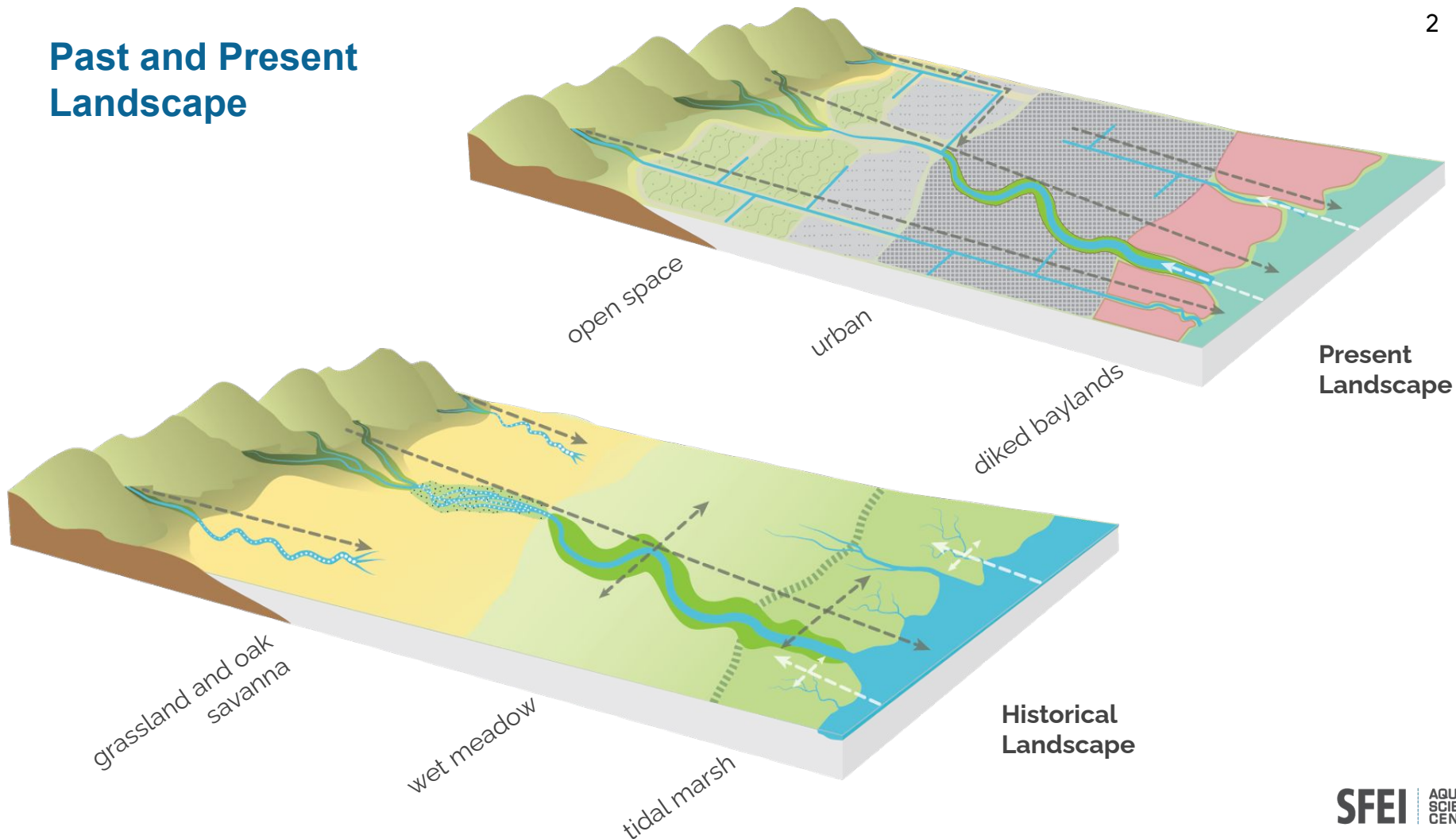


Protect, Accommodate, Retreat:

