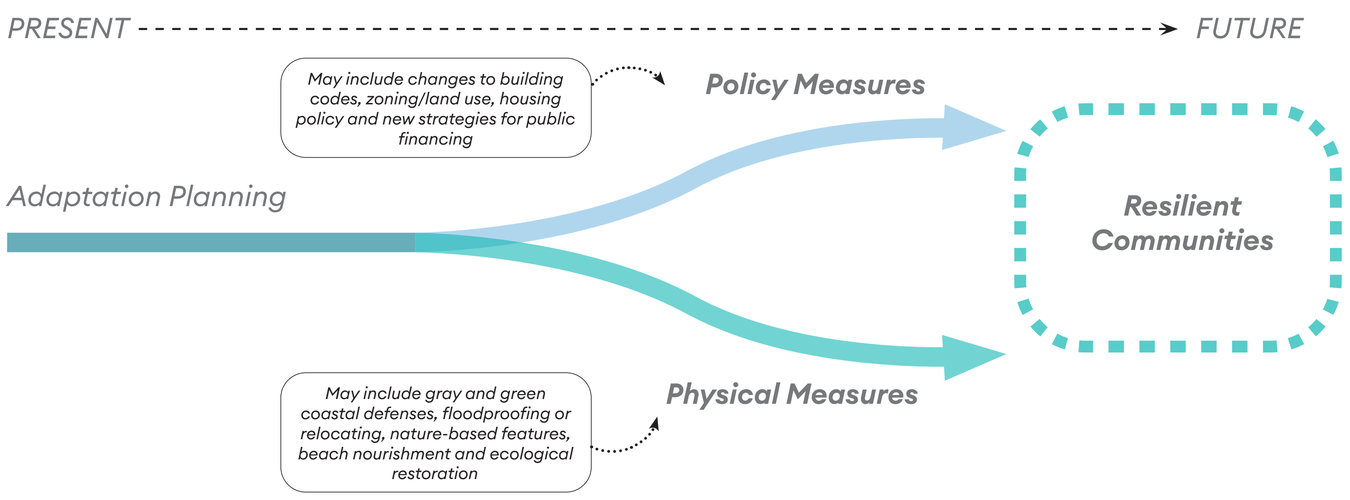
WHERE AND HOW TO ADAPT

SUBREGIONAL ADAPTATION PLANNING

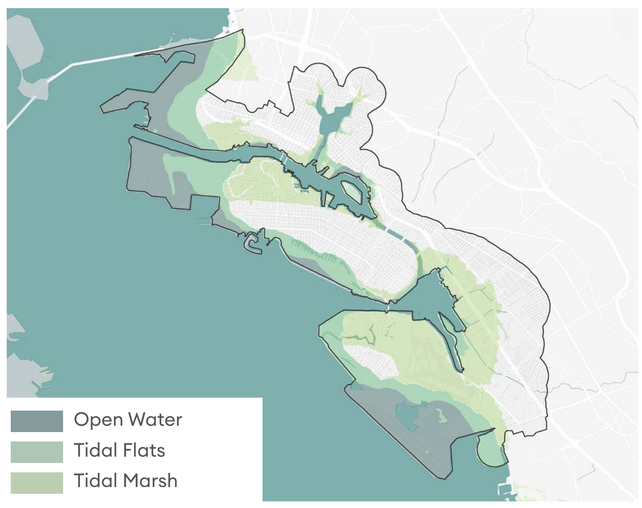
DEFINING THE ADAPTATION ZONE

Planning for long-term adaptation requires that we assess past, present, and future conditions. By overlaying the historical baylands zone (areas that were filled to create new land), areas of high liquefaction risk, and low elevation areas (below 17 feet NAVD88), we can define a conceptual boundary for the subregional adaptation zone, shown below in a purple dot hatch. The adaptation zone can also be described as a multi-hazard risk zone.

Within this zone, major changes won't happen everywhere. However, much of our shoreline and low lying inland areas will need to be adapted to manage future flooding. Adaptation will include physical changes such as the construction of levees as well as policy measures. In the future, this zone may operate as a jurisdictional zone, subject to specific policies intended to guide equitable adaptation.

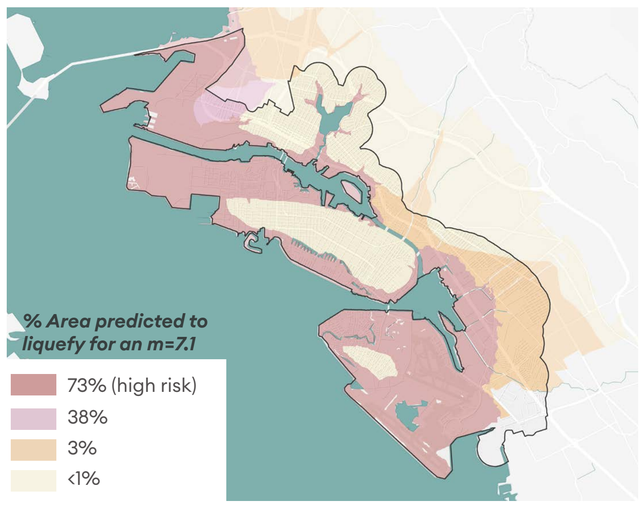


HISTORICAL BAYLANDS



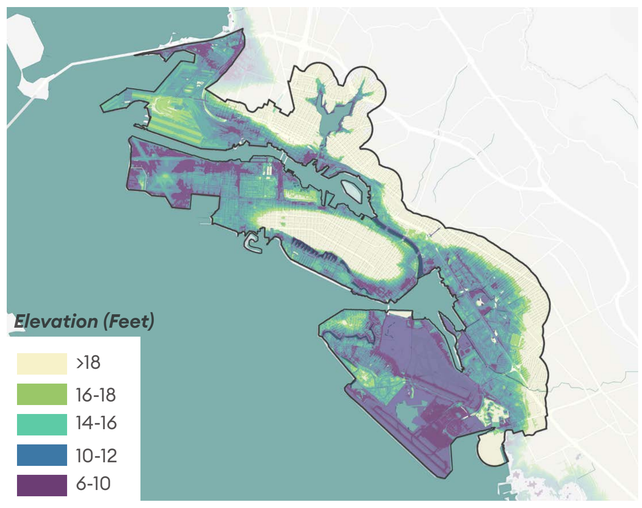
Much of the Oakland-Alameda Subregion was once marsh, tidal flats, or open water. Alameda Island was connected to the mainland, and Bay Farm Island was not.

