

NORTH BAY BAYLANDS REGIONAL CONSERVATION INVESTMENT STRATEGY

April 2024

NORTH BAY BAYLANDS REGIONAL CONSERVATION INVESTMENT STRATEGY

April 2024

Prepared by:

ESA

In Partnership with:

METROPOLITAN TRANSPORTATION COMMISSION

Caltrans

SAN FRANCISCO ESTUARY PARTNERSHIP

scta SONOMA COUNTY TRANSPORTATION AUTHORITY

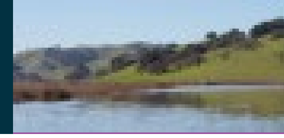
Table of Contents

TABLE OF CONTENTS

North Bay Baylands Regional Conservation Investment Strategy

Page

List of Figures



Page

List of Figures (continued)

List of Tables

Page

List of Tables (continued)

Appendices

CHAPTER 1

Overview of the Regional Conservation Investment Strategy

1. Overview of the Regional Conservation Investment Strategy

The North Bay Baylands Regional Conservation Investment Strategy (RCIS), enabled through the passage of Assembly Bill 2087 in 2016, is administered by the California Department of Fish and Wildlife (CDFW) and is designed to encourage regional planning for species and habitat conservation and enhancement. The North Bay Baylands RCIS is proposed by the Metropolitan Transportation Commission (MTC) and is sponsored by the California Department of Transportation (Caltrans) through a planning process that includes public input and collaboration with partner organizations and agencies.

The North Bay Baylands RCIS is a voluntary, non-binding, nonregulatory regional plan for species and habitat conservation that:

- Describes existing conditions and plans for future landscape changes resulting from land conversion, climate change, or investments in the region.
- Identifies goals, objectives, priorities, and actions that can be implemented to guide conservation. Examples of potential RCIS conservation and habitat enhancement actions include:
  - Land acquisition and protection.
  - Habitat creation and restoration.
  - Restoration of creeks and rivers.
  - Restoration of habitat on public land.
  - Installation of wildlife crossings and removal of fish passage barriers.
- Complements existing natural community conservation plans, habitat conservation plans, federal and state recovery plans, or other approved conservation plans that overlap the RCIS's boundaries.
- Enables the development of mitigation credit agreements (MCAs) with CDFW. MCAs could be used to fulfill mitigation requirements for projects in advance of project impacts.

The North Bay Baylands RCIS is not a regulatory document. Nothing in this RCIS is intended to, nor shall it be interpreted to, conflict with controlling federal, state, or local law, including California Fish and Game Code Sections 1850–1860, or any guidelines adopted by CDFW pursuant to Fish and Game Code Section 1858. It does not:

- Create or modify regulatory requirements (e.g., standards for issuance of incidental take permits, consistency determinations, take authorizations, lake or streambed alteration agreements, or any other permits or authorizations).
- Modify in any way the standards under California Environmental Quality Act (CEQA) or limit an agency's assessment of potential project effects. It does not constitute any of the following for the purposes of CEQA:
  - A plan, policy or regulation adopted by avoiding or mitigating an environmental effect,
  - A local policy or ordinance protecting biological resources, or
  - An adopted local, regional, or state habitat conservation plan.
- Prohibit or authorize any project or project impacts, including the creation of any presumption of agency approval or disapproval.

- Impact any requirements for the general plan of cities and counties overlapping the RCIS area.
- Regulate land use, establish land use designations, or affect or preempt the land use authority of a public agency to implement infrastructure and urban development in local general plans.

The RCIS is not a mitigation plan, but it may be used to find mitigation opportunities and enable MCAs (CDFW 2023a; see RCIS Guidelines Section 5.2.5).

The RCIS presents a vision for conservation in the North Bay Baylands region. As a holistic, regional plan, it provides an opportunity for strategic conservation investments that improve outcomes. The RCIS includes quantitative conservation targets that can be used to measure and track these outcomes. The conservation targets are voluntary and non-binding, are not regulatory requirements or standards, and are not regulatory compliance success criteria.

Conditions of RCIS development and CDFW approval include (CDFW 2023a)[1]:

- The RCIS must be developed and submitted by a public agency or federally recognized tribe after consulting with the local agencies with land use authority (i.e., each city and county) within the geographic area of the RCIS.
- The proposing entity shall notify CDFW of its intent to develop an RCIS.
- The RCIS will incorporate the best available scientific data and existing information.
- Actions will benefit the conservation of focal species and their habitats, non-focal species, and other conservation elements by addressing or responding to the identified pressures and stressors.

If approved by CDFW, an RCIS may be valid for up to 10 years. CDFW may extend the duration of an approved or amended RCIS for an additional 10 years provided the RCIS is updated to include new scientific information and the RCIS continues to meet the Program's requirements.

This RCIS was developed through an iterative process in coordination with a project team, technical working group, and interested stakeholders (Section 1.4, *Outreach to Stakeholders and the Public*). This process aimed to identify regionally important species, habitats, and ecological processes and develop conservation strategies to inform future investment. The document provides a snapshot of conditions at the time of writing and may be amended in the future.

1.1 RCIS Document Structure

The North Bay Baylands RCIS has five chapters:

- **Chapter 1** outlines the document's purpose and need, proposing agencies, development process and outreach, and provides an introduction on how to best use and access information in the RCIS document.
- **Chapter 2** provides a summary of the existing conditions in the region. This review of the region's natural and built environments includes community demographics, habitats, infrastructure, land use and existing

[1] The RCIS Program Guidelines (CDFW 2023a) contains a glossary of standard terms used in the program. Key terms may be highlighted as a side-bar in the North Bay Baylands RCIS. See the guidelines document for additional definitions.

conservation. The chapter also describes existing conservation and restoration planning in the region as well as pressures and stressors faced by species and habitats.

- **Chapter 3** describes the process for selecting the focal species, other conservation elements, and non-focal species and natural resources for inclusion in the RCIS.
- **Chapter 4** is the conservation strategy, which has priorities, goals, objectives, and actions for each focal species and other conservation element.
- **Chapter 5** describes implementation, advance mitigation (including development of MCAs), adaptive management and monitoring, and processes for extending and amending the RCIS.
- **Appendices** provide important supplemental information, including further documentation on project support, outreach and engagement efforts, and technical data. Technical appendices include review of other planning documents, climate vulnerability assessment, and non-focal species information.

1.1.1 How To Use the RCIS

The RCIS is intended be benefit an array of user groups, such as conservation organizations, land managers, infrastructure agencies, project proponents, municipalities, governments, mitigation sponsors, and regulatory agencies. The success of the RCIS will depend on these users being able to access pertinent information in the document and then to use it to inform their conservation and habitat enhancement actions. The RCIS can additionally assist with project approvals and funding. **Table 1-1** identifies how organizations may choose to use the RCIS and provides relevant document sections where information can be obtained.

TABLE 1-1: HOW TO USE THE NORTH BAY BAYLANDS REGIONAL CONSERVATION INVESTMENT STRATEGY, BY OBJECTIVE TYPE

Objective Type	Potential Organizations	How to Use the RCIS	Relevant RCIS Section
Strategically acquire property for conservation purposes.	• Land trusts • Entities acquiring land for mitigation purposes • Organizations wishing to restore habitat	• Review figures and data portal[2] to see locations with overlapping habitat values. • Review conservation strategies for regional land acquisition priorities.	Section 2.3: Natural Communities, Biodiversity, and Connectivity Section 2.6: Land Conservation Chapter 4: Conservation Strategy
Improve effectiveness of restoration and enhancement actions.	• Land managers • Restoration project proponents • Entities seeking mitigation	• Review climate resiliency actions and incorporate them into project designs. • Review and understand existing conditions and restoration planning efforts already underway in the region. • Align restoration project design elements with conservation element goals and objectives. • Ensure project alignment with other regional plans by reviewing the regional planning overview.	Chapter 2: Regional Conditions Section 2.4: Major Infrastructure Section 2.7: Existing Conservation Plans, Studies, Policies, and Compliance Chapter 4: Conservation Strategy Appendix G: Existing Plans and Studies

2 The North Bay Baylands data is anticipated to be integrated in the Bay Area Greenprint (www.bayareagreenprint.org) or other online data portal.

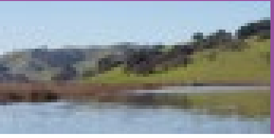


TABLE 1-1: HOW TO USE THE NORTH BAY BAYLANDS REGIONAL CONSERVATION INVESTMENT STRATEGY, BY OBJECTIVE TYPE

Objective Type	Potential Organizations	How to Use the RCIS	Relevant RCIS Section
Avoid or minimize impacts on areas with high conservation value.	• Regulatory agencies • Project proponents	• Review figures and data portal for locations with overlapping habitat values to assess potential impacts. • Review Priority Conservation Areas and conservation strategies that identify high-value areas for conservation.	Section 2.3: Natural Communities, Biodiversity, and Connectivity Section 2.6: Land Conservation
Obtain funding for restoration, enhancement, stewardship, or acquisition projects.	• Landowners, including land trusts, governments, non-profits, private owners, and other organizations acquiring land for conservation	• Demonstrate the alignment of proposed projects with RCIS actions. • Include Priority Conservation Areas and actions in funding requests.	Chapter 4: Conservation Strategy
Support education and outreach efforts.	• Nonprofit organizations • Landowning agencies with an educational mission	• Review regional conditions information such as demographics, infrastructure, and habitats to understand communities and how they relate to the RCIS area. • Use conservation element profiles to provide education on species and habitat needs and threats in the region.	Chapter 2: Regional Conditions Chapter 4: Conservation Strategy
Permit projects and mitigation plans.	• Regulatory agencies • Project proponents	• Review existing and proposed infrastructure. • Review maps to identify areas of potential habitat for avoidance or restoration. • Implement actions identified in the RCIS.	Section 2.4: Major Infrastructure Section 2.3: Natural Communities, Biodiversity, and Connectivity Section 2.6: Land Conservation Chapter 4: Conservation Strategy
Design more resilient, sustainable, and beneficial projects.	• Regulatory agencies • Project proponents	• Review climate resiliency strategies and actions and incorporate them into project designs.	Chapter 4: Conservation Strategy
Develop or update general plans, master plans, or other planning documents.	• Government agencies • Regional collaboratives	• Review Priority Conservation Areas and conservation strategies that identify high-value areas for conservation. • Incorporate actions addressing policy, such as zoning changes in high-value conservation areas, into new planning documents.	Chapter 4: Conservation Strategy

NOTE: RCIS = Regional Conservation Investment Strategy

1.2 North Bay Baylands RCIS Conservation Purpose and Need

Guiding legislation (California Fish and Game Code Section 1852[b]) states:

> *The purpose of a regional conservation investment strategy shall be to inform science-based and voluntary conservation actions and habitat enhancement actions that would advance the conservation of focal species, including the ecological processes, natural communities, and habitat connectivity upon which those focal species depend, and to provide nonbinding voluntary guidance for one or more of the following:*
>
> *(1) Identification of wildlife and habitat conservation priorities, including actions to address the impacts of climate change and other wildlife stressors.*
>
> *(2) Investments in resource conservation.*
>
> *(3) Infrastructure.*
>
> *(4) Identification of areas for compensatory mitigation for impacts to species and natural resources.*

The North Bay Baylands RCIS area is made up of sensitive tidal marsh, brackish marsh, and freshwater marsh habitats, and adjacent upland habitats. Many of these areas are biodiversity hotspots and provide important wildlife and habitat connectivity linkages. Healthy marsh habitats provide flood control functions through wave attenuation and reduce impacts of storm surge on infrastructure and communities. However, these habitats are at risk of being converted to open water habitat as sea levels rise. Storm surge in addition to sea level rise can exacerbate this conversion. Maintaining a sustained supply of sediment to these marshes—and conserving transition zones between marsh habitats and available accommodation space—is necessary to allow the San Pablo Baylands' (Baylands) marsh habitats to persist and migrate, and to reduce the impacts of flooding on infrastructure and communities.

