An aerial photograph of a coastal wetland area. A winding waterway flows through green marshes. In the background, there is a large body of water, likely a bay or estuary, with a distant shoreline and mountains under a clear sky. The water reflects the sunlight, creating a shimmering effect.

# Sunnyvale Shoreline Resilience Vision

2021 Executive Summary



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## Key Takeaways

- This stakeholder group was convened around the shared goals of climate resilience, ecological restoration, increasing access to the Bay, reducing risk and enhancing quality of life for workers and residents along and near the Sunnyvale shoreline. Members of the Sunnyvale Shoreline Resilience Vision (“Vision”) group are landowners and land managers along the San Francisco Bay shoreline from Stevens Creek to San Tomas Aquino Creek, the “Sunnyvale Shoreline.” The group formed in 2019 to facilitate information sharing and to identify ways to collaboratively address shared challenges, including climate change adaptation.
- The Vision group is a platform for exploring synergies between individual planning efforts that could help produce coordinated action toward shared objectives. Opportunities identified include streamlining and improving the aging stormwater management system, enhancing ecological function and biodiversity in both the urban area and the baylands, and developing a subregional shoreline adaptation approach.
- One area of focus for the Vision group has been Phase III of the South San Francisco Bay Shoreline Feasibility Study, a process led by the United States Army Corps of Engineers (USACE), in partnership with Valley Water and the State Coastal Conservancy. This study is the first step toward federal funding for a multi-purpose project to achieve coastal flood risk reduction, shoreline adaptation to sea-level rise over a 50-year period, ecological restoration, and public access. Engagement in this Vision group has been an opportunity for all stakeholders to learn about the USACE process, what to expect in the terms of phases and timelines, and how to support and expedite the process. The Vision group has successfully completed preparatory actions and is now waiting for an appropriation from Congress to allow USACE to initiate the study.
- Adapting to climate change is a long-term endeavor. Stakeholders are committed to continuing to collaborate and will work together to share information, coordinate across individual planning efforts, and further develop concepts for topics of interest, including stormwater management and ecological enhancement. This document is intended to provide a public-facing overview of the effort to date.



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## Overview

The Sunnyvale Shoreline Resilience Vision (“Vision”) is a collaborative effort between a group of organizations deeply invested in long term regional resilience and interested in coordinating across their individual planning efforts. The area of interest is the shoreline from Stevens Creek to San Tomas Aquino Creek and associated urban areas south to Hwy 101 and Hwy 237. The Vision group is focused on adaptation efforts to address climate change risks including sea-level rise, extreme precipitation, and extreme heat. A coordinated regional adaptation and resilience effort extending across ownership and jurisdictional boundaries is likely to be more efficient and effective than a combination of piecemeal strategies. Topics explored by the group include streamlining and improving the aging stormwater management system, enhancing ecological function and biodiversity in both the urban area and the baylands, and developing a subregional shoreline adaptation approach to rising water levels.

The Sunnyvale shoreline is vulnerable to rising sea levels because it is protected by the berms surrounding former salt evaporation ponds, which were not designed to function as long-term flood risk management levees. Therefore, a key focus of the Vision group has been preparing for an anticipated feasibility study led by USACE (Phase III of the San Francisco South Bay Shoreline Feasibility Study) which is the first step in identifying the scope of federal funding for coastal flood risk management, shoreline adaptation to sea-level rise over a 50-year period, ecological restoration, and recreation along the Sunnyvale shoreline.

On January 17, 2019, a first workshop, sponsored by the Santa Clara Valley Water District (Valley Water) and Google, was held to bring together stakeholders to coordinate planning for resilience along the complex Sunnyvale shoreline. The stakeholders in the Vision group are the City of Sunnyvale, Valley Water, Lockheed Martin, the Midpeninsula Regional Open Space District, NASA, the US Fish and Wildlife Service, the South Bay Salt Pond Restoration Project, and Google.



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## Objectives and goals

Stakeholder engagement has been structured around the following objectives:

- a. Share the goals of individual partners;
- b. Share current planning efforts and projects;
- c. Explore opportunities and constraints;
- d. Discuss potential group approaches to shoreline planning;
- e. Brainstorm opportunities for coordinating actions and find creative opportunities for cross-jurisdictional collaboration and/or win-win scenarios;
- f. Use funding efficiently: reduce redundancy of effort, including community outreach;
- g. Coordinate between different planning efforts without replacing any individual process, developing a joint vision for the shoreline that addresses individual goals; and,
- h. Identify and prioritize multi-benefit solutions.