LIQUEFACTION RISK



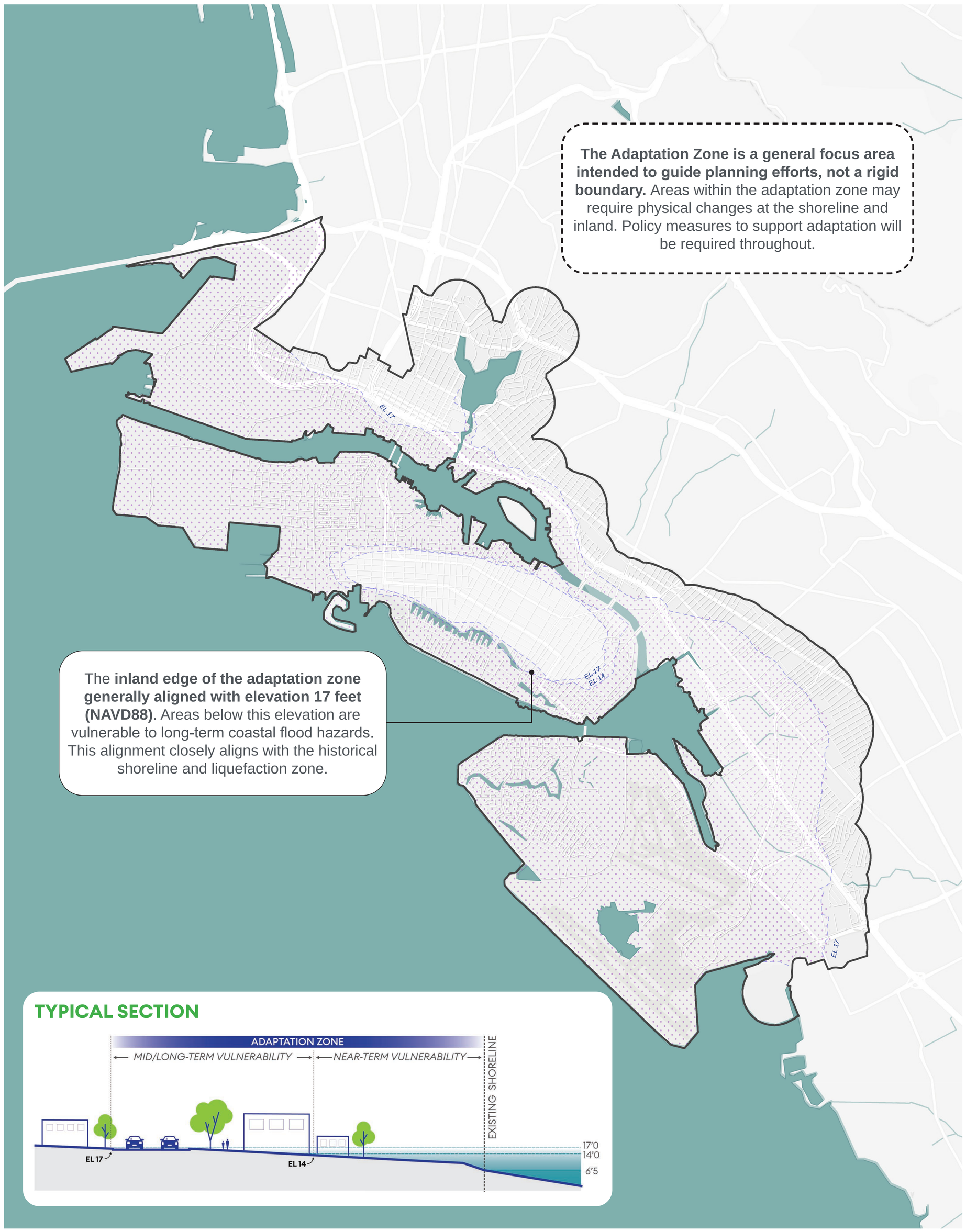
Liquefaction is when soil temporarily loses strength and acts like a fluid, often during an earthquake. High liquefaction risk is associated with historical marshes, tidal flats, and baylands that were filled to create space for development and industry.

LOW-LYING FLOOD-PRONE AREAS



The low-lying areas of the Oakland-Alameda Subregion reflect its history of land reclamation and correspond with areas are most vulnerable to coastal flooding. The highest areas (pale yellow) are largely aligned with the shoreline of the 1800s. The lowest areas (purple) are constructed on bayfill and are at risk of flooding today during an extreme tide event.

ADAPTATION ZONE



The Adaptation Zone is a general focus area intended to guide planning efforts, not a rigid boundary. Areas within the adaptation zone may require physical changes at the shoreline and inland. Policy measures to support adaptation will be required throughout.

The **inland edge of the adaptation zone generally aligned with elevation 17 feet (NAVD88)**. Areas below this elevation are vulnerable to long-term coastal flood hazards. This alignment closely aligns with the historical shoreline and liquefaction zone.

TYPICAL SECTION

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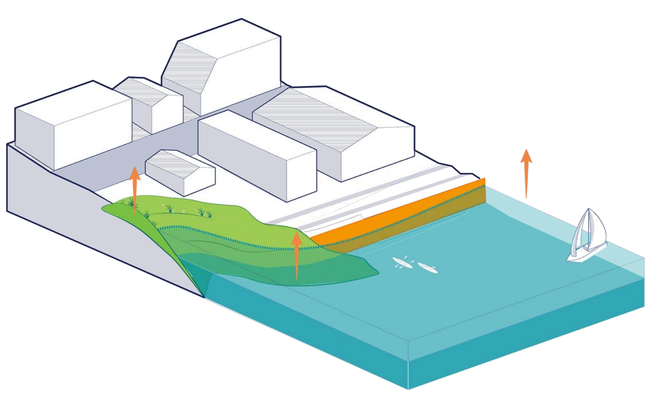
APPROACHES TO ADAPTATION

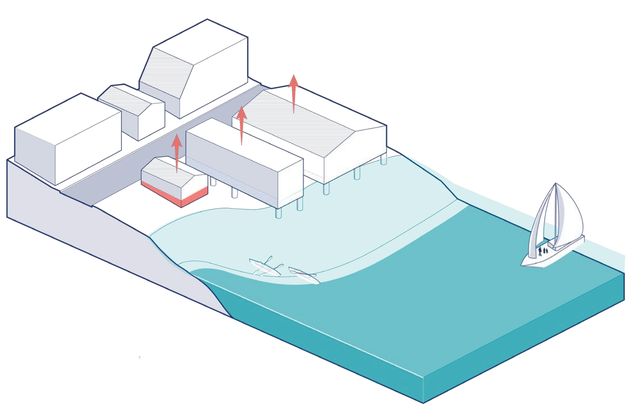
SUBREGIONAL ADAPTATION PLANNING

TRADITIONAL APPROACHES TO SHORELINE ADAPTATION

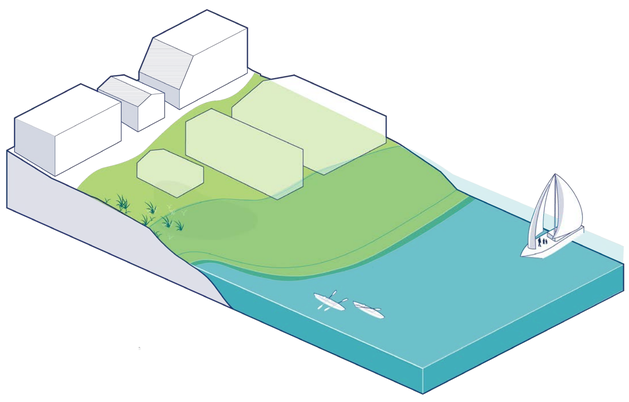
Communities can combine the protect, accommodate, and retreat approaches to reduce coastal flood risk. Different locations require different approaches - and often a combination of approaches - to best meet community needs and priorities specific to that location.



