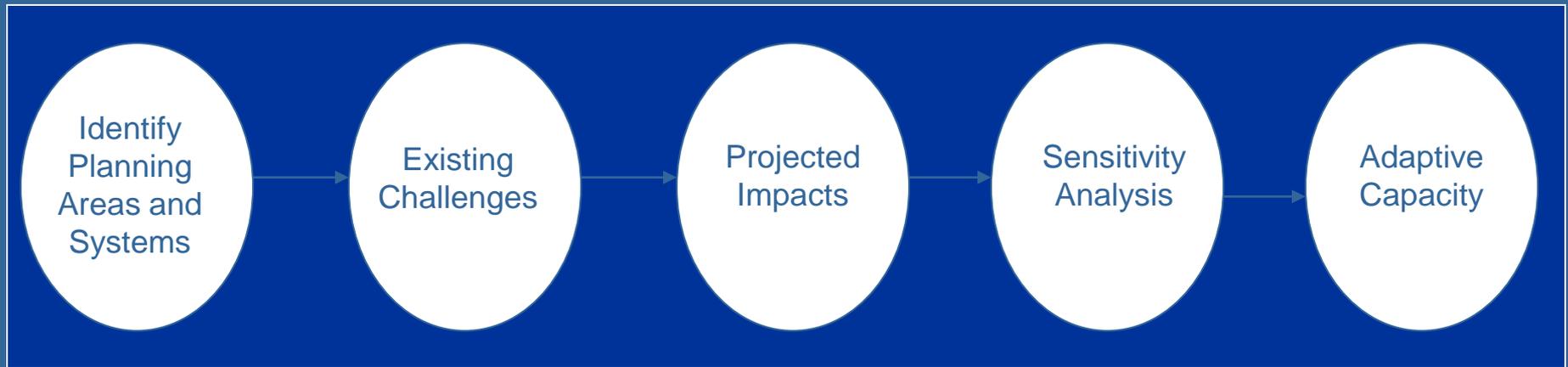


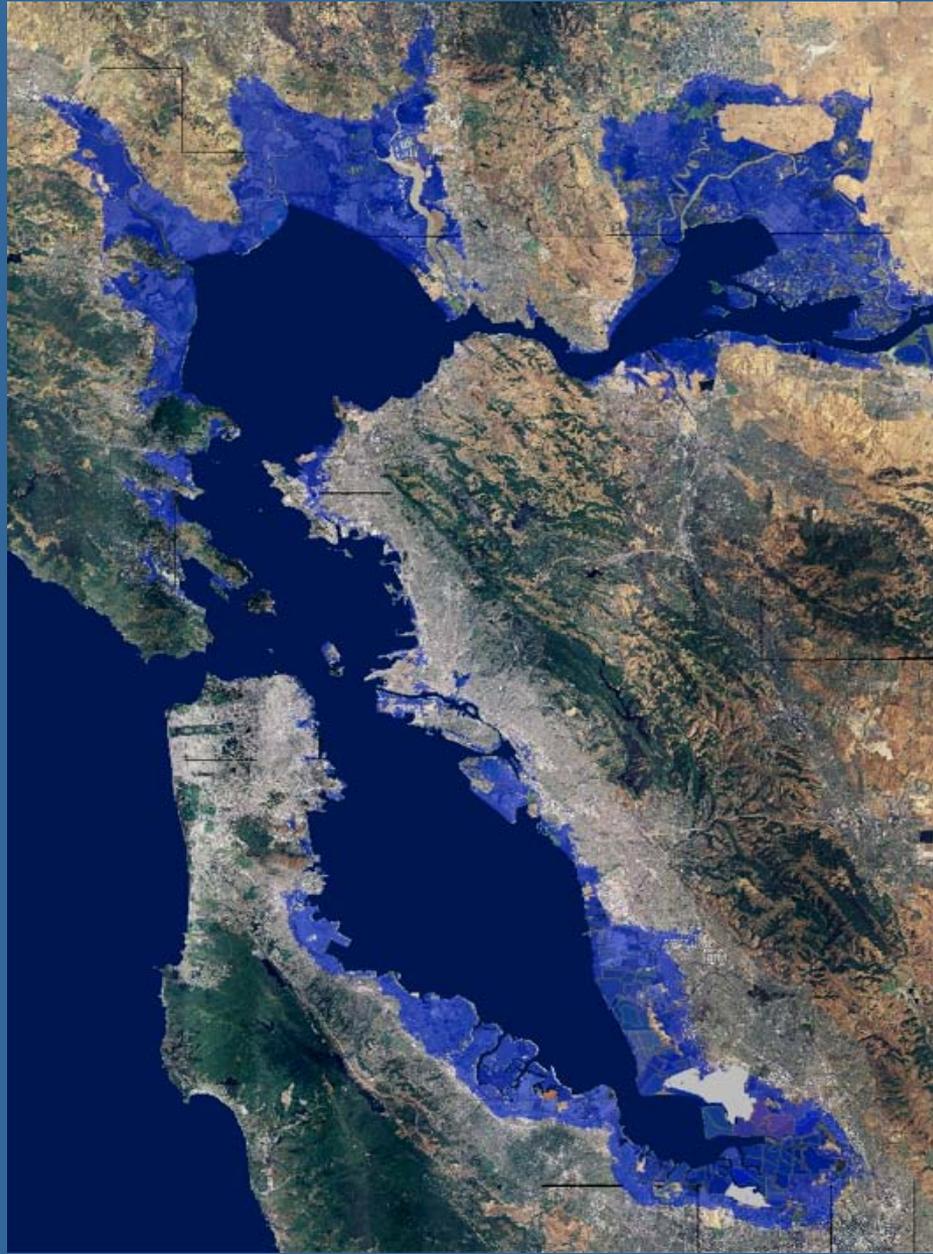
BCDC Climate Change Program



Steve Goldbeck
Chief Deputy Director
San Francisco Bay Conservation
and Development Commission