The North Bay Baylands RCIS is being developed with consideration of a range of climate projections, to identify conservation actions that will increase the resiliency of the Baylands' habitats, transportation infrastructure, and neighboring communities to sea level rise and extreme-weather events. Future habitat restoration and infrastructure resiliency projects, such as the Resilient State Route 37 Project, will benefit from a holistic regional plan—one that outlines strategic conservation investments, some in the form of advance mitigation, that can be implemented to reconnect and improve marsh habitats and build landscape resilience.

Large-scale restoration, enhancement of natural infrastructure, and land acquisition will be necessary to ensure that Baylands habitats function properly for native species conservation, and to maintain beneficial ecosystem functions over time. This will require increased regional collaboration among stakeholders and public agencies. The North Bay Baylands RCIS has been developed to integrate the best available scientific data, existing conservation plans and priorities, and anticipated mitigation needs to enhance resiliency and buffer the region against projected climate change impacts.

1.3 Project Team and State Agency Sponsor

The North Bay Baylands RCIS is proposed by the MTC, with Caltrans as the state sponsoring agency. Appendix A provides the state agency sponsoring letter. The San Francisco Estuary Partnership, Sonoma County Transportation Authority, and Environmental Science Associates, along with the MTC and Caltrans, are part of the Project Team. Funding was provided by the Wildlife Conservation Board and MTC. CDFW manages the RCIS Program and will be the authorizing agency.

1.4 Outreach to Stakeholders and the Public

Diverse input from stakeholders, tribes, and the public is a key component in developing any regional planning effort with community buy-in. A series of stakeholder meetings was conducted to notify and engage a broad array of stakeholders, including local public agencies with land use authority, in the development of the RCIS. Additionally, public notice was issued to announce RCIS development, and a public meeting was held in accordance with California Fish and Game Code requirements.

A stakeholder engagement plan was developed at the outset of RCIS development to guide the process. It identified the following key engagement goals:

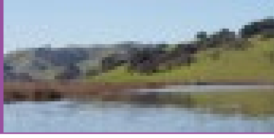
- Provide accessible and engaging opportunities for community members and stakeholders to provide input that will guide development of the RCIS.
- Leverage existing processes and expertise without overfocusing on existing planning efforts (*e.g.,* avoid State Route 37 “project fatigue”).
- Engage with tribal entities and Equity Priority Communities, building on existing community relationships.

The process developed relied on a tiered engagement approach with review and input from a technical working group, stakeholders’ group, and other targeted outreach (**Figure 1-1**).

**Focused outreach included outreach to Tribes, community groups, regulatory agencies, and other conservation organizations.*

Figure 1-1: Engagement Levels for Development of the Regional Conservation Investment Strategy

Feedback from the Technical Working Group, stakeholders, and other focused outreach meetings was incorporated into this document to the extent feasible and when consistent with the RCIS Program’s goals and guidelines. **Table 1-2** shows stakeholder involvement and public outreach efforts; comments from public meeting and public review period are provided in Appendix B.



1.4.1 Technical Working Group

A group of environmental organizations engaged in the RCIS development process as members of a technical working group. During development of the RCIS, this group provided key insight into the best available science, regional priorities, and existing data sources. Invited Technical Working Group members came from the following organizations:

- San Francisco Estuary Institute
- California State Coastal Conservancy
- Point Blue Conservation Science
- Ducks Unlimited
- Sonoma Land Trust
- National Estuarine Research Reserve
- U.S. Fish and Wildlife Service
- CDFW
- Marin County Parks

Members of the Technical Working Group were invited to participate in working discussions in advance of stakeholder meetings. They participated in the stakeholder and public meetings described below.

TABLE 1-2: STAKEHOLDER INVOLVEMENT AND PUBLIC OUTREACH

Date	Engagement Target	Objective/Topics
April 2022	Project website	Establish website as a communication tool for the RCIS.
March 24, 2022	RAMP TAC meeting	Introduce the North Bay Baylands RCIS.
April 26, 2022	Stakeholder meeting	Introduce the North Bay Baylands RCIS to stakeholders.
June 16, 2022	RAMP TAC meeting	Get feedback from multiple regulatory agencies on RCIS implementation.
August 4, 2022	Technical Working Group meeting	Prepare for the stakeholder workshop.
August 22, 2022	Tribal outreach	Identify and incorporate tribal perspectives into RCIS content
August 22, 2022	Community-based organization first outreach	Identify and incorporate community-based organizations' perspectives into RCIS content
September 8, 2022	Stakeholder workshop	Identify regional threats and actions.
September 20, 2022	RCIS symposium	Briefly introduce project goals and vision.
October 19, 2022	Public meeting	Review RCIS progress to date and provide an opportunity for input.
November 29, 2022	San Francisco Bay Joint Venture meeting	Introduce the North Bay Baylands RCIS concept and solicit feedback development approach.
December 7, 2022	Caltrans interagency meeting	Receive agency feedback on potential RCIS content for cross-agency use and alignment for mitigation opportunities.
December 9, 2022	Community-based organization second outreach	Identify and incorporate community-based organizations' perspectives into RCIS content

Date	Engagement Target	Objective/Topics
January 18, 2023	Technical Working Group meeting	Review the draft Conservation Strategy.
March 1, 2023	Meeting with Federated Indians of Graton Rancheria	Discuss the North Bay Baylands RCIS concept and solicit input on elements to include.
August 10, 2023	Stakeholder meeting	Review draft RCIS in advance of the public comment period.
April 26, 2024	Stakeholder meeting	Review and process public comments received on the RCIS and incorporate responses to comments.

NOTES: Caltrans = California Department of Transportation; RAMP = Regional Advance Mitigation Planning; RCIS = Regional Conservation Investment Strategy; TAC = Technical Advisory Committee

1.4.2 Stakeholder Outreach

A list of potentially interested organizations, including governmental and nonprofit organizations, community-based organizations, tribes, and regulatory agencies was developed early in the RCIS development process. Additional organizations and individuals were added to the stakeholder distribution list upon request. The list represents more than 85 organizations and more than 100 individuals. The following cities and counties with land use authority were included in the stakeholder notifications:

- San Rafael
- Novato
- Petaluma
- Sonoma
- American Canyon
- Napa
- Vallejo
- Marin County
- Napa County
- Sonoma County
- Solano County

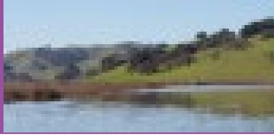
Additionally, the points of contact for the Pacific Gas and Electric Company Habitat Conservation Plan and Solano County Multispecies Habitat Conservation Plan were included as stakeholders and provided with updates about development of the RCIS and the opportunity to participate during document development.

The primary mechanisms for engaging stakeholders during development of the RCIS were stakeholder committee meetings held virtually, email notices, and updates to the RCIS website (www.baylandsrcis.org).

1.4.3 Focused Outreach

Additional focused outreach efforts were conducted with key groups. These efforts included:

- Calls and emails to community-based organizations, followed by one-on-one phone conversations with Fresh Air Vallejo and All Positives Possible.
- Letters to tribal contacts, followed by tribal consultation meetings, one each with the Federated Indians of Graton Rancheria and the Yocha Dehe Wintun Nation.
- Presentation at the Caltrans interagency meeting.
- Presentation at the San Francisco Bay Joint Venture meeting.



1.4.3.1 Outreach to Community-Based Organizations

On August 22, 2022, the RCIS Project Team sent initial outreach emails to Multicultural Marin, Fresh Air Vallejo, the North Bay Organizing Project, All Positives Possible, and Marin City Climate Resilience and Health Justice to alert them to the effort to develop an RCIS and request their participation in an RCIS engagement meeting solely dedicated to the perspectives of tribal and community-based organizations. Each email was followed up three days later with a voicemail message calling attention to the email and extending the invitation to the engagement meeting a second time. This outreach resulted in a phone conversation between RCIS Project Team staff and Fresh Air Vallejo on August 26, 2022.

A second round of email outreach to these same entities (other than Fresh Air Vallejo) occurred on December 9, 2022, again followed up by voicemail messages reiterating the content of the emails. This outreach resulted in a phone conversation between RCIS Project Team staff and All Positives Possible on December 21, 2022.

1.4.3.2 Tribal Outreach

CDFW's Tribal Communication and Consultation Policy (CDFW 2014) acknowledges:

> *"California's Tribes and their members have long served as stewards of the state's fish, wildlife, and plants and possess unique and valuable knowledge and practices for conserving and using these resources in a sustainable manner."*

Additionally, the Office of the Governor issued a Statement of Administration Policy (Policy) regarding Native American Ancestral Lands that reaffirms Executive Order B-10-11 encourages state agencies to communicate and consult with tribes. This Policy encourages state agencies to "facilitate tribal access, use, and co-management of State-owned or controlled natural lands and to work cooperatively with California tribes that are interested in acquiring natural lands in excess of State needs" (California 2020). Policy recommendations relevant to the RCIS include:

- Facilitate the access of California Native Americans to sacred sites and cultural resources;
- Improve the ability of California Native Americans to engage in traditional and sustenance gathering, hunting and fishing; and
- Partner with California tribes on land management and stewardship utilizing Traditional Ecological Knowledges.

Importantly, this Policy also says the state should consider: "Adopting preferential policies and practices for California tribes to access natural lands under the ownership or control of the State that are located within a California tribe's ancestral lands, including coordinating with local governments to zone natural land in excess of State needs in a way conducive to tribal access and use."

The RCIS Project Team has contacted the tribes to engage them as part of the development process by:

> In August 2022, the RCIS Project Team sent initial outreach emails to the Federated Indians of Graton Rancheria (FIGR), the Yocha Dehe Wintun Nation (Yocha Dehe), and the Suscol Intertribal Council to alert them to the effort to develop an RCIS and request their participation in an RCIS engagement meeting solely dedicated to the perspectives of tribal and community-based organizations. The RCIS Project Team received a response letter from the Yocha Dehe, dated September 6, 2022, identifying the RCIS as an activity occurring within the aboriginal territory of

the Yocha Dehe and requesting a consultation on that basis. Subsequently, in November 2022, Caltrans provided letters to Mishewal Wappo, FIGR and the Yocha Dehe. FIGR and Yocha Dehe replied in writing requesting a consultation meeting. The meeting with FIGR was held on March 20, 2023, and included a discussion of how projected sea level rise was mapped in the area.

1.4.4 Notice of Intent

On September 15 and 16, 2022, a Notice of Intent was posted with the four counties within the RCIS area: Marin, Napa, Sonoma, and Solano. The notice was also sent to the California Governor's Office of Planning and Research (State Clearinghouse) and CDFW.

Previously, on May 21, 2021, the California Wildlife Conservation Board filed a Notice of Exemption from the California Environmental Quality Act for development of the RCIS with the State Clearinghouse (State Clearinghouse Number 2021050522).

1.4.5 Public Meeting

A public meeting was held in person in Vallejo, California, within the boundaries of the RCIS area, on October 19, 2022. There was also a virtual meeting option. Notice of the public meeting was published on September 16, 2022, more than 30 days in advance of the meeting, to CDFW's RCIS notification list and the RCIS's stakeholder list, which includes all local public agencies with land use authority. Verbal and chat comments received during the public meeting are summarized in Appendix B; no written comments were received.