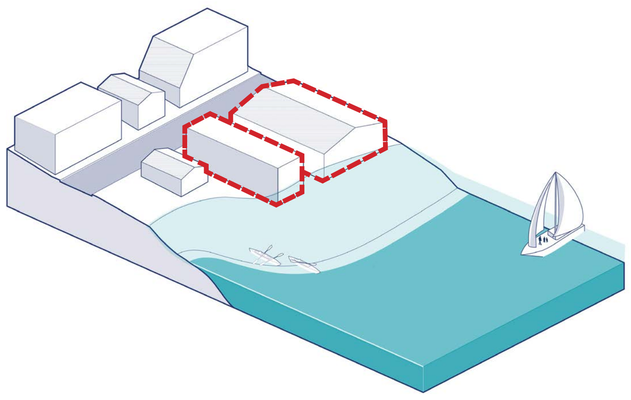
Protect
Keep coastal water out, stay in place



Accommodate
Let coastal water in, stay in place



Retreat or Avoid
Move out of the area over time

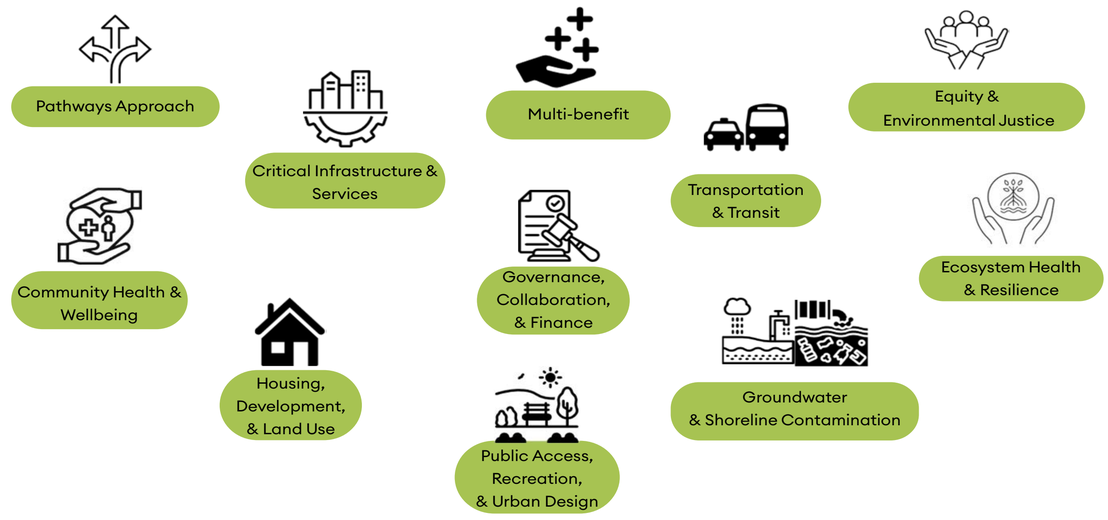


Do Nothing
Stay in place; sustain damages and disruption

PLANNING PRINCIPLES

The **OAAC ADAPT Planning Principles** have been developed in support of the vision and goals established by the Oakland-Alameda Adaptation Committee and the OAAC ADAPT Project Charter. These principles guide the approach to physical and policy-based adaptation strategies and will inform the evaluation process.

These principles may be revisited and revised over time based on changing conditions and community feedback.



POTENTIAL POLICY TOOLS

Policy tools are just as important as the physical strategies they enable for implementing adaptation. Local jurisdictions will need to review and update, and in some cases create new policies. These can include updates to land use plans, sea level rise guidance, and local building codes.

Next 10 and UC Berkeley developed Bayshore Urbanism (2024) to explore how property regimes shape vulnerability and adaptation to sea level rise around the San Francisco Bay Area of California. Reports such as this provide context and new ideas that will help local practitioners think outside the box when it comes to adaptation.

Moving Property Rights
- Rolling easements
- Transfer of development rights
- Land readjustment

Land Use Strategies
- Zoning
- Land use changes
- Flood protection overlay

Public Financing Strategies
- Geologic hazard abatement districts
- Joint powers authorities
- Enhanced infrastructure financing districts
- Climate resilience districts

Split Tenure Housing
- Manufactured home parks + resident-owned communities
- Houseboat Marinas

- **Redressing Historical Property Injustice**
- Land Back
- Reparations

Collective Ownership
- Community land trusts
- Limited equity cooperatives
- Condominiums
- Homeowners' associations

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PRIORITIZE NATURE-BASED SOLUTIONS