Adaptation strategies in the face of sea-level rise

Jeremy Lowe, Ellen Plane, Laura Feinstein

Past and Present Landscape



**Historical
baylands**



Bay



Sea level

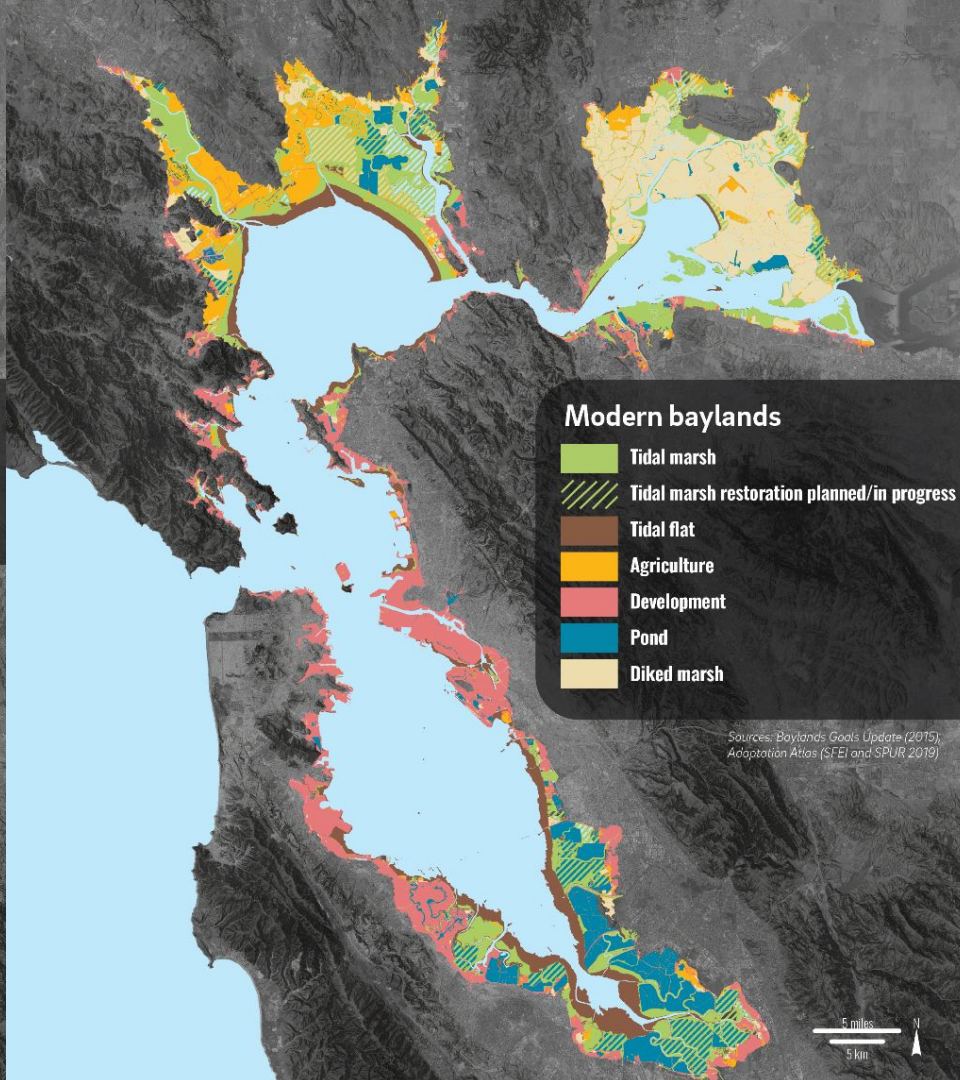
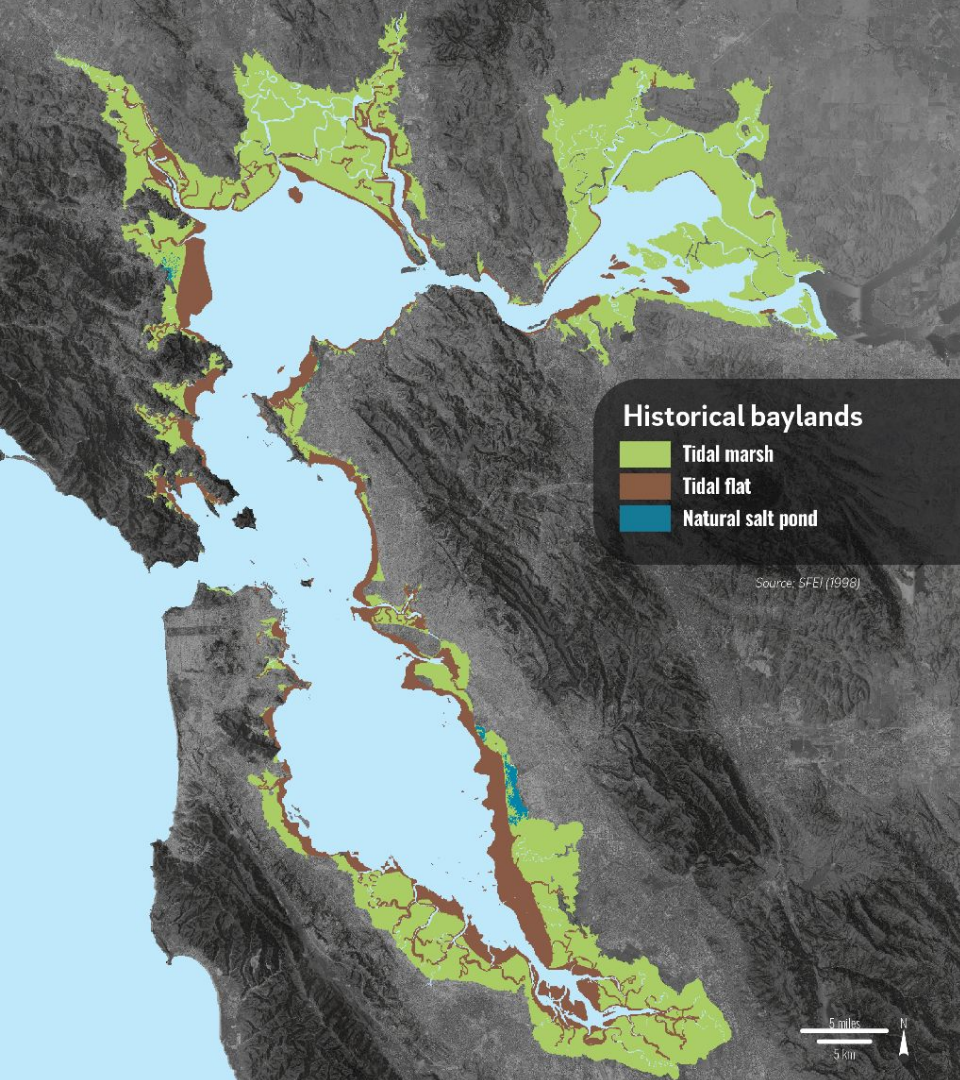


