COLMA CREEK
ADAPTATION PLANNING
Project Team_
Hassell
CHS Consulting
The Civic Edge Consulting
E2 Design Lab
Lotus Water (2019)

Project Working Group_
Bay Area Regional Collaborative
Allison Brooks
San Mateo Flood & Sea Level Rise Resiliency District
Len Materman
San Mateo County
Supervisor Dave Pine / Jim Porter / Michael Barber / Erika Powell (2019)
City of South San Francisco
Jake Gilchrist / Philip Vitale / Christina Fernandez

Special thanks to our community partners_
SSF Parks & Rec Summer Camp
San Francisco Estuary Institute
San Bruno Mountain Watch
SSF Councilmember Mark Nagales
SF Philippine Consulate General
Martin Elementary school

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EXECUTIVE SUMMARY

The Colma Creek Adaptation Study – “Colma Creek Connector” is a continuation of work done by Hassell and San Mateo County for the Resilient by Design Bay Area Challenge which focused on the Colma Creek Watershed over 2017-18.

In 1959 the San Mateo County Flood Control District was formed, with one of its key objectives being to address the recurring flooding problems along Colma Creek that had been impacting the community. Subsequent changes along Colma Creek were designed to protect against a 50-year storm event, which has a 2% probability of occurring in any given year. With the emergence of global climate change and the increased intensity of storms, it is now necessary to re-evaluate the carrying capacity of the creek. This process also presents the opportunity to evaluate the public amenity potential and provide improvements along the channel given changes to accepted best practice since the channelization occurred.

The Colma Creek corridor currently has limited public access and is identified within Plan Bay Area as a Priority Conservation Area and a key link to the Bay Trail.

During the previous stage of the project, the team facilitated community engagement and an inclusive design process to map out a range of ways to make the City of South San Francisco (City) stronger and reverse the area’s real and symbolic separations from the water by restoring public access to and along it, and establishing more open spaces and parks.

This study aims to explore the design options and feasibility of adaptation along Colma Creek using publicly owned land, in order to:

- MANAGE FLOODING AND SEA-LEVEL RISE;
- RESTORE CREEK ECOCOMES;
- INCREASE PUBLIC ACCESS TO THE CREEK;
- IMPROVE PUBLIC ACCESS BETWEEN COLMA CREEK, THE BAY AND THE BAY TRAIL.

The adaptation planning began with a focus on the creek between Orange Memorial Park and Highway 101. Additional grant funding allowed for that scope to extend from Highway 101 to the Bay. With the guidance of the Bay Area Regional Collaborative, San Mateo County and the City of South San Francisco, this study was aligned with long-term planning for the area, in particular the General Plan Update currently being prepared.

The Colma Creek corridor currently offers few benefits and has little to no relationship to the community.

The creek acts more as barrier than a public service. The corridor has enormous potential for an ecological and open space connection between the community and the Bay. By restoring the native ecology, more wildlife could return and create a more holistic natural community.

The planning study aims to establish key information for assessing the feasibility of various adaptation scenarios along the creek corridor to drive cross-sectoral discussion around the right path forward. Further the scenarios will serve to raise awareness within the community around a range of feasible options for a balanced approach to improving the creek corridor.

This project is a critical planning pilot that will inform other areas across the County and the region with similar features and challenges. The adaptation toolkit has been developed with this in mind and will be packaged separately as a regional resource for other creek restoration project teams and aspiring communities.

The waterfront isn’t far away – just over a mile as the crow flies – but it’s practically impossible to walk to.”

Alastair Bland, Estuary News
June 2018
Below are the six key stages of the project that structured our investigation, community engagement and design across the project...

**Stage 1**
Detailed Work Program & Budget
- Project Plan
- Detailed Workplan
- Detailed Program

**Stage 2 (Ongoing)**
Engagement
- Stakeholder Working Group
- Community Engagement
- Planning Department & General Plan Consultant Engagement

**Stage 3**
Data & Analysis
- Coordination of Existing Data Goals
- Additional Data Collection
- Site Analysis - Opportunities & Constraints

**Stage 4**
Adaptation Tool Kit
- Project Principles
- Creek Restoration/Adaptation Benchmarking
- 'Tool Kit' Part/Section/Axis

**Stage 5**
Adaptation Scenarios
- Priorities Assessment
- 'Park to Bay' Access Scenarios
- Mobility Planning Assessment
- Conceptual Adaptation Design Proposals (Key nodes)

**Stage 6**
Implementation
- Feasibility/Benefits Assessment
- Delivery Road Map
- Funding Opportunities
- Stakeholder Goals

**Stage 7**
Report
- 1st Draft, May 2020
- 2nd Draft, June 2020
- Final, July 2020
## PROGRAM 2019

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### 01 Detailed Work Program & Budget

### 02 Engagement

- Stakeholder Working Group
- Public Engagement
  - Online Engagement & Awareness Building
  - Planning Department & General Plan Consultant Engagement

### 03 Data & Analysis

- Coordination of Existing Data Goals
- Additional Data Collection

### 04 Design

- Identify ‘Park to Bay’ Access Scenarios
- Feasibility/Benefits Assessment
- Conceptual Adaptation Design Proposals
- Mobility Assessment of Design Proposals

### 05 Implementation Framework

### 06 Final Report

- Other
  - General Plan Update (Consultant: Raimi)
  - Colma Creek Advisory Council
  - San Mateo Adaptation Plan (Consultant: ENE)
  - San Mateo Sustainability Office

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<th>Public Engagement Workshop</th>
<th>Design Team Meeting</th>
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<td>Parks Alive! Streets Alive!</td>
<td>Mission Blue Nursery Native Plant Sale</td>
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### Legend

- Client Meetings
- Workshops
- Internal Meetings
- Key Deliverables
- External Deliverables
- Engagement
# Colma Creek Adaptation Planning Design Report

Prepared for BARC, San Mateo County & City of South San Francisco

## Section 1 - Executive Summary

### PROGRAM 2020

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<td>03 Data &amp; Analysis</td>
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#### Task 02 Engagement

- Stakeholder Working Group: Stakeholders engaged in meetings and workshops.
- Public Engagement: Public participation through workshops, public meetings, and online engagement.
- Online Engagement & Awareness Building: Online platforms for communication and awareness.

#### Task 03 Data & Analysis

- Additional Data Collection: Gathering of data for analysis.
- Site Analysis - Identify Opportunities & Constraints: Identification of site opportunities and constraints.

#### Task 04 Adaptation Toolkit

- Workshops: Conducted for stakeholder engagement.
- Design Reviews: Reviews of design proposals.
- Project Principles: Development of project principles.
- Creek Restoration/Adaptation Benchmarking: Benchmarking for restoration.
- Develop 'Tool Kit': Development of an adaptation toolkit.

#### Task 05 Adaptation Scenarios

- Park to Bay Access Scenarios: Scenarios for park access.
- Conceptual Adaptation Design Proposals: Proposals for conceptual adaptation.
- Mobility Assessment of Design Proposals (by others): Assessment of design proposals by experts.

#### Task 06 Implementation Framework

- Feasibility/Benefits Assessment: Assessment of feasibility and benefits.
- Delivery Road Map: Road map for delivery.
- Funding Opportunities: Identification of funding opportunities.
- Stakeholder Goals: Setting of stakeholder goals.

#### Task 07 Report

- Draft: Draft report.
- Final: Final report.

### Legend

- Client Meetings
- Workshop
- Internal Meetings
- Key Deliverables
- External Deliverables
- Engagement

### Key Deliverables

- Online Engagement & Awareness Building
- Stakeholder Working Group
- Online Storytime
- Online Public Engagement
- Youth Creek Walk
- Mark Nagales Storytime
- Philippines Consul General Storytime
- SSF Summer Camp
- SSF Summer Online Bike Raffle

### Dates

- February: 03.02, 10.02, 17.02, 24.02, 02.03, 09.03
- March: 16.03, 23.03, 30.03, 06.04, 13.04, 20.04
- April: 27.04, 04.05, 11.05, 18.05, 25.05
- May: 01.06, 08.06, 15.06
- June: 22.06, 29.06
- July: 06.07, 13.07

### Updated Scope

- Updated Scope Team Kick-Off

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Colma Creek Adaptation Planning Design Report
Prepared for BARC, San Mateo County & City of South San Francisco

Hassell ©
CREEK PARK
Refer pp. 190 - 199
This project originated with the HASSELL+ team’s design proposal from the Rockefeller Foundation sponsored Resilient By Design Bay Area Challenge. This phase of work was commissioned by the Bay Area Regional Collaborative (BARC) with Caltrans SB1 Grant funds in February 2019. A working group was formed including San Mateo County and the City of South San Francisco. Additional funds were accessed through the Metropolitan Transportation Commission’s (MTC) Priority Conservation Grants program in late 2019. Extending the study area and work schedule to mid 2020.
“In those days, one would head for the beach with his bathing trunks and a towel. No lunch, no snacks, no bottled water, etc. Just salt water and sunshine”

Kari Rolih, 87
South San Francisco Resident

The ‘Colma Creek Connector’ project looks to maximise community benefit and improve creek health by leveraging public land adjacent to the corridor. Envisioned as the first stage of the Resilient South City strategy (developed in the Resilient By Design Challenge), the project focuses on versatile tools that can be translated across the many other channelised creeks around the Bay Area. This work is also positioned in the context of the larger climate change adaptation work that is being supported by regional agencies around the Bay Area.

The objectives of the two grants supporting this project align around the 4 major project objectives mentioned in the previous chapter. Further information on the Caltrans SB1 Grant and MTC Priority Conservation Area (PCA) Grant can be found on the following spread. PCA Grant eligibility for this project is the result of the connection between Orange Park and the Bay Trail being identified in the Plan Bay Area as a key potential access corridor. This connection existed previously, prior to urban development, and the construction of the Caltrain corridor and Highway 101 has severed access.

Here in California and across the globe, communities are feeling the impacts of climate change. Extreme weather events are increasing, and trends in precipitation and temperature are quickly departing from those that existed as human life emerged on this planet. Many scientists have now begun to refer to this new climate era as the Anthropocene, a distinct geomorphological epoch shaped by human activity. While the continued transition away from fossil fuels and onto renewable energy sources continues to be critical, dovetailing climate mitigation and climate adaptation has become imperative.

Climate change has presented an opportunity to re-imagine our relationship to the natural world and to each other. As we plan for the impacts of climate change in the Bay Area, we must seek transformational change toward true long-term prosperity. This transformation will require confronting our shared history, and centering social equity in our decision-making processes. When solutions center social equity, they are best positioned to result in positive outcomes across social-ecological systems. Climate adaptation provides a tremendous opportunity to facilitate innovation.

South San Francisco is a small city at the fringe of the Bay Area’s largest city center. The population of South San Francisco is small (only around 63,000 people) but rapidly growing and extremely diverse, with more than 40% born outside the United States. South San Francisco has major transport connections (including the 101 Highway, BART, and the adjacent international airport) and one of the world’s largest clusters of biotech companies. But many of its residents meet several criteria as ‘Communities of Concern’ and there is significant vulnerability within the population, particularly around the downtown area.

However, the City retains a strong sense of identity, distinct from neighboring San Francisco, with historic industries on the Bay and diverse cultures of its downtown. The South San Francisco community is rightfully proud of its social and cultural heritage and have great hopes for its future.

Colma Creek is a major drainage corridor through the area, incorporating the cities of South San Francisco, Colma and parts of Daly City and San Bruno. The lower sections of Colma Creek connect key places in South San Francisco including the BART station, sites for the new Civic Campus & PUC developments (under design), Orange Memorial Park, the Lindenville Industrial Precinct, the underside of the rail line, 101 Highway, and the South San Francisco Water Treatment Plant at the Bay’s edge. The Creek corridor is a place of community meaning – a place where people could (in a time past) swim, fish, meet and move throughout South San Francisco.

According to our discussions with the community, Colma Creek has flooded regularly over the last several decades. Businesses and street infrastructure have been greatly affected by these floods and there is a sense of concern about the potential impacts of future flood events in the context of a changing climate.
Section 2 - Project Context

SB1 Grant Objectives

- Advance transportation related GHG emission reduction project types/strategies (i.e., mode shift, demand management, travel cost, operational efficiency, accessibility, and coordination with future employment and residential land use, etc.)