Vulnerability Analysis





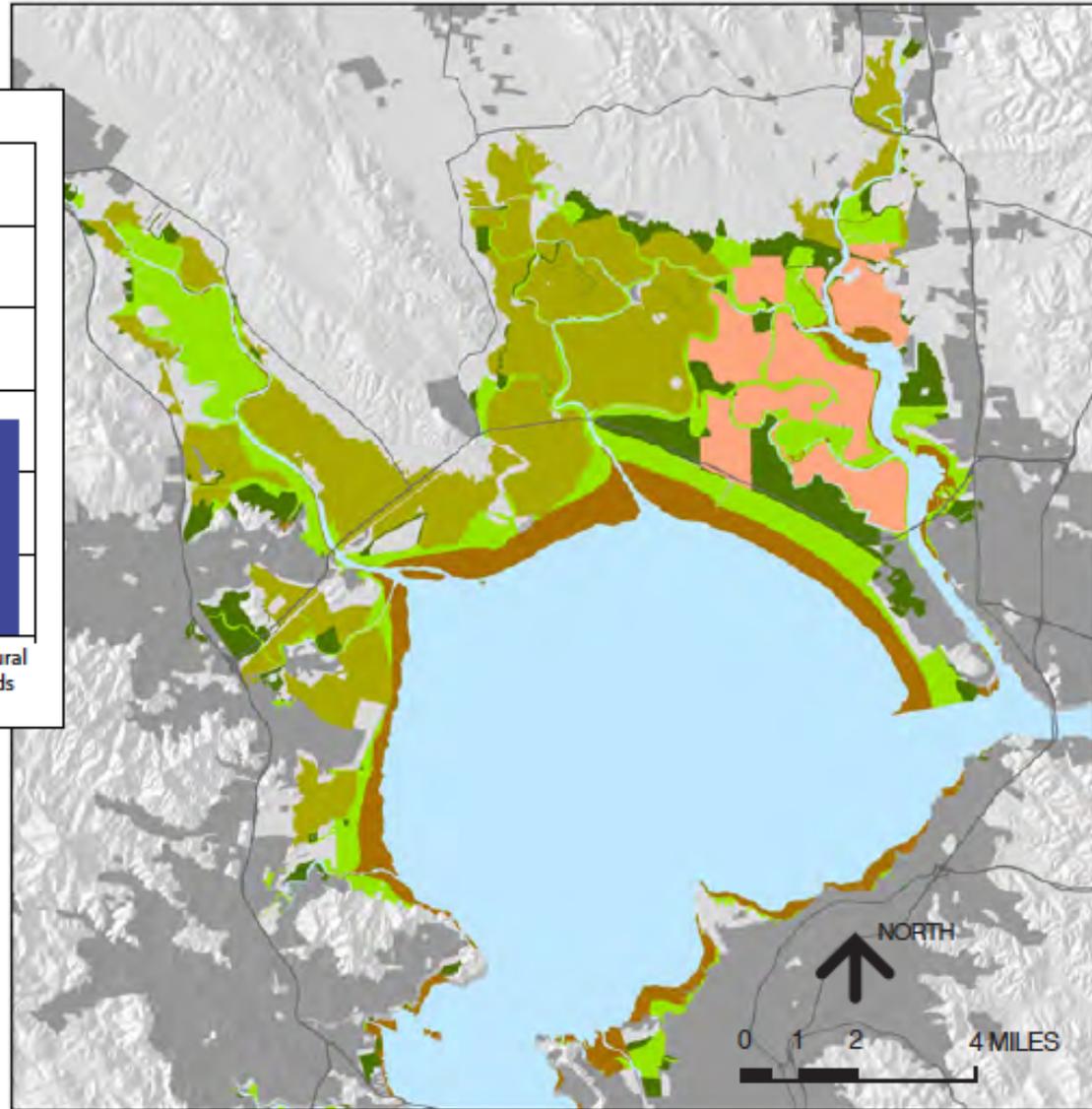
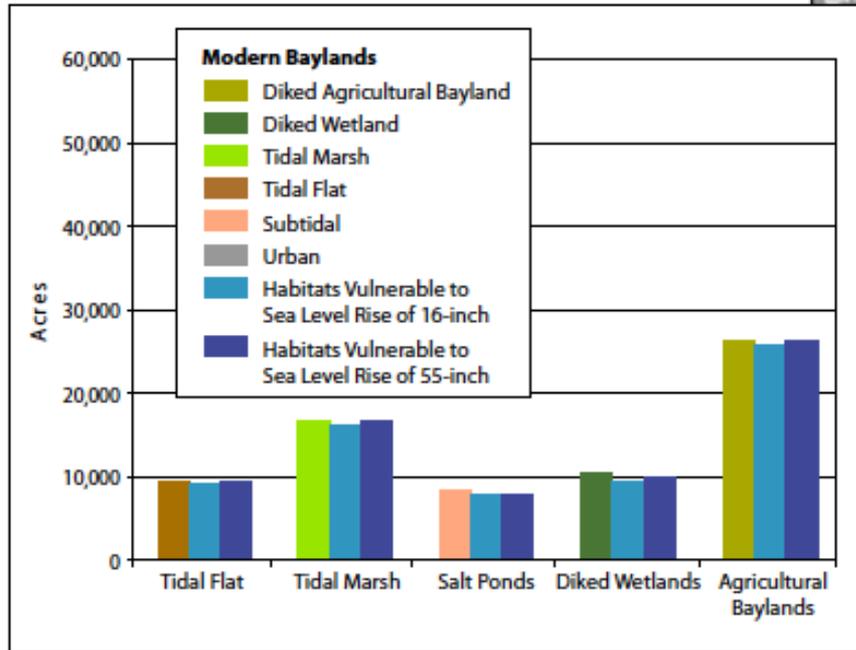
Consequences

- Approximately 270,000 residents vulnerable to flooding
- Approximately 81 schools
- 11 fire stations
- 9 police stations
- 42 healthcare facilities

Costs

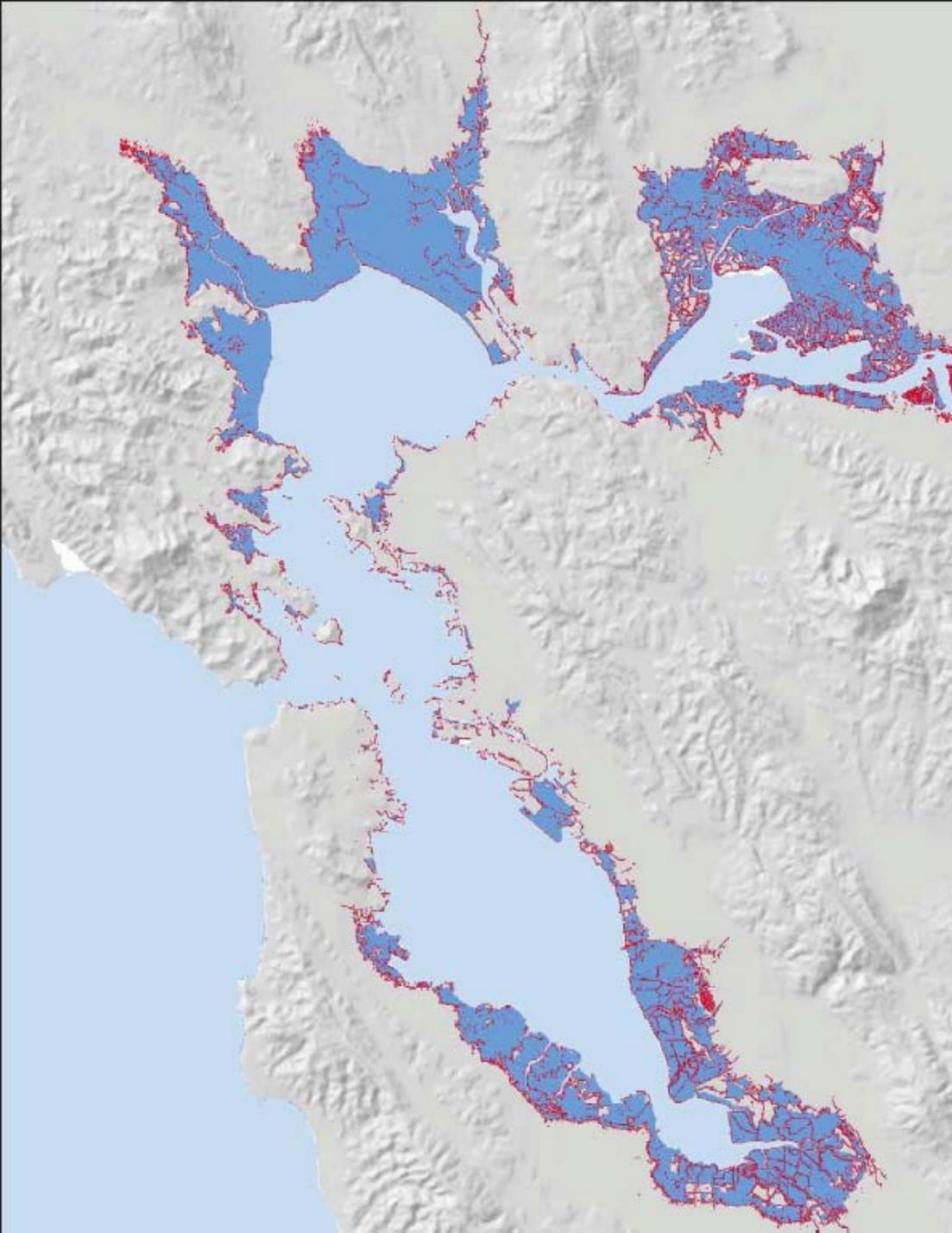
- \$62 Billion replacement value SF Bay Area
- \$32 Billion for the rest of Ca shoreline