CHAPTER 2

Regional Conditions

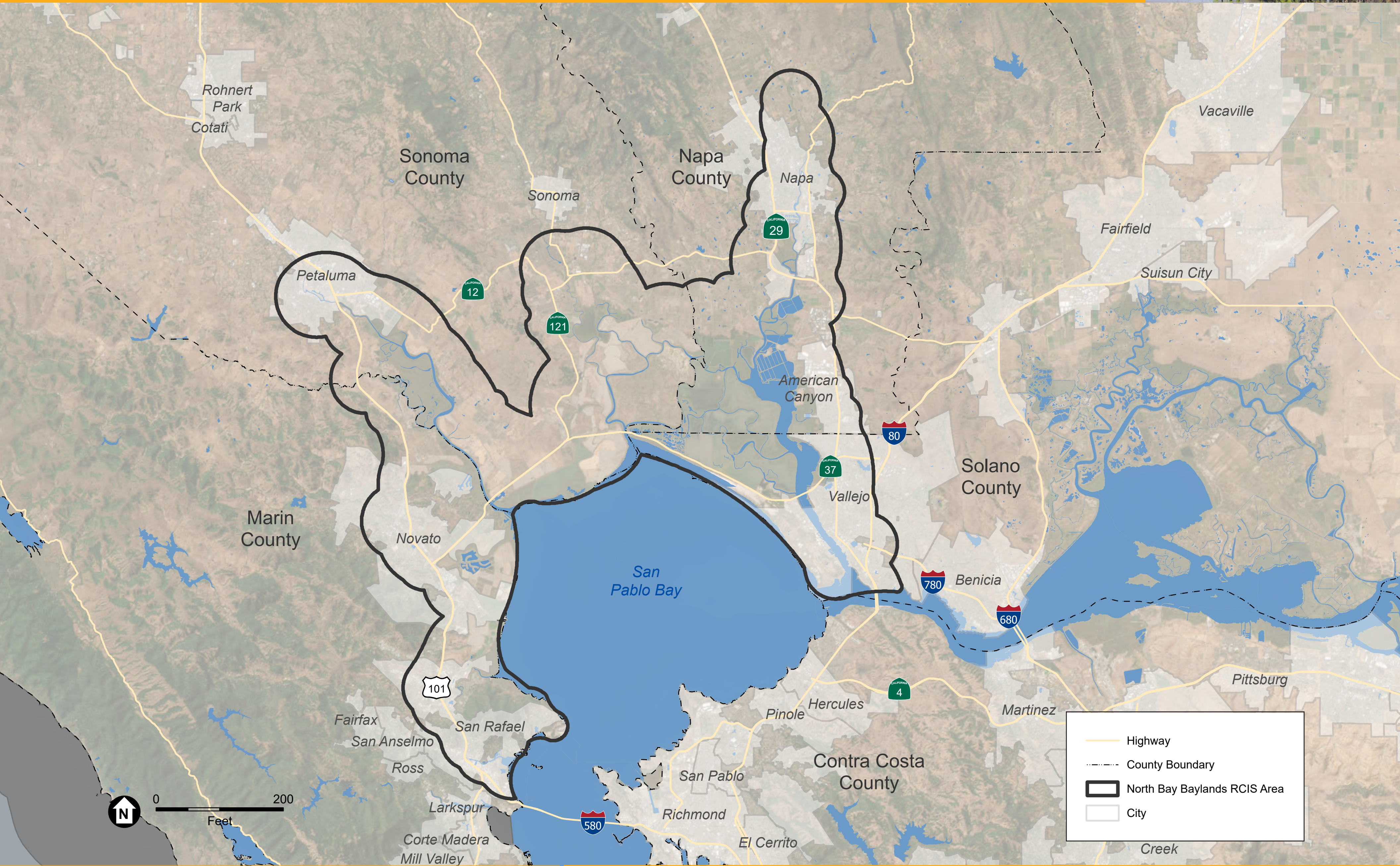
2. Regional Conditions

2.1 North Bay Baylands Region

The North Bay Baylands consist of historic tidal marsh areas (between the minimum and maximum tide) in the northern end of the San Francisco Bay in Marin, Sonoma, Napa, and Solano Counties. While much of the historic marshlands have been lost or altered, a significant amount of restoration is underway, and there are unique opportunities for future restoration, enhancement, and increased climate resilience due to relatively undeveloped land and open spaces. Compared to other places around the Bay, the North Bay Baylands have functionally intact natural processes (including significant freshwater inputs and deltas) and connected watersheds. The North Bay Baylands are envisioned as large, restored areas of tidal marsh within a mosaic of dynamic, diverse, and connected watershed lands (Goals Project 2015).

2.1.1 North Bay Baylands RCIS Area

The North Bay Baylands RCIS area encompasses the historical North Bay Baylands extent, plus adjacent mudflats, plus a 1-mile upland buffer from the western touchdown of the Richmond–San Rafael Bridge to the northern touchdown of the Carquinez Bridge. This includes parts of Marin, Sonoma, Napa, and Solano Counties, including portions of the cities of San Rafael, Novato, Petaluma, American Canyon, Vallejo, and Napa (**Figure 2-1**). The California Ocean Protection Council's H++ sea level rise scenario—a projected 10.2 feet of sea level rise plus 100-year storm surge—determined the maximum flood extent included in the RCIS area (OPC 2018). The H++ scenario is the most extreme sea level rise scenario, and OPC (2018) encourages its consideration for large and long-term infrastructure projects. A 1-mile buffer that extends landward around this area considers large-scale landscape aspects of the RCIS, as well as to capture areas that could potentially serve as potential future tidal wetland habitat migration and wetland-upland transitionary habitat, due to potential sea level rise and climate change effects. The RCIS area extends bayward into San Pablo Bay along the existing San Pablo Bay shoreline to encompass mudflats adjacent to the shoreline, which provide habitat for migratory bird species and special-status fish species. These terrestrial and aquatic extents were selected in consideration of the projected climate change impacts in the area, with a focus on sea level rise inundation and changes in storm severity and frequency. The RCIS area also includes streams, rivers, and smaller tributaries that deliver sediment to the San Pablo Baylands. Its larger tributaries include the Napa River, Sonoma Creek, Petaluma River, Novato Creek, San Rafael Creek, and Gallinas Creek (**Table 2-1**). Areas beyond 1-mile from the sea level rise boundary noted above were excluded in order to provide a plan focused on the unique characteristics and habitat values provided by the North Bay Baylands consistent with the regional vision established by the Baylands Ecosystem Habitat Goals Project and other existing regional strategies.



SOURCE: ESA, 2023

Figure 2-1
RCIS Area Overview

2.2 Regional Overview and Communities

This section provides an overview of the physical and cultural landscape, past and present, within the RCIS area.

2.2.1 USDA Ecoregions

The RCIS area is in Central California; is bordered by the San Francisco Bay to the southeast, extends inland to the Coast Range, and has a Mediterranean climate. It occurs within the U.S. Department of Agriculture (USDA)-defined ecoregion California Coastal Chaparral Forest and Shrub Province, which is in the Mediterranean Division (Cleland et al. 2007). The Sierran Steppe/Mixed Forest/Coniferous Forest/Alpine Meadow Province, located in the in the Mediterranean Division – Mountain Provinces, is to the north and the California Dry Steppe Province, located in the Mediterranean Division, is to the east (**Table 2-1**).

TABLE 2-1: USDA ECOREGION PROVINCES IN AND ADJACENT TO RCIS AREA

Provence	Division	Location	Key Characteristics
California Coastal Chaparral Forest and Shrub Province	Mediterranean	In RCIS area	• Discontinuous coastal plains, low mountains, and interior valleys near Pacific Ocean • Mediterranean climate • Composed of chaparral, grassland, and woodland communities • Major migration route for water and land birds
Sierran Steppe/Mixed Forest/Coniferous Forest/Alpine Meadow	Mediterranean – Mountain Provinces	North of RCIS area	• Covers northern Coast Range and other mountain ranges ringing the Central Valley • Different vegetation associations occur in foothill, montane, subalpine, and alpine zones
California Dry Steppe Province	Mediterranean	East of RCIS area	• Covers Central Valley • Precipitation limited to winter rainfall • Historically made up of natural grasses, presently made up mainly of agricultural cover

2.2.2 Historical Ecology

Broad expanses of shallow bays and both tidal and seasonal wetlands characterize the North Bay Baylands, and once encompassed more than 50,000 acres adjacent to San Pablo Bay (Baylands Group 2017). Historically, the region's baylands extended from the edge of the bay inland along rivers and streams to the cities of Petaluma, Novato, and Sonoma. Napa River, Sonoma Creek, Petaluma River, and additional streams delivered nutrients essential to maintaining the baylands' ecosystems and marsh elevation . Beginning in the mid-1800s, 75 percent of San Pablo Bay's tidal wetlands were diked, drained, and disconnected from the estuary for urban development, agriculture, salt production, and infrastructure, including State Route (SR) 37 and rail lines, resulting in land subsidence (Goals Project 2015).

Such large-scale landscape changes dramatically altered many ecological functions of the region and resulted in the extensive loss of native habitats as well as a substantial loss of understanding of natural estuarine functions, which hinders current efforts toward ecosystem restoration and management. Nonetheless, the 1980s and 1990s brought a slowing and eventual reversal of habitat deterioration through land protection and restoration activities. Today, there are many restoration projects planned and in progress within the RCIS area (SFBJV 2022; SLT 2020, 2023).

2.2.3 Indigenous History

The RCIS area falls within the distinct unceded ancestral Indigenous territories of the Coast Miwok, Ohlone, Wappo, and Patwin (Byrd et al. 2017 **Figure 2-2**). Traditionally, each of these Indigenous groups were hunter-gathers, lived in villages with well-defined tribal territories, interacted and traded extensively with neighboring groups, and spoke unique languages within the Penutian-speaking phylum (Byrd et al. 2017). With the influx of European explorers in the late 1700s, and the subsequent establishment of Spanish missions in the late eighteenth century, Native populations were reduced and displaced, and their traditional way of life was dramatically altered (Milliken 1995).

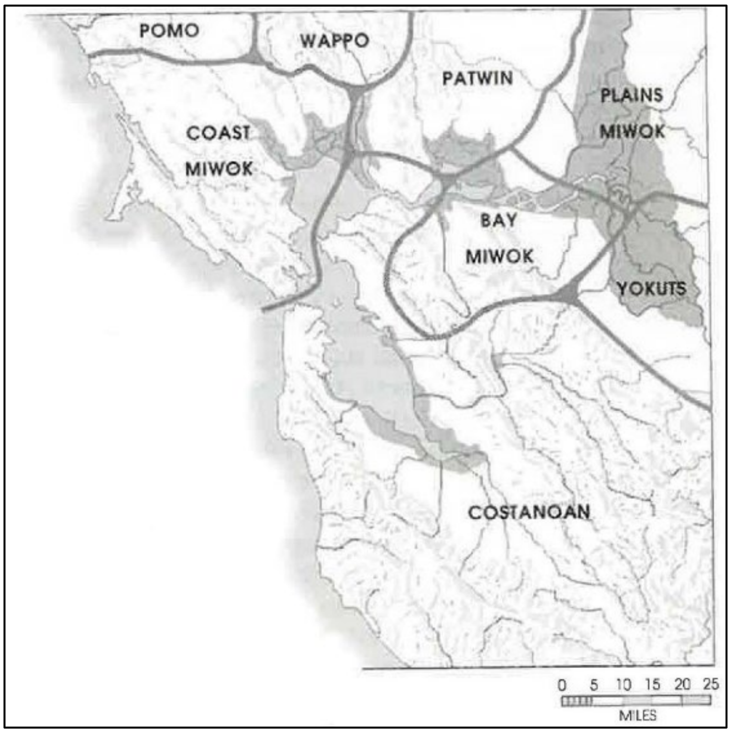


Figure 2-2
Ancestral Lands of the North Bay Indigenous People
(Milliken 1995)

California's Tribes and their members have long served as stewards of the state's fish, wildlife, and plants and possess unique and valuable knowledge and practices for conserving and using these resources in a sustainable manner (CDFW 2014). Indigenous populations persist in the North Bay Baylands region today, actively working to preserve and revive their cultures (Native Land 2022). Tribal members from within the RCIS area, such as the Federated Indians of Graton Rancheria (Coast Miwok and Southern Pomo) the Mishewal Wappo Tribe (Wappo), the Yocha Dehe Wintun Nation (Patwin) and the Confederated Villages of Lisjan (Ohlone), continue to be actively involved in the preservation and revitalization of their native cultures and environment. The RCIS provides an opportunity to acknowledge and support traditional Indigenous land conservation practices in the region.