- Identify and address deficiencies in the multimodal transportation system, including the needs of environmental justice and disadvantaged communities, including Native American Tribal Governments and rural communities

- Encourage stakeholder collaboration & involve active community engagement

- Result in funded and programmed multimodal transportation system improvements

PCA Grant Objectives

- Protect or enhance critical habitats, ecosystems, watersheds, and resource areas as defined in California Government Code Section 65080.01

- Provide or enhance bicycle and pedestrian access to regional parks, trails, open spaces and recreation areas. Notable examples are the San Francisco Bay Trail and Bay Area Ridge Trail systems.

- Provide or enhance parks and green spaces in urban areas to improve community health, increase habitat connectivity, capture carbon emissions, and address stormwater.

Images:
1. Plan Bay Area, Priority Conservation Areas
2. San Bruno Mountain Watch Volunteer Planting Day
3. SFEI Adaptation Atlas
4. SFEI Adaptation Atlas
5. RBD flyer featuring historic flooding events near Colma Creek
We have engaged the local South San Francisco community through digital and in-person forums over an 18 month period. Our focus has been on raising awareness within the community about flood risk, and the potential for the creek to be transformed into an ecological asset that improves public amenity. We have built a following of supporters of the project, primarily through local South City families.
Section 3 - Community Engagement

Youth engagement at SSF Parks & Rec Summer Camp
Section 3 - Community Engagement

The first half of the project saw successful engagement events held as part of South San Francisco Parks & Rec's 'Parks Alive Streets Alive' and Youth Summer Camps, both in Orange Park by the Creek. Additionally we shared the project with community members visiting the Mission Blue Nursery’s Native Plants Sale, the venue for much of the restoration plants used on San Bruno Mountain.

Throughout 2019 we introduced the community to the Adaptation Planning scope of the project and the challenges being addressed in the Colma Creek corridor. Over our community events, youth summer camps and Mission Blue Nursery plant sale day we talked to the community about stormwater, landscape amenity and access. These were discussed across the entire watershed, and with a specific focus on Colma Creek from Orange Park to the Bay.

At these events we shared a map of the city’s stormwater system and conducted an activity where residents pinned their house and traced the stormwater network from their street down to Colma Creek. This was to display that every drop of water that enters the City’s stormwater system ends up in the Creek. We also shared historic photographs of flood events impacting the blocks surrounding the Creek, fostering the sharing of personal stories from residents of flood events they had experienced in their time living in South City.

We shared information with residents on native plants from the City. Residents were keenly interested in learning about the plants, touching and taking home the samples that we gave away. Local kids were also interested in our Native Plant Cards that explained the preferred home and unique features of each plant from across the watershed. The local kids were further inspired on our 'Creek Walks'. They enjoyed our VR simulation of sea-level rise along the corridor, talked about where they could and could not ride their bikes safely, and collected and swapped our temporary tattoos of native birds, fish and flora from Colma Creek. Many of the kids shared information with the parents and grandparents, spreading the word about the project.
The COVID-19 crisis and subsequent 'Shelter-in-Place' order that was implemented in March resulted in the cancellation of planned engagement events with the Boys & Girls Club of San Mateo, South San Francisco Parks & Rec Summer Camp, and the Silicon Valley Bike Coalition. Our project engagement approach adapted to the situation and looked to focus on online engagement for children and youth stuck at home looking for activities to fill their days.

Thanks for coming to our storytime with the Colma Creek Connector team to read about Christina and her grandma exploring the creek! We have been working with people like Christina and her grandma for years, figuring out the best way to make the creek safe and fun for us to live and play! We want to create more spaces to ride bikes, enjoy picnics, and take walks out in nature. All while making sure the plants and animals have safe places to live too! Check out these fun activities to keep learning! Remember to tag @ColmaCreekConnector for your chance to win an amazing new bike!

The story was read online by local South San Francisco Council-member Mark Nagales, with his two children. The video was shared through the City Library website’s children’s page and various local social media channels. Local news site Everything South City also shared the video and link to the downloadable story book. This was shared to hundreds of local families with versions in 4 languages (English, Spanish, Tagalog and Mandarin).

The downloadable book also came with kids activity sheets, including educational word games and puzzles, as well as a coloring competition to win a bike.

Copies of the story book were mailed to almost one hundred families who requested a copy. Community groups, local Primary Schools and the City Library were also sent multiple bound copies to share with the community once 'Shelter-in-Place' concludes.

We received an overwhelming response to the bike/coloring competition and were able to share entries through our social media channels to further draw attention to the project and the issue of adaptation in the City of South San Francisco.
COMMUNITY RESPONSE

“Thank you for writing and for your efforts to find new ways of engaging the community with the project. The storybook is fantastic, it shares the vision of the project beautifully.”

Ariel, Director of San Bruno Mountain Watch
“I teach preschool [in SSF], I would love one for my son and one for my classroom! I grew up playing in Colma Creek near Orange Park in Mayfair Village. I tell my son how we use to ride bikes, find frogs and tadpoles. Such fun childhood memories.”

Miles, from Sign Hill, SSF

“This is so helpful. My husband actually took our kids today to the Orange Park area after being inspired by the book! My 4 year old noticed all the pretty birds.”

Lindsay, South City Resident

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Lindsay, South City Resident

“ Heard about this through Facebook. I live not too far from Colma Creek, and teach kinder/TK in South San Francisco. Very excited as since it is a local area, I can encourage kids to visit the area and surrounding areas with their families, having a book will make it tangible for them! And get them excited to explore as well.”

Ann from Lindenville, SSF. She teaches at a school in SSF and requested a book for each student in her class

“ Heard about this from Katie DeLeuw, PTA president at Sunshine Gardens Elementary”

Lindsay from Winston Manor, SSF
“Love the book, so excited to learn about Colma Creek and share the importance of caring for our waterways with my kids and the SSG and SSF communities!”

Katie from Sign Hill and PTA president at Sunshine Gardens Elementary School

“I grew up at the base of the San Bruno Mts on Irving St and love what you do to protect and educate people about this area. Thank you.”

Susan in San Jose
Both the community engagement process and the design process for the project were based on an agreed set of Design Principles. The principles were formed across three themes based on the project objectives; water, ecology and access. These principles form the basis for our approach to creating multi-benefit solutions across both the Adaptation Toolkit and the final Adaptation Scenarios for Colma Creek.
WATER

#LETITFLOW

Mitigate flooding & sea-level rise

Reducing flood risk and adapting to climate change and sea-level rise are the primary drivers of adaptation along the creek corridor. Through creating more room for the creek and reducing obstructions, the project aims to increase the capacity of the creek during peak flow events.

At the same time, the project also acknowledges the large fluctuation in water levels on an annual basis, with Colma Creek’s daily flow for the vast majority of the year being less than 1’ As such, the improvement of water quality and the daily experience of water will be critical at the lower water levels.

Prioritise nature based solutions for sea-level rise

- Use horizontal levees and marshland to better absorb storm impact
- Create space for habitat to migrate with sea-level rise
- Use islands to create protected habitat while reducing storm surge impact

Maintain daily water level + flow

- Design adaptation for daily water levels
- Optimize low water levels and flow to improve water quality while creating habitat

Design for public safety + egress

- Meet requirement of safe egress from accessible areas of the Creek
- Integrate egress within the design of creek edges

Design for inundation in flood events at varying levels and frequencies

- Acknowledge the frequency of various flood events and design for access at a variety of water levels
- Use of resilient materials able to withstand inundation

Increase capacity of canal for flood + sea-level rise

- Expand the creek section to manage increased flooding and additional flood risk with sea-level rise
- Design to accommodate for additional barriers for future sea-level rise at the Bay edge

Reduce flood obstructions within the creek

- Design interventions to provide for uninterrupted flow during flood events
- Adaptations focused primarily at the edges and without impact of flood water flows

Improve water quality through combined grey + green infrastructure

- Use planting and rough surfaces to improve water quality during low flow
- Treat stormwater at point of entry into the creek
- Explore emerging combinations of natural and engineered systems

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**ECOLOGY**

#LETITGROW

**Restore native ecologies**

Restoring ecologies within the creek offers the potential to transform the corridor and surrounds from a piece of grey infrastructure to a community amenity and positive ecological asset. Restoring native ecologies along the creek and across some adjacent public land, offers an opportunity to build resilience through ecosystem services.

The approach to restoration needs to consider the future impacts of climate change. The impacts of sea-level rise on zones of habitat, as well as the impacts of more frequent flooding on sensitive species, are a key consideration for design. Additionally, designing opportunities for community involvement in the restoration process will provide for a pragmatic approach to adaptation scenarios, and ensure the success and longevity of the project.

**Design for community participation in restoration and stewardship**

- Use simple construction and restoration techniques should where possible to allow for community participation
- Design for stewardship to ensure the community can take ownership of the project into the future

**Develop specific strategies for fresh, brackish and salt water conditions**

- Restoration strategies to address these zones separately, and design for the transition between them
- Adaptation designs to account for climate change impacts on these zones

**Increase ability for people to engage with nature**

- Establish a greener creek as a shared amenity for South City
- Create opportunities for nature play and exploration
- Create opportunities for distant appreciation of habitat

**Support layers of habitat (tidal/wet + ground cover + canopy)**

- Integrate habitat zones within the daily water level, as well as frequent flood event levels
- Access to various levels to be coordinated to as not to fragment habitat zones

**Improve conditions for aquatic life**

- Create habitat for aquatic life connecting from the Bay up the creek to the park

**Create connected ecological corridors**

- Create connected habitat along the creek
- Create connected habitat areas adjacent to the creek

**Futureproof for species transition + migration in raised sea level conditions**

- Incorporate sloped edges for species migration in flood events
- Sloped edges and connected corridors for species migration in future sea-level rise (up sides and along tidal zones)

**Restore native ecologies**

Restoring ecologies within the creek offers the potential to transform the corridor and surrounds from a piece of grey infrastructure to a community amenity and positive ecological asset. Restoring native ecologies along the creek and across some adjacent public land, offers an opportunity to build resilience through ecosystem services.

The approach to restoration needs to consider the future impacts of climate change. The impacts of sea-level rise on zones of habitat, as well as the impacts of more frequent flooding on sensitive species, are a key consideration for design. Additionally, designing opportunities for community involvement in the restoration process will provide for a pragmatic approach to adaptation scenarios, and ensure the success and longevity of the project.

**Design for community participation in restoration and stewardship**

- Use simple construction and restoration techniques should where possible to allow for community participation
- Design for stewardship to ensure the community can take ownership of the project into the future

**Develop specific strategies for fresh, brackish and salt water conditions**

- Restoration strategies to address these zones separately, and design for the transition between them
- Adaptation designs to account for climate change impacts on these zones

**Increase ability for people to engage with nature**

- Establish a greener creek as a shared amenity for South City
- Create opportunities for nature play and exploration
- Create opportunities for distant appreciation of habitat

**Support layers of habitat (tidal/wet + ground cover + canopy)**

- Integrate habitat zones within the daily water level, as well as frequent flood event levels
- Access to various levels to be coordinated to as not to fragment habitat zones

**Improve conditions for aquatic life**

- Create habitat for aquatic life connecting from the Bay up the creek to the park

**Create connected ecological corridors**

- Create connected habitat along the creek
- Create connected habitat areas adjacent to the creek

**Futureproof for species transition + migration in raised sea level conditions**

- Incorporate sloped edges for species migration in flood events
- Sloped edges and connected corridors for species migration in future sea-level rise (up sides and along tidal zones)
# ACCESS

## LETUSGOTOTHECREEK

**Increase access to and along the creek**

Public access is a primary objective of restoration, connecting the public to the creek edge and along the creek to the Bay and Bay Trail. The South City community is currently disconnected from the Bay through a lack of access paths and currently impassable barriers like the Caltrain and 101 corridors.

The connection to and along the Creek should prioritize a legible and accessible path for pedestrians and bikes. While the creation of habitat is also a priority, the considered design of access to the corridor and to nature is a key opportunity for education related to climate change.