Ground level



Levee





What are adaptation outcomes?



"Gray" Infrastructure
Levees
Seawalls



"Green" Infrastructure
Habitat Restoration
Ecotone Levees



Protect Shorelines

Elevating Structures
Flood Resistant
Materials



*Accommodate
the Water*

Restrict Development
Equitably Relocate



*Avoid or Retreat
Developed Areas*

Move levee to more sustainable location (setback levee)



Bel Marin Keys Unit V,
Marin County

Reduce number of homes/businesses at risk



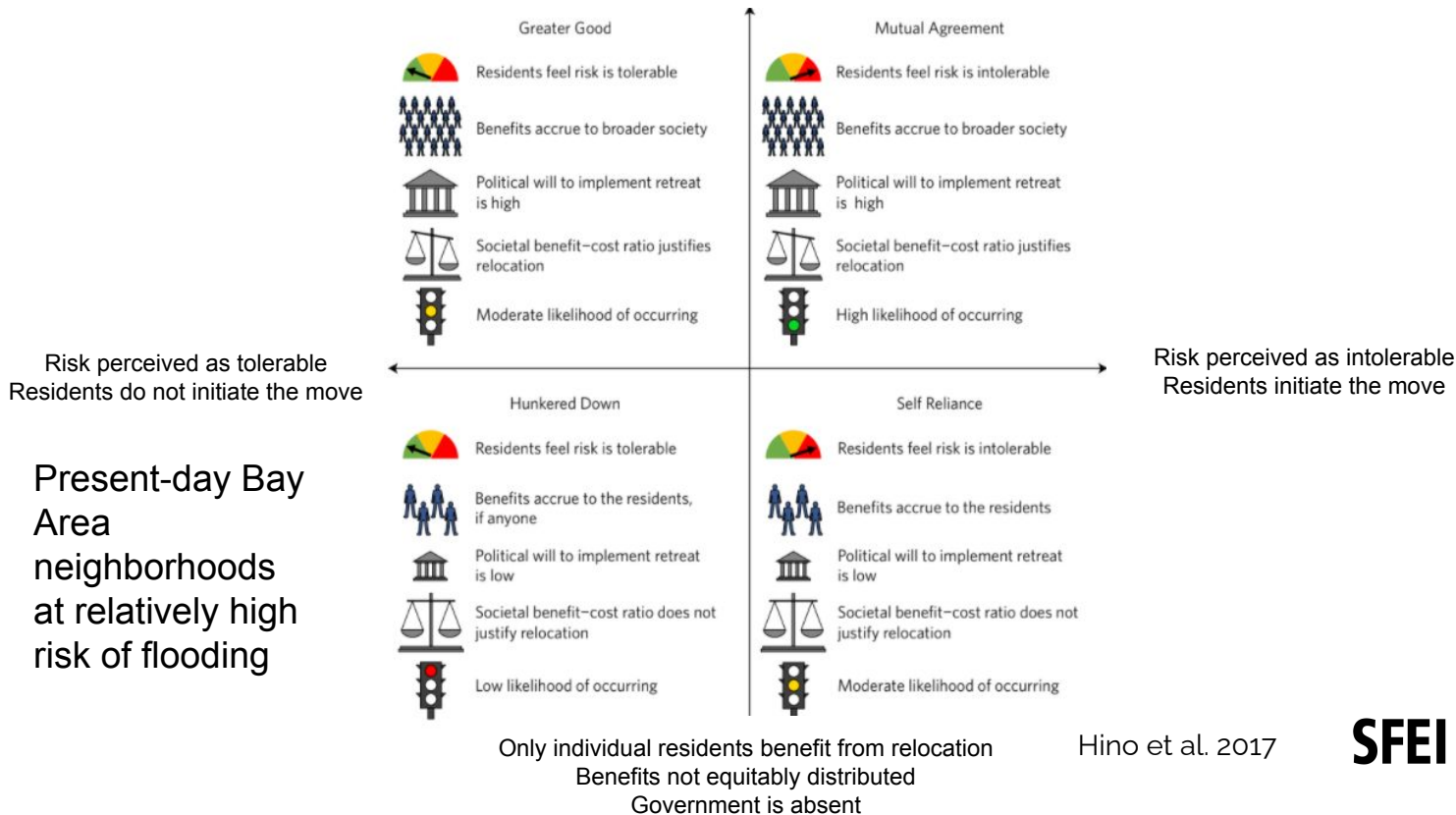
Oakwood Beach, Staten Island, **2010**



Oakwood Beach, Staten Island, **2021**

Who makes decisions on managed retreat?

Society and residents benefit
Benefits equitably distributed
Government plays an active role



Hino et al. 2017

An Adaptation Pathway that Lays Groundwork For Better Options

Retreat is a long way off: decisions on retreat won't need to be made until near the end of the century.

Potential scenario for a low-lying Bay Area community:

- In 2100, a levee is reaching the limit of its design capacity
- There is a rising risk of levee failure during a storm surge
- There is increasingly frequent nuisance flooding
- Many residents feel risk is intolerable

What were the decisions made earlier that determined the community's options in 2100?

2022

Funding to Support Equitable Resilience Planning and Implementation

Ensure communities have equitable resources for resilience planning; this likely means greater resources directed to disadvantaged communities.

Install Green Infrastructure

Take advantage of the window of opportunity to restore wetlands before rising sea levels make it more difficult

Require that new development in vulnerable areas design for protection and/ accommodation

Consider what accommodation strategies can be incorporated in major building and infrastructure retrofits.

Community-Led Conversations on Adaptation Strategies

Educate and inform the community. Discuss scenarios for future sea level rise.

