# Waterfront Ecologies: Redefining the Urban Edge of the San Francisco Bay

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Waterfront Ecologies re-envisions the edge condition around the San Francisco Bay, creating a new set of relationships between urban life and ecology. In 24 sites along the contested shoreline of the Bay Area, our redevelopment strategy illustrates a new methodology to design holistically as we face challenges posed by climate change and a growing population.

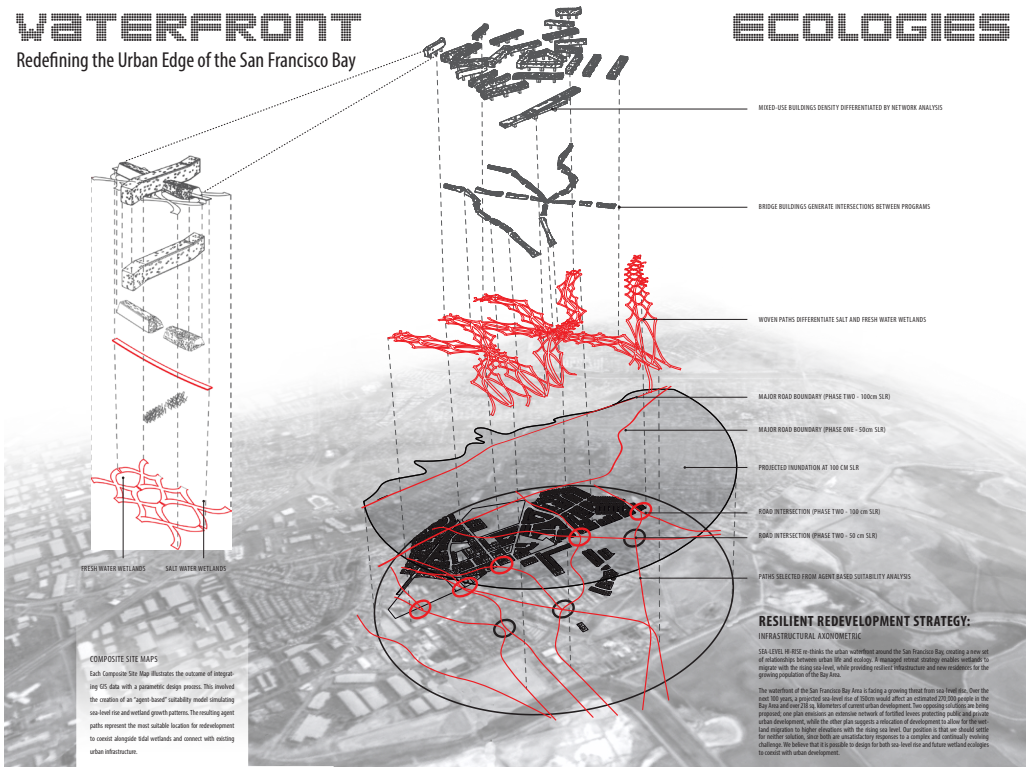
The waterfront of the San Francisco Bay Area is facing a growing threat from sea-level rise. By the end of the century, a projected sea-level rise of 140cm would affect an estimated 270,000 people in the Bay Area and over 331 sq. kilometers of current urban development. Two opposing solutions are being proposed; one plan that envisions an extensive network of fortified levees protecting public and private urban development and the other plan suggests a relocation of development to allow for the wetland migration to higher elevations with the rising sea level.

We propose that both may be accomplished by a staged retreat of existing development, enabling a wetland migration with the rising sea-level, while introducing a resilient new development and infrastructure that is uniquely defined by the region's ecological characteristics. The new development would be built on "finger" levees that are horizontal to tidal action, allowing for wetlands to coexist between the buildings, acting as a native habitat and a buffer against storm surges. Mid-rise and hi-rise buildings would replace the current low-density suburban development, creating a significantly smaller footprint, while providing twice as much housing for a growing Bay Area population.

Our design strategy involves the creation of an "agent-based" model to simulate sea-level rise and wetland growth patterns around the San Francisco Bay. GIS mapping data on sea-level rise, wetlands, demographics, and urban infrastructure was integrated with parametric modeling software to allow the site conditions to directly inform the design outcome. Our research demonstrates that through the use of new technologies in mapping and modeling, we can better utilize interdisciplinary knowledge to inform a design approach, mitigating the relationship between ecology and urban development.