**Increase ability for people to engage with water**

- Provide opportunities for people to get close to the daily water level
- Improve the water quality to support this experience

**Increase visual connectivity from to water from surrounds**

- Change the shape of the creek section to improve sight lines
- Control the water level where appropriate

**Create a continuous and legible access route**

- Create a singular legible route that connects people from the Park to the Bay

**Increase connectivity across the creek**

- Incorporate low cost opportunities for crossing the creek safely during average daily flows
- Provide additional pedestrian safety measures on bridges and streets to connect to the multi-use path

**Provide comfortable and accessible connections**

- Design for a maximum 5 degree slope to meet ADA requirements and avoid additional handrails
- Provide shade for pedestrians and cyclists

**Provide singular and consolidated bike + pedestrian path**

- Provide a minimum 8’ width path for shared use between pedestrians and bikes
- Ensure paths are clearly marked for safety of shared use

**Provide safe + welcoming connections that encourages dwelling**

- Front active uses or areas with 'eyes on the street' where possible
- Lighting, shade and seating to provide safe and comfortable places to spend time

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FLOODABLE TERRACED PARK
Refer pp. 212 - 227
This study is focused on Colma Creek & adjacent public land from Orange Park to the Bay. The research and analysis looked to understand the changing sectional profile of the creek, key zones of flood risk, areas with no public access or significant barriers, as well as opportunities and constraints to adaptation based on creek adjacencies (now and in the future General Plan Update).
The stretch of Colma Creek addressed within this study includes a diverse range of sectional profiles and a transition from concrete channel upstream to a more natural Baylands condition downstream. The Creek width grows from less than 40’ to over 180’ and the depth shrinks from 12’ to 2’. It meanders beneath a series of roads and between changing land uses that impact its adaptation potential.

The following site analysis is structured to understand the unique aspects of each section of the creek, as well as how the corridor functions itself and how it connects into the surrounding City fabric.

Through 12 unique sections we identify the changing conditions along the creek. A series of maps identify opportunities and constraints along the entire corridor. The understanding resulting from this analysis allows us to group areas to help define them as character zones. Finally look at analysis of the long section to help define opportunities for habitat creation relative to flood and tidal zones.

Potential Value Creation

Public amenity in an area with a growing residential population nearby and about to undergo land use change next to the creek.

Health benefits for residents able to exercise along a continuous path from the Park to the Bay.

Opportunities for outdoor learning and engaging the community in restoration.

Reduced heat island and increased comfort for pedestrians and cyclists.

A safe and direct connection between BART, CalTrain and the Ferry providing new affordable commuting opportunities to residents.

Ecosystem benefits for resilience in a changing climate.
KEY SECTION ANALYSIS

13 unique sections have been analyzed to highlight the various creek profile and adjacent land use/ownership conditions throughout the study area.

The upstream sections show a deep narrow concrete canal where people on are kept far from the daily water level. The downstream sections show a low wide more natural creek with a large tidal range and sea-level rise to manage.

*Water levels taken from the ColmaCROA model dated August 8, 2019
Section 5 - Site Analysis & Opportunities

**KEY SECTION 01**

A narrow vertical concrete edged section with tightly planted mature eucalyptus close to the banks on either side. Park on either side offers flexibility for adaptation.

**KEY SECTION 02**

A deep concrete section with mixed vertical and chamfered edge. Fenced from public access and lined with public paths and date palms. Park on either side offers flexibility for adaptation.
KEY SECTION 03

45 degree sloped concrete channel, bordered by Sister Cities linear park on the south. North Canal Rd to the north is a wide street with a planted buffer and fence along the edge of the creek. There is no pedestrian access along the north edge of the creek.

KEY SECTION 04

Similar to section 03 but with sides transitioning to vertical walls and expanded capacity due to the high tides reaching this point in the creek. A narrow buffer run along the north edge of the creek.
KEY SECTION 05

Wide concrete channel with vertical concrete walls extending above the street level. Duplicate road infrastructure on either side of the creek with no sidewalks that run next to the creek. Industrial properties adjacent.

KEY SECTION 06

Creek bends and winds under CalTrain corridor. No public access adjacent to the creek, though both sides include some public land through a pump station/service site (north) and an access right-of-way (south).
Deep and wide vertical concrete section with walls extending above banks due to flood levels and sea level rise threats. No adjacent public access. Narrow publicly owned land on both sides with larger area to the north.

Brackish marsh begins in this low flat section, with flood walls extending above the banks due to flood levels and sea level rise threats. No existing public access but public land adjacent associated with nearby 101 freeway.
Section 5 - Site Analysis & Opportunities

**KEY SECTION 09**

Flood walls against edges of this low flat marshland section. Bordered by private carparks on both sides, with no public access to creek edge.

**KEY SECTION 10**

Flood walls against edges of this low flat marshland section. Bordered by a public street to the north with narrow sidewalk access along the creek edge, separated by levee wall. No public access on the south.
Levee walls are present through this stretch of marshland. The creek contains significant vegetated tidal wetlands and is bordered by private property on both sides of the creek.

In the area South of Utah Ave, sediment has built up on the eastern side of the creek adjacent to industrial properties and a historic Union Pacific right-of-way. Properties on the western side of the creek have no flood wall between carparks and the creek edge, often flooding with king tide events.
The creek widens as it approaches the mouth, with extensive tidal marsh on both sides. The Bay Trail is situated to the north within a narrow shoreline park, and San Bruno Water Quality Treatment Plant to the south.
Scope (Creek Corridor Extents)
The study area takes in the broader creek corridor as
shown, and is drawn to incorporate adjacent public land
including roads, interstitial spaces, and public maintenance
parcels. The channelized creek is contained within walls for
much of its length, to mitigate flooding events to locals.
Consideration of the adjacent land uses influences the
scales and opportunities for creek adaptation.

Creek/Channel Edge Conditions

Visual access to the creek is very limited. Particularly
through the areas where there is business and residential
abutting the creek, significant concrete walls are in place to
contain peak water volumes.

Legend
- Colma Creek - project extents
- Freight rail corridors extents
- Public land - agency to be confirmed

Legend
- Hard edge / Levee wall
- Concrete creek base
- Natural creek base
- Channel Improvement (Zones Proposed)
- Channel Improvement
Pedestrian Access and Circulation

Pedestrian access to the creek is predominantly limited to Orange Park and Sister Cities Park, where there are opportunities to get close to the creek. There is little opportunity to interact with the creek between Spruce Ave and the Bay where the creek intersects the San Francisco Bay Trail.

Road Network and Vehicular Access

Whilst there are numerous roads that cross Colma Creek, only North and South Canal Rds run directly alongside the creek—serving to disconnect pedestrian and local community from the creek. North and South Canal Rds also provide the sole access point to several properties/driveways. The low traffic counts along these roads offer opportunity for reconfiguring lanes and use to provide greater public amenity.

Mitchell Ave is known to sustain significant truck traffic due to its connection to the industrial areas making it unlikely to undergo wholesale change to its function.

Maintenance access to the creek is possible at multiple points, typically aligned to existing roads.
Historic Creek Route

Much of South San Francisco abutting Colma Creek is former marshland. Historically, the river meandered from San Bruno mountain down to the Bay. The creek has since been re-routed and channelized and seen significant development though the former marshy areas.

FEMA Flood Zones + Flood Risk

FEMA flood mappings show a prevalence of flood hazard along and around the creek - which has occurred through this area for many years. Flooding is known to impact lower Colma Creek, through the Lindenville Industrial Precinct and much of the property near the bay.

FEMA Flood Zones are likely to be exacerbated by increased risk of sea level rise.

An independent research group, The First Street Foundation, recently released national data for flood risk that they claim captures additional risk not currently accounted for within FEMA’s assessment. The maps take into account sea-level rise projections and new rainfall data to highlight properties facing additional risk of various levels that they believe should be captured by FEMA maps.
5’ Sea Level Rise + 100 Year Storm

The Colma Creek catchment also faces risks from sea-level rise scenarios. Depending on severity, many of the sites along the former creek mouth, and current creek mouth are likely to be impacted.

This will also exacerbate existing stormwater flood risk along the corridor, particularly when peak water events coincide with high tides. The tides are understood to influence water levels so far up as Spruce Ave, where the creek bed steps up.

Tree Canopy Cover + Invasive Species

There is little to no tree and canopy cover through the study area and in neighborhood streets surrounding. In fact, less than a third of the street trees in blocks closer to Grand Ave. The preponderance of trees fall in Orange Memorial Park, which is characterized by its dense planting along the creek edge.

Invasive species are also found at points along the creek and into the Bay, with significant instances of Fennel and Invasive Spatina.
Stormwater Drainage and Creek Pumps

The Colma Creek catchment takes in much of the surrounding neighbourhoods and much of the stormwater infrastructure is conveyed along and under streets, and ultimately arrives in the creek. At locations where the creek water level is often higher than stormwater outfall points, pumps have been placed to discharge into the creek.

Utilities

Between Orange Avenue and Linden Ave there are numerous existing services, including fiber, conduits and sewage/stormwater, situated within the road reserve to the north of the creek. This is likely to limit the appetite for significant reshaping of the north side of the creek through this stretch. Utilities are unlikely to impact adaptation opportunities in other locations.
Zoning

Designing to current and future land use adjacent to the creek corridor will be essential to the revitalization of the creek. Opportunities for redefining the creek will emerge from sensibly utilizing public land overlays, and inviting private development to rethink its relationship to the creek.

Land Use

Current land uses are typified by low density residential towards Orange Memorial Park and light industrial from the Linden area northeast to the Bay. A cluster of hotels exists close to Hwy 101 and the exits either side.

New medium density residential developments are under construction and planned on the west side of 101, potentially extending residential uses from the Park to the Freeway.
Opportunities Analysis

Leveraging the significant public land available, along and adjacent to the creek corridor, begins to illustrate the key opportunities for creek improvements. In combination with changes to zoning and land use, a clearer picture emerges of the opportunities to rejuvenate the creek and build a usable public asset for the community.
Colma Creek is predominantly channelised throughout the study area with levee walls serving to contain peak water flows in high-risk flood areas. A more detailed understanding of the creek can be gained by distinguishing sections of the creek into character zones, identifiable by the adjacent land use. These adjacent conditions are key determinants in what adaptation potential can be unrolled through each area. Each character zone provides different opportunities and constraints, these will inform the scale and impact of change for the creek.
Defining Characteristics

- Flood risk is low & forecast sea-level rise risk is low
- Good public access on both sides
- Adjacent park land provides flexibility for adaptation, while existing community programming (including active sports) will likely need to be maintained
- Existing vegetation close to creek is a potential constraint to adaptation
- Water detention opportunities allow for capture and slow release
- Water treatment project with subterranean storage planned for park expansion area
Defining Characteristics

- Flood risk is moderate and forecast risk of sea-level rise is low (particularly between Spruce & Orange Avenues).
- Public access exists along the north and south of the creek, although only Sister Cities Park offers formalised bike and pedestrian access by the creek.
- Adjacent streets and linear park provide flexibility for adaptation.
- Major infrastructure under North Canal Rd. (fiber and sewer) constrains adaptation options to the north.
- Nearby land use transitions from low density residential to light industrial.
- Industrial property access points along South Canal Rd require innovative street typology in order to extend Sister Cities Park to Linden Ave.
- The general plan update includes re-zoning scenarios to transform industrial land north and south of the creek into medium density residential.
- Fire department located on North Canal Rd. at Spruce Ave. - access to be maintained.
### RAIL

**Defining Characteristics**

- Flood risk is high and forecast sea-level rise risk is moderate
- No public access exists next to the creek
- Clearance under Caltrain bridge is minimal
- Public land provides potential for adaptation, especially to the north of the creek
- Development applications have been submitted for 3 sites north of the creek between Linden and San Mateo Avenues.
- The general plan update includes rezoning scenarios to transform the produce market site into a mixed use neighborhood
- Freight corridor diverges east just after Colma Creek providing opportunity

**Legend**

- Annual chance flood hazard area
- Special flood hazard area
- Possible rezoning due to General Plan update
- Likely rezoning due to General Plan update
- Development application already submitted
- Movement barriers
- Pedestrian paths
- Creek improvements zone
- Future no build zone
- Creek improvements zone

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Section 5 - Site Analysis & Opportunities
### Defining Characteristics

- Flood risk is high and forecast sea-level rise risk is moderate.
- No public access exists next to the creek.
- A large number of heavily trafficked roads crossing the creek are barriers for creating continuous safe access path.
- Clearance under bridges is minimal.
- Underutilized public land adjacent to the freeway provides potential for ecological adaptation.