2.2.4 Climate

Hot, dry summers and wet, mild winter characterize the USDA California Coastal Chaparral Forest and Shrub Province. Moderate year-round temperatures, pronounced summer drought, and wildfires are characteristic of this ecoregion. The combination of wet winters and dry summers produces vegetation of hard-leaved evergreen trees and shrubs that are adapted to prolonged periods of dryness and heat, which comprise the region's forest, woodland, and scrub habitats (USDA 1995). The region's temperature and precipitation, in combination with landform and hydrology, affect water availability, plant communities, evaporation rates, salinity, and duration of ponding in the baylands (SFEI 1994).

In the North Bay Baylands, climate is a major driver in controlling the amount of water and sediment; these in turn control the form and ecological function of the baylands and adjacent habitats. Climatic events that bring increased sediment, such as storms and strong waves, can result in marsh plain expansion, while sea level rise leads to the baylands moving inland (Goals Project 1999). The Bay Area is experiencing climate change, including an increase in the severity and frequency of storm events (BCDC 2023). This, in combination with sea level rise and tides, can lead to flooding. The Pressures and Stressors section below and **Appendix C** describe more information about climate change and its effects on the region.

2.2.5 Hydrology

The United States Geological Survey (USGS) Hydrologic Unit Code (HUC) 10 San Pablo Bay Watershed (180500020801) makes up most of the RCIS area (USGS 2019). The 1-mile buffer extends the RCIS area beyond the HUC 10 San Pablo Bay Watershed to parts of seven adjacent watersheds and shows both the watersheds of the RCIS area and the major stream systems (**Figure 2-3**). The major rivers and streams present in the RCIS area include the Napa River, Novato Creek, Larkspur Creek, Miller Creek, Adobe Creek, Fowler Creek, Schell Creek, Carneros Creek, American Canyon Creek, Tulucay Creek, Milliken Creek, San Rafael Creek, Gallinas Creek, Sonoma Creek, Petaluma River, and Tolay Creek (USGS 2019).

The major sources of water for the baylands are the tides and freshwater runoff from watersheds (Goals Project 1999). The North Bay Baylands are relatively flat, resulting in large areas of baylands with tidal influence and susceptibility to sea level rise and storms. Streams within the RCIS area contribute fresh water to the baylands and affect both sediment supply and distribution as well as salinity. The streams also provide habitat for many species and serve as migration corridors for fish and aquatic invertebrates.

Due to historical diking and draining of wetlands and subsequent land subsidence, a system of levees and pumps affect how water flows around the baylands. These levees and pumps serve to drain excess water and prevent daily flooding of SR 37 and other roads, railroads, farms, and residences.

SOURCE: ESA, 2023; USGS and NRCS, 2013

Figure 2-3
Watershed Map

2.2.5.1 Groundwater

The Public Trust Doctrine imposes an obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries (Environmental Law Foundation v. State Water Resources Control Board (2018), 26 Cal. App. 5th 844; National Audubon Society v. Superior Court (1983), 33 Cal. 3d 419). Baylands habitats, particularly upland and transitionary areas, are influenced by groundwater, but the connection between groundwater pumping and interconnected surface water flows is not well understood in the region. Additional monitoring and measurement to better characterize surface water depletions associated with ground water pumping is needed.

Within the RCIS area, there are several groundwater basins: Novato Valley (2-030), Petaluma Valley (2-001), Sonoma Valley (2-002.02), and the Napa-Sonoma Lowlands (2-002.03). There are two groundwater sustainability agencies (GSAs), Petaluma Valley GSA and Sonoma Valley GSA (DWR 2022a). These agencies help develop and track groundwater sustainability plans, which provide goals and measurable objectives for groundwater management (DWR 2022b). CDFW strongly encourages proceeding with an environmentally conservative and protective approach when implementing groundwater management plans or making decisions related to groundwater management until more data is gathered. Groundwater planning and management should carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, Groundwater Dependent Ecosystems, and Interconnected Surface Waters. Conservation strategies for groundwater protection are further discussed under in Section 4.22, Hydrologic Processes.

2.2.6 Regional Demographics

The communities within the RCIS area are racially and socioeconomically diverse. According to the 2020 5-year census within the RCIS area, approximately 51 percent of the residents are White, 28 percent are Hispanic or Latino, and 21 percent are Black, Asian, or another race or ethnicity (ACS 2022). Almost 20 percent of the population are over the age of 65, and approximately 10 percent of the population have income below the federal poverty line. Nearly 40 percent of the population holds a bachelor's degree or higher (ACS 2022).[1] Five percent of the RCIS area is identified as a Community of Concern and eight percent is designed as a Disadvantaged Community (OEHHA 2022; **Appendix D**). Disadvantaged communities suffer from a combination of economic, health, and environmental burdens, such as poverty, high unemployment, air and water pollution, and presence of hazardous wastes as well as high incidence of asthma and heart disease (CPUC 2023).

One way that the state identifies these areas is by collecting and analyzing information from CalEnviroScreen, an analytical tool that combines several types of census-tract-specific information to determine which communities are the most burdened, or "disadvantaged" (CPUC 2023). Pollution from multiple sources disproportionately burdens these communities, which tend to have demographic characteristics that make them more sensitive to pollution. Several CalEnviroScreen Disadvantaged Communities in the 70th to 100th percentiles[2] occur in the RCIS area: the southern portion of the city of San Rafael near the Richmond-San Rafael Bridge landing, unincorporated Solano County north of Sears Point Road and Mare Island, and Vallejo,

1 Census data is based on census tracks within the RCIS area. Some of the tracks extend beyond the RCIS area, and therefore do not precisely reflect the residents within the RCIS area.

2 CalEnviroScreen uses a suite of indicators metrics to characterize pollution burden and population. Each indicator is assigned a score for each census tract. The scores are combined to give the final CalEnviroScreen score. The higher the score, the more the census track is considered disproportionately burdened by pollution.

including Mare Island (OEHHA 2022; **Figure 2-4**). Pollution burden experienced by these communities is highest for groundwater threats, hazardous waste, contaminated cleanup sites, solid waste, impaired water, and traffic. Specifically targeting these communities for investment in programs that reduce emissions and greenhouse gases using proceeds from the State's Cap and Trade Program (OEHHA 2022) may mitigate the environmental burdens. These same communities, in addition to several low-income designated communities near San Rafael and Novato, are also identified as California Climate Investment Priority Populations (CARB 2023). The RCIS goals are to improve and connect natural landscapes can benefit these communities by serving as carbon sinks and filtering pollutants, providing increased resilience to sea level rise and flooding, and serving as recreational amenities to support public health. Proposed projects, which could use the RCIS to plan actions or support mitigation, may also help to improve water quality, groundwater quality, hazardous waste sites, and traffic conditions in the region.

Similarly, Equity Priority Communities identified by MTC as part of Plan Bay Area 2050 include southern San Rafael near the Richmond-San Rafael Bridge landing; most of western Vallejo, excluding Mare Island; and southern portions of the city of Napa (**Figure 2-5**). Since 2001, MTC has been using data from the American Community Survey to identify communities (census tracts) that may have historically faced disadvantage and underinvestment due to their background or socioeconomic status. MTC has continually made updates to the framework definition—and the data are updated every four years—as part of the updates to Plan Bay Area. MTC uses the Equity Priority Communities Framework to help guide planning and policy decisions, investment of funds, and community engagement efforts (MTC 2023). As noted above for disadvantaged communities, the RCIS can help inform and drive investment in these areas.

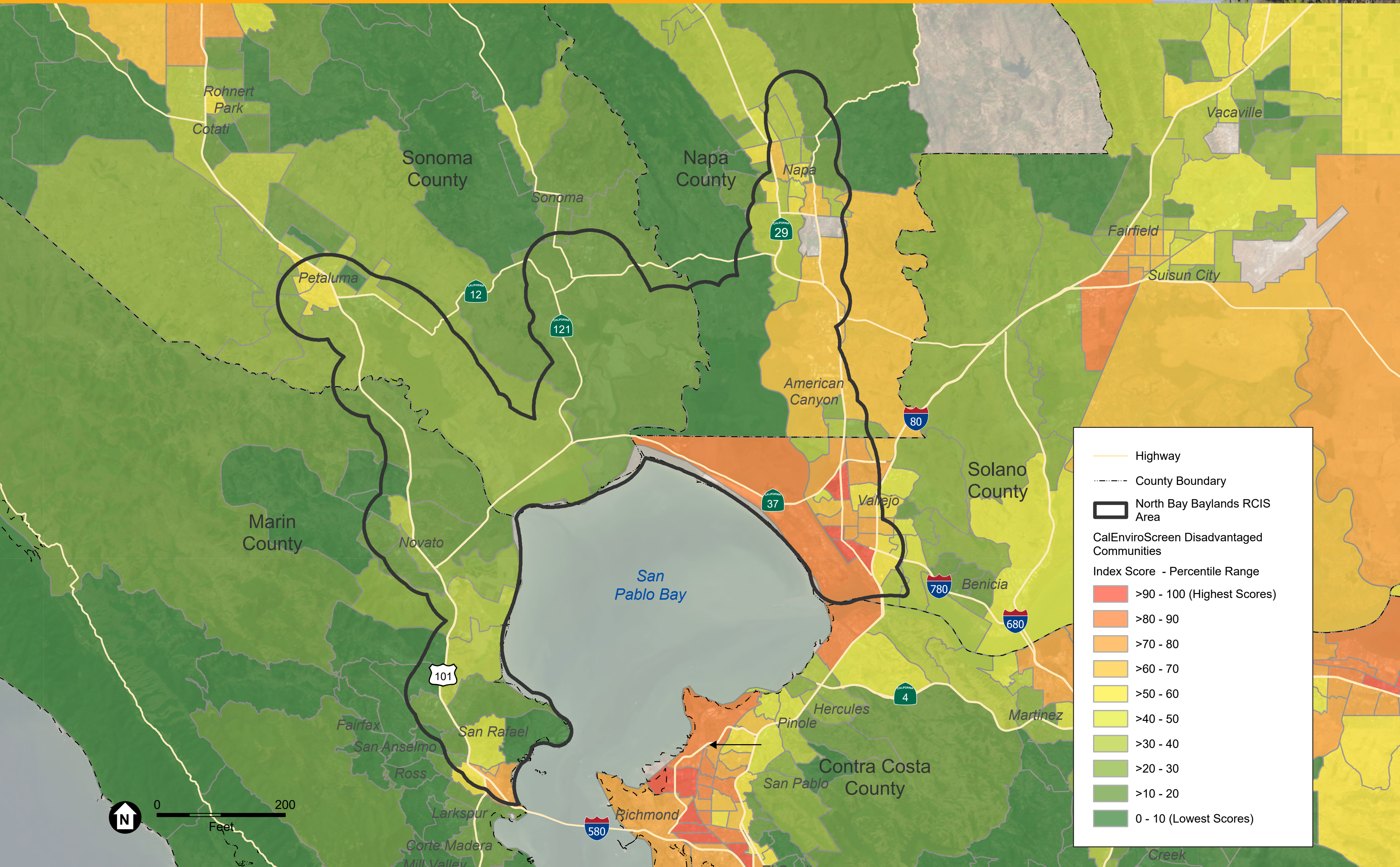
2.3 Natural Communities, Biodiversity, and Connectivity

This section provides an overview of the natural communities, biodiversity, and habitat connectivity within the RCIS area.