At the January 2019 workshop, participants reached a consensus on improving collaboration for cross-jurisdictional planning in the study area. The shared goals that the group articulated were:

- a. Improve “quality of life” for those who live and work in the area;
- b. Reduce flood risk and improve sea-level rise resiliency;
- c. Improve connectivity of local and regional trail and transportation networks;
- d. Expand open space and ecology within the urban setting;
- e. Restore wetlands and floodplains to help alleviate flooding and provide important habitat.



Photo by Joshua Cotten



Photo courtesy of Google

Photo by Virginia Hines

# Vision at a glance

Finding synergies between stakeholder projects to maximize ecological, human health, and shoreline resilience benefits



**23 acres**  
native riparian corridor



**2,500 acres**  
of restored tidal wetlands



**3+ miles**  
of ecotone slope providing valuable habitat



**7+ miles**  
of new Bay trail, including an existing 1.5 mile gap



**\$6.5M/yr+**  
annual damage reduction & protection of critical infrastructure  
(estimate in 2017 \$)



## Climate change & sea-level rise

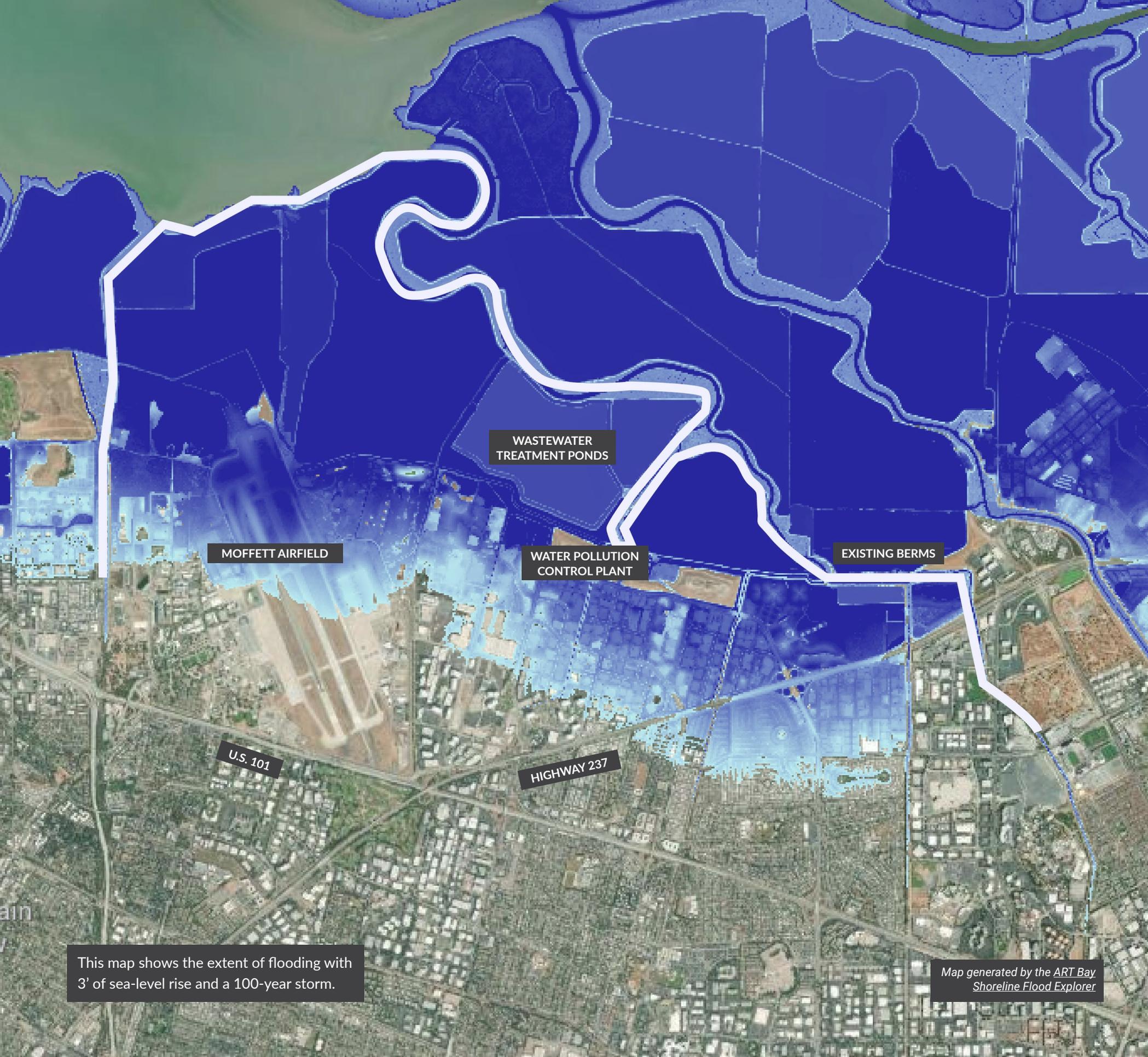
Sea level has risen about eight inches over the last century at the San Francisco tide gauge, and the rate of rise is increasing with global climate change. The most recent guidance from the state of California provides sea-level rise projections to use for local adaptation planning.<sup>1</sup> For Moffett Park, an area with a great deal of critical infrastructure and existing development, the recommended projection to use is 1.9 feet of sea-level rise by 2050 and 6.9 feet by 2100. Water levels will reach these thresholds intermittently during storm surges and king tides before they become a daily occurrence.