North Bay Marsh Habitats Vulnerable to Sea Level Rise





Today's Flood is Tomorrow's High Tide



 Area subject to high tide with 16 inches of sea level rise

 Current 100-year flood plain

San Francisco Bay Plan

San Francisco Bay Conservation
and
Development Commission



California's Climate Change Adaptation Programs and Initiatives

Executive Order S-13-08

Sea Level Rise

- Recognizes the need for statewide consistency in planning for sea level rise
- Proposes NAS panel to conduct sea level rise assessment by 12/01/10
- Directs state agencies to consider a range of scenarios in project planning to reduce risks in the interim

Climate Adaptation Strategy

- CA Natural Resources Agency coordinates and completes by June 30, 2009



State SLR Strategy

- Calls for State Agency adaptation plans
- Discourages Development in areas at risk
- OPC lead with BCDC, CCC, Coastal Cons, DFG & State Lands
- COCAT

Joint Policy Committee

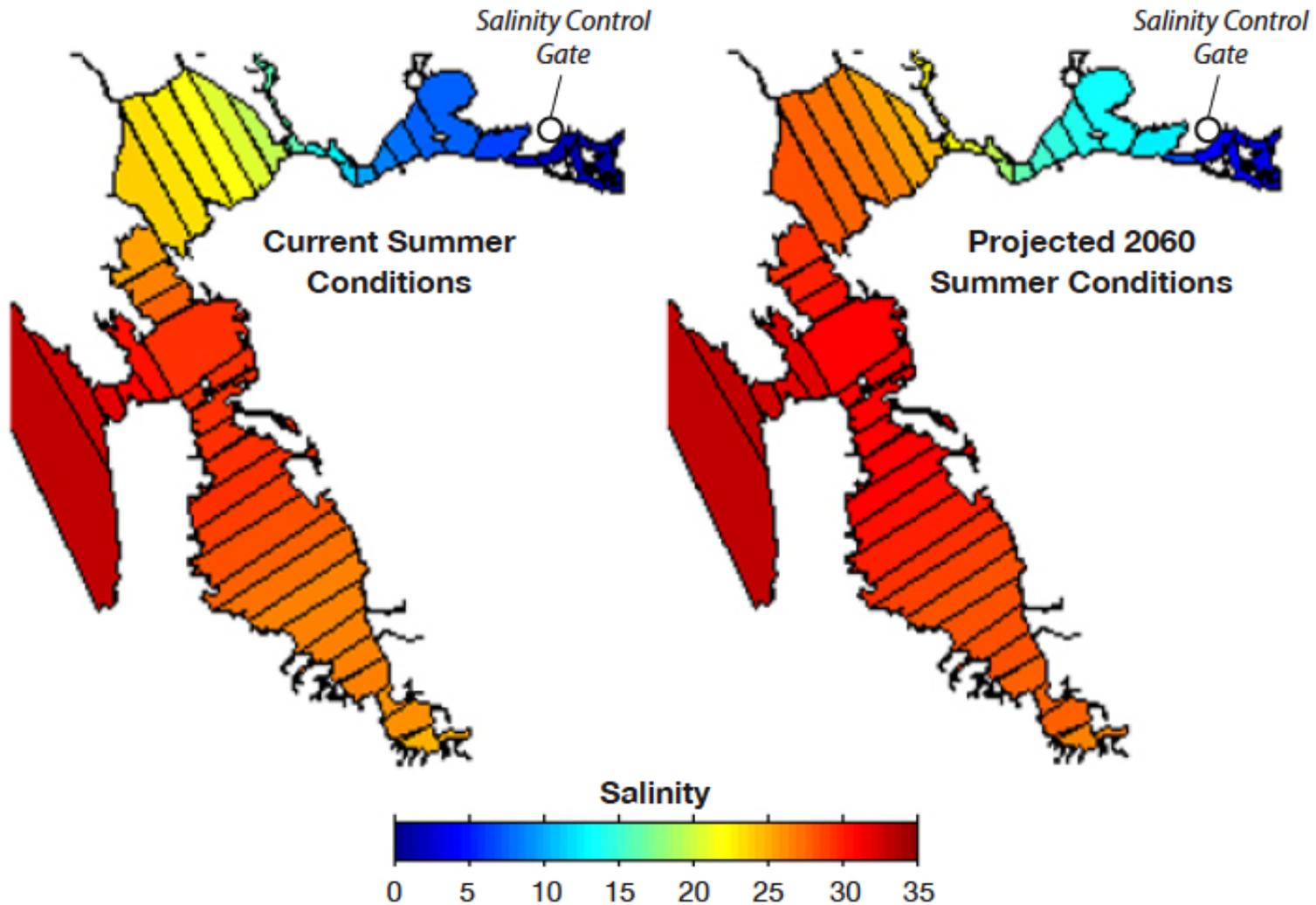
- Association of Bay Area Governments
- Bay Area Air Quality Management District
- BCDC
- Metropolitan Transportation Commission

Sustainable Communities Strategy

- Mandated by SB 375
- Reduce Greenhouse gas from driving
- MTC & ABAG leads



Salinity Change in the Bay and Suisun Marsh



Wet-Year summer salinity field shifts upstream
10-15km due to reduced spring/summer
snowmelt runoff

Regional Climate Action Plan

- Working With ABAG & CEC PIER
- Funded by PIER
- UC Berkeley Researchers

Local Government Assistance

- Provide support, outreach and resources to local governments on adaptation planning
- Partners include NOAA, NERR,





RISING TIDES



call for ideas



Rising Tides Design Ideas Competition

www.risingtidescompetition.com

Singapore

Australia

Hong Kong

Japan

Korea

New Zealand

Canada

Germany

Holland

Spain

England

Italy

Greece

Russia

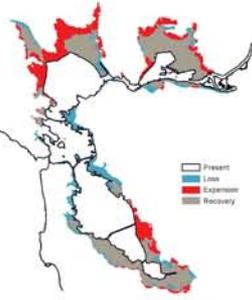
India

Costa Rica

Mexico

United States

EVOLUTIONARY RECOVERY

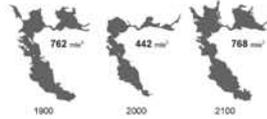


San Francisco Bay is one living organism. It breathes, circulates and transforms over time. During the past century, San Francisco Bay has suffered from tremendous loss of its body - more than 40% due to the heavy shoreline development.

The global warming phenomenon calls for both challenges and opportunities for San Francisco Bay. If continuous climate change is anticipated, the sea level at the Bay is projected to be 4.5 feet higher in 2100. This will result massive inundation of the San Francisco Bay shoreline. Ironically, the sea level rise will bring back the Bay to the size that it was a century ago.

Evolutionary Recovery begins.