2.3.1 Natural Communities and Land Cover

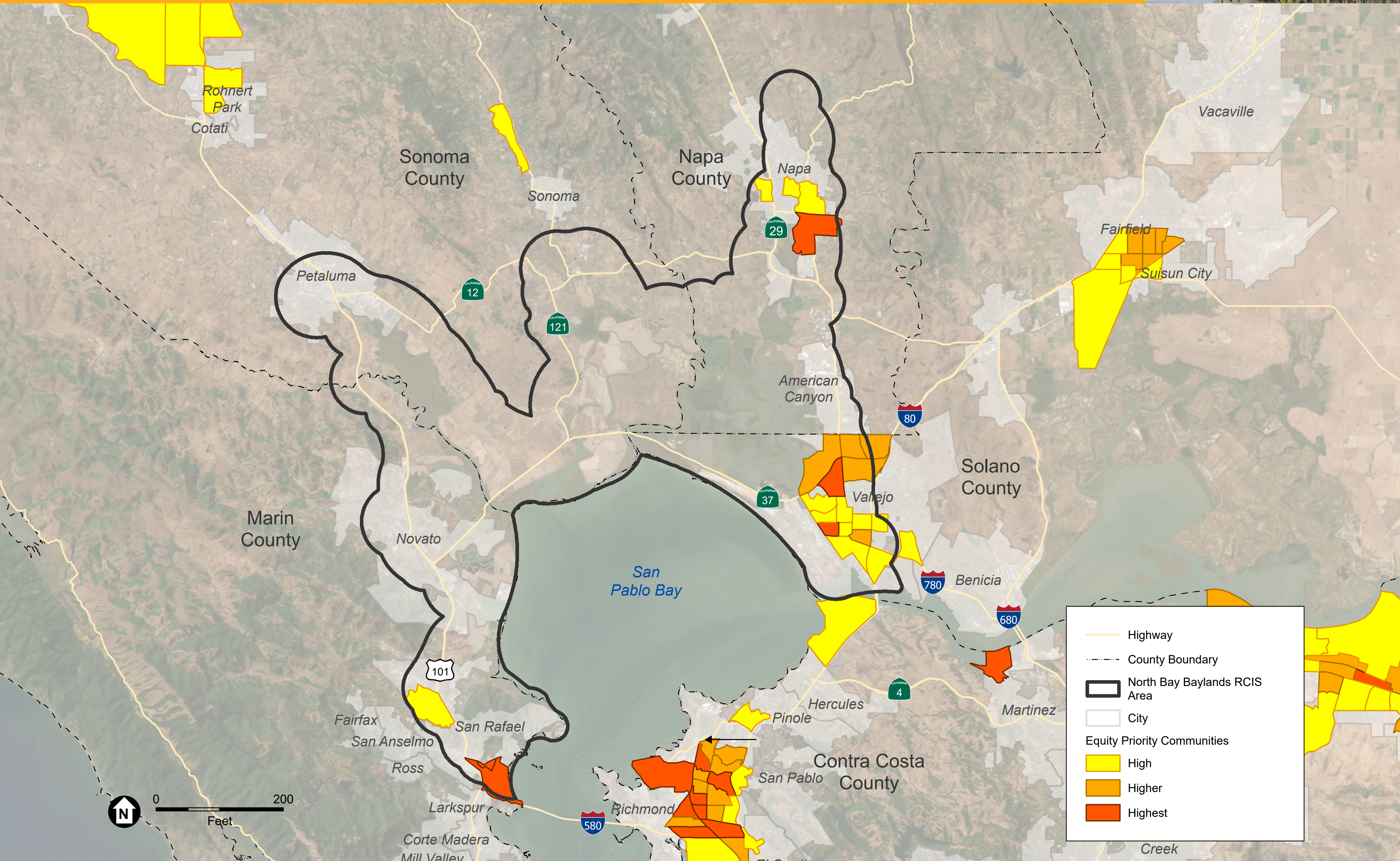
The RCIS uses a detailed GIS-based map of land cover types within the RCIS area to spatially characterize the distribution of existing natural communities and habitat. The data used in the RCIS is a compilation of multiple, current vegetation layers. This compilation layer is created from CDFW's Vegetation Classification and Mapping Program (VegCAMP) (CDFW 2020b, GGNPC 2021, Sonoma County Agricultural Preservation and Open Space District 2017, USDA 2018) combined with the 2022 Update of Modern Baylands (SFEI 2022). **Appendix E** provides more information on the vegetation data sources and a crosswalk between source vegetation layers and the compilation layer used for this report.

The Baylands Ecosystem Habitat Goals Project report (Goals Project 1999) describes dominant habitat types around the San Francisco Bay Area. Aquatic bayland habitats are bay habitats (deep bays, shallow bays, and channels with bottom elevations lower than mean lower low water [MLLW]) and bayland habitats (lying between MLLW and highest observed tide), including tidal flats and diked baylands. Bayland habitats support a broad variety of plants and animals and provide areas for feeding, breeding, nesting, roosting, resting, and other functions. While not described in the Baylands Ecosystem Habitat Goals Project report, the upland areas surrounding the baylands support a variety of habitats, including grasslands, coastal scrub, oak woodlands, and chaparral.



SOURCE: ESA, 2023; OEHHA, 2022

Figure 2-4
CalEnviroScreen Disadvantaged Communities



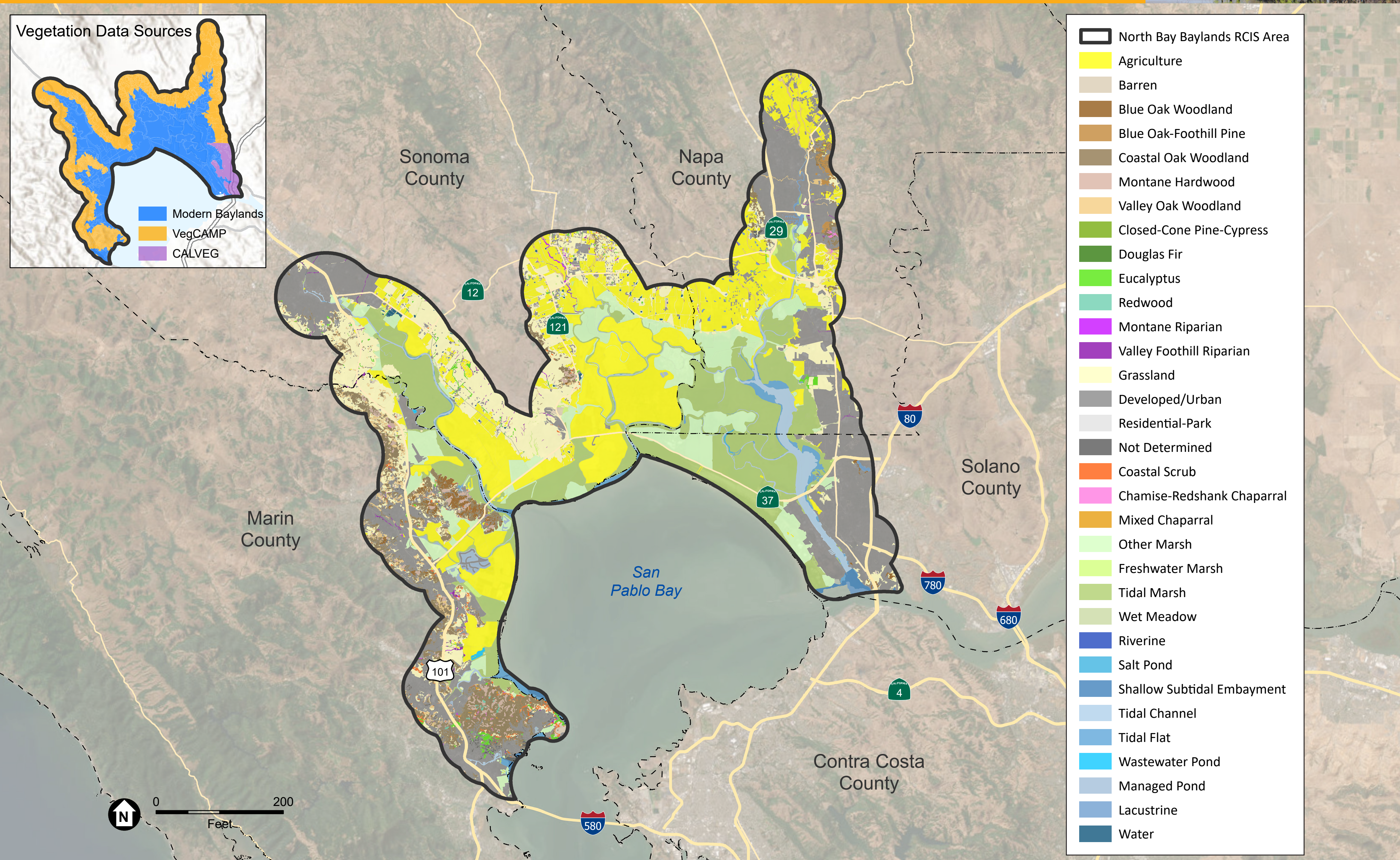
SOURCE: ESA, 2023; MTC, 2023

Figure 2-5
Equity Priority Communities

Communities present in the RCIS area are listed in **Table 2-2**, with total acres in the RCIS area and percent acres protected, as well as mapped in **Figure 2-6**: Vegetation Communities.

TABLE 2-2: VEGETATION COMMUNITIES AND EXTENTS IN THE RCIS AREA

RCIS Vegetation Communities	Total Acres	CPAD Protected	% Protected
Agriculture	38,351.1	7,885.8	21%
Barren	317.2	20.6	7%
Blue Oak-Foothill Pine	352.0	14.0	4%
Blue Oak Woodland	905.7	372.2	30%
Chamise-Redshank Chaparral	65.7	22.6	34%
Closed-Cone Pine-Cypress	<0.0	0	0%
Coastal Oak Woodland	7,162.2	2,838.5	40%
Coastal Scrub	563.1	223.9	40%
Developed/Urban	38,472.2.8	1,395.5	4%
Douglas Fir	1.3	1.0	77%
Eucalyptus	638.3	73.0	11%
Freshwater Marsh	593.9	339.5	57%
Grassland (Annual and Perennial)	22,045.4	2,740.4	12%
Lacustrine	647.7	90.2	14%
Managed Pond	500.7	201.4	40%
Mixed Chaparral	18.5	10.5	57%
Montane Hardwood	1,116.8	585.4	52%
Montane Riparian	125.8	5.9	5%
Not Determined	705.6	44.4	6%
Other Marsh	14,095.7	9,518.7	68%
Redwood	53.0	42.5	80%
Riverine	1.2	<0.0	2%
Residential-Park	126.7	1.2	1%
Salt Pond	46.1	13.5	29%
Shallow Subtidal Embayment	723.8	201.2	29%
Tidal Channel	4,421.4	291.2	7%
Tidal Flat	2,079.7	892.3	43%
Tidal Marsh	26,206.8	20,369.9	78%
Valley Foothill Riparian	390.9	36.1	9%
Valley Oak Woodland	1,929.2	311.0	16%
Wastewater Pond	79.4	0.0	0%
Water	227.6	7.3	3%
Wet Meadow	15.8	11.2	70%



SOURCE: ESA, 2024; Modern Baylands, 2022

Figure 2-6
Vegetation Communities

2.3.2 Biodiversity

The North Bay Baylands are rich in biodiversity, particularly among aquatic invertebrates, fishes, and birds. Many waterfowl and shorebirds depend on the baylands for foraging, nesting, and migration habitat. The Baylands Ecosystem Habitat Goals Project report identifies key baylands species that represent the RCIS's diversity (Goals Project 2015). The North Bay Baylands are particularly important as a layover location for migrating birds along the Pacific Flyway, a major north-south migratory route from Alaska to South America. The San Pablo Bay Wetlands is an Audubon Important Bird Area (Audubon 2008).