Multiple sources of flooding contribute to increasing flood risk in the Sunnyvale area.<sup>2</sup> Climate change will affect precipitation patterns, and the Bay Area is likely to experience more periods of drought and extreme storm events. When intense storms coincide with high Bay water levels, flooding is exacerbated. More regular and intense flooding events could increase channel erosion and strain levees, pumps, and other flood infrastructure.

Sea-level rise can also raise the level of overlying groundwater. Fine-grained silt and clay along the Sunnyvale shoreline create confined aquifer conditions that will likely slow the pace and limit the extent of groundwater rise impacts, as water moves less easily through these sediments than the loose material that some other urban areas are built on. However, over the long term (i.e. late 21st century), the water table is likely to continue to rise as it reaches equilibrium with rising sea levels, and adaptation strategies will need to address rising groundwater levels, particularly in areas with groundwater contamination.

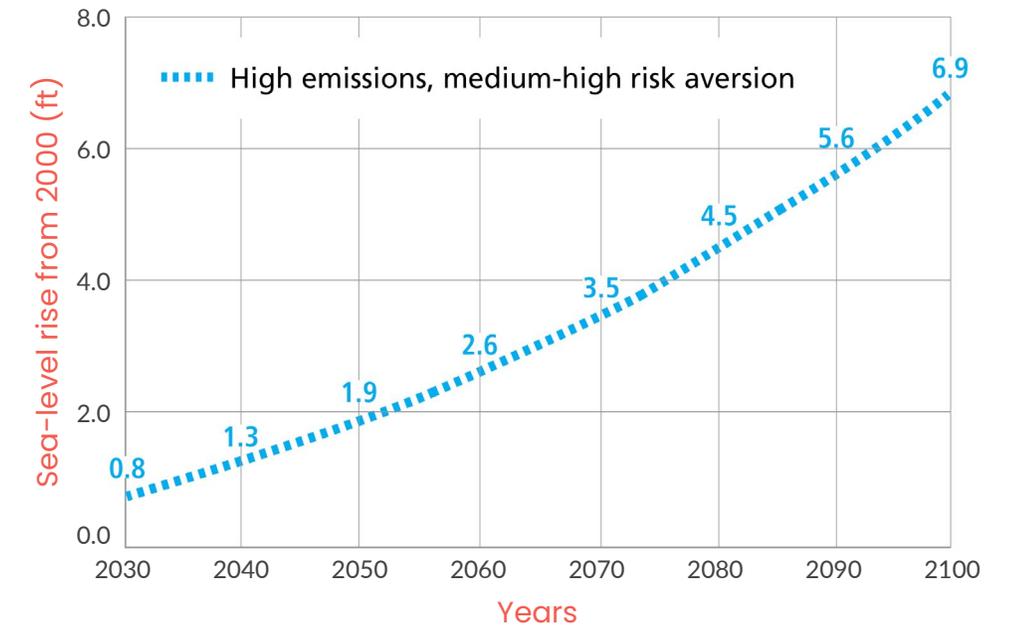
<sup>1</sup> CNRA-OPC. (2018). State of California Sea Level Rise Guidance, 2018 Update. California Natural Resources Agency and Ocean Protection Council. Sacramento, CA, USA, 84.