- The general plan update includes re-zoning scenarios to transform the produce market site into a mixed use neighborhood.
- Creek transitions from channel to soft base with levees.

### Legend

- Annual chance flood hazard area
- Special flood hazard area
- Possible rezone due to General Plan update
- Development application already submitted
- Movement barriers
- Pedestrian paths

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Section 5 - Site Analysis & Opportunities
Section 5 - Site Analysis & Opportunities

MARSH

Defining Characteristics

- Flood Risk is high and forecast sea-level rise risk is moderate
- Public access exists along Mitchell Ave only, with limited pedestrian space
- Aside from Mitchell Ave, there is a narrow strip of publicly owned land to the east of the creek
- Flood wall and tidal marsh zone provide some opportunities for adaptation
- No public access points between Mitchell and Utah Ave on east sides, and between S. Airport Blvd and Utah Ave on north and west sides
- Historical north-south rail right of way connects Mitchell Ave to rail corridor

Legend

- Movement barriers
- Pedestrian paths
- Informal pedestrian path
- Bike path / On-road bike path (dashed)
- Private service road
- High volume truck traffic
- Decommissioned rail right of way
Section 5 - Site Analysis & Opportunities

Defining Characteristics

- Flood risk is moderate and forecast sea-level rise risk is high
- Bay Trail access on north side of creek extending around Oyster Point
- Mudflats provide some opportunity for further strengthening of nature-based resilience measures
- 150' - 150' public parkland provides some opportunities for adaptation before low density industrial and R&D land uses
- The general plan update includes rezoning scenarios to upgrade industrial sites to R&D land uses. These sites are at risk from sea level rise

Legend

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<th>Description</th>
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<tr>
<td>Medium Blue</td>
<td>Inundation 5ft - 100yr</td>
</tr>
<tr>
<td>Dark Blue</td>
<td>Inundation 0ft - 100yr</td>
</tr>
<tr>
<td>Lightest Blue</td>
<td>Inundation 5ft - MSL</td>
</tr>
</tbody>
</table>

Character Zone

Land Use Change

FEMA Flood Zones

San Francisco Bay Trail
CREEK LONG SECTION

The long section reveals existing tidal influence extending all the way past Spruce Avenue.

The 2 year flow level indicates a significant difference in level with he daily tidal volumes, as well as unfortunately no clearance for public access above this level and below existing bridges.

The 10 year flow is extremely close to the underside of the Linden Ave bridge, which already significantly constrains the flow of a 100 year event.

Variation in the height of banks to the east of 101, along with the dynamic sediment movement causing variation in depths, is a major flood risk.

Tidal impact on flood risk shows the scale of vulnerability to sea-level rise, without widened profile of the creek between Spruce Ave and the Bay.

The extent of public access varies greatly between the various character areas along the Creek.

Opportunities for continual public access from the Park to the Bay exist predominantly on the northern side of the Creek.
CREEK ECOLOGY

Research into historical ecologies of the area reveals potential for restoration of zones transitioning from: a Central Coast Riparian Scrub Zone, to a Coastal Brackish Marsh Zone, to a Tidal Marsh Zone, to the shoreline mudflats.

Existing mature Eucalyptus Gums and Date Palms in Orange Memorial Park will likely remain, so a pragmatic restoration strategy is for a transition from this mixed cultural landscape to a fully restored native landscape downstream.

A restored creek would provide habitat suitable for a number of threatened native species like the Salt Marsh Harvest Mouse and the California Ridgeway Rail (which already exists within the shoreline areas).

Other well-loved local species may be easier to attract and more quickly build populations, like the San Francisco Garter Snake and the Pacific Chorus Frog.
**CREEK ECOLOGY**

**SAN FRANCISCO GARTER SNAKE**
*Thamnophis sirtalis leucotis*

**PACIFIC CHORUS FROG**
*Pseudacris regilla*

**WESTERN POND TURTLE**
*Pseudacris regilla*

**LONGFIN SMELT**
*Spirinchus thaleichthys*

**SALT MARSH HARVEST MOUSE**
*Rathbunodon hyvamensis*

**CALIFORNIA RIDGWAY’S RAIL**
*Rallus abscondita obscurus*

**Ideal Habitat**
- Dense vegetated ponds near open hillside where it can sun, feed, and find cover in rodent burrows
- Emergent and creek-bank vegetation - cattails, bulrushes and spike rushes provide protection from predators
- The zone between creek/pond habitats and grasslands or bank side is utilized for basking
- Dense vegetation or water provides escape cover

**Ideal Habitat**
- Ponds and other still waters, shallow water for breeding
- Fallen logs, rocks and tall vegetation, for example grasses, cattails, and shrubs provide protection from predators
- Terrestrial habitat is important for nesting and overwintering

**Ideal Habitat**
- Permanent and intermittent waters of creeks, ponds, marshes and drainage ditches
- Bask on land or near water on logs, branches or boulders

**Ideal Habitat**
- A range of low-salinity water and shallow fresh or brackish wetland habitats
- Sandy or gravel substrate could potentially provide spawning areas

**Ideal Habitat**
- Habitat can be enhanced for this species by widening the tidal marsh area and planting dense vegetation like pickleweed

**Ideal Habitat Restoration**
- Dense marsh vegetation for foraging and protection, in and along creeks and mudflat edges
We have extracted a series of existing conditions from Colma Creek based on sectional profiles, and adjacent conditions and land use. These conditions were selected as they have been identified as typical of the region. This has allowed us to explore a broad range of potential adaptations within the creek corridor and adjacencies. Grouped by the context surrounding the creek, diverse design options have been explored with outcomes evaluated against the flood, ecology and access objectives.
Section 6 - Adaptation Toolkit

The challenges faced by Colma Creek are similar to those faced by many locations and communities around the Bay. The historic pattern of large freeway and rail infrastructure circling the Bay has cut off many smaller communities from the shoreline. Main streets and creeks need to be revived and reconnected to the Bay as both social and ecological corridors enabling climate adaptation.

With the regional grants supporting this planning study comes an opportunity to support regional collaboration on climate adaptation. This project was inspired by the characteristics that Colma Creek and South San Francisco share with other creeks and communities around the region. More than 40 other creeks and communities share the challenges of limited open space and access to the Bay. These locations similarly have creek corridors that could be reconnected as ecological and access corridors supporting adaptation to climate change.

The design process for this project has aimed to differentiate the various character areas of Colma Creek to clearly define the conditions, constraints and opportunities that are shared with sections of these other corridors around the region. The team has explored a wide range of adaptation options and ranked whether they deliver resilient outcomes across 1, 2 or 3 of the objectives (Water, Ecology and Access) to make clear their most suitable application for other communities.

This chapter establishes the options for adaptation when working under varying constraints related to existing creek conditions, levee walls, adjacent public or private land, movement barriers, and sea-level rise risk. The breadth of options are also assessed for likely cost and impact, relative to the identified existing condition.

The Kit of Parts identifies smaller moves and techniques that are then combined into the Toolkit Options. Each section of the Toolkit highlights the best suited adaptation opportunities and an explanation of performance.

The Toolkit has been designed to flexibly translate to similar creeks across the Bay Area. As such, other locations with matching conditions have been identified.

Challenges of limited open space and access to the Bay are shared by 40+ Creeks and communities

A Regional Resiliency Network

Transport Network
Public Open Spaces
Local Creeks and Main Streets

A Regional Resiliency Network
The Kit of Parts identifies a series of detailed elements that work to improve access, ecology and water. These individual elements are deployed in a range of configurations that make up the options explored in the Adaptation Toolkit. Options within the Adaptation Toolkit are responsive to site conditions and can be supplemented and adapted with other pieces from the Kit of Parts.

**Bike Lane (1-way)**
A 7’ bike lane allows for one way dedicated bike access.

**Bike Lane (2-way)**
A 12’ bike lane allows for two way dedicated bike access.

**Horizontal Levee**
Horizontal levees are self-maintaining and use natural flood protection benefits of coastal tidal marshes to reduce the destructive forces of storms and sea level rise impacts.

**Floating Boardwalk**
Dynamic boardwalks respond to changing water levels, allowing continuous access during peak water events.

**Pedestrian Path**
A 7’ path at a maximum 5 degree slope provides generous, ADA compliant pedestrian access.

**Shared Path**
A 10’ path provides a consolidated bike and pedestrian path.

**Zebra Crossing**
Zebra crossings with pedestrian refuge islands allow for safe, pedestrian and bike priority road crossings.

**Signalized**
Signalized crossings provide priority access for pedestrians and bikes at key intersections along designated routes.

**Horizontal Levee**
Horizontal levees are self-maintaining and use natural flood protection benefits of coastal tidal marshes to reduce the destructive forces of storms and sea level rise impacts.

**Floating Boardwalk**
Dynamic boardwalks respond to changing water levels, allowing continuous access during peak water events.

**Tiered Seating**
Stepped access and seating along the creek edge allows for physical and visual connectivity to the creek, while also expanding the creek cross section.

**Seating**
Seating can provide places to stop and rest along the path.

**Planted Buffer**
Planting between roads and access paths increases public safety and comfort for pedestrians and cyclists, captures stormwater run-off, and increases biodiversity opportunities.
**KIT OF PARTS**

**Bioretention Swale**
Shallow, vegetated, landscape depressions capture and treat stormwater run-off before it enters the creek.

**Tree Pit**
Water capture tree pits intercept and treat stormwater run-off before it enters the creek and have minimal space requirements.

**Rocky Embankment**
Rocky embankments within the creek corridor improve water quality and provide opportunities for habitat.

**Rocky Edge**
Rocky edges within the creek corridor improve water quality and provide opportunities for habitat.

**Living Storm Barriers**
Raised sections of planting within the mudflats can provide protected habitat for birds while also reducing the impact of waves and storm-surge on the shoreline.

**Stepping Stone Weir**
Crossing points in the creek can also improve water quality through aeration of daily flow.

**Concrete Weir**
Aquatic plants that improve water quality can thrive in 1.5 feet of water. Small weirs can provide these conditions in many areas where the average daily flow is only half a foot.

**Ecological Terracing**
Discharging stormwater between certain plant species with gravity flow, can improve water quality while also creating habitat for creekside species.

**Rocky Embankment**
Discharging stormwater between certain plant species with gravity flow, can improve water quality while also creating habitat for creekside species.

**Swale Green Wall**
Street runoff can be redirected to irrigate green wall plants, in turn treating runoff.

**Detention Basin/Levee**
Lowered open landscape adjacent to the creek can provide detention for overland flow or when combined with operable levee/weir can detain fresh flow as part of downstream flood management.

**Tidal Green Wall**
Water quality can be improved and green habitat created within the tidal zone, replacing bare concrete walls.
TOOLKIT HOW TO

Preferred Adaptations

- Tool Kit Type
- Description
- Regional Application

Tool Kit Analysis

- Tool Kit Type
- Colma Creek Existing
- Tested Options
- Preferred Adaptation (previous spread)

Legend

- Flood & SLR Mitigation
- Access to Ecology
- Ecological Restoration Potential
- Continuous, Comfortable Access Along Creek
Common characteristics of solutions:

- Widening and sloping sides to enable visual access to the water and transition of park landscapes into Creek.
- Providing for access to the daily water level through landscape stepping, accessible paths and seating below the 2 yr flood level, and possibly using weirs to raise daily water levels closer to the Park.
- Terraced, sloped and lowered park landscapes can provide additional water benefits, allowing for treatment of runoff and stormwater discharge into the Creek, as well as expanding detention capacity to reduce flood risk downstream.
- The approach to restoration is based on a clear zone of riparian planting within the newly accessible lower portions of the creek.

