

RE-PLUMBING THE EAST BAY

OPPORTUNITIES TO INCREASE BAYSHORE RESILIENCY AND REDUCE INFRASTRUCTURE VULNERABILITY

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www.sfei.org/ebda-sea-level-plan



The East Bay Dischargers Authority (EBDA) currently discharges treated wastewater effluent into San Francisco Bay through a deep water outfall; however, this infrastructure is aging and vulnerable to rising sea level. Due to the Clean Water Act, many wastewater treatment plants discharged to the Bay with the goal of maximizing dilution. However, recognizing the potential benefits of freshwater flows to the baylands, this project assessed the opportunities and constraints of decentralizing EBDA's discharge and re-using treated wastewater for improved ecosystem function along the San Leandro to Fremont shoreline. While not shown here, we also explored water quality challenges and nutrient removal of wetlands, in addition to regulatory and governance needs for successful implementation of these types of innovative projects.

ADAPTATION

Decentralization of EBDA's infrastructure would remove infrastructure from the hazard zone with rising seas. The alternative concepts would also contribute to increased ecosystem resilience. For example, seepage slopes would create longer slopes in front of levees to provide migration space for marshes and routing treated wastewater through these seepage slopes would provide the hydrology needed to support native plants.

Seepage Slope

Creek Connections

historical

modern

future

ALTERNATIVE CONCEPTS:

- Routing through seepage slope (part of horizontal levee) (image above)
- Routing to creek systems (image above)
- Contained wetland treatment systems
- Re-use of water



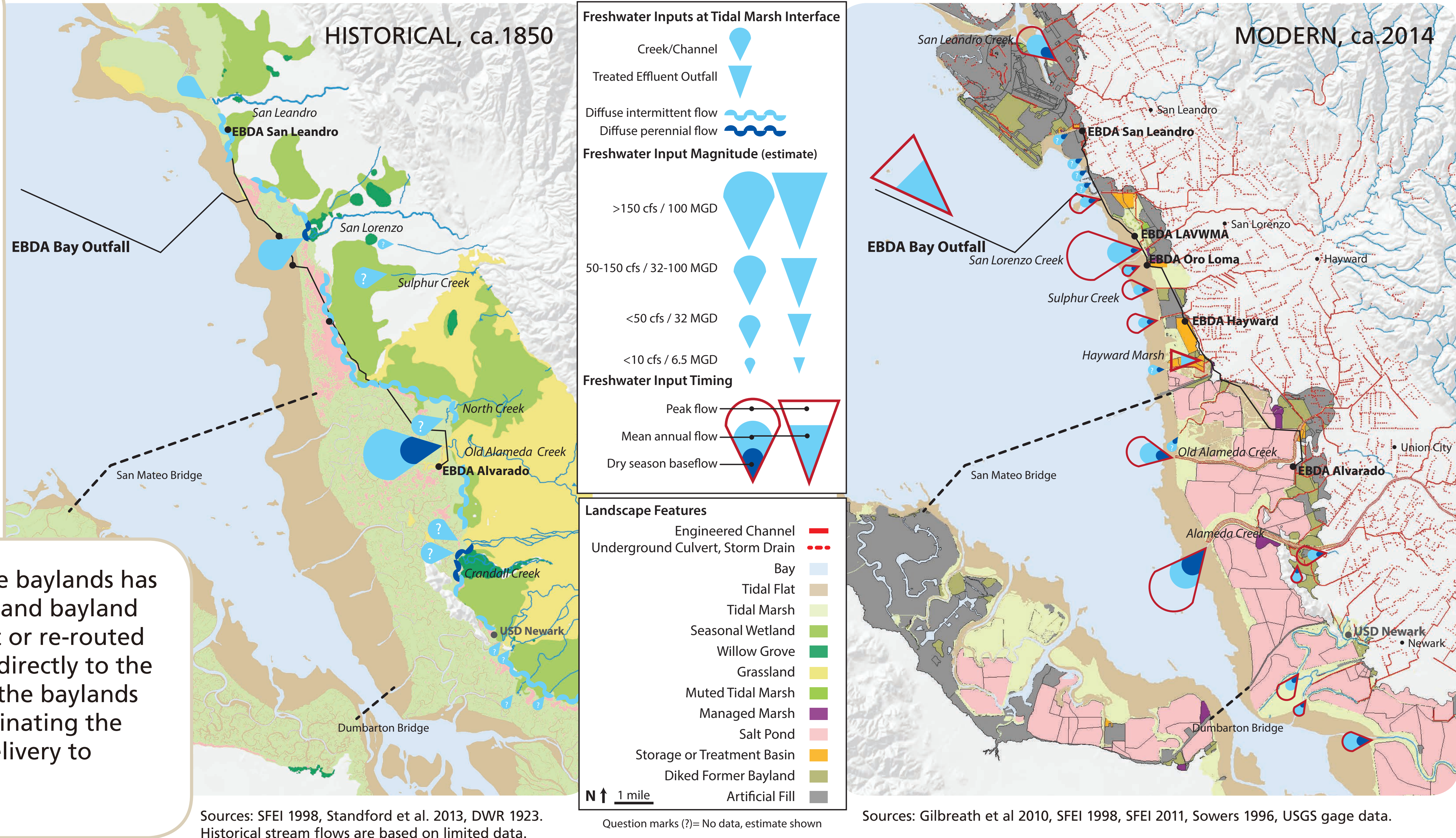
INTRODUCTION

The East Bay Dischargers Authority (EBDA) currently discharges treated wastewater effluent into San Francisco Bay through a deep water outfall; however, this infrastructure is aging and vulnerable to rising sea level. Due to the Clean Water Act,