<sup>2</sup> He, M., & Gautam, M. (2016). Variability and trends in precipitation, temperature and drought indices in the state of California. *Hydrology*, 3(2), 14. <https://doi.org/10.3390/hydrology3020014>

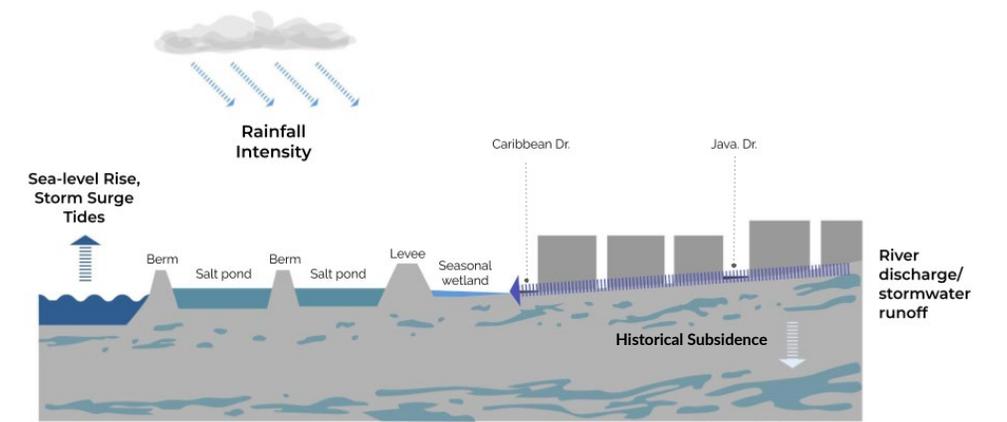


This map shows the extent of flooding with 3' of sea-level rise and a 100-year storm.

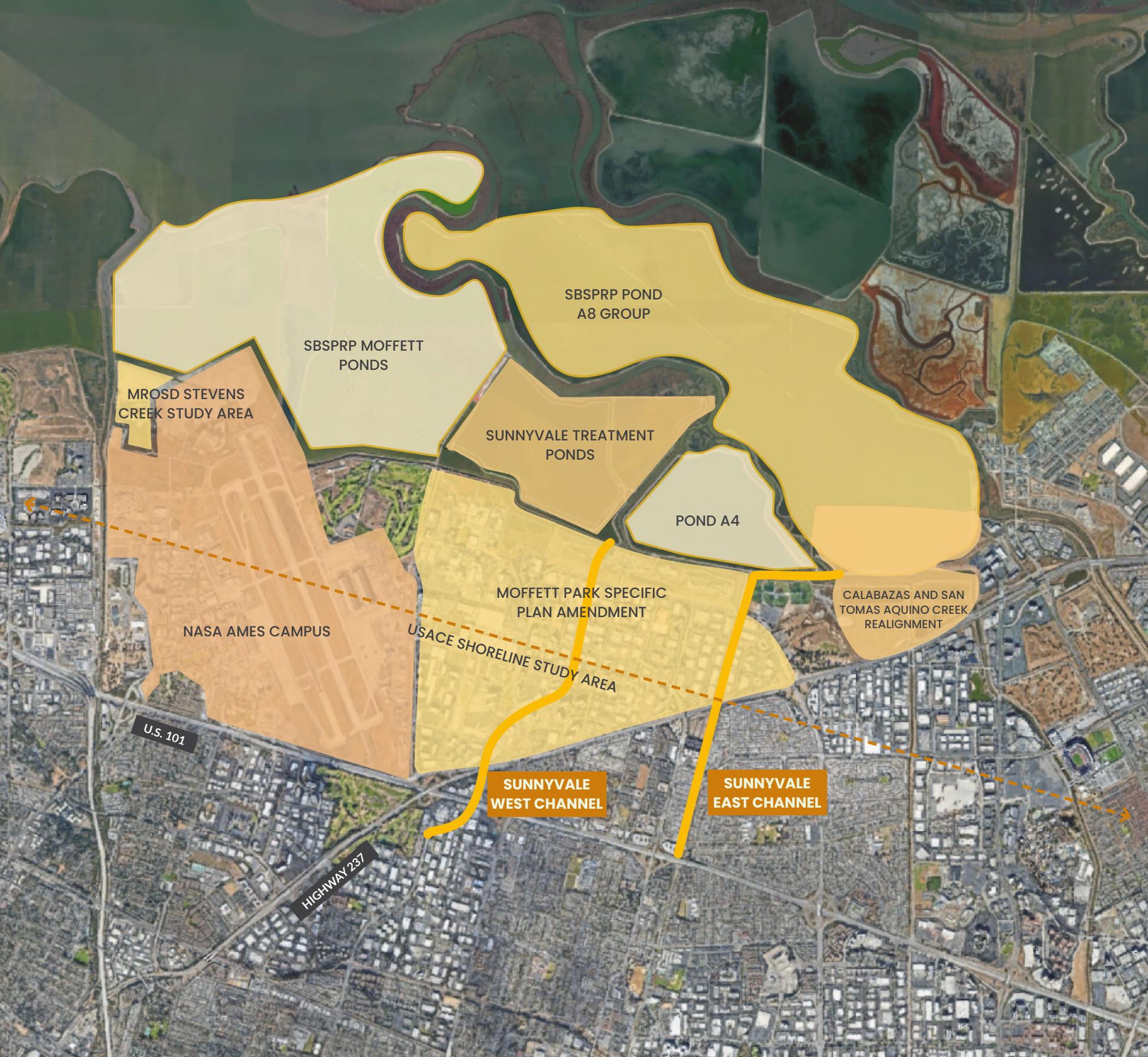
For more information on climate change & sea-level rise hazards, please reference the [recording](#) & [slides](#) of a public workshop hosted by the City of Sunnyvale on November 30, 2020, which was focused on sea-level rise in Moffett Park and implications for the Moffett Park Specific Plan.