# WATERFRONT ECOLOGIES

## Redefining the Urban Edge of the San Francisco Bay




### RESILIENT REDEVELOPMENT STRATEGY:

INFRASTRUCTURAL AXONOMETRIC

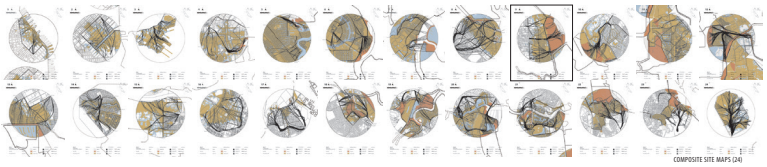
SEA-LEVEL HI-RISE re-thinks the urban waterfront around the San Francisco Bay, creating a new set of relationships between urban life and ecology. A managed retreat strategy enables wetlands to migrate with the rising sea-level, while providing resilient infrastructure and new residences for the growing population of the Bay Area.

The waterfront of the San Francisco Bay Area is facing a growing threat from sea level rise. Over the next 100 years, a projected sea-level rise of 100cm would affect an estimated 270,000 people in the Bay Area and over 218 sq. kilometers of current urban development. Two opposing solutions are being proposed; one plan envisions an extensive network of fortified levees protecting public and private urban development, while the other plan suggests a relocation of development to allow for the wetland migration to higher elevations with the rising sea level. Our position is that we should settle for neither solution, since both are unsatisfactory responses to a complex and continually evolving challenge. We believe that it is possible to design for both sea-level rise and future wetland ecologies to coexist with urban development.

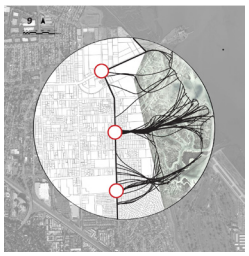
### COMPOSITE SITE MAPS

Each Composite Site Map illustrates the outcome of integrating GIS data with a parametric design process. This involved the creation of an "agent-based" suitability model simulating sea-level rise and wetland growth patterns. The resulting agent paths represent the most suitable location for redevelopment to coexist alongside tidal wetlands and connect with existing urban infrastructure.


PERSPECTIVE VISUALIZATION

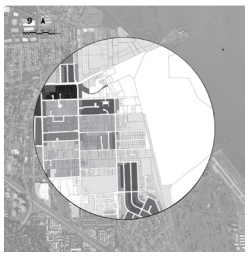


COMPOSITE SITE MAPS (24)

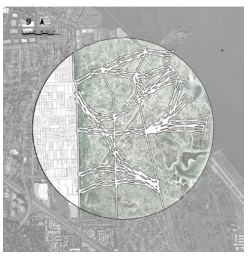
### AGENT / MAJOR ROAD INTERSECTION

Based on GIS information and sea-level rise predictions, a system of artificial intelligence wetland agents was generated. The agents grow and evolve based on water levels, soil sediment accretion and swarm behavior. The agents intersect with the major roads in different staged retreat levels according to rising sea-level stages (50cm,100cm, 150cm).



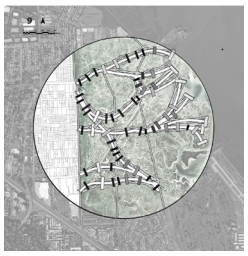
### CENSUS INFORMATION

The site's census information is used to differentiate the building typology and density. High-rise and mixed-used buildings are developed closer to the major roads, while mid-rise buildings are located along levee roadways. The development creates housing for the displaced residents and expected population growth in the Bay Area.



### WEAVING AGENTS / CONSTRUCTED WETLANDS

The agent pathways are used to develop new levee roadways, building foundations, and infrastructural systems for each site. Located within the woven levee system are freshwater wetlands that are used to treat grey water produced by the new urban development.



### MULTI-LAYERED INFRASTRUCTURE

The urban proposal enables the migration of the wetland ecologies, while providing new mixed-use developments for the growing population in a staged retreat and resilient redevelopment strategy. A new housing paradigm is proposed with the unique set of ecological and urban adjacencies.