ADAPTATION STRATEGIES

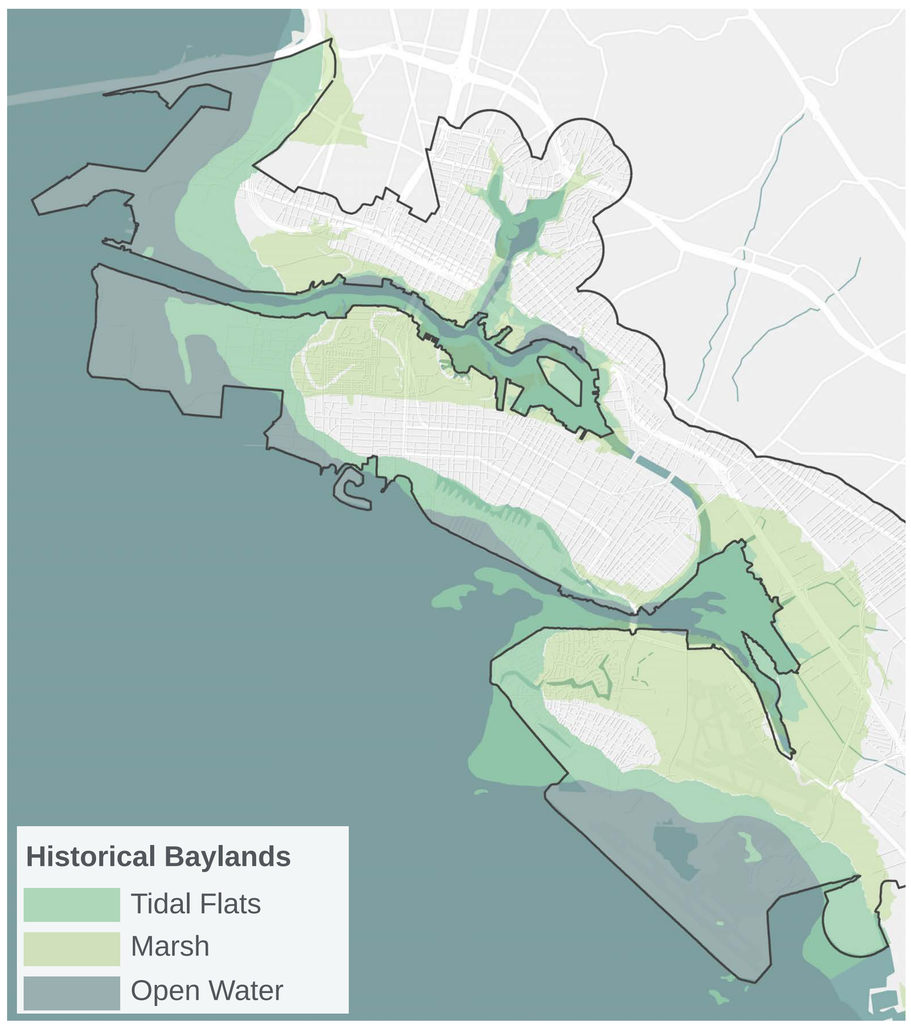
OPPORTUNITIES FOR NATURAL AND NATURE-BASED FEATURES

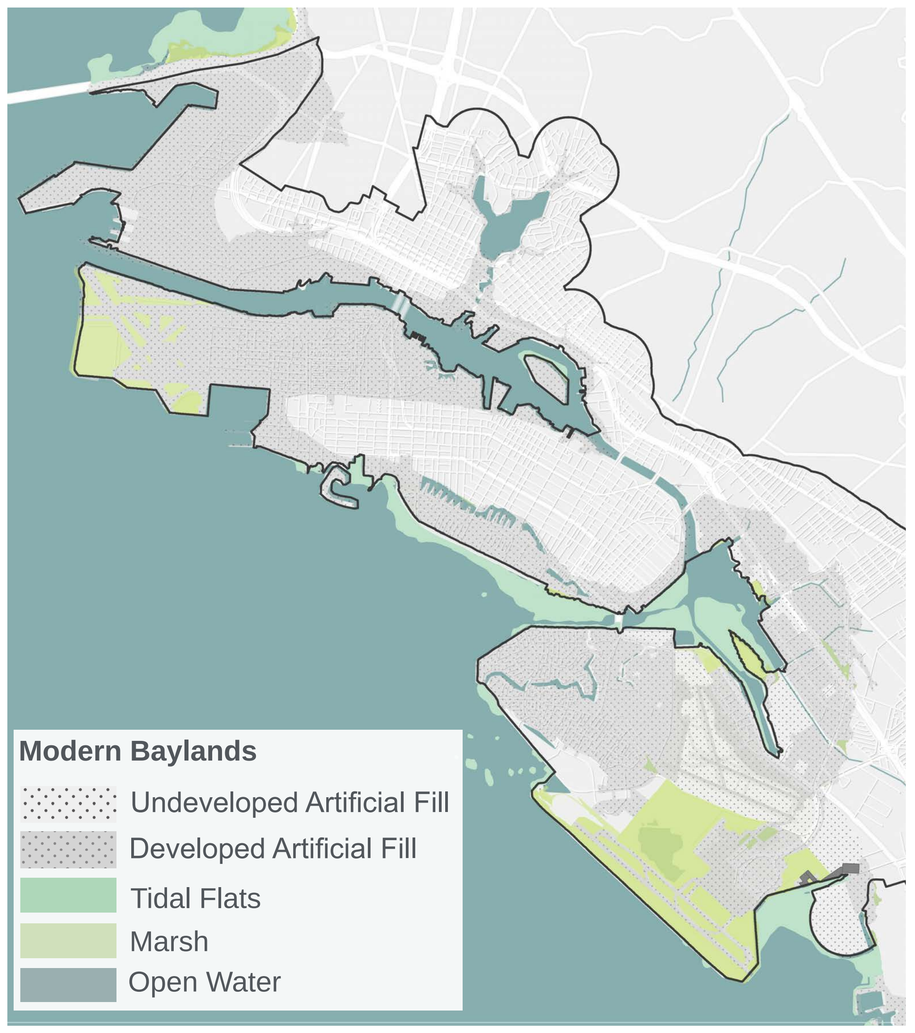
Historical Ecology and Landscape Transformation

The landscapes and shorelines of the San Francisco Bay have radically changed since the 1850's. Throughout the region, tidal marshes and mudflats were filled to create developable land. Sandy beaches have also been lost, with many eroded.

Today, much of Alameda and Oakland are located on land that was previously tidal marsh, mudflat or open water. As our cities have grown, we have lost landscapes that previously served critical roles in our overall resilience.

Restoring these landscapes, expanding remaining habitat patches, and implementing nature-based features to reduce flood risk, is a priority for adaptation planning and implementation in the Oakland-Alameda Subregion.

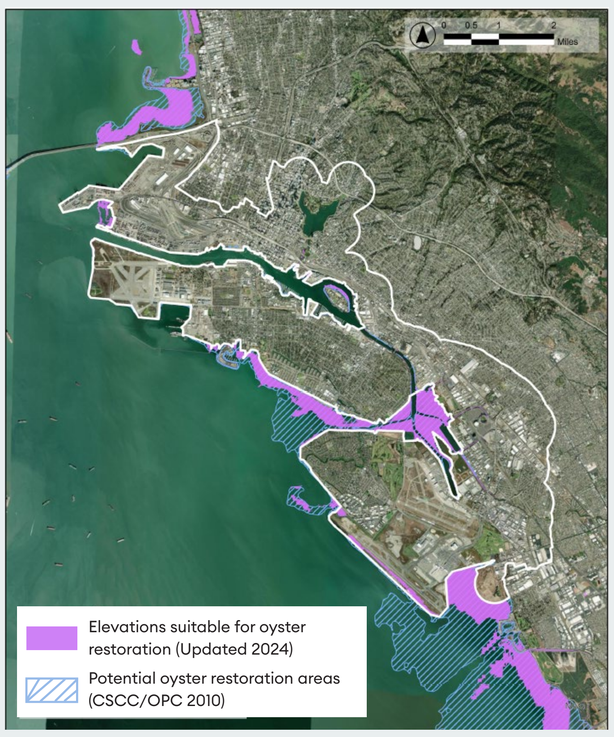




Preserve and Enhance Existing Ecotypes for Flood Protection and Ecological Benefit

There are many opportunities to expand existing habitat areas for flood protection and ecological benefit. Oyster beds, fringing tidal marsh, beaches, and eelgrass beds all deliver important benefits to the subregion -- from reducing wave energy and erosion, to delivering water quality improvements, sequestering carbon, and supporting a wide array of nature species. Efforts that build expanding existing habitat areas have a higher likelihood of success long-term, as suitable conditions for those habitats have already been found to exist.