Increase development nearby in less hazard-prone areas

Prioritize locating new housing and lifeline services such as transit, hospitals, utility infrastructure in low-hazard places.

Observe growing risks

More nuisance flooding, levees would no longer able to withstand a 200-year storm event

Mutual Agreement Model

Voluntary Option to Move, With Support System in Place

Community-Led Re-Evaluation of Adaptation Strategies

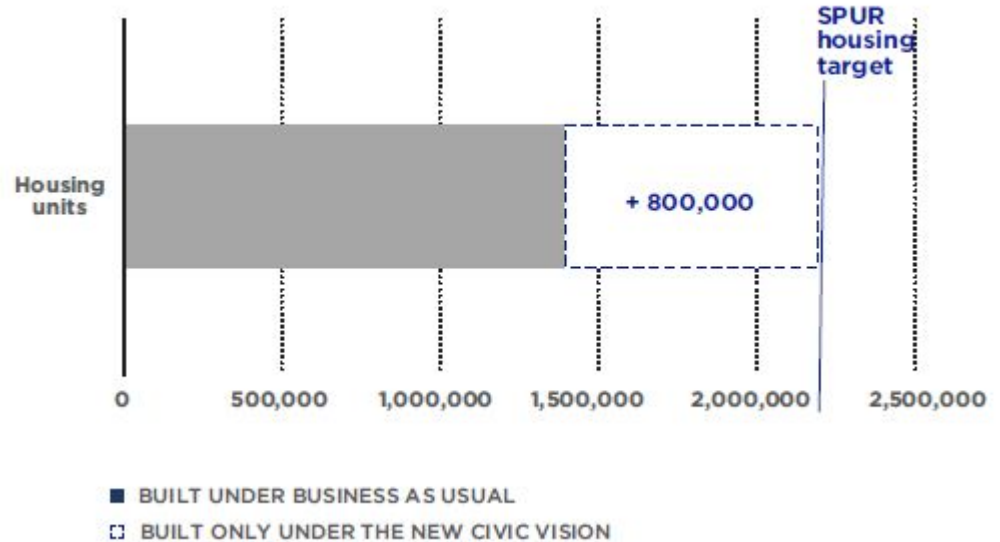
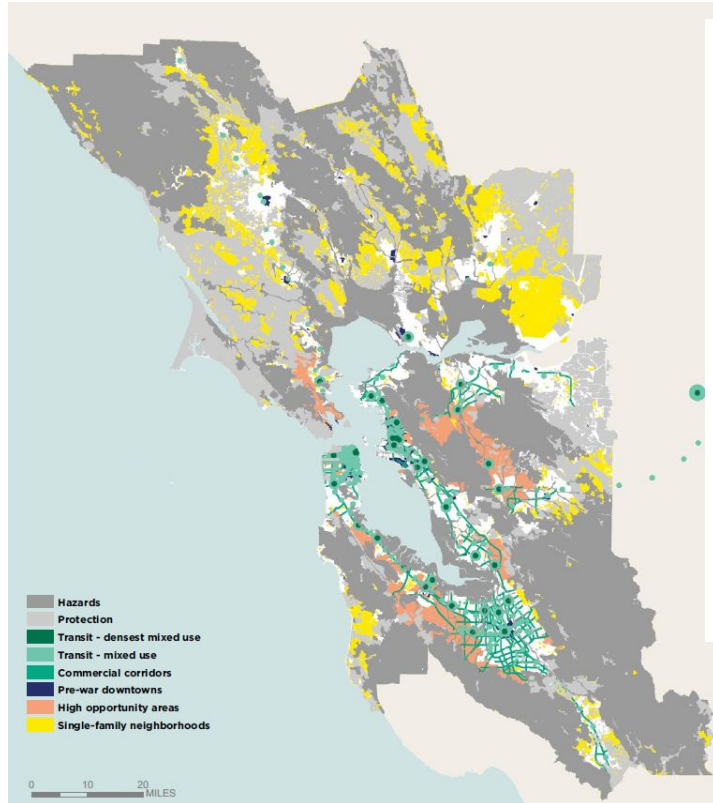
Costs of protection and accommodation increasing with rising tides; chance of failure growing more likely and consequences more likely to be severe.