Locations in the North Bay Baylands were reviewed for high biological value using the CDFW's Area of Conservation Emphasis Terrestrial and Aquatic Biodiversity datasets (CDFW 2018a, 2018b). Thes datasets value relative biological richness based on species diversity, rarity, and endemism. Locations with native species richness, rare species diversity, and a large variety of endemic species have a higher ecoregion ranking, assessed by a 1–5 scale (5 being the best ranking). The areas or portions of areas with a terrestrial biodiversity rank of 4 or 5 in the RCIS area are as follows[3] (CDFW 2018a):

- Burdell Mountain
- San Pedro Mountain
- Novato Creek
- Gallinas Creek
- Mare Island Strait
- Petaluma Valley
- Napa Valley
- Camps 2 and 3 and Areas 3 and 4 of Napa-Sonoma Wildlife Marshes

A majority of the RCIS area, excluding areas with higher elevations between the Petaluma River and the Napa-Sonoma Marshes, have an aquatic biodiversity ranking of 5 (CDFW 2018b).

2.3.3 Habitat Connectivity

The North Bay Baylands are critical for habitat connectivity throughout the region and beyond. Habitat connectivity is included as a focal other conservation element, and its conservation strategy is discussed in Chapter 4.

Habitat connectivity in the North Bay Baylands includes landscape-level connection between habitats, sub-watersheds, or watersheds across horizontal gradients. This includes east-west and north-south connections that are enhanced through connecting habitat fragments into larger intact landscape blocks. Aquatic (open water and baylands) to upland transition across elevational gradients includes levees, ecotone levees, horizontal levees, and natural habitat gradients that provide opportunities for movement with daily and annual tidal cycles as well as projected sea level rise. Hydrological connections, riparian corridors and grassland provide linear and spatial connections from upper watersheds to the bay. This includes streams that transport sediment and

[3] Maps of biodiversity, habitat connectivity, and terrestrial climate resilience can be viewed by accessing the online ACE portal at https://apps.wildlife.ca.gov/ace/.

nutrients from upstream sources to the bay; groundwater sources that can affect surface flows, nutrient and chemical movement, water availability for uptake by plants, and salinity; and tidal circulation that connects riverine to open water habitat and east-west across the North Bay Baylands RCIS area (SLT 2020).

Statewide and regionally, scientists and conservationists have been working to identify and map habitat connectivity and understand which habitat linkages are most important to habitat connectivity in California. As displayed in Chapter 4, efforts include the Missing Linkages project (Penrod et al. 2001), the California Essential Habitat Connectivity Project (Spencer et al. 2010), Critical Linkages: Bay Area and Beyond (Penrod et al. 2013). Connectivity has been integrated into California Biodiversity Initiative Roadmap (CNRA 2018), and, most recently, into California's 30x30 initiative (CNRA 2022).

Ground truthing, utilizing regional and local conservation input, will verify and refine the macro mapping projects. Habitat connectivity is important for supporting species at different life stages, maintaining ecosystem functions, supporting species migration, maintaining geneflow, and increasing resilience to climate change. A mosaic of habitats, natural ecosystem processes, and large, intact landscape blocks are essential elements of maintaining these values. Barriers to connectivity, including fish passage barriers, obstructed highway crossings, fragmentation of habitat areas, and other barriers to movement, such as linear transportation and development, affect the ability of species to survive in their habitat and to move across the landscape and negatively affect resilience.

2.4 Major Infrastructure

This section provides an overview of existing and reasonably foreseeable development of major infrastructure facilities in the RCIS area, including transportation, water, energy, and housing infrastructure. This RCIS considers the development of infrastructure planned in the next 10 years to help inform the RCIS conservation strategies. Infrastructure agencies may use this RCIS to inform siting of projects to reduce conflicts with natural resources and to identify conservation actions or habitat enhancement actions that could be used as mitigation to offset impacts from infrastructure projects or operations and maintenance.

Table 2-3 provides a listing and description of planned infrastructure in the RCIS area. **Table 2-4** describes specific planned infrastructure projects in the RCIS area.

2.4.1 Wastewater Treatment

There are six wastewater treatment facilities in the RCIS area, as shown on **Figure 2-7**. These facilities discharge treated wastewater into waterbodies in and around the RCIS area. Wastewater discharges must meet specific water quality criteria but can influence salinity, water quality parameters, and overall water levels in discharge locations. Wastewater treatment facilities have systems in place to capture untreated overflow but can have spills during large flooding events. Because of their location in low-lying areas near shorelines, wastewater treatment plants are sensitive to sea level rise, but they also have the potential to use nature-based solutions to increase climate resilience.

TABLE 2-3: RATIONALE FOR INCLUSION OF MAJOR INFRASTRUCTURE IN THE RCIS AREA

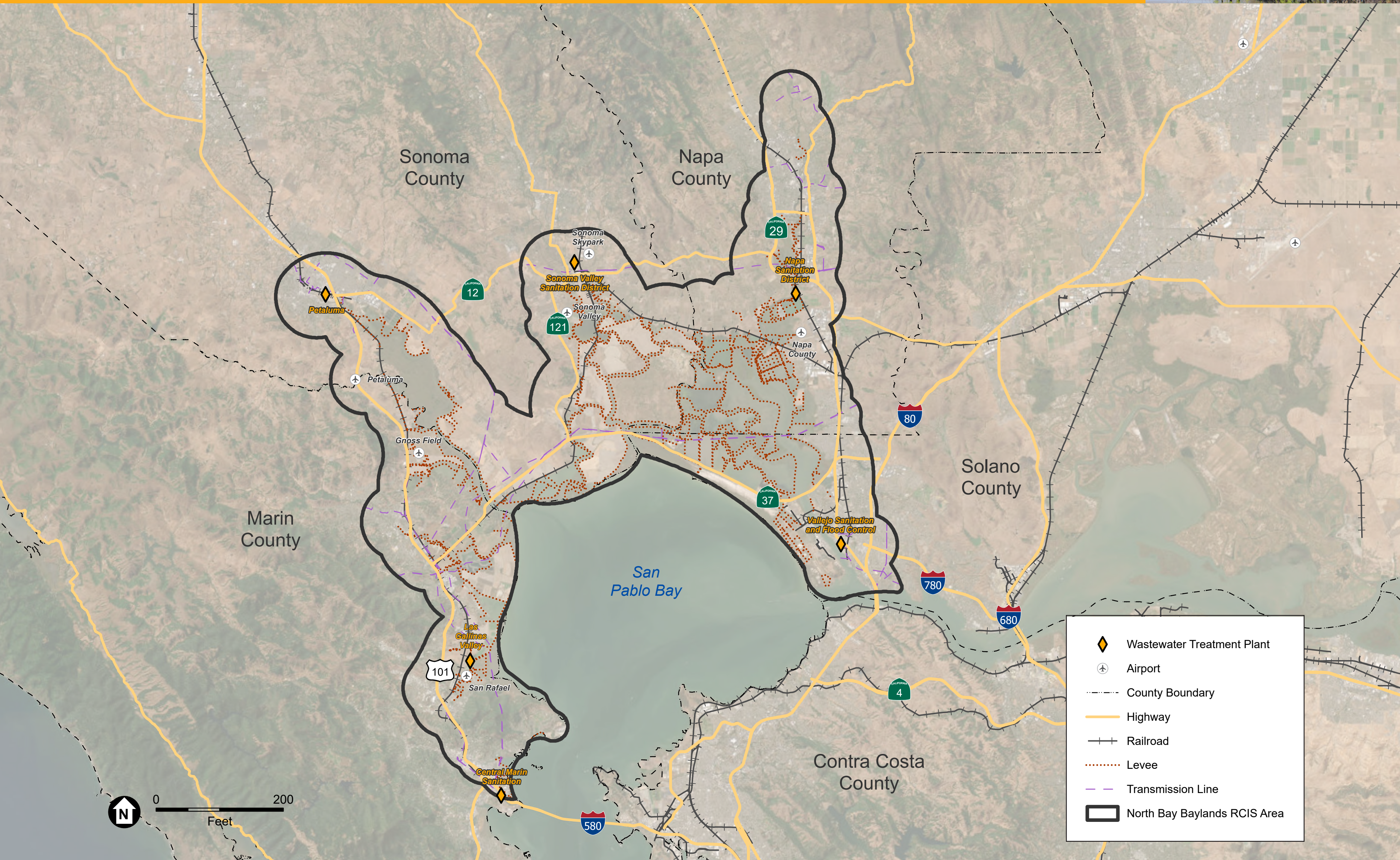
Major and Planned Infrastructure Described	Rationale for Consideration	How the RCIS Considers	Sources for Additional Information
Transportation • Roadway, rail, and ferry transit. • Projects aim to address growing population and traffic needs, repair and maintain old infrastructure, and add utility to existing transit facilities and routes.	• Infrastructure projects could result in impacts to focal species and other conservation elements. • RCIS strategies can be integrated into project design to avoid impacts, benefit ecosystems, and serve as project mitigation.	• Focal species and other conservation element selection considers anticipated impacts and mitigation needs. • Strategies consider opportunities for removing barriers and restoration of hydrological processes and connectivity currently impacted by linear roadway and rail features.	• Plan Bay Area 2050 • Caltrans SHOPP Projects • Caltrans Planning and Environmental Linkages Report for SR 37
Development/Housing • Projects aim to increase housing supply to support growing population.	• Development could impact focal species and other conservation elements. • Development also limits opportunity for habitat expansion in response to rising sea levels.	• Focal species and other conservation element selection considers anticipated impacts and mitigation needs. • Strategies consider protecting and restoring habitat transition areas to increase opportunities for habitat migration. • Strategies also include policy actions to limit development and support compatible land use types.	• Plan Bay Area 2050 • Bay Area Greenprint (Market Activity data from Greenbelt Alliance 2019)
Flood and Water Management Infrastructure • Projects aim to replace and repair aging infrastructure; manage water for beneficial uses, such as habitat; and to address flooding in consideration of climate change and sea level rise.	• Projects could impact focal species and other conservation elements. • Flood control (e.g., levees) and water management devices (e.g., gates) affect baylands' hydrology and the opportunities for restoration and other conservation action.	• Future conditions planning considers how sea level rise will affect current hydrological processes and water movement. • Strategies include actions to breach and restore connectivity while building in upland ecotone transition habitat to maintain flood protections where necessary.	• California Department of Water Resources (Flood Emergency Response Information Exchange) • Local water agencies and flood control districts
Water and Wastewater Treatment Plants, Ports	• Facilities and infrastructure susceptible to sea level rise may need to alter operations or facilities to adapt. These changes could impact focal species and habitats in the RCIS area or result in mitigation needs.	• Selection of focal species and other conservation elements considers anticipated impacts and mitigation needs.	• Conservation Biology Institute (Wastewater Treatment Plants)