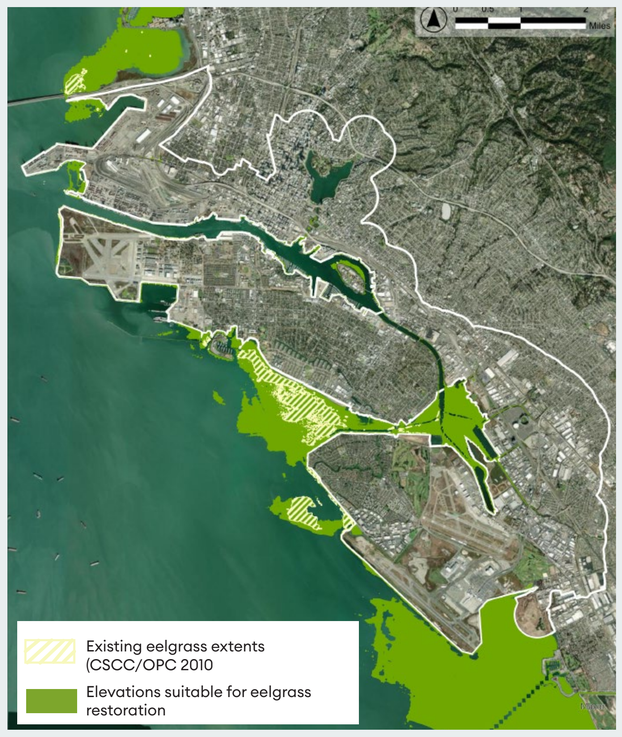
Oysters



Marsh edges

Beaches

Eelgrass



Examples of Other Nature-Based Features and Pilot Projects

Oysters

Gravel Beach Protecting Tidal Marsh

Tidal Marsh

Beaches

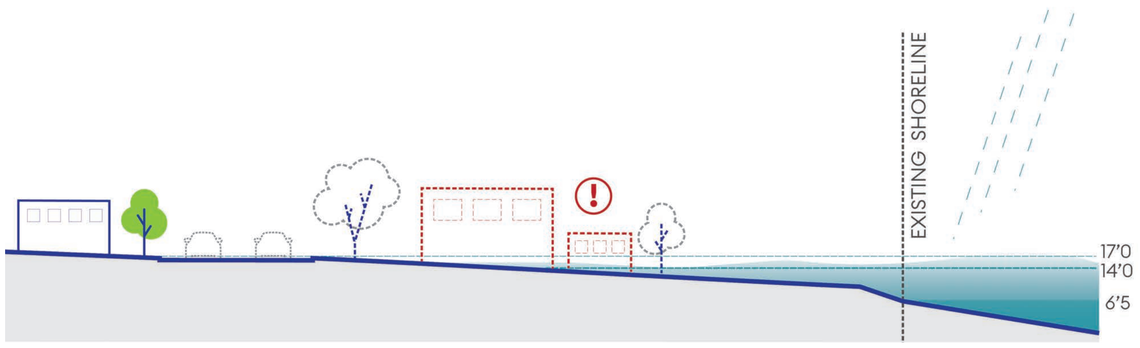
Eelgrass

Living Seawall

POTENTIAL PHYSICAL STRATEGIES

SUBREGIONAL ADAPTATION PLANNING

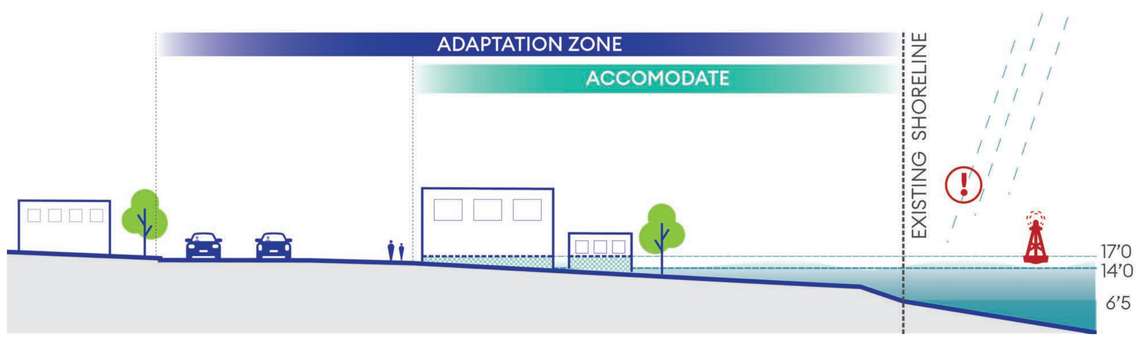
DO NOTHING



For the purposes of adaptation planning, doing “nothing” means **communities do not take proactive actions to reduce risk.** Emergency responders would continue to respond to disasters, infrastructure owners would maintain existing systems as best they are able, but the overall approach is to react to changing conditions once they have already happened.

Left: Bay water approaching bridge during King Tide

ACCOMMODATE

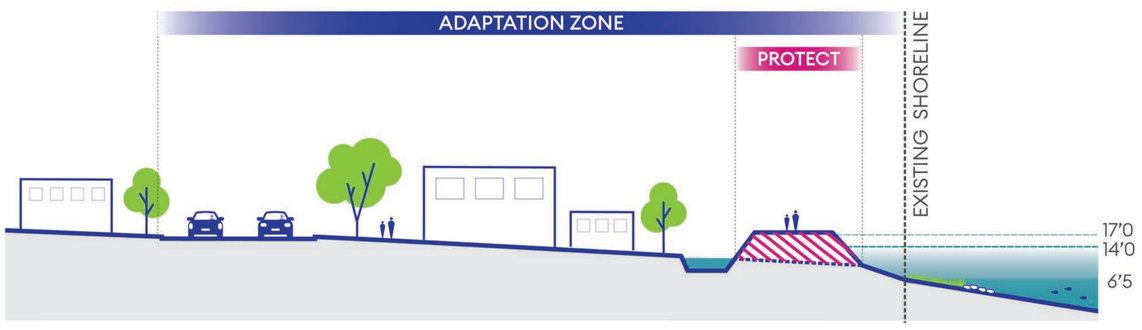


Accommodating floodwater is different from the “do nothing” strategy in that **communities anticipate risks** and make changes that will reduce the consequences of a flood when it occurs. Examples include flood resilience retrofits to buildings and infrastructure, moving sensitive equipment to upper floors, and installing or upgrading emergency warning systems.

Left: Floating home at Barnhill Marina

PROTECT

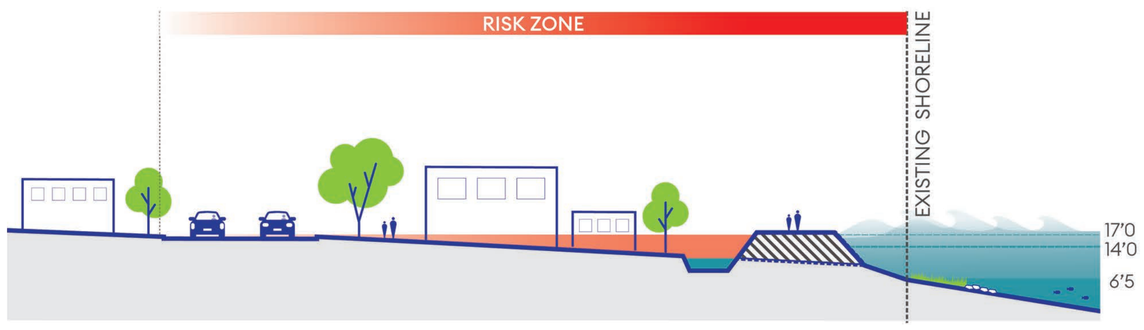
PROTECT AT SHORELINE



Protecting at the shoreline involves physical barriers between the Bay and people and property at risk. Examples include raised seawalls, levees and ecotone levees, floodwalls, and any integrated bayside features designed to reduce wave hazards such as wetlands, coarse beaches, living seawall enhancements, and other natural and nature-based features. Raising the shoreline also requires stormwater infrastructure changes inland to avoid exacerbating inland flooding.