There is no one magical solution for this recovery process. Some wounds have stitches to heal while some need simple clean-ups. Others require major surgery. This design proposal defines Bay's Evolutionary Recovery process and identifies 3 recovery zones. Protection, Operation, Adaptation.

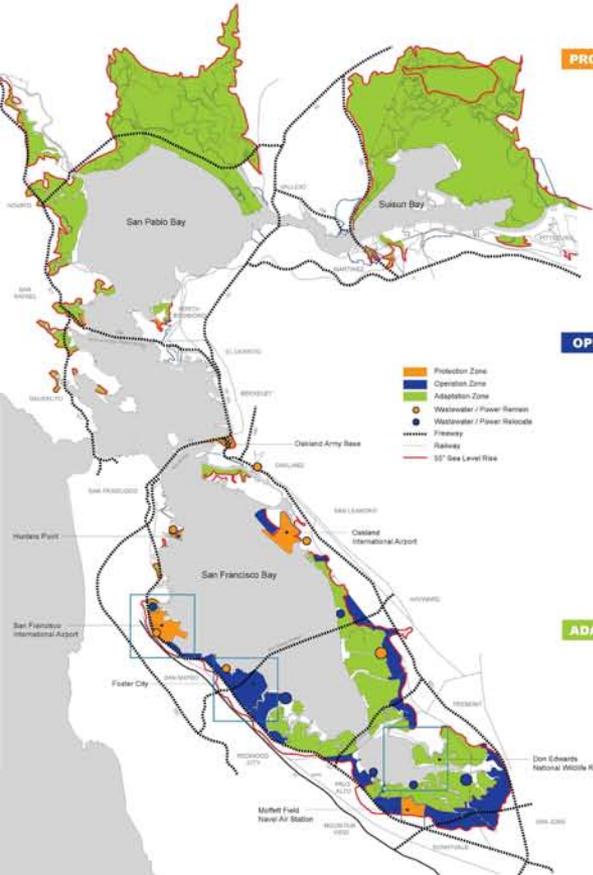
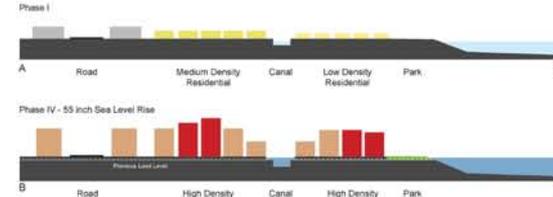
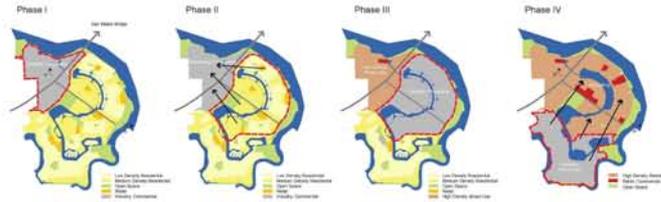


FOSTER CITY Operation Phasing Plan

Foster City, once San Mateo County's thriving shoreline tidal marsh, has formed its land by dredging the wetlands and pumping mud and sand onto the island raising it slightly above sea level.



Land subsidence and projected sea level rise put all of Foster City, built on 4 square miles of former bay wetlands, at risk of inundation, threatening 30,000 residents and businesses.

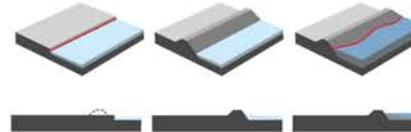


PROTECTION



Protect Shoreline Infrastructure

- Protect major shoreline infrastructure - Airports / Ports / Highways / Utilities
- Physical Barrier + Wetland = Double shoreline protection

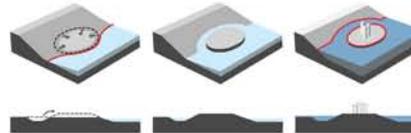


OPERATION



Operate Low-Grounds / Landfill Development

- Retreat : Existing development susceptible to future inundation
- Relocate : Creating New High-ground for Relocation
- Revitalize : New High-density development

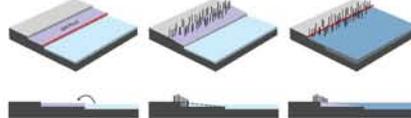


ADAPTATION



Adapt Existing Wetlands / Salt Ponds

- Tidal wetlands function as natural buffers against flood events. They adapt to sea level rise by gathering sediments and growing vegetation accelerated with carefully prescribed dredging and deposition accompanied with wetland planting.
- Salt ponds will be released as dredge materials and sediment washes into newly opened salt ponds.



RAYdike

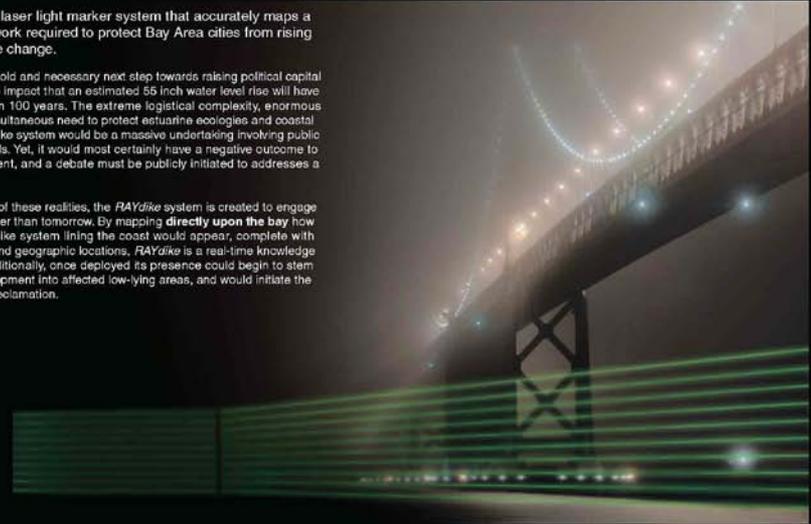
Representing the Real:
Creating public awareness by
delineating a possible future



RAYdike is a temporary laser light marker system that accurately maps a hypothetical barrier network required to protect Bay Area cities from rising waters caused by climate change.

The RAYdike proposal is a bold and necessary next step towards raising political capital and public awareness to the impact that an estimated 56 inch water level rise will have on the San Francisco Bay in 100 years. The extreme logistical complexity, enormous mitigation costs, and the simultaneous need to protect estuarine ecologies and coastal scenery with a continuous dike system would be a massive undertaking involving public involvement at multiple levels. Yet, it would most certainly have a negative outcome to the bay's life and development, and a debate must be publicly initiated to address a range of possible solutions.

To confront the significance of these realities, the RAYdike system is created to engage a cause for action today rather than tomorrow. By mapping **directly upon the bay** how a large, standard emitter dike system lining the coast would appear, complete with accurate elevation heights and geographic locations, RAYdike is a real-time knowledge and awareness system. Additionally, once deployed its presence could begin to stem the flow of new urban development into affected low-lying areas, and would initiate the process for tidal zone land reclamation.