TABLE 2-4: PLANNED INFRASTRUCTURE PROJECTS IN THE RCIS AREA

Planned Projects	Location	Description and Relevancy
Caltrans SHOPP Projects	Various locations along SR 29, 37, 116, and 121, US 101, and Interstate 80	• Caltrans' State Highway Operation and Protection Program (SHOPP) funds the repair and preservation, emergency repairs, safety improvements, and operational improvements on the State Highway System (Caltrans 2022). • Projects in the RCIS area include projects to upgrade curb ramps, install bike lanes, widen shoulders, construct roundabouts, repair culverts, rehabilitate pavement, and replace bridges • Impacts are usually limited in area but could result in some impacts to species and habitats in the RCIS area and require mitigation.
Corridor & Interchange Improvements – "Marin-Sonoma Narrows"	US 101 in Marin and Sonoma Counties	• This program implements interchange improvements at I-580 and a new southbound HOV lane between Novato and the Sonoma/Marin County line. The project is expected to have some impact on species and habitats in the RCIS and require mitigation.
SR 37 Sea Level Rise Adaptation	SR 37 in Marin, Sonoma, Napa, and Solano Counties	• The purpose of this project is to address recurring flooding and future sea level rise impacts to the existing SR 37. Flooding on SR 37 occurs during seasonal rain and high-tide events, causing delays and closures. • Flood protection and traffic congestion improvements are being developed. • This roadway serves as a major barrier to hydrology and habitat connectivity in the baylands. The first long-term sea level rise adaptation project for SR 37 is being designed in Marin County from the US 101 interchange to Atherton Avenue. Seven additional projects are anticipated to complete the corridor's sea level rise adaptation, and support restoration and resilience of the historic baylands.
SMART North Petaluma Station	City of Petaluma	• This program includes funding to implement a new SMART rail station at Corona Road in Petaluma, including a park-and-ride facility.
SMART Pathways	Marin and Sonoma Counties	• The Sonoma-Marin Area Rail Transit (SMART) District along with partner agencies have constructed 25 miles of Class 1 SMART Pathway within and along the railroad right-of-way, with another 14 miles fully funded for construction. • The SMART pathway provides first and last-mile connections to train stations and offers a safe way to travel along the rail corridor, particularly in areas where the SMART Pathway is the shortest path of travel between communities. • Evaluation of updates to the E/W rail line. This includes consideration of future elevations and the potential for alignment along SR 37 of freight and passenger rail. • Development of future segments may impact species and habitats in the RCIS area and require mitigation.
Corridor & Interchange Improvements, SR 29, Napa County	SR 29, Napa County	• This program includes funding to implement interchange improvements at SR 221 ("Soscol Junction"), Lincoln Ave, Madison St, Trower Ave, and Airport Blvd ("Airport Junction"); operational and multimodal improvements between Napa Junction and American Canyon Rd; and new highway lanes between SR 37 and American Canyon. • The project is expected to have some impact on species and habitats in the RCIS and require mitigation.

TABLE 2-4: PLANNED INFRASTRUCTURE PROJECTS IN THE RCIS AREA

Planned Projects	Location	Description and Relevancy
Bus Service Expansion	Various locations in RCIS area	• There are several programs planned to improve bus access for communities in the RCIS area. This may include roadway shoulder improvements in addition to increasing routes and services. • Project may have minimal impacts but would also serve to connect the local community to the open space within the RCIS area.
Priority Development Areas	City of Vallejo, City of Petaluma, City of San Rafael, City of Napa, and City of American Canyon	• Five cities in the RCIS area identified as locations of Priority Development. These cities are on the margin of the core RCIS area, they can impact the baylands by altering hydrology, reducing open space, and increasing pollution. By prioritizing development areas, development pressure is reduced in areas of higher conservation area. • As these areas are mostly developed already, they have limited direct impacts on the conservation elements of the RCIS. • Conservation strategies aim at addressing some of the indirect impacts of development, such as degradation of water quality.
San Quentin Pump Station Replacement Project	City of San Rafael	• The purpose of this project is to construct a new pump station and rehabilitate the existing pipe located between the station and the bay. This pump station provides flood protection to the Southern San Rafael area. • Due to construction and pipelines, there may be impacts to species and habitats in the RCIS region.
Pickleweed Park Enhancements/Field Renovation	City of San Rafael	• The purpose of this project is to convert the natural field to synthetic turf, other additional park amenities, and landscaping. • As this project area is already developed, there may be minimal impacts to species and habitat with potential for enhancement.
Caulfield Bridge Crosstown Connector	City of Petaluma	• The purpose of this project is to build a moveable bridge across the Petaluma River to connect east and west Petaluma. This project has the potential to impact the floodplain and habitat. • As this area is mostly developed, there may be minimal impacts to species and habitats in the RCIS.
PIPS Forcemain	City of Petaluma	• The purpose of this project is to construct a forcemain parallel to the existing forcemain. • This project has the potential to impact species and habitats within the RCIS region due to the pipeline traveling through open spaces and crossing multiple creeks.
Giovannoni Logistics Park	City of American Canyon	• The purpose of this project is to develop 2.4 million square feet of logistics center on 161 acres of the project site, which includes undeveloped land. • This project has the potential to impact species and habitats within the RCIS region and require mitigation.



SOURCE: ESA, 2023

Figure 2-7
Existing Infrastructure

2.4.2 Water Supply

Water supply collection, treatment, and distribution infrastructure span the RCIS area. Within the RCIS area, water is supplied by 13 reservoirs, the Russian River, and the State Water Project (SWP) via the North Bay Aqueduct. The North Bay Aqueduct connects the SWP via distribution lines to the Solano County Water Agency, City of Napa Water Division, and City of Vallejo Water Department. The five water districts in the RCIS area and their water infrastructure are described in **Appendix F**.

2.4.2.1 Biosolids

Biosolids are a nutrient-rich organic material from the treatment of domestic sewage produced at wastewater treatment plants. Biosolids have been applied in the North Bay Baylands RCIS area for decades and meet current federal and state regulations for agricultural uses (**Figure 2-8**). They are applied as a soil amendment to avoid synthetic fertilizer and build rich soil organic matter. Because of changes in legislation (SB 1383), biosolids are to be diverted from landfills for other beneficial uses (BACWA 2022).

In the North Bay, the restoration of diked agricultural lands to tidal marsh habitats raises the question as to whether application of biosolids has positive or negative impacts for wetland restoration. The addition of biosolids to soils increases total soil nitrogen and phosphorus concentrations compared to commercial fertilizers and can slow-release nutrients over multiple seasons. Biosolids have a higher phosphorus to nitrogen ratio than is optimal for plant growth and can lead to excessive phosphorus buildup, in addition to higher nitrates which can contribute to eutrophication and harmful algal blooms. The accumulation of heavy metals in the soil is also an issue as they can bioaccumulate to hazardous levels with repeated land applications of biosolids on the same site (Binder et al. 2002, Brown et al 2011, Lu et al 2012).

The compatibility of biosolids application with wetland restoration in the San Francisco Baylands has recently been explored (BACWA 2022). Current regulations (40 CFR Part 503) do not account for land application of biosolids in diked baylands. Requirements to prevent or reduce leaching into groundwater and runoff by setbacks and buffers are not necessarily applicable to diked baylands, where the entire landscape is prone to inundation and stormwater is pumped out of drainage ditches into the adjacent surface water (e.g., the Bay or Petaluma River). Questions remain regarding the compatibility of soils that have been amended with biosolids with wetland and aquatic habitats following unplanned levee breaches and seasonal ponding, or in locations with elevated groundwater tables, or with intentional levee breaches associated with habitat restoration projects. Further research is needed to understand potential effects of biosolid application before incorporating them into habitat restoration projects.

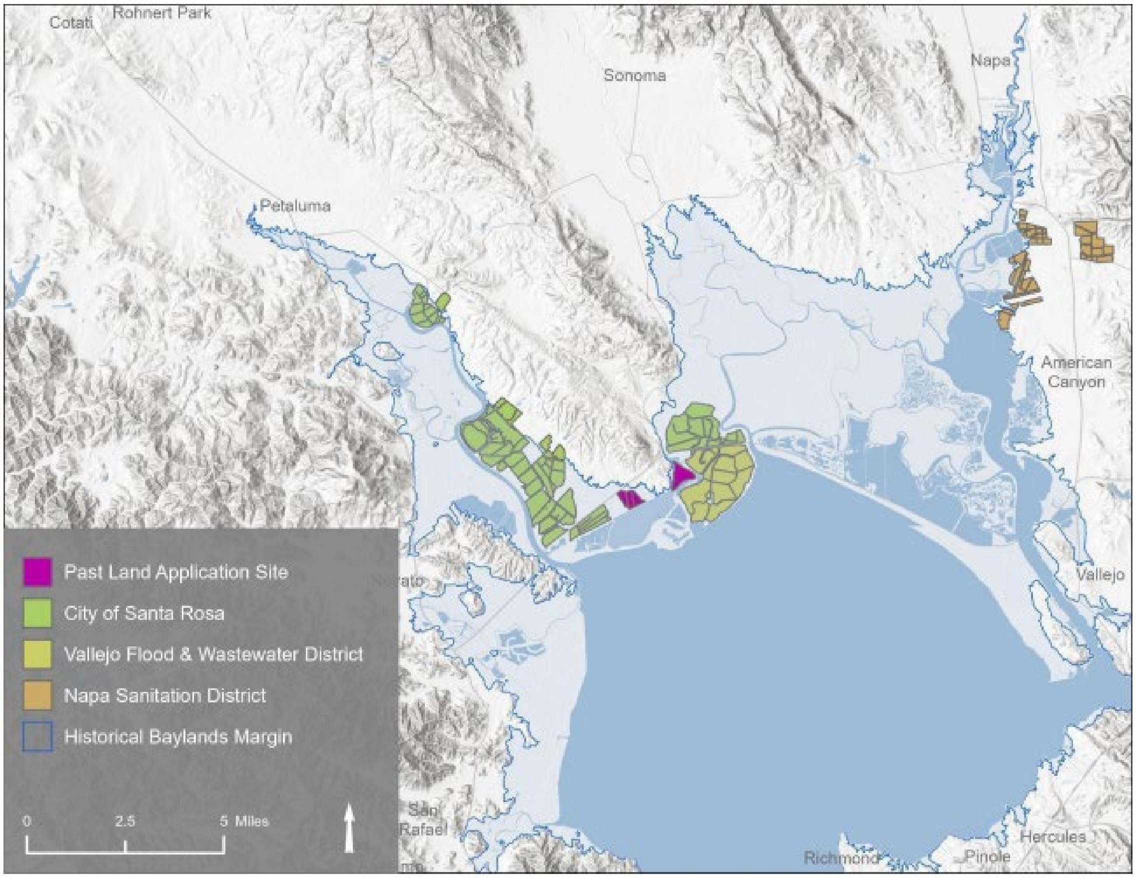


Figure 2-8
Past and Present Biosolids Land Application (BACWA 2022)

2.4.3 Flood Management Infrastructure

The North Bay Baylands are segmented by a network of levees that isolate diked wetlands, agricultural fields, managed ponds, and other landscape features. There are several miles of levees within the RCIS area (Figure 2-7). These levees serve many purposes, including defining habitats and land uses and protecting infrastructure from flooding. Many of these levees contain water control structures, such as gates or pumps that can be used to control water levels and circulation within and between areas. Water levels are managed for different purposes, such as keeping areas dry or maintaining tidal exchange. Three local mosquito and vector control/abatement districts (Marin/Sonoma, Napa, and Solano) work with land managers to manage waters and marshes in ways to limit mosquito populations. Levees are owned and operated by a variety of landowners in the North Bay Baylands.

Levees vary in age, condition, and height and thus have varying degrees of resilience to sea level rise. Climate adaptation planning along the shoreline by BCDC, SFEI and other agencies has provided a vision for nature-based restoration along the shoreline which could allow for improved habitat for aquatic and terrestrial species, and for inland migration of habitat. The San Francisco Bay Shoreline Adaptation Atlas analyses potential sea level rise impacts and identifies areas for restoration and adaptation to improve resiliency (Beagle et al. 2019). As projects in this region are implemented, significant project costs often include levee repair, maintenance, and raising surrounding elevations to protect habitats and infrastructure from flooding.