CHANGE OVER TIME

THEN... The San Leandro to Fremont shoreline was a complex mosaic of intertidal bayland habitats - tidal marsh, tidal channels, salt pannes, beaches, alluvial fans, deltas. Historically, freshwater interfaced with the baylands through direct creek connections and more diffusely via groundwater and surface runoff. Some of these inputs contributed freshwater to the baylands year-round (e.g., mouth of Alameda Creek, adjacent to willow groves or springs) while other freshwater inputs were highly seasonal (intermittent creeks, areas adjacent to seasonal wetlands). These freshwater inputs were an important component of the baylands ecosystem, creating salinity gradients that added physical and ecological diversity to the baylands landscape, while facilitating rapid vertical marsh growth. Sediment delivery from fluvial sources was also a key component of tidal marsh formation and maintenance, particularly during high flows when streams transported sediment from watersheds to marshes, allowing for natural sediment accretion and marsh establishment.

NOW... Today, the extent, magnitude, and seasonality of freshwater to the baylands has been greatly altered. Instead of streams discharging into the marsh or upland bayland interface, freshwater sources have now been paved over for development or re-routed to stormdrain networks carrying freshwater discharges past the baylands directly to the Bay margin. Channel leveeing has also reduced freshwater connection to the baylands as stream flow now almost exclusively bypasses the baylands, further eliminating the historical extent of the fresh-brackish-saline mixing zone and sediment delivery to baylands. Diffuse gradients are rare.



INCREASING RESILIENCE: LANDSCAPE SUSTAINING PROCESSES

- 1 Consider how Bay drivers (e.g., fine and coarse sediment supply and transport, tides, wave energy) shape and support diversity of intertidal habitats- mudflats, marshes, deltas, beaches when planning restoration
- 2 Nourish baylands with sufficient sediment to help marshes and alluvial fans to keep pace with sea level rise

- 3 Restore creek connection to tidal marshes to create salinity gradients by delivering freshwater during floods to the baylands
- 4 Create broader, shallower slopes (horizontal levee) to provide transition zone habitat and accommodation space for marsh transgression with sea level rise

- 5 Route treated wastewater through a horizontal levee and seepage slope to maintain transition zones habitat, nutrient sequestration, and faster marsh accretion with freshwater conditions
- 6 Focus clean freshwater inputs along the landward edge of the marshes

Watershed and Bay processes, such as fine and coarse sediment transport and floodplain inundation are essential to the continual evolution of these habitats. While many of these important processes have been altered or eliminated over the decades, facilitating their re-establishment to the fullest extent possible will enhance the existing habitats and provide a more resilient landscape for the future.

- 1 Corridors provide connectivity for wildlife between Bay, bayland and upland habitats
- 2 Salinity and topographic gradients provide increase hydrologic variability and habitat complexity
- 3 Topographic highs (natural levees, marsh mounds) provide high water refuges
- 4 Estuarine-terrestrial transitional zones provide gradual transitions for species movement and support upland transgression of marsh
- 5 Patch sizes large enough to support life history functions
- 6 Redundancy in habitat types to provide resiliency with changing conditions
- 7 Accommodation space to allow for marsh migration and species range shifts

INCREASING RESILIENCE: CONNECTIVITY & COMPLEXITY

Our emerging Resilience Framework (Beller et al. 2015, resilientsv.sfei.org) shows the different components of a landscape that contribute to resilience. In addition to improving the physical functioning of the shoreline by reestablishing geomorphic and hydrologic processes, shoreline planning and restoration should integrate ecological resiliency principles of landscape connectivity, diversity and complexity, redundancy, and scale. Restoration actions (e.g., horizontal levee, creek connection to baylands) should also be organized and structured in a way that supports ecological functions and biodiversity, referred to as landscape coherence.



IMPLEMENTATION AND NEXT STEPS

Decentralization alternatives have to fit with other planning efforts being undertaken along the EBDA shoreline including BCD's ART Project, South Bay Salt Ponds, BEHGU, among others. Further assessment is needed to consider policy implications, regulatory requirements, governance, and funding needed for decentralization of EBDA's infrastructure. This project was successful in informing EBDA of opportunities that would be more resilient to sea level rise other than maintaining its vulnerable outfall. Importantly it brought together diverse stakeholders to further the conversation on using treated wastewater effluent as a resource for a resilient future East Bay shoreline.

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