Left: Bay Trail on levee

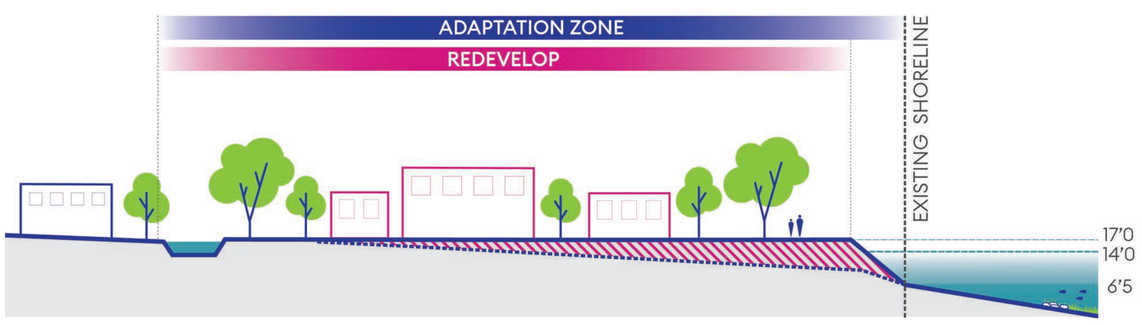
RESIDUAL RISK OF SHORELINE PROTECTION



Shoreline protection is effective at reducing inland risk, but it is important for the community to understand that **these structures do not eliminate risk**. The term “residual risk” refers to risk that still exists after the protection structure is in place, such as the risk associated with a storm that is bigger than the structure was designed to handle or the risk of structural failure, which is one of the reasons why it is very important to secure funding for ongoing inspection and maintenance of protection structures. Communities may consider flood insurance and other risk reduction strategies even behind a protection structure.

SHORELINE REDEVELOPMENT

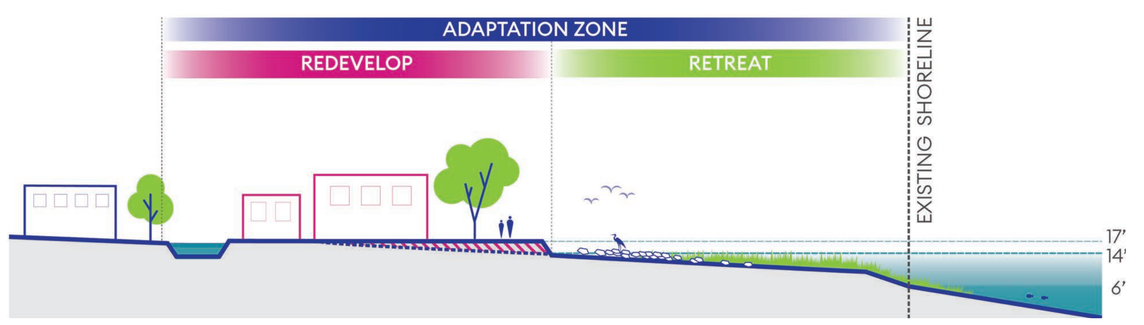
REDEVELOP AT SHORELINE



Another approach to protecting at the shoreline is by **redeveloping and raising a portion of the low-lying shoreline area at risk**. Especially if a redevelopment is intended to provide protection for the broader community, this approach requires coordination between development partners, adjacent property owners, and the City to ensure sea level rise design standards are met and that there aren’t gaps in the line of protection between properties.

Left: Waterfront Park

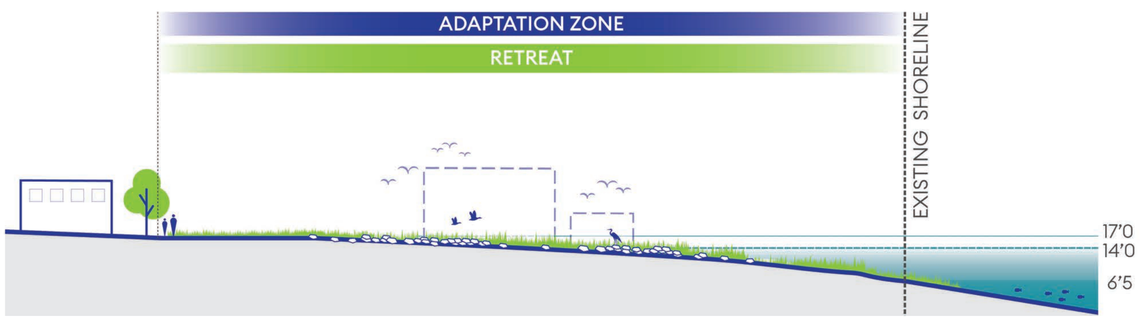
HYBRID APPROACH: RETREAT AND REDEVELOP



Redevelopment coupled with shoreline elevation can also happen inland from the existing shoreline. The ‘retreat’ area closest to the shoreline can be used for ecosystem restoration and/or nature based features designed to future reduce risk for the redevelopment parcel. This approach also requires coordination between development partners, adjacent property owners, and the City.

RETREAT

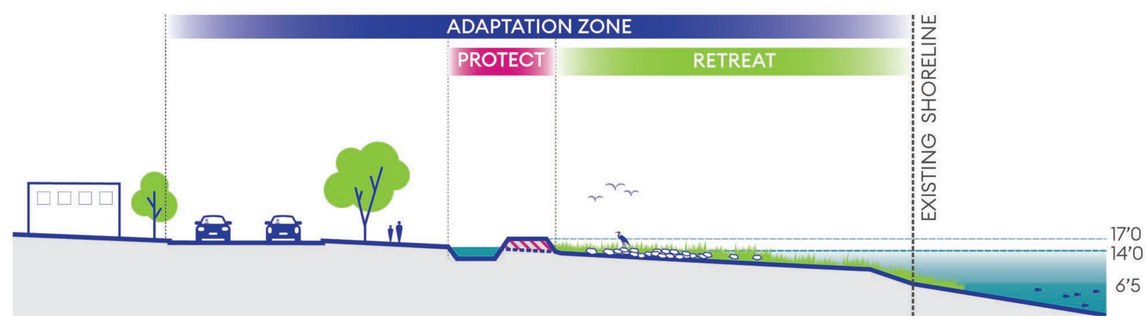
INLAND MIGRATION



Over time, people and infrastructure can choose to move out of high-risk areas. In addition to risk reduction benefits, this provides an opportunity for re-introduction of locally appropriate species and ecosystems.

Left: MLK Shoreline Marsh

HYBRID APPROACH: RETREAT AND PROTECT INLAND



Some communities may chose to partially retreat from high risk areas and establish a line of protection further inland. Areas bayward of the line of protection could be redesigned to provide ecological benefit.