VIEW OF RAYdike LASER LIGHT BARRIER DEPICTS A POTENTIALLY 30FT TALL DIKE ENCOMPASSING SAN FRANCISCO



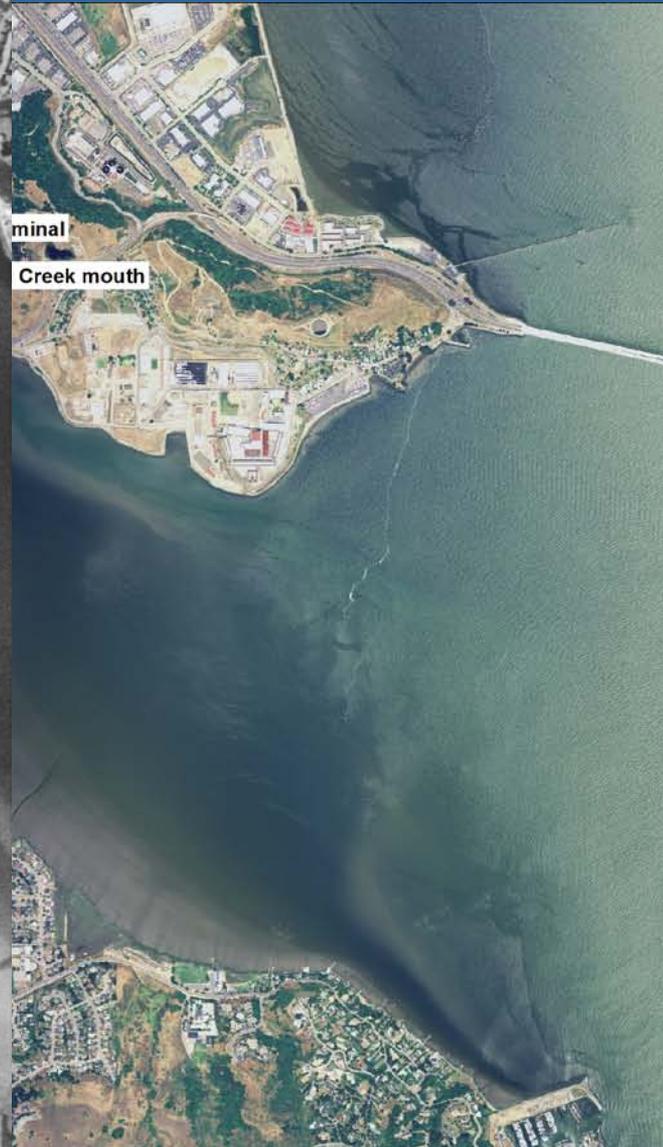
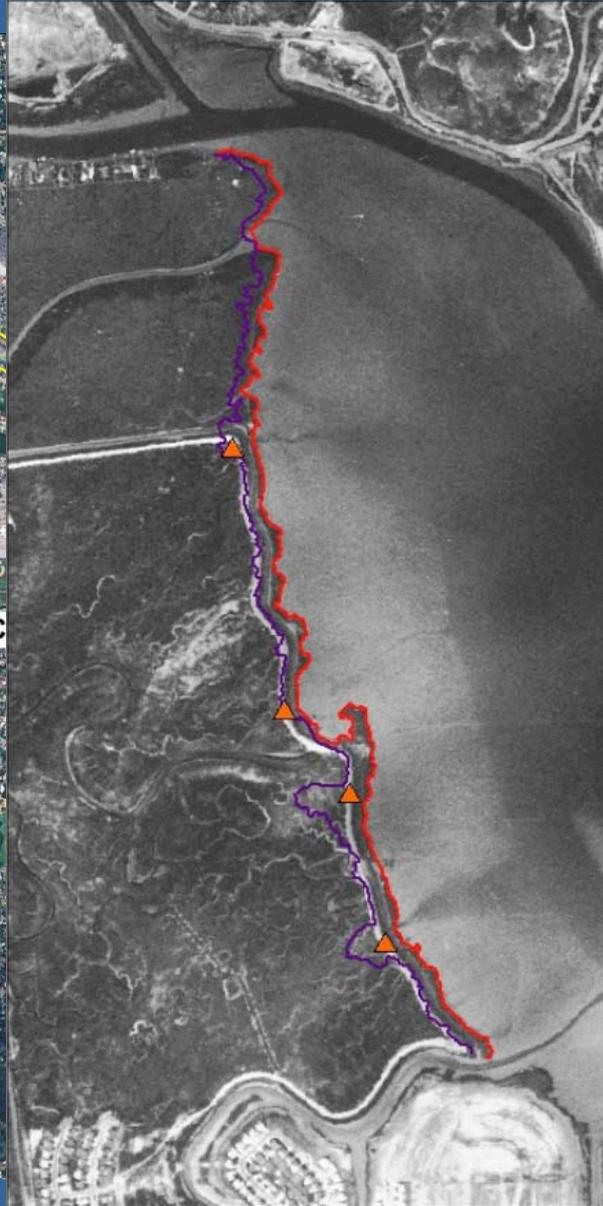
The RAYdike NETWORK CLOSELY FOLLOWS THE SHORELINE

-  RAYdike EMITTER NODE
-  RAYdike LIGHT PATH
-  EXTENDED FLOOD ZONE EMITTERS
-  EXTENDED FLOOD ZONE LIGHT PATH
-  POPULATION CENTERS
-  TIDAL FLOOD AREA (+55 inches by YEAR 2100)
-  SHIPPING LANE
-  PIPES BURIED
-  RESTRICTED AREA

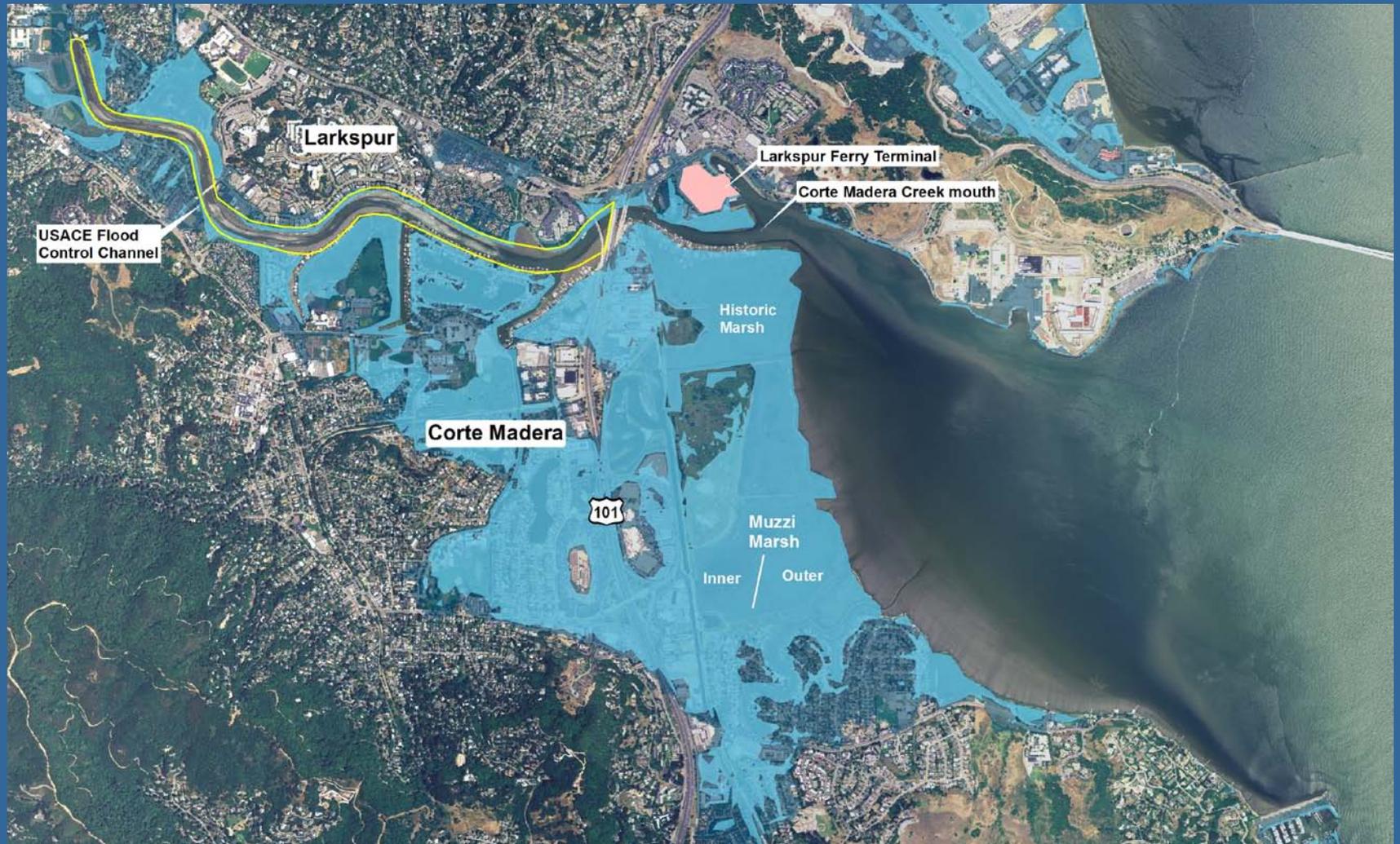
The RAYdike network relies on the bay's unique atmospheric condition for intermittent, low-lying, and year round fog, and uses a laser light beam system that projects potential barrier elevations through the dense night air under favorable conditions. The result is a hypothetical and realistic depiction of tall barrier walls surrounding urban cores and coursing through natural tidal shores. Rather than relying on disseminated informational texts and color-coded diagrams, RAYdike diagrams a future reality directly into our everyday urban lives.