Regional Applications:

- Coyote Creek - William Street Park, San Jose
- Stephens Creek - Whisman Park, Mountain View
- Wildcat Creek - John Herbert Davis Park, Richmond
- Saratoga Creek - Santa Clara Central Park

Visual representations of different park and creek adaptations are included, such as stepped edge, ramp to sunken path, terraced ecology, and wetland.
A narrow, deep concrete channel. Low flood and sea-level rise risk. Adjacent park land provides opportunity for adaptation, but existing programs may restrict options. Public access existing along top of creek edge, but limited visual access and no access close to water level. Existing vegetation close to creek poses potential constraint to adaptation.

Colma Creek Adaptation Planning Design Report
Prepared for BARC, San Mateo County & City of South San Francisco
Common characteristics of solutions:

- Additional width within road reserve used to introduce bike and pedestrian access adjacent to Creek edge, or reduced lane widths to give back part of road reserves to creek for flood & ecology.
- Stepping and sloping, where possible, to mediate between street and daily water levels. Also useful for treating stormwater discharge.
- Stepping into the road reserve to increase flood capacity.
- The introduction of trees for shade and comfort of pedestrians next to Creek.
- Many locations of this condition have duplicate infrastructure (i.e. Roads on both sides of the creek), allowing for the adaptation approach to balance access and ecology on the two sides.

Regional Applications:

- Alameda Creek - Industrial Parkway, Union City
- San Leandro Creek - Leet Drive, Oakland
- Calabazas Creek - Mission College Blvd, Santa Clara
- Colma Creek - Mission Rd, South San Francisco (Upstream of Study Area)
A wide, deep concrete channel. Moderate flood risk and low sea level rise risk. Adjacent linear park provides opportunity for adaptation. Private property next to linear park restricts adaptation zone. Public access is available through linear park, but there is limited visual and no physical access to the creek.

A wide, deep concrete channel with vertical walls. Moderate flood risk and low sea level rise risk. Adjacent linear park provides opportunity for adaptation. Private property next to linear park restricts adaptation zone. Public access is available through linear park, but there is limited visual and no physical access to the creek.
Common characteristics of solutions:

→ Access and water flow are often both restricted at major crossings, so more space for flood waters through either adjacent inundation zones, or widened underpass areas (or both) provide a dual benefit.

→ Options allowing for the multi-use path to share space with road or rail underpasses can provide more affordable solutions than new bridges or tunnels though the safety and quality of experience need to be considered.

→ When access is moved away from the Creek’s edge, lowered and sloped edges for inundation and runoff treatment become possible.

Regional Applications:

→ San Leandro Creek (B880/BART), San Leandro
→ San Pablo & Wildcat Creeks (Capital Corridor/B80), Richmond
→ San Lorenzo Creek (B880), San Lorenzo
→ Adobe & Barron Creeks (101), Palo Alto
CROSSINGS

A wide, deep concrete channel with vertical walls. Flood risk is high and accident rate is low. No local public access available along creek.

Low, wide, soft based marsh zone. Flood risk is moderate and accident rate is low. No local public access available along creek.

A dual carriageway with highway bridge over. No public access. Adjacent public land provides potential for ecological adaptation. Limited opportunities for other side development.

Semi-active freight line with highway bridge over. No public access. Adjacent public land provides opportunity for decommission one track.

Existing RoC01

Existing RoC02

Existing RoR01

Existing RoR02

Existing RoR03

Existing RoF01

Existing RoF02

Existing RoC05

Existing RoC04

Existing RoC03
Section 6 - Adaptation Toolkit

MARSH

Common characteristics of solutions:

- The introduction of public access, along with flood and sea-level rise protections can be designed to both allow close access to nature as well as provide for ecological connectivity up and down the tidal marsh.
- Elevated structures provide marsh connectivity beneath and can adapt to flood scenarios through floating mechanisms.
- Alternatively built-up sloped barriers can maintain visual access from paths immediately behind levees.
- This innovative integration of protective structures and public access provides for adaptation in areas where often little to no public land exists along the Creek side.

Regional Applications:
- Belmont Slough, Redwood Shores
- Alameda Creek, Union City
- Guadalupe River, Alviso
- Redwood Creek, Redwood City
Common characteristics of solutions:

- Placement and nature of Sea-level rise protection dictates the nature of public access, ecological and recreational space. It also can have impacts on future fluvial flooding and balance if fresh water and salt water inundation.
- The public access path becomes the natural transition between two types of environments.
- If parkland is dedicated to migrating marshlands, this provides for maximum restoration opportunities, while if dedicated to storm water detention then it could have the greatest possible flood benefits for adjacent parcels.
- Outboard marshland restoration can also provide storm surge protection reducing the size of required levees.

Regional Applications:
- Coyote Point Recreation Area, San Mateo
- Steinberg Slough, Redwood Shores
- India Basin, San Francisco
- Albany Mudflats State Marine Park, Albany
MARSH + BAY

MARSH
Low, wide marshland section with flood walls. High flood and sea level rise risk. Flood wall, tidal marsh zone and adjacent right of way provide some opportunities for adaptation. Limited public access available along creek.

OUTLINE

BAY
Wide tidal marsh section as creek meets the bay. Moderate flood risk and sea level rise risk. Wide adjacent public parkland provides significant opportunity for adaptation. Bay Trail provides access along creek and bay.
Combining the site analysis & adaptation toolkit, the following scenarios establish 3 potential continuous routes from Orange Memorial Park to the Bay, applying adaptation options to each character area of the creek to prioritize multi-benefit outcomes across the 3 project objectives.
Section 7 - Creek Adaptation Scenarios

SCENARIO 01
BRIDGE TO BRIDGE

16
16 minutes from Orange to Bay

1.8
1.8 miles from Orange to Bay

7
7 new bike/ped access

42
42 acres of improved public amenity

39
39 acres of connected ecology

Route details:
- Terraced seating and infilled rock edges open up the canal to the park and connect adjacent public activities down to the water's edge.
- New bike/ped access on the northern edge of the creek between Orange Park and Linden Ave, within existing carriageway widths. The edge of Sister Cities Park is softened with increased planting and habitat created within the Park.
- An accessible bike bridge enables a continued and legible access alongside the creek on its north bank.
- Another bike bridge spans Hwy 101 as a landmark structure associated with South City Hwy exits.
- A suspended boardwalk connects from Mitchell Avenue to the Bay Trail, with landform adapted to increase flood capacity and extend restoration of marshland into an ecotone.

Legend:
- Picnics access path
- Secondary access path
- Greenway
- Inundatable restoration zone
- Ecological restoration zone
- General Plan rezoning

16 minutes from Orange to Bay

8.3 Mins

4.0 Mins

5.2 Mins

0.34 Miles

0.7 Miles

0.8 Miles

1.8 miles of creek access

42 acres of improved public amenity

39 acres of connected ecology

Connect back to San Francisco Bay Trail

Introduction of pedestrian bridge over Highway 101 allowing views up and down the creek and acting as a gateway structure for South City.

Implementation of shared use path within creek corridor - use of elevated/suspended boardwalk or flotation to minimize impact.

Significant habitat opportunity adjacent to off-ramp. Connected back to creek and upgraded to offer improved ecology to wildlife.

Expanding the coastal brackish marsh provides important aquatic habitat for small fishes and crabs while it is flooded. During low tide, the low marsh is exposed which provides access to food and cover for wetland and terrestrial animals.

Rejuvenated Sister Cities park with increased ecological function and amenity.

Adjustments to channel to slow water, provide habitat opportunities, encourage community interaction/engagement with creek.

On-road separated bike path along North Canal Rd.

New public creekside access and bike bridge over Caltrain rail.

Maintained access and road width for emergency vehicles adjacent to fire station.

Expansion of creek cross-section to incorporate South Canal Rd. providing continued pedestrian connection to Sister Cities park, increased ecological and flood function. Limited vehicular access maintained.

16
1.8
42
39

2022

Hassell ©
SCENARIO 01

Key Features
- Realigned creek route slows water movement and encourages sediment build up for habitat within average daily water levels
- Slowed water movement enables community creek crossing
- New habitat created for increased biodiversity & improved water quality
- Amphitheatre seating invites renewed engagement with creek from adjacent active public recreation areas
- Redistributed lanes within existing roadway allows for bike path adjacent to creek
- New creek crossing opportunities during average daily flow, allowing access to and across the creek
- Road capacity maintained whilst providing significant public amenity improvements

Key Features
- Reconfigured roadway and lanes allows for bike path adjacent to creek, and visual access to water
- Road capacity maintained with increased cross-sectional capacity for creek
- Habitat opportunities created in greened creek edges - as well as throughout extended Sister Cities Park
- Limited vehicular access maintained on South Canal Rd through one-way single lane portion of street
- Bike bridge over rail line (85deg slope)
- Adaptation of existing public land within creek corridor to provide shared path access over rail bridge
- Lowering public land provides expansion of creek flood capacity as well as providing brackish marsh habitat opportunities
Section 7 - Creek Adaptation Scenarios

SCENARIO 01

Key Features
- Bike/ped bridge over highway
- Adaptation of existing public land within creek corridor to provide shared path access over bridge
- Lowering public land provides expansion of creek flood capacity as well as providing brackish marsh habitat opportunities
- New creekside public access through elevated boardwalk
- Restored brackish marsh with cut and fill allowing full ecotone transition up to flood protection height
- Potential for boardwalk to float/elevate during flood events

Key Features
- Boardwalk through expanded inundation zone
- Habitat designed for inundation and gradual migration with sea-level rise
- Access to bay edge and kayak launch
- Living storm barriers for wave attenuation and protection from sea-level rise

Highway

Marsh

Bay
Route details:

- Naturalized channel edge and concrete dam within the Park provides for habitat restoration and increased visual access to the canal from adjacent paths. Improvements within the park will slow water and improve water quality, provide greater visual amenity with the creek, and provide habitat and detention opportunities.

- Combining a lowered Sister Cities Park into the creek corridor will integrate ecological value (vegetation and habitat within the creek) and critical increase in cross-sectional capacity. Additional street trees and swales in North Canal offer shade and habitat while a new ped/bike/planting zone along South Canal Rd allows continual active mobility.

- After crossing Linden Ave, a narrow R.O.W is used along the south side of the creek - crossing beneath Caltrain in a protected underpass.

- At San Mateo Ave, the shared path turns north to cross the river. Rejuvenation of access along San Mateo Ave South Airport Blvd under Hwy 101 and through to Mitchell Ave sees the insertion of a separated on-road bi-directional cycleway. Beneath this zone a new culvert expands high flow of the creek across Hwy 101.

- Users then travel along Mitchell Ave to Harbor Way and through the industrial precinct on a new shared path before connecting to the Bay.

- Significant ecological improvements through the marsh section of the creek enable protected habitat restoration.

SCENARIO 02
SISTER CITIES TO STREET

17.9 miles from Orange to Bay
1.9 minutes from Orange to Bay
1.2 minutes of creek access
9 intersections
40 acres of improved public amenity
33 acres of connected ecology

Legend
- Primary access path
- Secondary access path
- Greenline
- Inundatable restoration zone
- Ecological restoration zone
- General Plan rezoning

---

Section 7 - Creek Adaptation Scenarios

0.01 Miles
0.05 Miles

1.9 Miles
1.2 Miles

40 Acres
33 Acres
SCENARIO 02

Key Features
- Softened creek edges and rock edge slows water movement, weir holds a depth suitable for aquatic plantlife, improving daily water quality.
- Slowed water movement enables community creek crossing.
- Habitat restoration adding to overall biodiversity within the park.
- Softened edges and raised water level provide for better visual connection to the creek from adjacent paths and spaces.
- Reconfigured roadway and lanes allows for more street trees and bioswale, expanding the effective width of ecological corridor across street.
- Softened creek edge on South slows water movement and provides for aquatic plantlife to improve water quality. Creek section expanded for increased flood capacity.
- Continuous safe bike/ped shared path created along South Canal Rd, for creekside access.
- A single (wide) lane preserved on South Canal Rd for vehicular movement.