Left: Levee with tidal marsh

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NEAR- MID- AND LONG-TERM ADAPTATION

SUBREGIONAL ADAPTATION PLANNING

POTENTIAL ADAPTATION TIMELINE

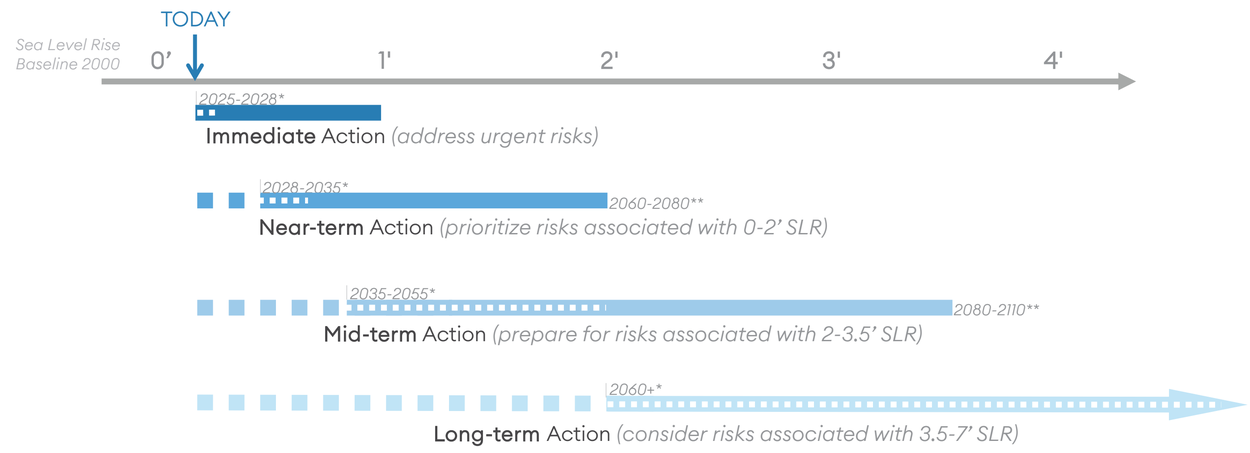
Adaptation actions won't happen everywhere all at once. Cities and other land stewards will continue to take immediate actions to address urgent risk while planning for adaptation further into the future.

Near-term actions prioritize reducing risk associated with 0-2 feet of sea level rise, largely focused on the lowest portions of the shoreline.

Mid-term actions will prepare us for risks associated with 2-3.5 feet of sea level rise.

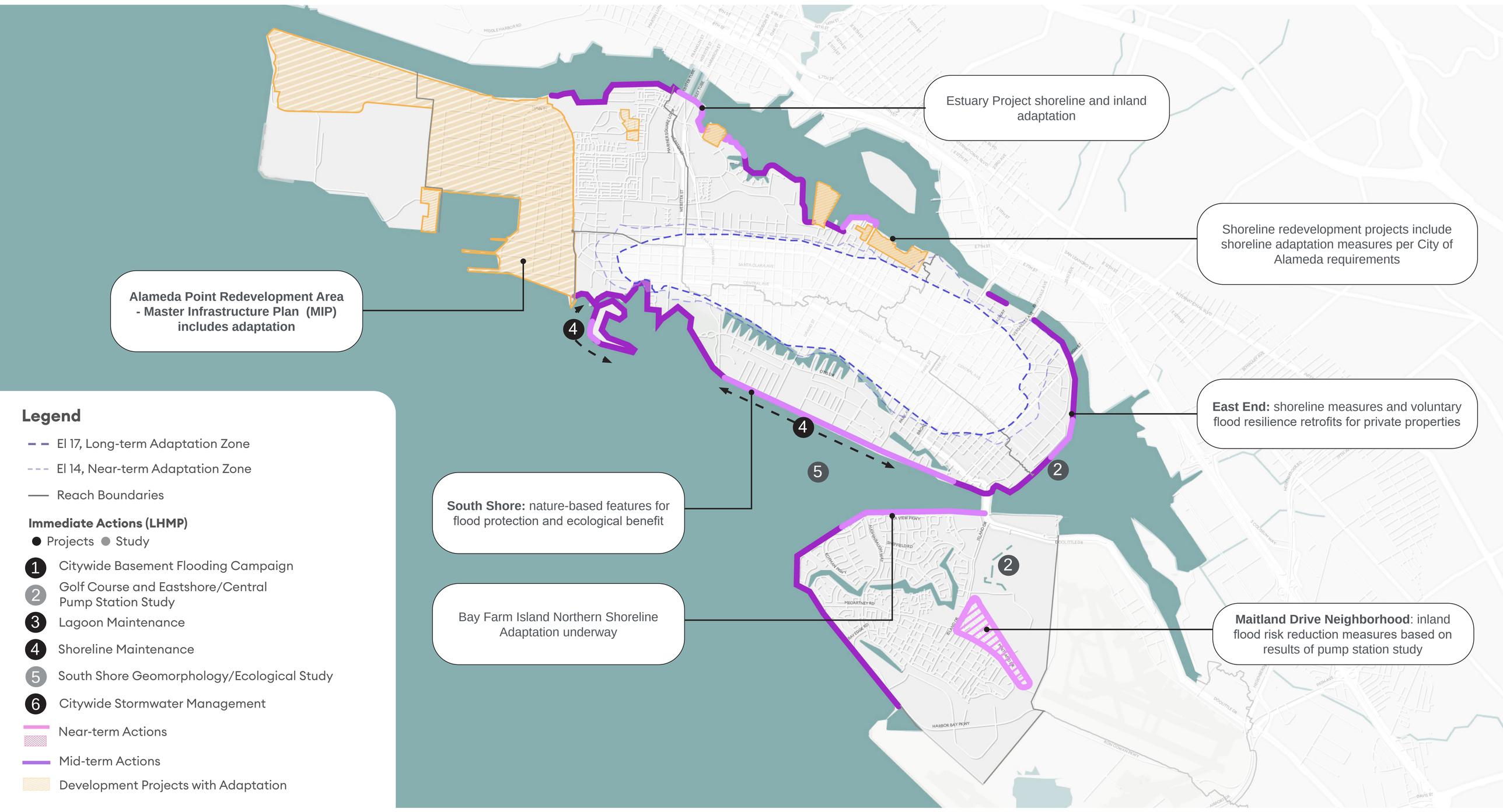
Long-term actions will consider risks associated with 3.5-7 feet of sea level rise.

Final decision-making about mid- and long-term actions will be made by future generations, but the decisions we make today influence the options they will have.