Sea-level rise projections for San Francisco, from the State of California Sea-Level Rise Guidance (CNRA-OPC, 2018). The blue line shows the 0.5% probability sea level rise curve under a high emissions scenario, which is the State's recommended projection for medium-to-high risk aversion planning purposes. This is the appropriate projection to use for Moffett Park, given existing critical infrastructure and development.



Sources of flooding.



## Opportunities for joint planning

### Relevant regional shoreline adaptation efforts

A federal study is underway in the region to improve flood protection in the face of sea-level rise. The South San Francisco Bay Shoreline Feasibility Study (“Shoreline Study”) is a Congressionally-authorized study led by USACE in partnership with Valley Water and the State Coastal Conservancy. The goal of the study is to identify projects in Santa Clara County promoting coastal flood-risk management, shoreline adaptation to sea-level rise over a 50-year period, ecological restoration, and public access that should receive federal funds. Updates about the project can be found on Valley Water’s [website](#).

The Shoreline Study is being conducted in phases, with the Alviso area in San José covered in Phase I, Palo Alto and Mountain View in Phase II, and NASA Ames Research Center & Moffett Airfield and Sunnyvale intended as Phase III. The Vision group has successfully advanced preparatory actions for a future USACE feasibility study for the Moffett Airfield and Sunnyvale shoreline, increasing alignment between stakeholders, exploring synergies between individual planning efforts, and gathering data USACE will need for their analysis. The Shoreline Study’s start is dependent on the receipt of federal funds. The group is now awaiting federal funding to initiate the USACE process.

In addition to work preparing for future inclusion in the federal Shoreline Study effort, Vision stakeholders have also been undertaking other efforts to advance adaptation in the region. Marsh restoration efforts through the South Bay Salt Pond Restoration Project (SBSRP) will aid in shoreline adaptation by reducing wave action and levee erosion, once restored marshes have had a chance to build up over time. The Sunnyvale East and West channel upgrades will increase capacity for stormwater drainage and reduce combined urban and coastal flood risk



—— Future shoreline levee (preferred alignment)  
..... Existing channel levees

This map shows one possible restoration scenario for the ponds bayward of the Sunnyvale Shoreline. Multiple restoration scenarios are possible and will be guided by the South Bay Salt Ponds Restoration Project's adaptive management plan.

The levee alignment shown is based on Valley Water's Preliminary Feasibility Study for South San Francisco Bay Shoreline (SCVWD 2017).

The preferred levee alignment will tie into existing creek levees.

in the context of sea-level rise. The proposed Moffett Park Specific Plan suggests mixed use development, provisions to increase the resilience of buildings, infrastructure, open space, and the urban landscape to changing climate conditions. Campus master planning efforts at Google, NASA, and Lockheed Martin aim to improve the quality of life for employees and upgrade facilities to meet the challenges of a changing climate. Habitat enhancements are being considered at the Stevens Creek Shoreline Nature Study Area to increase resilience of sensitive species to climate change.

### Levee alignment

Between Sunnyvale and the Bay there are large areas of former salt ponds owned by the U.S. Fish and Wildlife Service as part of the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge). The existing berms on the outermost edge of the ponds set the water levels in the ponds and currently serve as the first line of defense for flooding from the Bay. The berms surrounding the ponds are old and not constructed to current flood risk management levee standards. If the existing berms surrounding the salt ponds fail, a significant amount of high-value infrastructure and development in and adjacent to the City of Sunnyvale could flood. Critical infrastructure at risk includes the wastewater treatment plant and Highway 237. Existing neighborhoods South of Highway 237 are also at risk.