Key Features
- Reconfigured roadway and lanes allows for more street trees and bioswale, expanding the effective width of ecological corridor across street.
- Softened creek edges slow water movement and provide for aquatic plantlife to improve water quality.
- Continuous safe bike/ped shared path through Sister Cities Park.
- Lowered Sister Cities Park creates opportunities for closer connection to daily water level as well as expanded flood capacity for the creek.
- Adapted R.O.W on south side of creek to provide 5 degree ramped underpass for bike/ped.
- Lowered public land on north side provides brackish marsh restoration as well as increased flood capacity.

Key Features
- Reconfigured North Canal Rd and lanes allows for more street trees and bioswale, expanding the effective width of ecological corridor across street.
- Softened creek edge on South slows water movement and provides for aquatic plantlife to improve water quality. Creek section expanded for increased flood capacity.
- Continuous separated bike/ped shared path created along South Canal Rd, for creekside access.
- A single (wide) lane preserved on South Canal Rd for vehicular movement.

Key Features
- Softened creek edges and rock edge slows water movement, weir holds a depth suitable for aquatic plantlife, improving daily water quality.
- Slowed water movement enables community creek crossing.
- Habitat restoration adding to overall biodiversity within the park.
- Softened edges and raised water level provide for better visual connection to the creek from adjacent paths and spaces.
- Reconfigured roadway and lanes allows for more street trees and bioswale, expanding the effective width of ecological corridor across street.
- Softened creek edge on South slows water movement and provides for aquatic plantlife to improve water quality. Creek section expanded for increased flood capacity.
- Continuous safe bike/ped shared path created along South Canal Rd, for creekside access.
- A single (wide) lane preserved on South Canal Rd for vehicular movement.
SCENARIO 02

Key Features
- Expanded tidal marsh zone on both sides of the creek, through relocating tidal wall to outer edge of public land.
- Expanded flood capacity within tidal zone
- Adaptation of vacant land around freeway exit to provide for treatment of runoff
- Rearrangement of lanes for insertion of a separated shared path.
- Bridge structure provides for additional excavation on South side for buffer separated bike/ped
- New box culvert created under cycleway for additional creek flood capacity under 101

Key Features
- Restoration of ecotone through the marsh section of the creek creating protected habitat through section without public access.
- Cut and fill to expand flood capacity within creek
- New shared bike/ped path within road reserve
- Seals landscape buffer separating from maintained 2-way carriageway
- New horizontal levee provides protection from sea-level rise and flood
- Living storm barriers create protected habitat and reduce impact of waves/storm surge on shoreline
- Potential fresh water detention on park-side

Key Features
- Restoration of ecotone through the marsh section of the creek creating protected habitat through section without public access.
- Cut and fill to expand flood capacity within creek
- New shared bike/ped path within road reserve
- Seals landscape buffer separating from maintained 2-way carriageway
- New horizontal levee provides protection from sea-level rise and flood
- Living storm barriers create protected habitat and reduce impact of waves/storm surge on shoreline
- Potential fresh water detention on park-side
Section 7 - Creek Adaptation Scenarios

**SCENARIO 03**

**RAILS TO TRAILS**

- Naturalized creek edges and new wetland edge on northern side of the creek. Informal playing fields lowered to provide stormwater detention for overland flow and detention with new operable weir.
- Bike access on the north of the creek between Orange Park and Caltrain, utilizing existing road reserve. Sister Cities park is lowered to expand creek cross-section and provide critical habitat opportunities for creek wildlife.
- New public spaces created on both sides of the creek in conjunction with upzoning and redevelopment. Parks set below street level for detention and flood mitigation.
- Vacant and disused public land adjacent to the rail corridor is connected to the creek for expanded water detention and ecology. In conjunction with new Caltrain corridor underpass which overs expanded high flow capacity for the creek.
- The Union Pacific freight line is partially transformed into a new linear park, with shared access path, new vegetation and ecology (maintaining rail use on half the corridor until being decommissioned). Returning to the creek down existing Union Pacific RoW.
- Mitchell Ave focuses on expanding creek cross-sectional capacity and adapting the public space to better service creek access.
- The access path is then continues over Mitchell Ave within Union Pacific RoW adjacent to existing flood wall, to the Bay and Bay Trail.

**Legend**

- Primary access path
- Secondary access path
- Subdivision
- Non-inundable reclamation area
- Ecological reclamation area
- General Plan rezoning

<table>
<thead>
<tr>
<th>Park</th>
<th>Street 01</th>
<th>Street 02</th>
<th>Rail</th>
<th>Highway</th>
<th>Marsh</th>
<th>Bay</th>
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<td></td>
<td></td>
<td>2</td>
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</tr>
<tr>
<td>1.4</td>
<td></td>
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<td>6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>81</td>
<td></td>
<td></td>
<td>76</td>
<td></td>
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</tr>
<tr>
<td>0.8 Miles/0.3 Mts</td>
<td>0.37 Miles/2.2 Mts</td>
<td>0.89 Miles/0.9 Mts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Minutes from Orange to Bay: 19, 2, 6
- Intersections: 5
- Acres of improved public amenity: 81
- Acres of connected ecology: 76

- 0.8 Miles
- 0.3 Mts
- 1.4 Miles
- 0.6 Acres
- 73 Acres
- 0.37 Miles
- 2.2 Mts
- 0.89 Miles
- 0.9 Mts

- 2 Miles
- 6 Intersections
- 81 Acres
- 76 Acres
- 19 Minutes
- 2 Minutes
- 6 Minutes

- 0.89 Miles
- 0.9 Mts
- 8.3 Mins
- 0.37 Miles
- 2.2 Mts
- 6.8 Mins

- Lowered Sister Cities Park
- Increased ecological function and amenity as well as expanded flood capacity

- Adjustments to channel to slow water, provide habitat opportunities, encourage community interaction/engagement with creek

- On-road separated bike path along North Canal Rd.
**SCENARIO 03**

**Key Features**
- Naturalized creek edges and new wetland edge on northern side of the creek to provide new habitat, flood capacity and amenity
- Informal playing fields lowered to provide stormwater detention for overland flow and detention with new operable weir.
- Weir creates daily water depths suitable for aquatic plant life to improve water quality.
- Reconfigured roadway and lanes allows for separated bike path adjacent to creek.
- Naturalized creek edges and new creek crossing opportunities during average daily flow provide for access to the creek as well as new habitat within tidal zones.
- Lowered Sister Cities Park increases flood capacity within the creek.
- Road capacity maintained whilst providing access immediately adjacent on both sides of the creek.
- Continuous bike/ped paths on north and south of creek.
- New tidal habitat created through setting boulders within existing concrete section, meandering flow and improving water quality.
- New ramped bike/ped underpass which can provide increased capacity in flood.
- Terraced landscape for detention and new tidal marsh habitat on public land north of creek.
- Increased amenity for planned medium density residential north of the creek.
- New tidal habitat created on south side of the creek, connecting to new detention park.
- New tidal brackish marsh zones created on south side of the creek.
- Increased amenity for planned medium density residential north of the creek.
**SCENARIO 03**

**Key Features**
- Expanded tidal marsh zone on both sides of the creek, with piped connections through to freeway exit island for expanded habitat and detention.
- Expanded flood capacity within tidal zone.
- Adaptation of vacant land around freeway exit to provide for treatment of runoff.
- Partially adapted freight corridor for shared path connection.
- Planted buffers with maintained freight line (rarely used).
- New planting and swales within corridor to manage runoff.
- Operable storm barrier for protection against king tides during future sea-level rise scenarios.
- Fresh water detention within parkland.
- Salt water marshland at base of horizontal levee which allows for treatment of pumped detained fresh water.

**Key Features**
- Shared path located on Union Pacific R.O.W along with new trees for shade.
- Expanded brackish marsh and ecotone through excavated sediment.
- Increased flood capacity within creek.

**Bay**

**Highway**

**Marsh**
MARSHY EDGE
Refer pp. 228 - 235
The segments of the various scenarios are interchangeable for maximum flexibility in the delivery stages of this project. Different cost and regulatory barriers exist to different design moves, as well as different funding opportunities. This chapter lays out this implementation landscape for the pieces of the previous scenarios, as well as focusing in on defining short, medium and long term project opportunities.
## Scenario Assessment

### Park Street 01 Street 02 Rail Hwy March Bay

### Existing: Key Opportunities & Challenges
- Large adjacent public land
- No tidal influence and sloped creek sides
- Likely land use change adjacent to the creek with upzoning in General Plan Update
- Adjacent publicly owned land and current development applications
- Existing underpasses that could be adapted for bike and pedestrian access (Freight Line & South Airport Blvd)
- Remnant marsh for restoration. Continuous Union Pacific R.O.W for connection to Bay Trail
- The Bay Trail, public parkland and existing Ridgeway Rail population

### Physical access to the water
- Concrete channel with poor water quality
- Distance from access to the water. Concrete channel with poor water quality
- Distance from access to the water. No ped/bike access adjacent to the creek. Vertical concrete walls
- No public access to or along creek. Vertical concrete walls
- Non-continuous public access. Invasive species and trash collecting on banks
- Sea-level rise risk.

### Scenario 1: Delivery Opportunities & Constraints
- Full project control of project by Parks & Rec. Strong case for benefit of access to water by sports community
- Existing road width provides for multi-use path on North Canal Rd, maintaining number of vehicle lanes. Sister Cities park can be lowered for additional flood capacity
- Existing road width provides for multi-use path on North Canal Rd, maintaining number of vehicle lanes
- Direct and legible connection on North Side of Creek. Publicly owned sites for adaptation
- Direct access can be maintained adjacent to creeks. Visible ped/bike connection over Hwy 101 provides opportunity for Caltrans investment
- Reshaping of banks has potential to reduce flood risk. New public access could directly extend Bay Trail from shoreline to Hwy 101
- Adaptation of publicly owned land

### Scenario 2: Delivery Opportunities & Constraints
- Full project control of project by Parks & Rec. Habitat restoration will provide for grant funding opportunities to deliver amenity
- Safety of public access will need to be ensured
- Access to the water’s edge could likely not be delivered as ADA accessible
- Cycleway cannot be separated at firebreak for turning radius. Small section of South Canal Rd maintained as one-way street for access to a handful of properties
- Expensive and complex structure
- Expensive, low-span, and complex structure
- Potential complex approvals with BCDC due to movement of fill and boardwalk structure
- Potential complex approvals with BCDC related to storm barrier islands fill

### Scenario 3: Delivery Opportunities & Constraints
- Full project control of project by Parks & Rec. Habitat restoration & flood mitigation impacts will provide for grant funding opportunities
- Trees on North Canal are constrained by existing services. ADA accessible path in Sister Cities Park cannot be lowered for expanded flood capacity
- Existing services within North Canal Rd. Negotiations with property owners on South Canal Rd
- Narrow R.O.W on south side of Creek, may be difficult to construct
- Challenging intersection with bike/ped conflicting with Hwy 101 access
- Increased restoration grant opportunities without direct public access
- Adaptation of publicly owned land

### Scenario 4: Delivery Opportunities & Constraints
- Full project control of project by Parks & Rec. Habitat restoration & flood mitigation impacts will provide for grant funding opportunities
- Integrated water quality, restoration, flood mitigation impacts will broaden grant opportunities
- Integrated water quality, restoration, flood mitigation impacts will broaden grant opportunities
- Integrated public access, flood mitigation and restoration proposal using only publicly owned land and adjacent to increasing residential population
- Singular Union Pacific R.O.W connecting all the way to the Bay Trail
- Singular Union Pacific R.O.W connecting all the way to the Bay Trail. Expanded flood capacity and restoration provides access to more grant funding
- Adaptation of publicly owned land

### Alignment with future projects & General Plan Update
- Current stormwater capture project is likely to start too soon to align any creek access improvements, but our proposals do not conflict with existing plans
- Key connection between approved and planned new residential population to the east and Orange Memorial Park to the west. Critical to save pedestrian and bike connections to the park
- Re zoning of sites on both sides of the creek opens opportunities required landscape setbacks with detention capacity
- Current development applications for three sites on North of Creek between Linden Produce Ave indicates a growing residential populationfronting the creek
- New Utah Ave vists/access to Hwy 101 provides opportunities for rework of what is recognized as a problem exit
- San Mateo County proposal for additional flood protection could be adjusted to align with public access objective on West side of creek. Current City negotiations with Union Pacific could be expanded
- Future expansion of Genentech’s campus and potential rezoning of shoreline

### Project Owners
- SMC Flood & SLR Resiliency District, SSF Public Works
- SMC Flood & SLR Resiliency District, SSF Public Works
- SMC Flood & SLR Resiliency District, SSF Public Works
- SMC Flood & SLR Resiliency District, Caltrans
- SMC Flood & SLR Resiliency District, Union Pacific
- SMC Flood & SLR Resiliency District, BCDC

### Additional Stakeholders
- Colma Creek Adaptation Planning Design Report
- Colma Creek Adaptation Planning Design Report
- Colma Creek Adaptation Planning Design Report
- Colma Creek Adaptation Planning Design Report
- Colma Creek Adaptation Planning Design Report
- Colma Creek Adaptation Planning Design Report

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176 Colma Creek Adaptation Planning Design Report
Prepared for BARC, San Mateo County & City of South San Francisco

Hassell © 177
The successful delivery of the project will rely on accessing grant funding from regional, state and federal government agencies. The project objectives align with current best practice in creek restoration as well as the environmental and social impact aligning with the mission of many established grant programs.

