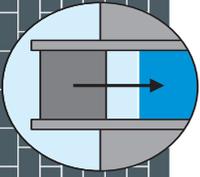


Pump stations have the appearance of simple sheds

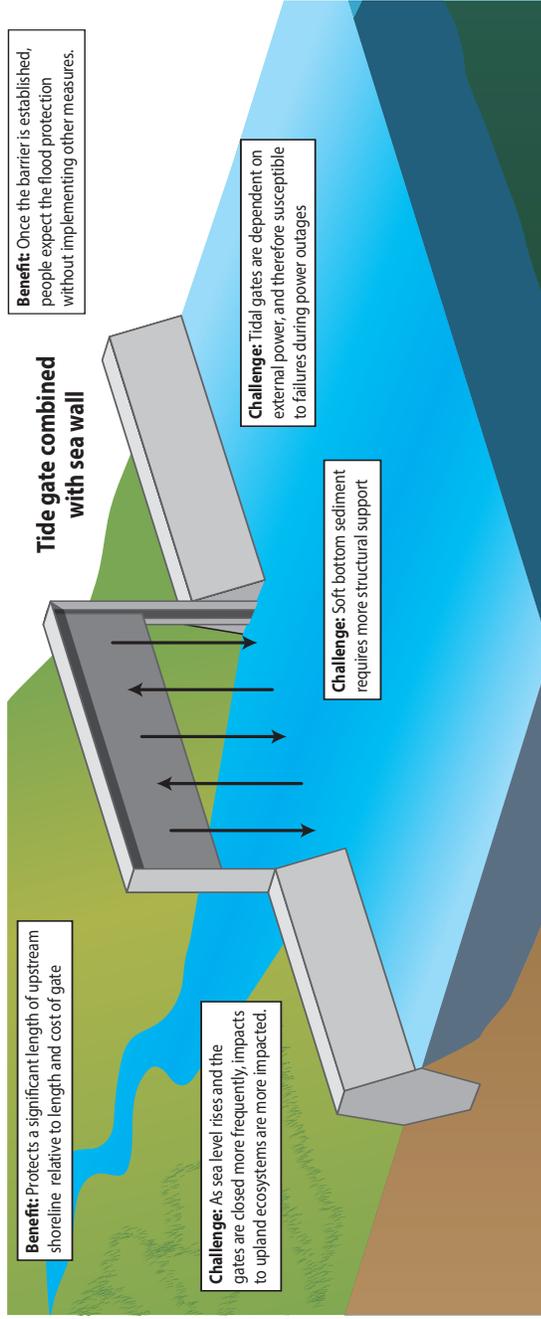


Technical information and costs detailed in Draft: Marin Ocean Coast Sea Level Rise Adaptation Report, July 2017

# Protect in Place: Tidal Gates



Tide gates control water levels by restricting flow of water from one area (often a levee or sea wall) to another. Tide gates can range in size from fairly small flaps on the ends of pipes to large structures that keep the ocean or large rivers from flowing naturally.



**Benefit:** Once the barrier is established, people expect the flood protection without implementing other measures.

**Challenge:** As sea level rises and the gates are closed more frequently, impacts to upland ecosystems are more impacted.

**Challenge:** Soft bottom sediment requires more structural support

**Challenge:** Tidal gates are dependent on external power, and therefore susceptible to failures during power outages

**Tide gate combined with sea wall**

Tide gates can be designed to be fish-friendly



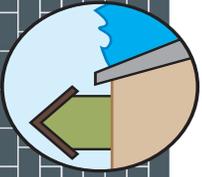
Tide gates can be used in conjunction with pump stations to increase water circulation