To prevent this from happening, a higher, engineered levee needs to be constructed to manage existing and future flood risk. Because levees are built at a fixed height, they have a finite design life as sea-levels rise. Based on the USACE approach across the Bay, it is anticipated that the proposed levee will be designed to provide about 50 years of protection given current sea-level rise projections. As sea levels rise and new development is built, the risk will increase. Constructing a levee is not the end of the line, but rather opens the opportunity to plan future modifications for even higher sea levels.



Protecting individual sections of the shoreline in a piecemeal fashion will not be effective in preventing flooding and could increase vulnerability for neighboring areas. Thus each section of shoreline protection needs to be designed for connection to a robust bay-wide system of resilience. Neighboring levee projects can tie into the opposite banks of channels to ensure a consistent line of regional protection. With stakeholder alignment and collaboration, levee construction can unlock opportunities for broader ecological, health, and economic benefit by allowing large-scale restoration of tidal marshes bayward of the levee. Vision partners have begun to evaluate potential alignments for a future shoreline levee that could reduce flood risk along the Sunnyvale shoreline as sea levels rise. In 2017, Valley Water conducted a preliminary feasibility study to assess potential storm damage and conceptual levee alignments along the South Bay shoreline.<sup>3</sup> This alignment provided a starting point for Vision discussions.

The Vision Group prefers that any new levee run south (landward) of the former salt ponds to allow future restoration efforts to progress. The levee should run north (bayward) of Moffett Park to protect existing development, and should stretch from Stevens Creek to Alviso, tying into adjacent creek levees to provide a continuous line of integrated coastal and urban flood protection. The final levee alignment will be determined during the Phase III Study process in coordination with the Vision group, regulators, and the public.

### Baylands ecological restoration & enhancement

The South Bay Salt Pond Restoration Project (SBSRP), a collaborative project between regional, state, and federal agencies, represents the largest tidal wetland restoration project on the West Coast. When complete, the project will restore 15,100 acres of industrial salt ponds to a rich mosaic of tidal wetlands and other habitats. As part of this effort, the SBSRP plans to restore the salt ponds in the Alviso complex directly bayward of the Sunnyvale shoreline. Some of the ponds will be restored to tidal marsh and other, deeper ponds will continue to be managed as open water habitat for waterbirds, with restoration decisions guided by

<sup>3</sup> SCVWD. (2017). Preliminary Feasibility Study for South San Francisco Bay Shoreline Economic Impact Areas 1-10: Final Evaluation Report.



the SBSPRP's adaptive management plan and local riverine and coastal hydrology. Tidal marsh habitat is essential for endangered species like salt marsh harvest mouse and Ridgway's rail and provides nursery habitat for fish like leopard shark and steelhead. Dry ponds, berms, and shallow flats provide habitat for shorebirds and roosting waterbirds, and deeper ponds provide habitat for the many migratory bird species that stop in the Bay Area during the journey along the Pacific Flyway.

The restoration of marshes in the former salt ponds can only occur if a future shoreline levee is set back toward development. Marshes have significant ecological and recreational value and reduce flood risk by reducing waves that can cause levee erosion. Marshes fringe the bayfront side of levees in many parts of the SF Bay shoreline. Many tidal marsh restoration projects in the Bay have demonstrated the synergies between tidal restoration and shoreline protection efforts, including at nearby ponds restored during early phases of the SBSPRP. There are also opportunities to restore valuable transitional habitat on the levees themselves, by designing the levees with shallow bayward slopes (ecotone levees) to create a softer transition between upland habitats and marshes.