Corte Madera - today



Corte Madera - tomorrow



Phase 1 – Flooding today

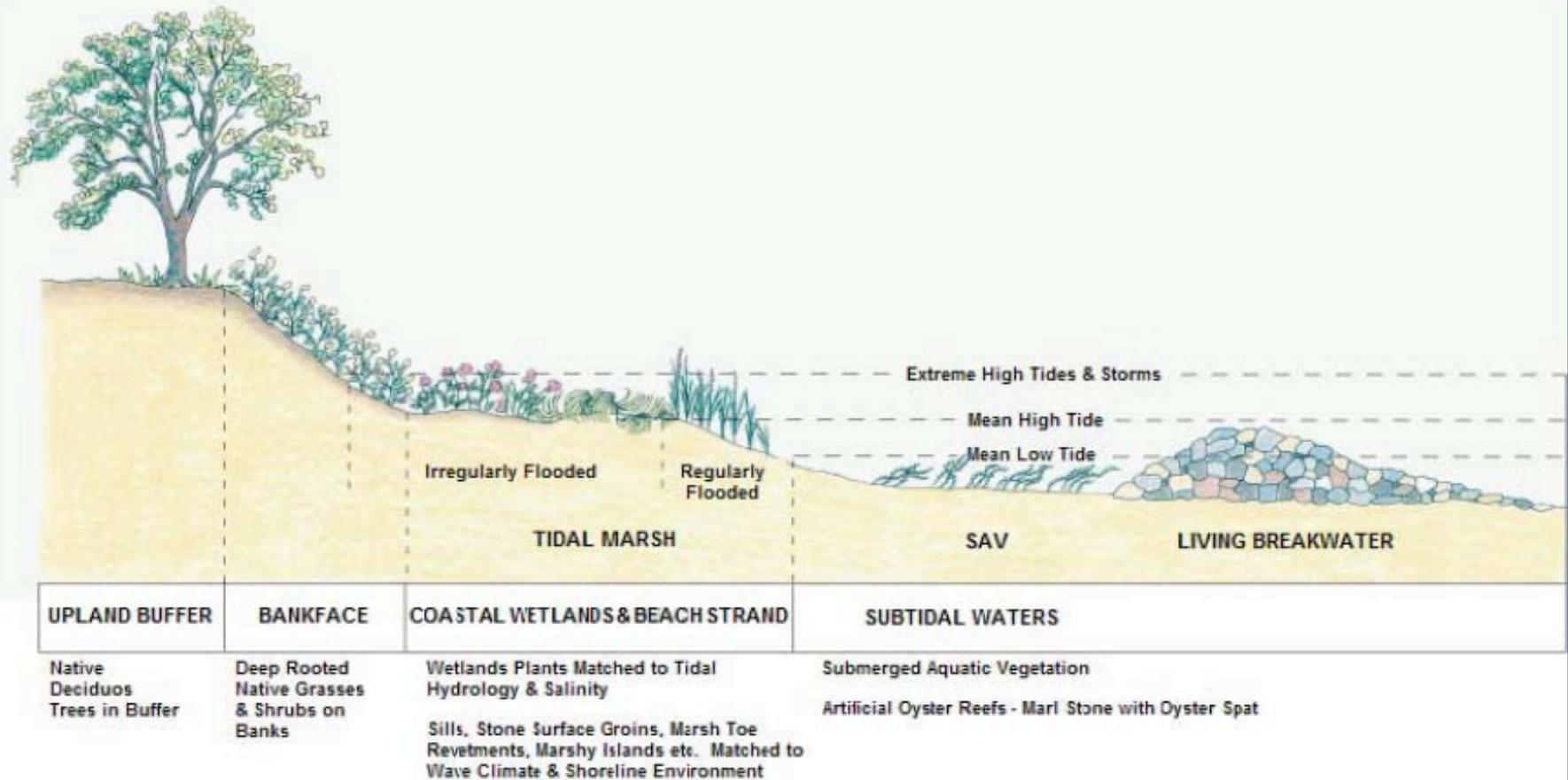




Marin

San Francisco Bay

Adaptation



RSM

- Focused science and management
- Use the LTMS structure
- \$175,000 from CIAP
- \$295,000 from CSMWG
- \$580,000 in LTMS study funds

Head of Tide

- Where tides meet sweetwater in tributaries
- Extensive development
- Vulnerable to sea level rise