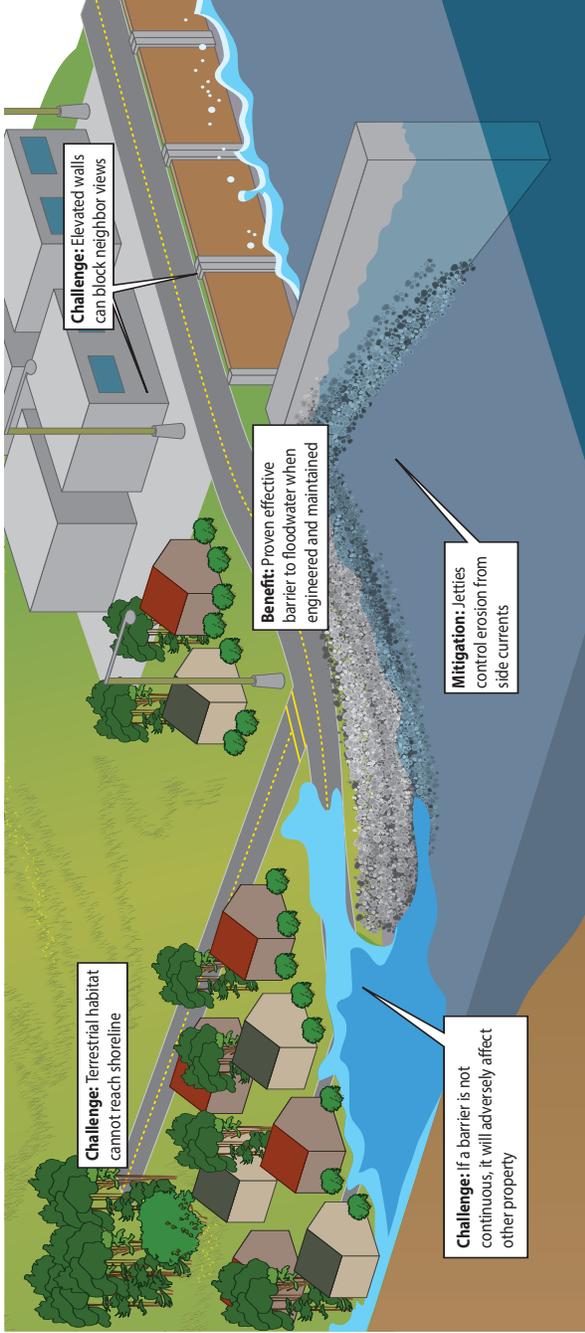
## At a Glance

<b>Uses</b>	Provides protection without major levees, seawall costs, elevation, or right-of-way acquisitions.			
<b>Things to Consider</b>	Water quality may be impacted, as well as the natural ecology			
<b>Works best with</b>	Small Flaps	Levee	Pumping	Sea Wall
Measures that control the movement of water	Simple	Medium	Complex	None
<b>Constructability</b>	Negative	Neutral	Positive	None
<b>Ecological Impacts:</b> Access to habitat, habitat quality, and water quality	Negative	Neutral	Positive	None
<b>Costs</b>	\$\$\$\$\$			
<b>Visual Changes and Appeal</b>	Negative	Neutral	Positive	None
<b>Changes to Public Access</b>	Negative	Neutral	Positive	None
<b>How it works</b>	<ul style="list-style-type: none"> <li>Tide gates rely on hydraulic pumps or manual operation to move a barrier to prevent water flow during high tides.</li> <li>When deployed, they keep sea water out and water levels low along the entire waterway on the landward side</li> </ul>			

# Hard Armoring: Seawalls and Raised Bulkheads



Walls, including seawalls, floodwalls, bulkheads, revetments, and other similar structures are used to stop water from flooding property on the other side. Walls must either surround the entire area to be protected or join higher areas to create a barrier against water. They often extend underground to limit seepage and must be well-maintained or risk catastrophic damage with failure.