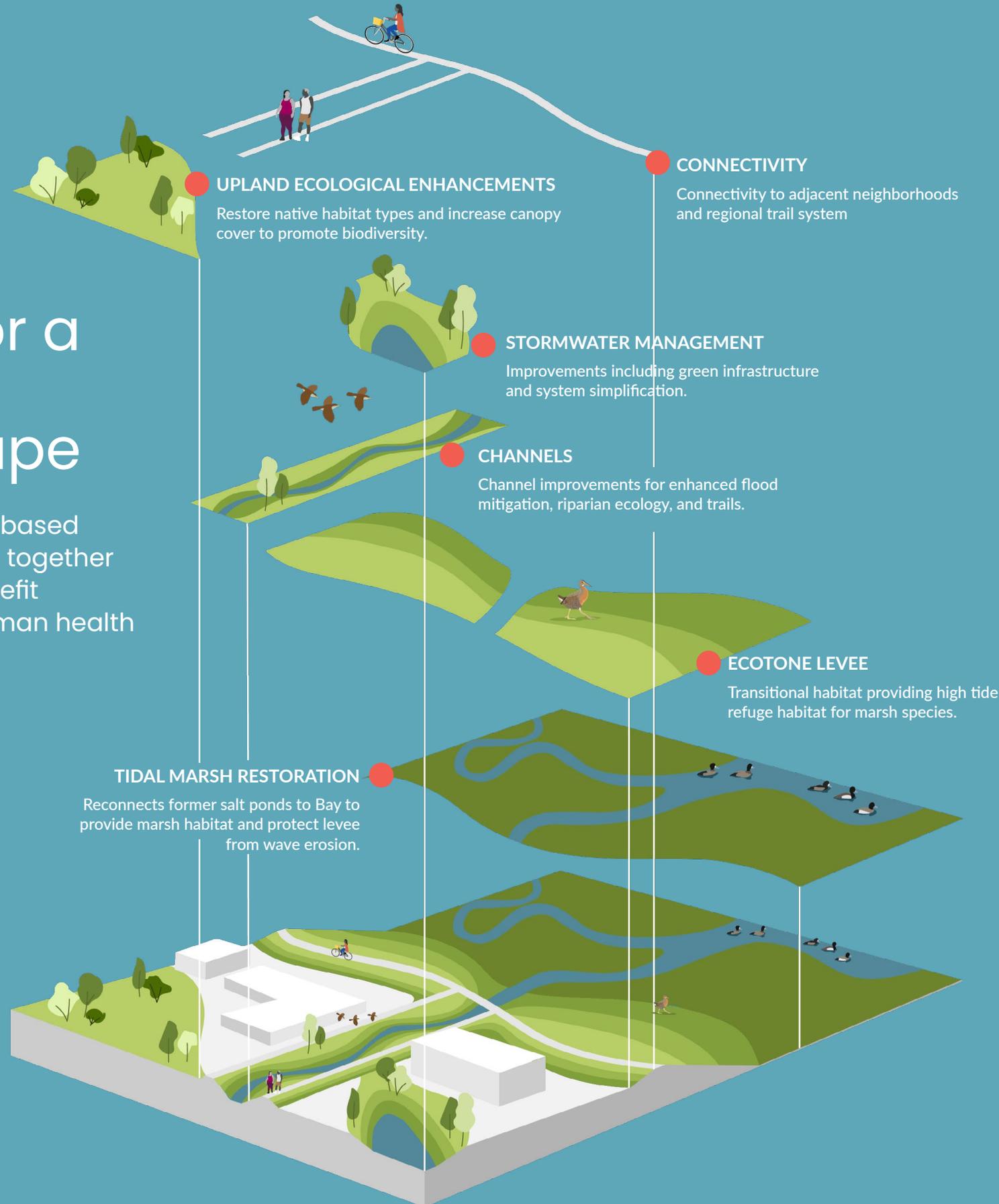
### Uplands/urban ecological restoration & enhancement

The rich mosaic of habitats that used to be found in this area, including salt marshes, wet meadows, and connections to the upper watersheds, has mostly been lost to development. Open spaces are concentrated along the shoreline with the channels and creeks serving as the primary connections to the Bay. There are few trees, which negatively impacts wildlife and exacerbates the urban heat island effect.

The Vision group identified strategies to connect ecological enhancements in urban areas to planned baylands restoration projects, improving habitat conditions across the landscape from the city to the Bay. These strategies are focused on supporting biodiversity and building ecological resilience to climate change impacts, including rising temperatures, increased intensity of precipitation events, and sea-level rise. They can also enhance health benefits, provide recreational

# Vision for a Resilient Landscape

Integrated nature-based solutions that work together to protect and benefit ecological and human health



opportunities and improve quality of life for those who live and work in the area. Some of these strategies are:

- 1. Incorporate nature-based shoreline elements to reduce flood risk, improve sea-level rise resiliency, and increase shoreline habitat value.** Actions can include restoring tidal marshes, managing ponds as wildlife habitat, enhancing transition zones (e.g. managing invasive vegetation), building ecotone levees, and reconnecting creeks to the baylands.
- 2. Create corridors that facilitate recreational opportunities, ecological movement, active mobility, urban cooling, and stormwater resilience.** Actions can include connecting and improving trails along the shoreline, enhancing streams and channels to act as ecological and recreational corridors from the city to the Bay, and connecting existing and new patches of ecological landscapes.
- 3. Create green spaces that provide urban cooling, stormwater capture, and immersive nature experiences, and enhance local biodiversity.** Actions can include enhancing existing ecological landscapes (e.g. by planting native species), expanding existing freshwater wetland areas and creating a terrestrial buffer zone for species, and creating and distributing new patches of ecology.
- 4. Integrate nature throughout the urban matrix to deliver cooling, stormwater retention, and health benefits.** Actions can include restoring native habitat types, increasing canopy cover and native species in the urban forest, designing stormwater features to function ecologically, and using wildlife-friendly building and lighting design.