Climate Ready Estuaries Pilot



Salt Marsh Conceptual Model

Climate Drivers

Changes in Air Temperature

Changes in Precipitation

Sea Level Rise

Changes in Storm Climatology and Wind

Stressor Interactions

Changes in Water Temperature

Changes in Salinity

Flooding

Sedimentation and Erosion

Invasive Species

Contaminants

Other Human Uses

Altered Flows/Water Demand

Land Use/Land Cover Change

Ecosystem Processes

Community Interactions

Primary Productivity

Nutrient Cycling

Water Purification

Sediment Retention

Water Retention

Indicators

Species Population Size

Biodiversity

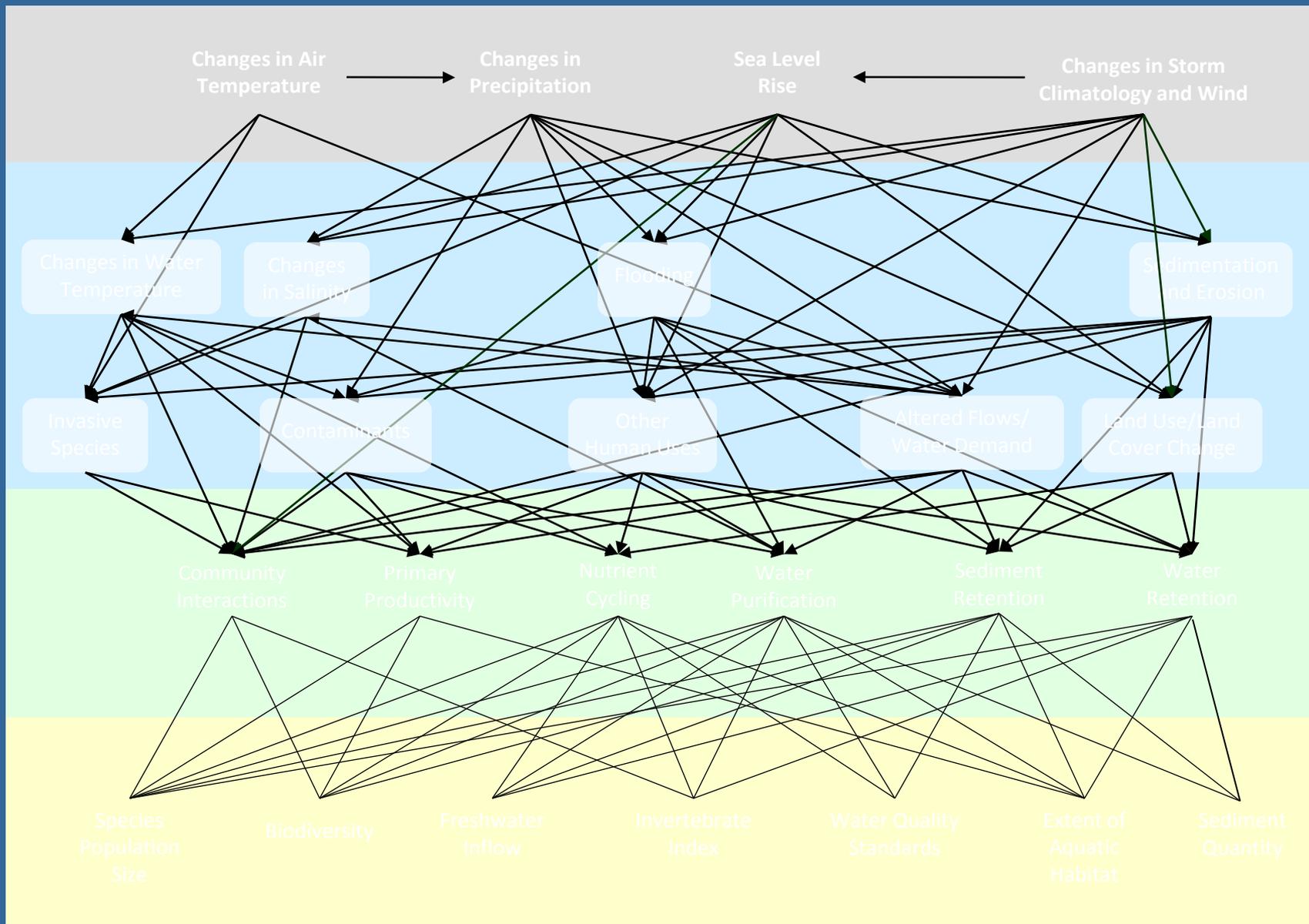
Freshwater Inflow