Grants related to urban greening, habitat restoration, water quality improvement and increased open space are listed below from organizations such as The Bay Restoration Authority, California State Coastal Conservancy and California Natural Resources Department. Flood mitigation funding is available through the Federal Emergency Management Agency (FEMA). And grants aimed at public access and active mobility are identified from MTC, BART and the Federal Department of Transport.

### Restoration/Parks/Water

**Measure AA (2016)**  
http://sfbayrestore.org/restoration-authority-grants

**Parks & Water Bond Act – Proposition 68 (2018)**  
https://www.parks.ca.gov/?page_id=29906

**SF Bay Area Climate Ready Grants - Proposition 68 (2018)**  
https://scc.ca.gov/grants/prop-68-grants/

**Proposition 1 Grants**  
https://scc.ca.gov/grants/prop-1-grants/

**National Fish Habitat Partnership**  
https://www.fhwa.dot.gov/specialfunding/tp/

**CA Natural Resources – Urban Greening Grant Program**  
https://resources.ca.gov/grants/urban-greening/

**Flood**

**FEMA flood Mitigation Assistance Grant Program**  
https://www.fema.gov/flood-mitigation-assistance-grant-program

### Access/Transportation

**Active Transportation Program**  

**Climate Initiatives Program**  

**Recreational Trails Program**  
https://www.fhwa.dot.gov/environment/recreational_trails/

**Surface Transportation Block Grant**  
https://www.fhwa.dot.gov/specialfunding/tp/

**Congestion Mitigation and Air Quality Improvement Program (CMAQ)**  
https://www.fhwa.dot.gov/environment/air_quality/cmaq/

**Safe Routes to BART (SR2B) – Measure RR**  
https://www.bart.gov/about/planning/safe-routes

**Caltrans Sustainable Communities Grants**  
https://dot.ca.gov/programs/transportation-planning/regional-planning/sustainable-transportation-planning-grants

**Union Pacific Foundation Grants**  
https://www.up.com/aboutup/community/foundation/local-grants/index.htm

**One Bay Area Grant**  
https://mtc.ca.gov/our-work/fund-invest/investment-strategies-commitments/focused-growth/one-bay-area-grants

**Bay Area Water Trail Grant Program**  
https://scc.ca.gov/webmaster/project_sites/watertrail/water-trail-grant-program.pdf
## IMPLEMENTATION ROADMAP

### Short term / Start-up

<table>
<thead>
<tr>
<th>Project description</th>
<th>Potential Project Partners</th>
<th>Potential Grant Contributors</th>
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<tbody>
<tr>
<td>Water quality improvements through rocky weirs and low-flow interventions</td>
<td>SSF Parks &amp; Rec</td>
<td>CalTrans, SCC, SFBRA, CalFish &amp; Wildlife, FEMA</td>
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<tr>
<td>New pedestrian bridge crossing</td>
<td>CalTrans</td>
<td>CalFish &amp; Wildlife, Cal Coastal Conservancy, FEMA</td>
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<tr>
<td>Painted bikeway on North Canal Rd, relocated centerline</td>
<td>SSF Public Works, MTC, BAAQMD</td>
<td>SCC, SFBRA, FEMA</td>
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<tr>
<td>Demonstration restoration planting and upper edge changes within Sister Cities Park</td>
<td>SSF Parks &amp; Rec, SCC, SFBRA</td>
<td>MTC, FEMA, FEMA</td>
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<tr>
<td>Painted bikeway on North Canal Rd, relocated centerline</td>
<td>SSF Public Works, MTC, BAAQMD</td>
<td>SCC, SFBRA, FEMA</td>
</tr>
<tr>
<td>Temporary closures of South Canal Rd (e.g. Parks Alive Streets Alive Festival)</td>
<td>SSF Public Works, SSF Parks &amp; Rec</td>
<td>MTC, FEMA</td>
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<tr>
<td>Public artwork marking distance to the shoreline and highlighting planned public access (potentially on existing gas station site)</td>
<td>SSF WQCP, Gas Station Owner</td>
<td>MTC, FEMA</td>
</tr>
<tr>
<td>Temporary public access to creek in partnership with adjacent residential developments</td>
<td>SSF WQCP, SSF Public Works, Adjacent Developers</td>
<td>MTC, FEMA</td>
</tr>
<tr>
<td>Public artwork marking distance to the shoreline and highlighting planned public access (vertical structure visible from freeway)</td>
<td>SSF WQCP, Gas Station Owner</td>
<td>CalTrain, MTC</td>
</tr>
<tr>
<td>Temporary fencing and access along Union Pacific freight rail line, as trial rails to trails project</td>
<td>Union Pacific, SSF Public Works</td>
<td>MTC, FEMA, FEMA, FEMA</td>
</tr>
<tr>
<td>Gravel public access trail from Mitchell Rd to Utah Ave (Stair over existing wall at Mitchell)</td>
<td>SMC Public Works, MTC</td>
<td>SCC, SFBRA, FEMA</td>
</tr>
<tr>
<td>Community planting days for removal of invasives and restoration of native plants</td>
<td>SMC, San Bruno Mountain Watch</td>
<td>CalTrans, BAAQMD, FEMA</td>
</tr>
<tr>
<td>Outdoor classroom pod on shoreline</td>
<td>SMC, San Bruno Mountain Watch</td>
<td>CalTrans, CalFish &amp; Wildlife, FEMA</td>
</tr>
<tr>
<td>Community planting days for removal of invasives and restoration of native plants</td>
<td>SMC, San Bruno Mountain Watch</td>
<td>FEMA, FEMA</td>
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### Medium / Impact

<table>
<thead>
<tr>
<th>Project description</th>
<th>Potential Project Partners</th>
<th>Potential Grant Contributors</th>
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<tbody>
<tr>
<td>Terraced seating, water access as rocky weirs for water quality improvements</td>
<td>SSF Parks &amp; Rec</td>
<td>CalTrans, SCC, SFBRA, FEMA</td>
</tr>
<tr>
<td>Widened and naturalized creek profile with limited public access to new habitat</td>
<td>CalFish &amp; Wildlife, Cal Coastal Conservancy</td>
<td>FEMA, FEMA</td>
</tr>
<tr>
<td>Demonstration restoration project, slope changes and habitat creation along Sister Cities Park</td>
<td>SSF Parks &amp; Rec, SSF Public Works</td>
<td>FEMA, FEMA</td>
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<tr>
<td>Rework of North Canal Rd: Street trees, bioswale and separated multiuse path</td>
<td>SSF Parks &amp; Rec, SSF Public Works</td>
<td>FEMA, FEMA</td>
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<tr>
<td>Rework of North Canal Rd: Street trees, bioswale and separated multiuse path</td>
<td>SSF Public Works</td>
<td>FEMA, FEMA</td>
</tr>
<tr>
<td>Rework of South Canal Rd with ped/bike lane adjacent to creek with new street trees and bioswale</td>
<td>SSF Public Works, MTC</td>
<td>FEMA, FEMA</td>
</tr>
<tr>
<td>Partial conversion of Union Pacific freight corridor into trail for bike/ped access under Hwy 101</td>
<td>Union Pacific</td>
<td>CalTrans, MTC</td>
</tr>
<tr>
<td>Rework of South Airport Blvd for ped/bike access under Hwy 101, including box culvert beneath bike path for additional flood capacity under 101</td>
<td>SSF Public Works, CalTrans</td>
<td>SCC, SFBRA, FEMA</td>
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<tr>
<td>Removed terrestrial vegetation and sediment to restore ecotone on east bank and increase flood capacity</td>
<td>SMC Public Works, SMC</td>
<td>SCC, SFBRA, FEMA</td>
</tr>
<tr>
<td>New public access path along Union Pacific R.O.W.</td>
<td>SMC, San Bruno Mountain Watch</td>
<td>FEMA, FEMA</td>
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<tr>
<td>New pedestrian bridge over new tidal marsh parkland</td>
<td>CalTrain</td>
<td>FEMA, MTC</td>
</tr>
<tr>
<td>Partial removal of South Canal Rd and introduction of low-level paths and parkland as continuation of Sister Cities Park</td>
<td>SSF Parks &amp; Rec</td>
<td>FEMA, MTC</td>
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<tr>
<td>Removal of South Canal Rd along with redevelopment of sites south of the creek, including new floodplain public park</td>
<td>SSF Parks &amp; Rec</td>
<td>SCC, SFBRA, FEMA, Developers</td>
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### High Cost / Impact

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<tr>
<th>Project description</th>
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<tr>
<td>Freshwater wetland, operable weir and above ground detention within park</td>
<td>SSF Parks &amp; Rec</td>
<td>CalTrain, SCC, FEMA</td>
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<tr>
<td>Subsurface detention tank for flood control</td>
<td>CalTrans</td>
<td>CalFish &amp; Wildlife, Cal Coastal Conservancy, FEMA</td>
</tr>
<tr>
<td>Widened and greened creek profile, water access and quality improvements as well as lowered Sister Cities Park</td>
<td>SSF Parks &amp; Rec, SSF Public Works</td>
<td>FEMA, FEMA</td>
</tr>
<tr>
<td>Widened and greened creek profile, water access and quality improvements as well as lowered Sister Cities Park</td>
<td>SSF Parks &amp; Rec, SSF Public Works</td>
<td>FEMA, FEMA</td>
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<tr>
<td>Widened creek mouth, expanded marshland with access boardwalks and horizontal levees for flood &amp; SLR protection</td>
<td>SMC Public Works</td>
<td>FEMA, FEMA</td>
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<tr>
<td>Storm gate, horizontal levees and freshwater wetland on landslide</td>
<td>USACE</td>
<td>FEMA, FEMA</td>
</tr>
</tbody>
</table>

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**Section 8 - Implementation Roadmap**

*Prepared for BARC, San Mateo County & City of South San Francisco*
Conceptual designs have been prepared to test the application of the toolkit and scenarios to specific site conditions along the creek. Proposals attempt to illustrate the detailed adaptation of a number of key sites, communicating both technical and immersive aspects of how the toolkit approach lands on these sites.
PARK

Based on Scenario 01
Opening the creek to the park. This proposal brings people right down to the creek edge through stepped seating edges, integrating this key waterway back into Orange Park. Sections of the creek are softened with the new vegetation and rocky edges providing new habitat for fauna and flora. The creek meanders past rocky outcrops and terraced seating, cleaning the water and providing diverse opportunities for engagement with the creek.
CREEK PARK

The transformation of the existing street, creek, and Sisters Cities Park between Orange Avenue and South Spruce Avenue into a linear, floodable parkland.