Riprap or revetments can serve as sea walls to protect against strong wave action

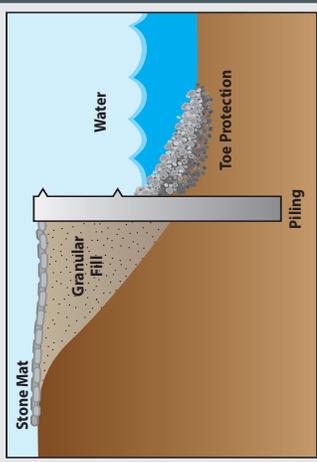


Steel floodwall in San Rafael can protect against high tides along canal



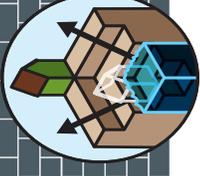
## At a Glance

<b>Uses</b>	Effective protection in narrow spaces
<b>Things to Consider</b>	Uninsightly, isolates shoreline from habitat and other uses, zoning challenges
<b>Works best with</b>	Measures that control the movement of water
<b>Constructability</b>	
<b>Ecological impacts:</b> Access to habitat, habitat quality, and water quality	
<b>Costs</b>	
<b>Visual Changes and Appeal</b>	
<b>Changes to Public Access</b>	
<b>How it works</b>	Stone or metal is buried into existing footing and wall is secured to current bank edge

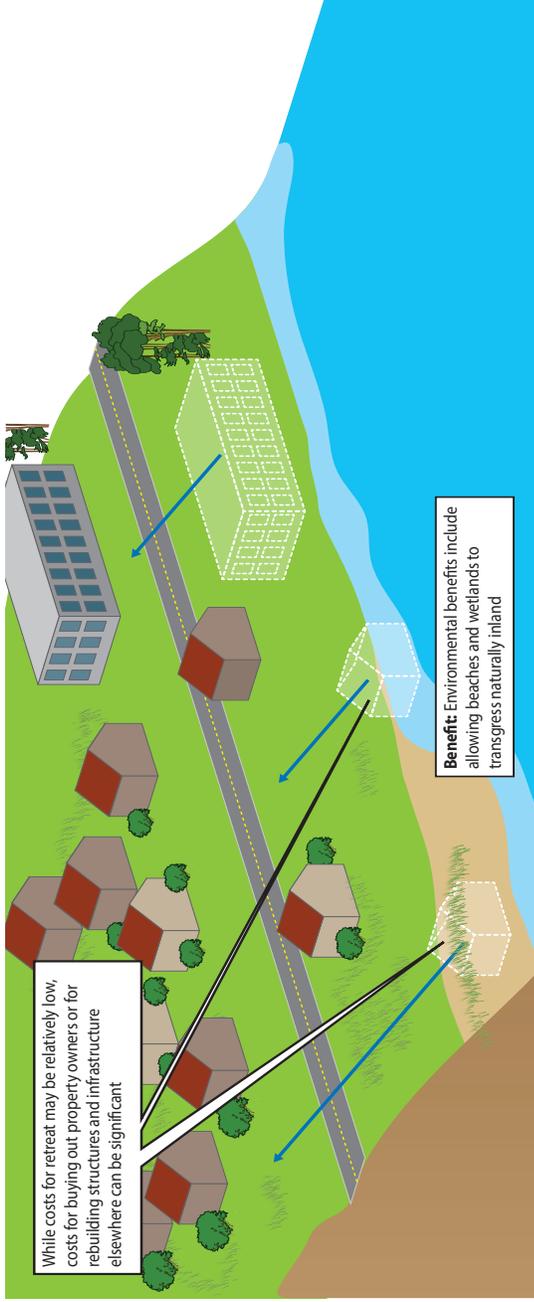


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# New Development Strategies: Managed Retreat