Invertebrate Index

Water Quality Standards

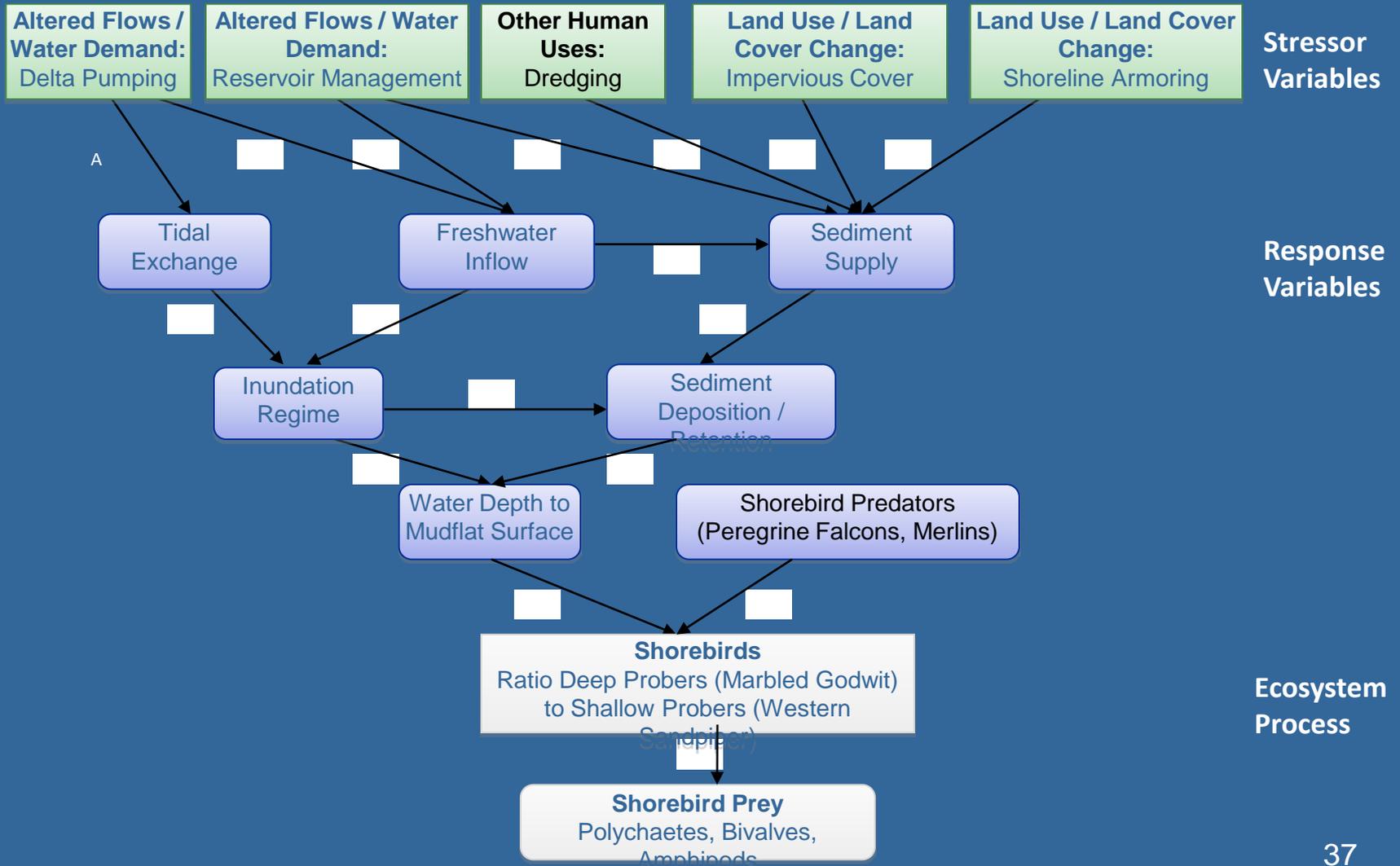
Extent of Aquatic Habitat

Sediment Quantity



Community Interactions Influence Diagram

Influence Diagram—Community Interactions (Shorebirds), North Bay



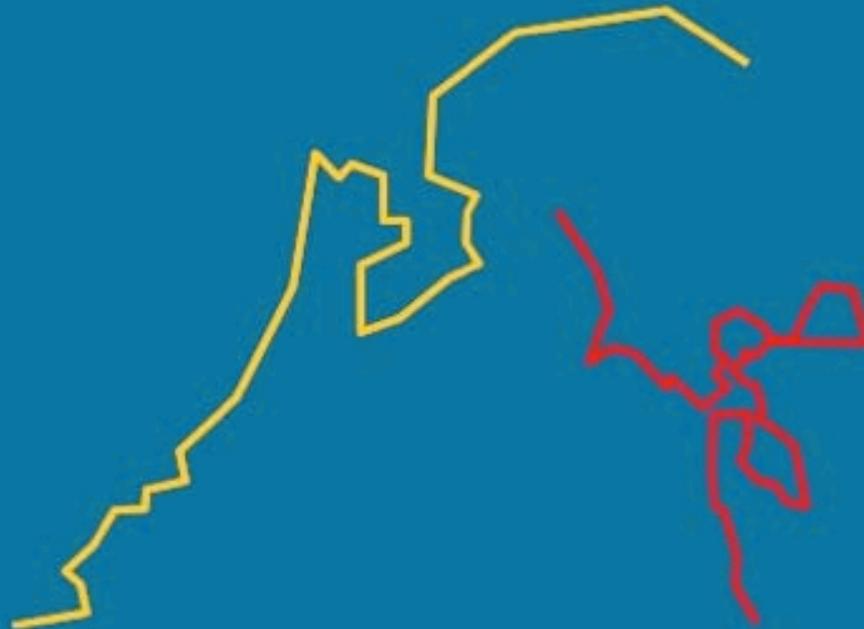
Bay Area Ecosystem Climate Change Consortium



The Dutch



San Francisco Bay: Preparing for the next level



21 September 2009



ARCADIS

Deltares

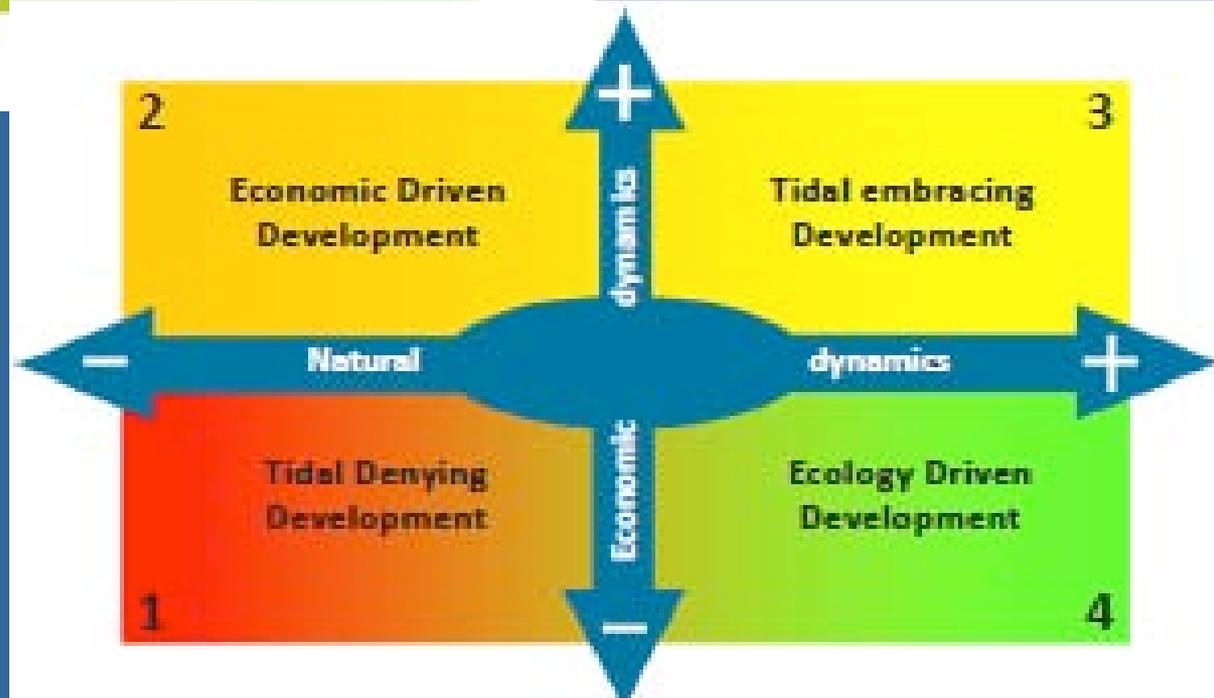
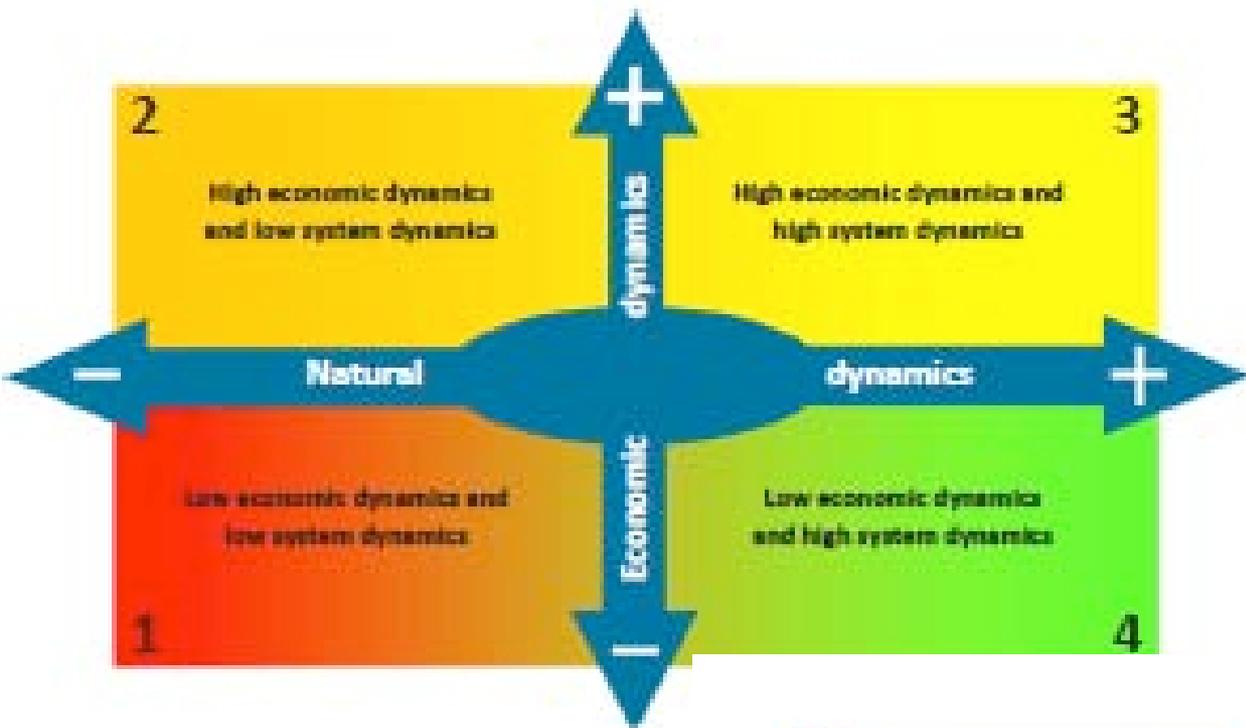


ALTERRA

WAGENINGENUR

*In collaboration
with:*





Adapting to Rising Tides
Bay Area Communities Working Together