Though mitigated somewhat through accommodation, costs and disadvantages of staying have increased as sea level rises. Work has been done to make a voluntary retreat more tenable.

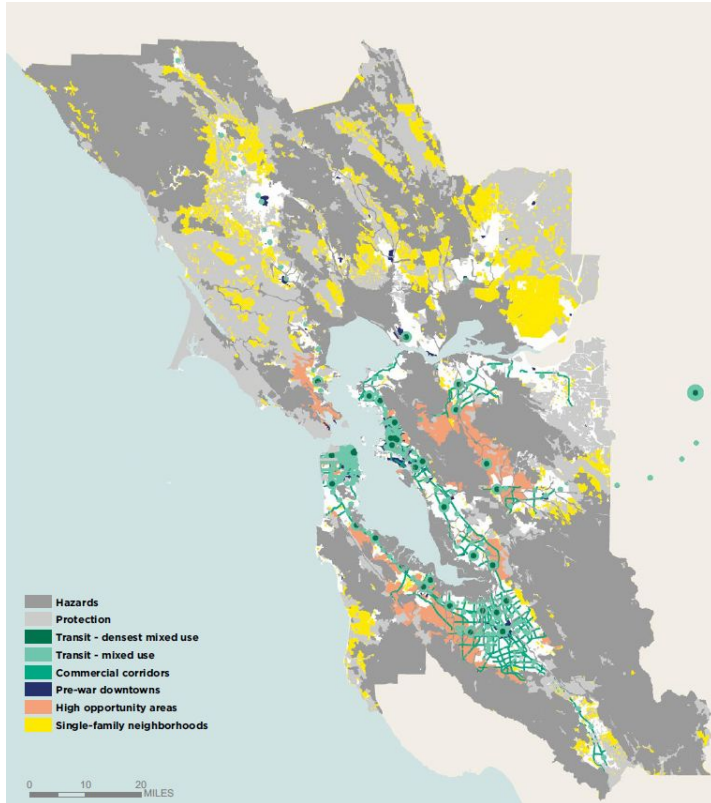
Create tools to acquire high-risk property and enable voluntary moves

- Voluntary buyouts
- Open Space Acquisitions
- Conservation Land Trusts
- Land Swaps
- Leasebacks
- Life Estates and Future Interests

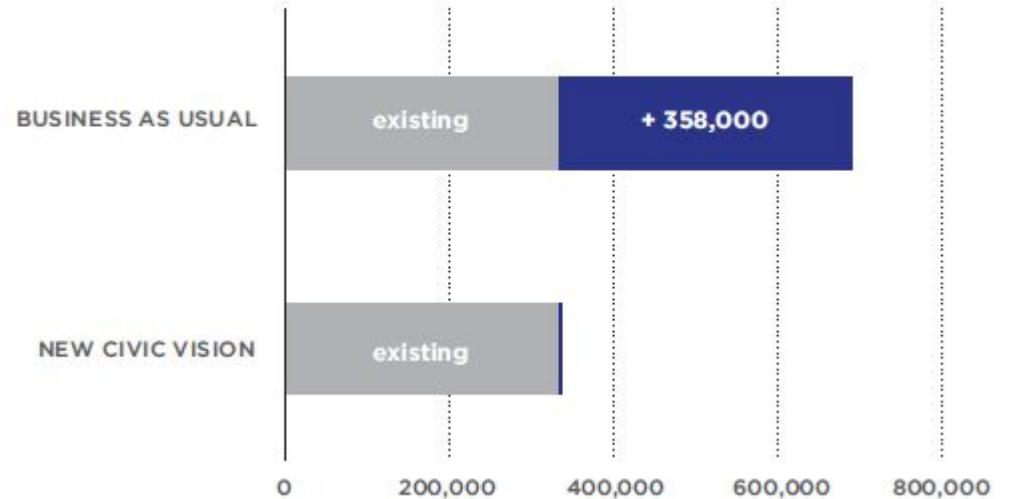
SPUR Regional Strategy



SPUR Regional Strategy



Housing units added in hazardous areas



Similar pattern for new jobs

Conclusions

We're investing in protection and accommodation

Retreat is a long way off for the Bay Area

We need to plan now to leave more and better options on the table when risk does become intolerable