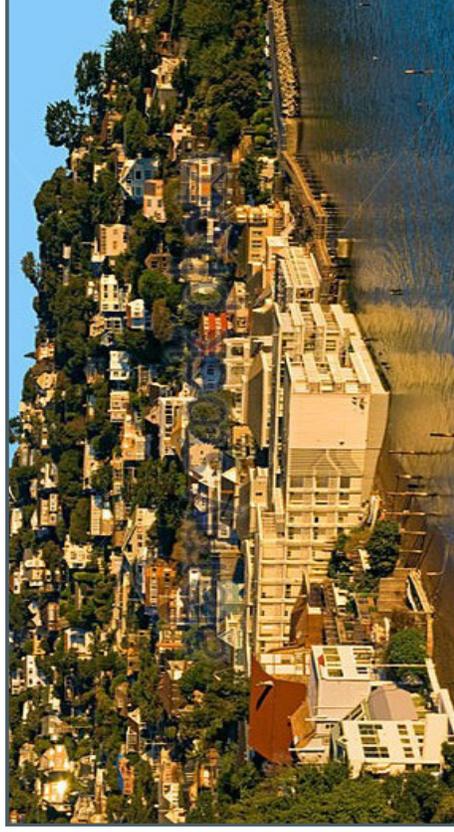
Managed retreat is a planned removal of structures from harm's way. Retreat could occur before or as risks increase or after an event that could cause the area to be unsafe.



**Rolling and Conservation Easements**

Open space or conservation easements move or ambulate with some identified reference feature, such as the Mean High Water line (MHW) for coastal properties. As the coast retreats during rises in sea level, the easement line migrates inland along with it, and then development is removed and becomes part of that easement. This helps ensure maintenance of beach width and protection of the natural shoreline.

In places like Sausalito, finding additional upland space is challenging



## At a Glance

<b>Uses</b>	Provides protection for all sea level rise and flood conditions by eliminating exposure or use within hazard areas
<b>Things to Consider</b>	<ul style="list-style-type: none"> <li>Uncertainty over who pays and who benefits</li> <li>While intuitively a straightforward solution, often challenging or infeasible due to space constraints, ownership, and financing</li> </ul>
<b>Works best with</b>	Measures that allow water flow or large-scale planning
<b>Constructability</b>	<ul style="list-style-type: none"> <li>Complex</li> <li>Medium</li> <li>Simple</li> </ul>
<b>Ecological Impacts:</b> Access to habitat, habitat quality, and water quality	<ul style="list-style-type: none"> <li>Negative</li> <li>Neutral</li> <li>Positive</li> </ul>
<b>Costs</b>	\$\$\$\$\$
<b>Visual Changes and Appeal</b>	<ul style="list-style-type: none"> <li>Negative</li> <li>Neutral</li> <li>Positive</li> </ul>
<b>Changes to Public Access</b>	<ul style="list-style-type: none"> <li>Negative</li> <li>Neutral</li> <li>Positive</li> </ul>
<b>How it works</b>	<ul style="list-style-type: none"> <li>As homes or structures age or deteriorate, they are rebuilt at nearby, higher elevations.</li> <li>Ideal when already considering demolition or major reconstruction of existing structures in flooded areas</li> </ul>