## Stormwater management

The Bay is not the only source of flooding in the Sunnyvale shoreline area. Managing flood risk landward of the levee is also required for infrastructure and development and to keep people and property outside the floodplain. This is especially true in the context of climate change, as more intense precipitation events in the future may require a more robust stormwater management system to prevent flooding in urban areas. The Vision group held a technical workshop to discuss the existing stormwater system and identify ideas for improvement. The existing system is aging and complex, with multiple pump stations and various organizations managing different parts of the system. Opportunities were identified to increase efficiency, performance, and cost effectiveness by streamlining the system, particularly in the context of planned flood management and restoration changes along the shoreline.

Potential concepts for stormwater planning identified by the group included:

- a. reducing flood risk;
- b. simplifying complex plumbing and discharging cleaner water to the Bay more directly;
- c. providing more space along the shoreline for a future shoreline levee; and
- d. supporting habitat restoration.

Some of the ideas for achieving these objectives included straightening stormwater channels to discharge more directly to the Bay, combining existing channels to reduce complexity, increasing detention capacity, and using green infrastructure to remove pollutants and reduce runoff volumes entering the stormwater system.

Stormwater improvements need to be coordinated with the construction of a future shoreline levee and all the other proposed changes along the Sunnyvale shoreline that will increase resilience and vibrancy of the area for people and wildlife. Projects to reduce flood risk, enhance wetland and upland habitat, and increase recreational access are all interconnected and interdependent. Stakeholders are working together to ensure the planning efforts are coordinated.

# From the city to the Bay

creating a connected, resilient urban fabric

Status Quo:



Car-centric urban design



Channelized creeks

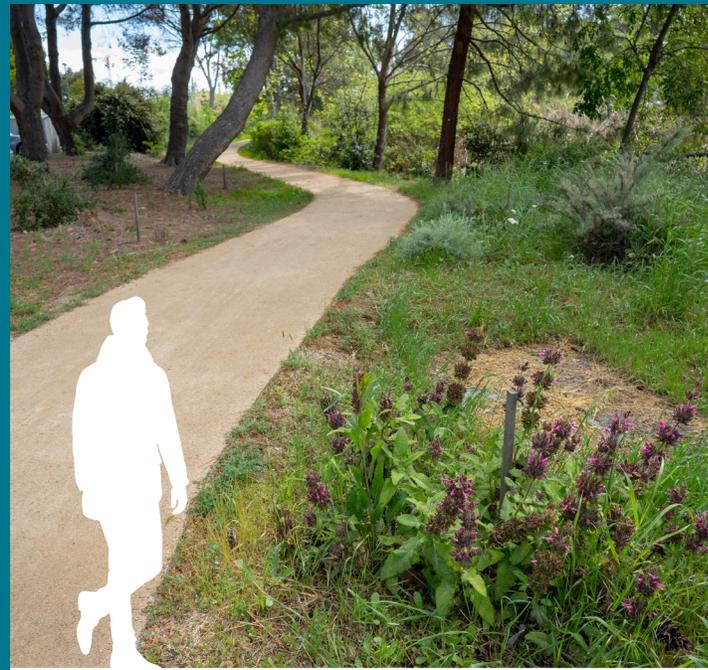


Neighborhoods disconnected from Bay



Decomissioned salt ponds

## The Vision:



Vibrant, biodiverse urban open spaces with integrated stormwater management



Riparian habitat and trails connecting neighborhoods to the Bay



Ecotone levee providing transitional habitat



Restored tidal marshes providing habitat and protecting the levee from wave erosion



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## Moving forward

Stakeholders are committed to ongoing collaboration and coordination efforts. The first phase of collaboration from 2019 to 2021 focused on understanding USACE's feasibility study process and gathering data for a future study. Stakeholders will continue working together and plan to stay closely coordinated around the anticipated feasibility study once funding is made available.

The Sunnyvale Shoreline Resilience Vision will continue to serve as a central resource and open communication channel to help streamline efforts being pursued at local, regional, and federal levels, increasing the efficiency and effectiveness of adaptation planning along the Sunnyvale shoreline. Stakeholders will continue to meet and advance topics including stormwater management, ecological restoration, access to nature, and opportunities for recreation.

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*The Sunnyvale Shoreline Resilience Vision is facilitated by the San Francisco Estuary Institute (SFEI) and Environmental Science Associates (ESA), and funded by Valley Water and Google.*



Photo by Cris Benton