Section 9 - Design Tests

CHARACTER AREA - STREET 1
KEY SECTION - 03

Based on Scenario 01

EXISTING VOLUME

PROPOSED VOLUME

32% increase in creek capacity/volume

2ac gray to green transformation
Section 9 - Design Tests

CREEK PARK

1. Planted embankment - riparian scrub species
2. Viewing platform
3. Rocky edge and freshwater marsh planting
4. Daily water level
5. Storm water - water collection and treatment
6. Street tree planting
7. Shared path
8. Riparian meadow planting
9. Existing concrete base retained

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

North Canal Street Creek Park Sister Cities Park

Shared Path Freshwater Marsh
Section 9 - Design Tests

CREEK PARK

1. Planted embankment - riparian scrub species
2. Viewing platform
3. Rocky edge and freshwater marsh planting
4. Daily water level
5. Street swale - water collection and treatment
6. Street tree planting
7. Shared path
8. Riparian meadow planting
9. Existing concrete base retained

San Francisco Garter Snake
Thamnophis sirtalis tetrataenia

Pacific Chorus Frog
Pseudacris regilla

Western Pond Turtle
Actinemys marmorata

Bay Checkerspot
Euphydryas editha bayensis
CREEK PARK
CREEK PARK

Allowing people to be next to and close to the water... this proposal introduces ped/bike access along the northern edge of the creek, expands the creek capacity with a lowered Sister Cities Park, softens the sides and introduces rocky edges for habitat and access down to the water’s edge. More trees line the paths for pedestrian shade and comfort, while native plants and flowers bring back the bird life and butterflies to entertain passers-by. Street and creek become a singular green corridor.
EXPANDED FLOODPLAIN

The transformation of the existing creek and streets - both North Canal and South Canal between South Spruce Avenue and South Linden Avenue into a linear, floodable parkland.

32% increase in creek capacity/volume
1.8ac gray to green transformation

Based on Scenario 01
Section 9 - Design Tests

EXPANDED FLOODPLAIN

1. Existing floodwall and channel base (retained)
2. Stepped, retaining wall edge planted with riparian scrub species
3. Viewing platform
4. Rocky edge and brackish marsh planting
5. High Tide area
6. Shared path
7. Berm edge planted with riparian meadow species
8. Street swale - water collection and treatment
9. Expanded street verge planted with riparian meadow species
10. Street tree planting
11. Creek-edge siltwalls
12. Future ‘floodable’ park space
13. Possible water detention beneath street

North Canal Street
Expanded Floodable area

Detail area

Street Swale
Brackish Marsh
Shared Path and Creek Edge Access
Future Floodable Park Space
EXPANDED FLOODPLAIN

Section 9 - Design Tests

1. Existing floodwall and channel base (retained)
2. Stepped, retaining wall edge planted with riparian scrub species
3. Viewing platform
4. Rocky edge and brackish marsh planting
5. High Tide zone
6. Shared path
7. Berm edge planted with riparian meadow species
8. Street swale - water collection and treatment
9. Expanded street verge planted with riparian meadow species
10. Street tree planting
11. Creek-edge sidewalk

Longfin Smelt
Spirinchus thaleichthys

Pacific Chorus Frog
Pseudacris regilla

Western Pond Turtle
Actinemys marmorata

Long Billed Curlew
Numenius americanus

California Ridgway’s Rail
Rallus crepitans

Ridgway’s Rail
Rallus obsoletus

Bay Checkerspot
Euphydryas editha bayensis

Colma Creek Adaptation Planning Design Report
Prepared for BARC, San Mateo County & City of South San Francisco

Hassell ©
EXPANDED FLOODPLAIN
EXPANDED FLOODPLAIN

From grey to green, the stark walls make way for stepped terraces of greenery... this proposal brings people back to the edges of the creek and turns the design focus from disaster to daily use. Stepped landscapes no both sides treat runoff while staggered rocky outcrops in the creek meander the daily flow for brackish habitat and quiet local fishing perches. Access paths on both sides accommodate those moving by quickly or those looking to sit for a while and enjoy the sounds of the creeks flow and returning water birds.
**GREENER STREETS**

Retro-fitting streets with additional tree planting to shade sidewalks and shared paths and installing linear street swales and rain gardens to collect and treat water falling onto road surfaces and pedestrian pavements.

---

**Canopy cover - street tree planting**

- Big Leaf Maple
- California Buckeye
- Pacific Dogwood
- California Sycamore
- Coast Redwood
- American Eucalyptus

**Linear street swales, rain gardens and verges**

- Sea-milkwort
- Pacific Aster
- Marsh Rosemary
- Marsh Gumplant
- Baltic Rush
- Creeping Spikerush
- Deerweed
- Brass-buttons
- Seaside Ducks
- Coast Buckwheat
- Western Goldenrod
- Saltmarsh Cowberry
- Feather Reed Grass
- Northern Ragwort
- Marsh Ragwort
- Saltmarsh Baccharis
- Coquille Point Baccharis
- Mahogany
- Salmonberry
- Bottlebrush Buckwheat
- Siberian Pea
- Russian Sage
- Blue Dicks
- Russian thistle
- Joshua Tree
- Russian almond
- Oregon Grape
- Seaside Daisy
- Sea Rose
- Mexican Tansy
- Santa Lucia Bluebell
- Seaside Primrose
- Desert Pea
- Yarrow
- Asclepias
- Hummingbird Sage
- Penstemon
- Goldenbush
- Beach Burdock
- Coastal Lomatium
- California Fuchsia
- Desert Rose
- Desert Sunflower
- Common Sunflower
- Desert Thistle
- Desert Yucca
- Cholla
- Desert Holly
- Soaproot
- Desert Willow
- Mesquite
- Desert Sage
- Desert Paintbrush
- Desert Dandelion
- Desert Sunflower
- Desert Hyacinth
- Desert Yucca
- Desert Willow
- Coastal Thryptomene
- Desert Holly
- Soaproot
- Desert Sage
- Desert Paintbrush
- Desert Dandelion
- Desert Sunflower
- Desert Hyacinth
- Desert Yucca
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- Desert Sage
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- Desert Dandelion
- Desert Sunflowe
FLOODABLE TERRACED PARK

The creation of a new floodable parkland stretching from South Linden Avenue through to the Bayshore Freeway.
The enclosed experience of a cyclist riding under the Caltrain corridor opens up into an expansive brackish marshland flourishing with fish and birdlife. The stretched ecotone spans from the creek up to the viewing platforms and new residential developments, with diverse species spanning the salt and fresh water divide. This proposal imagines a transformation from fenced lands to a dynamic tidal habitat in one of the most interesting ecological zones of the creek.
1. Expanded tidal mudflat
2. Brackish marsh planting
3. Boardwalk and viewing platform
4. Sphagnum stormwater detention planted with riparian meadow species
5. Mounding pathways
6. Parkland with scattered tree planting
7. Floodable terraces planted with riparian scrub species
8. Shared path
9. Street tree planting
10. Existing flood wall (shown in red)
11. Additional tree planting and wetland - water collection and treatment installed within existing conditions, adjacent to Colma Creek - where possible
12. Marsh Park
Colma Creek Adaptation Planning Design Report
Prepared for BARC, San Mateo County & City of South San Francisco

Section 9 - Design Tests

ECOTONES

1. Expanded tidal mudflat
2. Brackish marsh planting
   "Brackish marsh" vegetation in this region is characterized by the dominance of sedge family species (tules, bulrushes) in the low to mid-marsh zone, and the relative high frequency of rushes (Juncus spp.) in the high marsh zone.

3. Boardwalk and viewing platform
4. Terrestrial edges planted with riparian scrub species and meadow species

- Baltic Rush
- Iris-Leaved rush
- Salt Grass
- Distichlis spicata
- Tule Scirpus acutus
- Tule Scirpus californicus
- Bulrush Typha sp.
- Pickleweed Sarcocornia pacifica
- Saltmarsh Baccharis Baccharis douglasii
- California Buckeye Aesculus californica
- Pacific Dogwood Cornus nuttallii
- Big Leaf Maple Acer macrophyllum
- Deerweed Acmispon glutinosus
- Marsh Ragwort Senecio hydrophilus
- Hummingbird Sage Salvia spathacea
- Penstemon Penstemon heterophyllus
- Tufted Hairgrass Deschampsia cespitosa
- Coyote-Brush Baccharis pilularis
- Goldenrod Solidago californica
- Coastal Buckwheat Eriogonum latifolium
- Yarrow Achillea millefolium
- Marsh Gumplant Grindelia stricta
- Western goldenrod Euthamia occidentalis
- Creeping Spikerush Eleocharis dilatata
- Brass-buttons Brass-matula
- Jaumea Jaumea carnosa
- Pacific Aster Aster lendus
- Marsh Stinkgrass Deschampsia cespitosa
- Marsh Goldenbush Zathamnia occidentalis
- Wavy-leafed aster Aster dumosus
- Marsh Hockey-Stick Grindelia stricta
- Marsh Hockey-Stick Grindelia stricta
- Marsh Hockey-Stick Grindelia stricta
- Marsh Hockey-Stick Grindelia stricta
1. Expanded tidal mudflat
2. Brackish marsh planting
3. Boardwalk and viewing platform
4. Sloped edges planted with riparian scrub species
5. Mounding paths through riparian meadows
6. Parkland with scattered tree planting
7. Creek edge pathway
8. Rocky edge planted with riparian scrub species

Section 9 - Design Tests

SECTION BB
1. Expanded tidal mudflat
2. Brackish marsh planting
3. Terraced edge planted with riparian meadow species
4. Parkland with scattered tree planting ('floodable fields')
5. Berm edge planted with riparian meadow species
6. Parkland with scattered tree planting and ephemeral stormwater detention
7. Floodwall
8. Creek edge pathway

SECTION CC

Section 9 - Design Tests

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels
1. Expanded tidal mudflat
2. Brackish marsh planting
3. Terraces and creek edge embankment planted with riparian meadow species
4. Viewing platform
5. Adjacent property
6. Creek edge embankment planted with riparian scrub species
7. Creek edge pathway
8. Berm edge planted with riparian meadow species
9. Future ‘floodable’ park space and stormwater detention space

—— 100 Year Flow Climate Change
—— 100 Year Flow
—— 10 Year Flow
—— 2 Year Flow
—— Daily/Tidal Water Levels

Low marsh

Expanded tidal mudflat

Low marsh

Future ‘floodable’ fields
A MARSHY EDGE

CHARACTER AREA - MARSH
KEY SECTION - 12

EXISTING VOLUME

PROPOSED VOLUME

Based on Scenario 01/03
1. Proposed floodwall
2. Viewing platform/walkway with seating edge
3. Salt marsh re-vegetation
4. Expanded tidal mudflat zone
5. Carpark swale - stormwater capture and treatment
6. Permeable pavement zone adjacent to creek edge
7. Tree planting
8. Existing groundline
A M ARSHY EDGE

1. Proposed floodwall
2. Viewing platform/walkway with seating edge
3. Salt marsh re-vegetation
4. Expanded tidal mudflat zone
5. Carpark swale - stormwater capture and treatment
6. Permeable pavement zone adjacent to creek edge
7. Tree planting
8. Existing groundline

Salt Marsh Harvest Mouse - Reithrodontomys raviventris
Cordgrass - Spartina foliosa
Pickleweed - Sarcocornia pacifica

Long Billed Curlew - Numenius americanus
California Ridgway’s Rail - Rallus crepitans
Ridgway’s Rail - Rallus obsoletus
Section 9 - Design Tests

A MARSHY EDGE

From fennel to tidal, this design imagines a restored ecotone and expanded tidal and flood zone along this forgotten corridor. New public access threaded between the flood wall and industrial properties, with near views of a restored tidal marshland and ecotone drawing diverse species up from the bay shoreline. The watery edges of the creek protected by the flood wall from nearby pedestrians, able to watch the creek life from the nearby path under the shade of new trees lining the path.
The river’s mouth opened up, and the bay tidal life washed into the park. Through cut and fill, the path is lowered into a widened and restored marsh, widening the discharge into the bay, reducing flood risk and preparing for sea-level rise. The boardwalk wraps the shoreline, punctuated by curated interpretive elements and weathered structures shared by local schools (outdoor classrooms) and local bird enthusiasts (hides). The Ridgeway rails gather on the edges of the mudflats, while the salt marsh harvest mouse darts between pickleweed thickets.