# APPENDIX C

## SUMMARY TABLES

### OF TOOLS

Table 1. Regulatory Land Use Tools

	Regulatory Tools	Additional Details
1.1	Zoning Overlays	<i>Specific overlays or combining districts</i>
1.2	Setbacks/Buffers	<i>Such as erosion-based setbacks, tiered setbacks, buffer zones for vulnerable areas, wetland buffers (not standard property line setbacks)</i>
1.3	Substantial Improvement	<i>Calling something new development or a rebuild once the improvements in a permit application are substantial (substantial can be 50% of structure or other)</i>
1.4	Stormwater Management Measures	<i>Bioswales, retention basins, green streets or other project-specific requirements</i>
1.5	Dedications and Easements	<i>For open space or conservation purposes especially</i>
1.6	Deed Restrictions	<i>For example, BCDC public access dedications or assumptions of risk and disclosure are implemented through restrictions recorded on the deed.</i>
1.7	Site-Specific Capacity Standards	<i>Based on capacity of site to sustain new development. Requires analysis of local site conditions on developable property to determine the extent of development the site can sustain.</i>
1.8	Rebuilding Limitations/ Prohibitions	<i>For example, after a natural disaster</i>
1.9	Development Moratoriums	<i>A hold on new development that can last up to two years</i>
1.10	Policies on Hard Shore Armoring	<i>For example, provisions to limit or facilitate armoring or guidelines to reduce adverse impacts of armoring</i>
1.11	Policies on Nature-Based Infrastructure	<i>For example, streamlined permitting for soft infrastructure might limit hard shoreline armoring</i>
1.12	Limitations on Nonconforming Structures	<i>Finding ways to let non-conforming structures continue, but putting restrictions in place that will limit lifespan of the non-conformity</i>

Table 2. Market-Based Tools

	<b>Market-Based Tools</b>	<b>Additional Details</b>
2.1	Tax Credit Programs	<i>A program that provides credit against business, personal income, or property tax, like So Carolina that provides tax credits for homeowners who pay flood insurance costs greater than 5% of their income</i>
2.2	Tax Incentives for Siting Development	<i>Especially for siting development outside of flood zones</i>
2.3	Relocation/Retrofit Tax Incentives	<i>Tax incentives for relocating away from vulnerable areas or for retrofitting development to accommodate flooding</i>
2.4	Geologic Hazard Abatement Districts	<i>An independent special district providing hazard prevention and mitigation within a defined area which could be well-suited to sea level rise protection</i>
2.5	Other Special Assessment Districts	<i>For example, Mello Roos bond-created district</i>
2.6	Development Impact Fees	<i>For example, impact fees for siting development in flood zones</i>
2.7	Stormwater Management Fees	<i>Based on the amount of impervious service on a lot. Used to fund storm water management.</i>
2.8	Transfer of Development Rights	<i>Transfer of certain property rights from one lot to another.</i>
2.9	Density Bonuses	<i>Allow greater density to be built on a site than would otherwise be allowed through underlying zoning, commonly for low income housing or Transferred Development Rights.</i>
2.10	Conservation Easements	<i>A mechanism by which public entities can preserve land while allowing it to remain in private ownership. Landowners receive a tax deduction. Rolling easements could provide a rolling boundary as the shoreline migrates inland, but are largely untested.</i>
2.11	Land Banking	<i>Purchase of land at an alternate location for use later</i>
2.12	Acquisitions	<i>Acquiring property from willing sellers to protect public safety</i>
2.13	Real Estate Disclosures	<i>Disclosure of hazards during transaction that could include an assumption of risk and/or waiver of liability.</i>

Table 3. Floodplain Management Tools

	<b>Floodplain Management Tools</b>	<b>Additional Details</b>
3.1	Freeboard/Elevation Requirement	<i>Elevating an existing structure or constructing new structures so that the elevation of a building's lowest floor is above the minimum base flood elevation (BFE) established by FEMA and or adding height to the BFE to accommodate sea level rise.</i>
3.2	Restricting Hazardous Materials in Floodplains	<i>Such as an ordinance prohibiting ammonia, sulfur, and/or acetone in floodplains</i>
3.3	Limiting Fill for Elevation	<i>Limiting or prohibiting the use of fill to elevate structures</i>
3.4	Policies Extending V-Zones Standards to A-Zones	<i>Extending V-Zone (areas subject to additional damage from wave action in the 100-year floodplain) standards to the A-Zone (100-year floodplain)</i>
3.5	Requirements for Flood-Resistant Designs	<i>Designing structures with flood resistant or flood-proof building materials to enable floodable designs (those that allow for a certain level of flooding with no or negligible damage)</i>
3.6	Flood Tax/Impact Fee	<i>A tax or fee paid when new development is located in a flood zone and will require public infrastructure to keep it safe.</i>

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