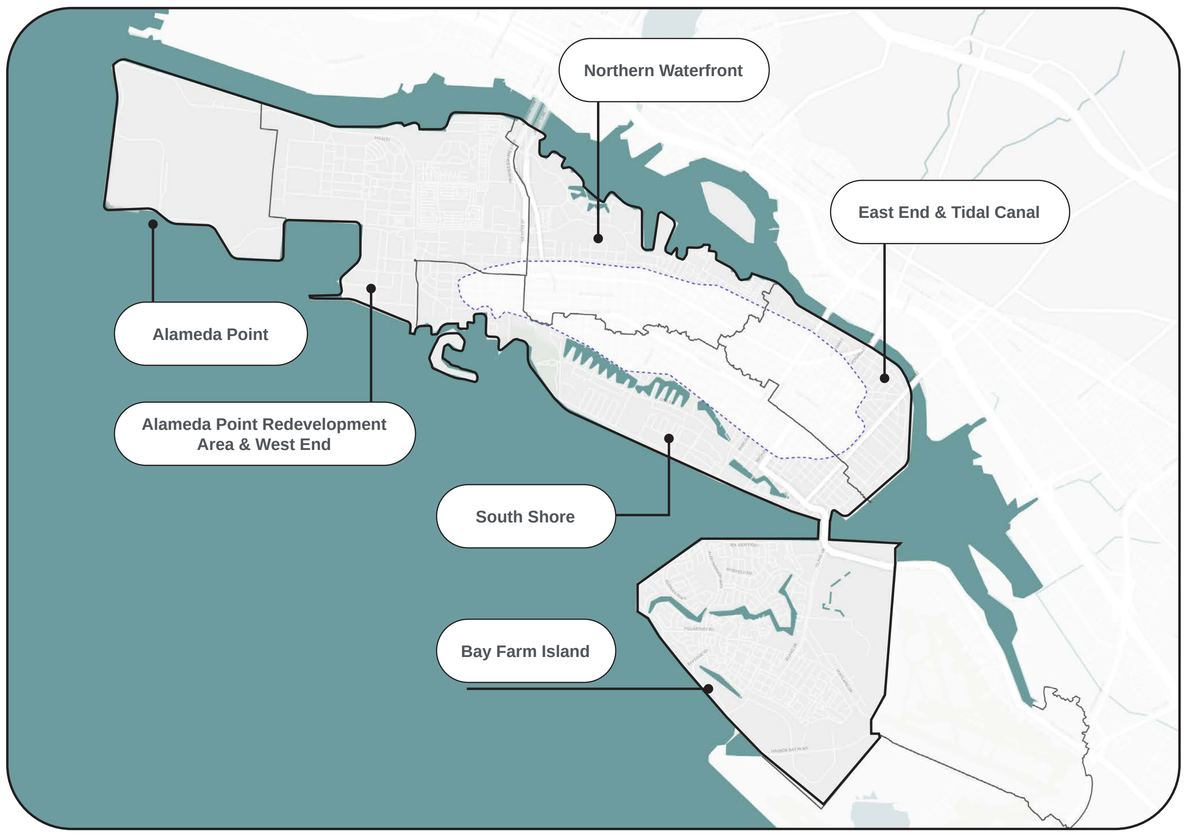


*Implementation timeframes subject to change.
**Sea level rise timing based on approximate High and Intermediate projections. OPC, OST, and CA Sea Level Rise Task Force 2024.

NEAR- AND MID-TERM ADAPTATION STRATEGIES



LONG-TERM ADAPTATION



Questions to Consider

Approaches to long-term adaptation will vary significantly across the Alameda shoreline reaches, given variable levels of vulnerable and other constraints. While we aren't making decisions now, we want to start the conversation on long-term adaptation. Please consider the following questions:

- *Where can we continue to tolerate occasional flooding? For how long?*
- *Where could we raise the shoreline to defend against coastal floods?*
- *Raising the shoreline can trap water inland from rainfall, creeks and sloughs, and rising groundwater. How can we address these inland flood risks given limited space for infrastructure?*
- *What land use and policy tools could help us build toward a longer-term vision?*
- *Talking about long-term future changes can be difficult. Sometimes it feels too big. Sometimes it feels too distant. Keep in mind that small, thoughtful steps in the right direction today could open possibilities for future generations to improve community safety, health, habitats, and daily life.*

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EVALUATING OPTIONS

SUBREGIONAL ADAPTATION PLANNING

EVALUATION CRITERIA

The evaluation criteria categories **inform strategy development and support decision-making processes** for near-, mid-, and long-term strategies. They are designed to reflect the **OAAC subregional goals** and they are informed by the **OAAC planning principles**.

RISK REDUCTION

Risk reduction is about making our communities safer and reducing negative outcomes of disasters. BCDC's RSAP guidelines are focused on reducing risk associated with coastal flood hazards and sea level rise, though other hazards are important to consider as well.

Example questions:

- *Does this alternative sufficiently mitigate flood risk for the project's expected lifespan?*
- *Does it support other risk reduction efforts, e.g., related to earthquakes and contamination?*
- *How could this alternative exacerbate other risks, now or in the future?*

SOCIETY AND EQUITY

Society and equity refers to the positive and negative effects of an adaptation strategy on people, communities, and the services on which they rely, with a focus on disproportionate impacts due to existing inequities.

Example questions:

- *What immediate benefits beyond risk reduction does this alternative bring for the local community?*
- *Does this alternative maintain and protect existing housing?*
- *Does this alternative increase or improve public access?*
- *How does this alternative affect local air quality and public health?*

ECONOMY

Economy refers to the positive and negative effects of an adaptation strategy on local and regional businesses, jobs, infrastructure, and other components of economic activity.

Example questions:

- *Does this alternative maintain and protect existing critical infrastructure?*
- *Does this alternative protect existing local and regional jobs and businesses? Could it generate new jobs?*
- *How does the cost of this project compare to the benefits?*

ADAPTABILITY

Adaptability refers to how easily a strategy can be expanded or built upon to address increasing risk (e.g., higher rates of sea level rise) further into the future. If you design a strategy to be adaptable, it can save money and make it easier to keep people safe in the long run.

Example questions:

- *How could we build on this project to address higher rates of sea level rise?*
- *Does this alternative enable multiple adaptation options open for future generations?*
- *How else could this alternative affect future actions? now? Under what changing conditions?*

ENVIRONMENT

Environment refers to the positive and negative effects of an adaptation strategy on species, habitats, and ecosystems.

Example questions:

- *How would this alternative affect threatened and endangered species?*
- *How does it enhance habitat connectivity?*
- *How does this alternative compare to others in terms of greenhouse gas emissions or sequestration?*

GOVERNANCE

Governance refers to organizational structure, jurisdiction, and mechanisms of participants that affect vulnerability to impacts.

Example questions:

- *Does this alternative support collaborative, transparent decision-making?*
- *Does it address adaptation information gaps or barriers to access?*
- *Does it encourage broad public and/or private sector partnerships?*

Tell us what you think!

We welcome you to use the comment cards provided to let us know whether these criteria reflect your values.

What criteria would you emphasize or prioritize?

What is missing?

FEASIBILITY

Feasibility refers to whether a strategy is possible and practicable considering current or future conditions such as funding, political support, community support, technologies, and laws and regulations. Some strategies may be infeasible for near-term implementation, but potentially feasible in the long term.

Example questions:

- *Is this alternative feasible based on current technologies and policies?*
- *Could we find funding for this option with enough lead time to install it before the risk is too high?*
- *Could this alternative become feasible several decades from now? Under what changing conditions?*

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