2.4.4 Transportation

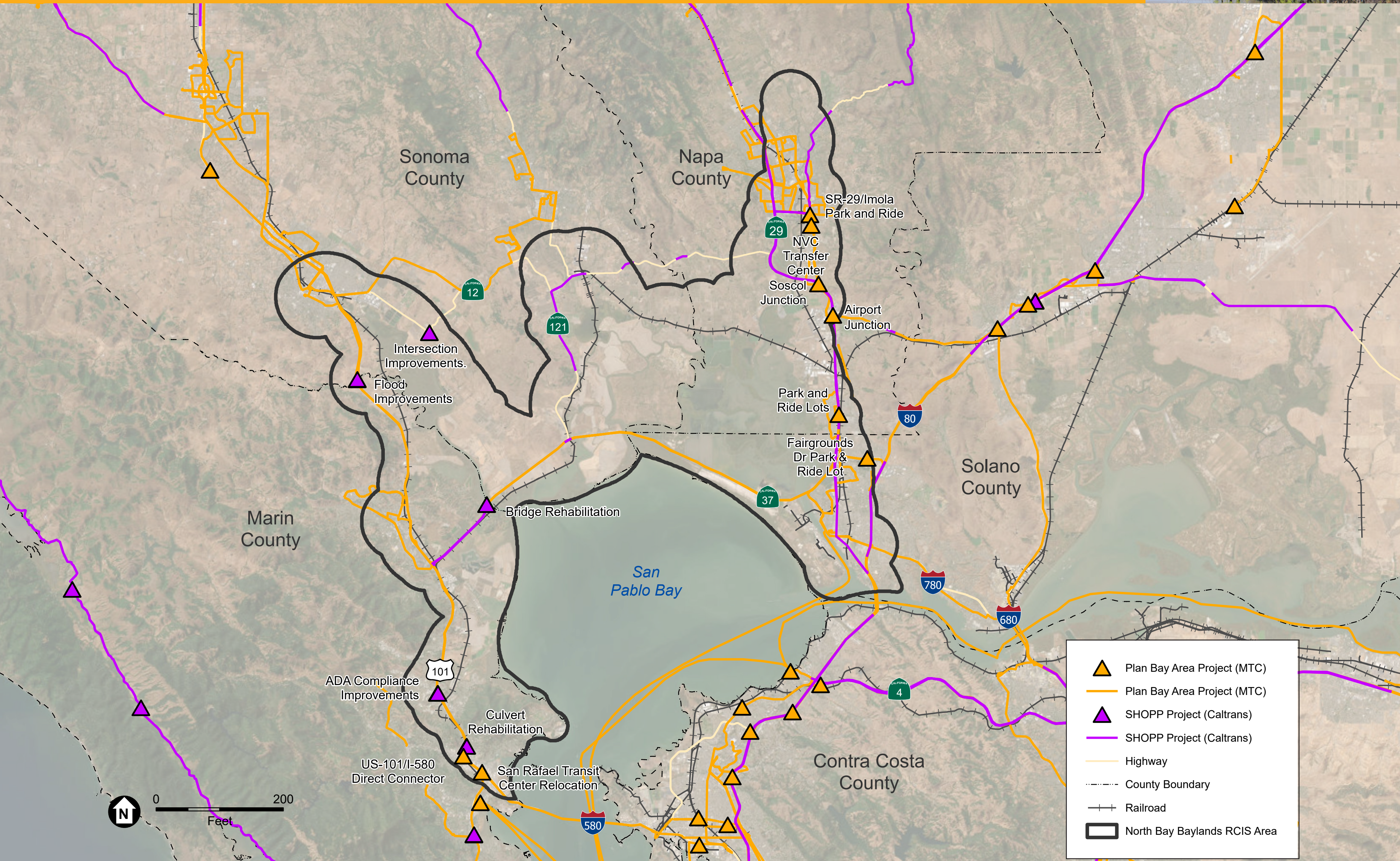
Transportation networks that serve the RCIS area are shown in Figure 2-7. SR 37 and the Sonoma-Marin Area Rail Transit (SMART) line bisect the San Pablo Baylands' remaining historical tidal wetlands. The segments of SR 37 and the SMART rail that were constructed in subsided areas are vulnerable to flooding and dependent on an aging system of berms and pumps that are under increasing pressure as the sea level rises. During the winter of 2016–2017, SR 37 experienced catastrophic flooding resulting in more than three weeks of road closure that forced commuters to find alternative routes (Baylands Group 2017).

Within the North Bay Baylands RCIS area, there are also three ferry locations—at Mare Island, Vallejo, and Larkspur. These terminals provide overwater connection to San Francisco, Marin County, the East Bay, and South San Francisco. Future development at ferry terminals could especially affect shoreline species and open water habitats.

Looking forward, Plan Bay Area 2050 is a 30-year plan developed by the MTC and the Association of Bay Area Governments that provides a regional strategy aimed at creating a Bay Area that is affordable, connected, diverse, healthy, and vibrant for all residents. Plan Bay Area 2050 includes transportation strategies that maintain and optimize the existing transportation system, create healthy and safe streets, and build a next-generation transit network. The plan identifies 12 transportation projects planned for Marin, Napa, and Sonoma Counties, including improvements to bus service and road interchanges, extension of the SMART rail service, and a new SMART rail station. These projects are briefly described in the Transportation Project List under Final Supplemental Reports in the Final Plan Bay Area 2050 report (ABAG and MTC 2021).

The Caltrans State Highway Operation and Protection Program (SHOPP) Management plans, develops, manages, and reports the four-year SHOPP portfolio of projects. The 2022 SHOPP is the State Highway Systems' "fix-it-first" program that funds repair and preservation, emergency repairs, safety improvements, and some highway operational improvements on the State Highway System. Within the RCIS area, a total of 33 SHOPP projects are planned. Projects include SR 37 and U.S. 101 in Marin and Sonoma Counties, SR 29 in Napa and Solano Counties, SR 121 and SR 116 in Sonoma County, and U.S. 80 in Solano County (Caltrans 2022a, **Figure 2-9**).

The State Route 37 project, referred to as the Resilient SR 37 program, is an important project for the future of the North Bay Baylands. Caltrans, MTC, and the four North Bay Area counties are partners in the Resilient SR 37 program working on multiple studies addressing the corridor's critical flooding, sea level rise, congestion, ecosystem connectivity, and multimodal issues. Caltrans District 4 conducted a Planning and Environmental Linkages Study for the SR 37 corridor between U.S. 101 to U.S. 80 to identify a transportation vision, determine needs, and consider alternatives within this critical corridor. The preferred alternative would be made up mostly of a causeway, with some portions constructed at grade or on an embankment. Conservation and habitat enhancement actions identified in the North Bay Baylands RCIS could be integrated into design components of the program that would reconnect and improve marsh habitats throughout the corridor.



SOURCE: ESA, 2024; AGAB and MTC, 2021; Caltrans, 2022a

Figure 2-9
Planned Infrastructure

2.4.5 Airports

There are eight public or private general aviation airports within the RCIS area (Figure 2-7). There are no commercial or federal airports in the RCIS area. Most of these small airports lie within areas projected to be inundated with sea-level rise and may need to adapt to avoid future inundation. In addition to on-the-ground infrastructure associated with airports, air traffic has the potential to negatively affect birds—the North Bay Baylands provide an important stopover for migrating birds along the Pacific Flyway. There is a Federal Aviation Administration–mandated buffer surrounding airports that limits habitat restoration types in an effort to limit bird strikes.

2.4.6 Rail

There are three railroad operators in the RCIS area: California Northern Railroad, Napa Valley Railroad Company, and Northwestern Pacific Railway Company, LLC. Figure 2-7 and Figure 2-9 show rail lines and proposed rail lines in the RCIS area. Rail lines are susceptible to sea level rise; they can fragment habitats and thus reduce species mobility and hydrological connectivity between areas; and they can function as a barrier to habitat transition that will need to occur to address sea level rise.

2.4.7 Energy

Pacific Gas and Electric Company (PG&E) operates and maintains 314 miles of electrical transmission lines, as well as natural gas transmission lines, within the RCIS area (Figure 2-7). As the landscape changes, these facilities will need to continue to be accessible and serviceable to support the growing population. In addition, electric transmission lines, particularly in high fire-prone upland areas, are being updated throughout California to reduce potential for wildfire ignition.

No major new renewable energy infrastructure is currently planned in the RCIS area. Two Community Choice Aggregators operate in the RCIS area—Marin Community Energy (MCE) (covering Marin, Napa, and Solano Counties) and Sonoma Clean Power (covering Sonoma and Mendocino Counties). Current MCE projects include photovoltaic arrays installed on rooftops and carport shade structures, a photovoltaic system on a 60-acre remediated brownfield site, and biogas at the Central Marin Sanitation Agency. There could be interest in developing further renewable energy projects, including solar and wind projects, in the RCIS area in the future.

2.4.8 Housing

California state law mandates, via the Regional Housing Needs Allocation (RHNA), that all California cities, towns, and counties must plan for housing needs. The final RHNA allocation by county, city, and income level is available at the Association of Bay Area Governments website (ABAG 2021).

There are 11 Priority Development Areas (PDAs) within the RCIS area (ABAG and MTC 2021; **Appendix D**). PDAs are places near public transit that are planned for new homes, jobs, and community amenities. Six of these are areas of Vallejo (Mare Island, Sonoma Boulevard, Waterfront and Downtown, Central Corridor East, Central Corridor West, and Carquinez Heights). Other areas include Petaluma (Corona, Lakeville), San Rafael (Downtown), Napa (Downtown Napa and Soscol Gateway Corridor), and American Canyon (Highway 29 Corridor).

2.5 Land Use

Significant development has occurred around the San Francisco Estuary, and the North Bay Baylands RCIS area and surroundings are no exception. The RCIS area includes several centers of urban development focused on the cities of San Rafael, Novato, Petaluma, American Canyon, Vallejo, and Napa (Figure 2-1).

2.5.1 Other Development

In addition to the infrastructure facilities described above, other important development facilities in the region include the Ignacio Electric Switch Yard, City of Petaluma's Ellis Creek Recycling Water Facility, San Rafael Rock Quarry, McNear Brick Yard, Sonoma Raceway, and numerous golf courses. Mare Island, where the first U.S. Naval installation on the west coast once operated and was decommissioned in 1996, leases property to Touro University and numerous commercial and industrial businesses, provides civilian housing, and is in the process of transferring property to private developers and several government agencies, including the U.S. Fish and Wildlife Service (USFWS). The RCIS area also includes a U.S. Coast Guard Station in Vallejo.

2.5.2 Open Space

Open spaces in the RCIS area largely consist of land with a variety of features that is undeveloped. Identifying habitat and species related to open space is critically important for land use planning and as a tool for conservation and support for species survival. Open space identified in watersheds, prioritized for preservation and restoration, can accommodate marsh retreat (i.e., the upslope migration of marsh habitat) resulting from sea level rise. Open space includes current extensive agricultural, grazing, and otherwise relatively undeveloped lands.

2.5.3 Working Lands

Thirty-eight percent of the RCIS area is identified as farmland in the Farmland Mapping and Monitoring Program (FMMP) database (CDOC 2019; **Appendix D**;). **Table 2-5** provides a breakdown of the farmland types by acreage and percentage of the RCIS area. Agricultural lands include vineyards and hay production as well as grazing (Goals Project 2015). Much of the farmland in the RCIS area is below sea level and currently floods or is projected to be impacted by rising sea levels; therefore, there is some interest in the region to convert some agricultural lands back to wetland habitats.

TABLE 2-5: FARMLAND MAPPING AND MONITORING PROGRAM MAPPED FARMLAND WITHIN THE RCIS AREA

FMMP Classification	Acres	Percentage of RCIS area
Prime Farmland	4,596	3%
Farmland of Statewide Importance	7,796	5%
Unique Farmland	3,480	2%
Farmland of Local Importance	30,799	19%
Suitable Grazing Land	14,897	9%
Total	**61,568**	**38%**

2.5.4 Restoration Projects

Numerous restoration projects in the RCIS area are currently in the planning, implementation, or post-project monitoring phases. In total, the goals for the North Bay subregion are to increase the area of tidal marsh from 16,000 acres to approximately 38,000 acres and create approximately 17,000 acres of diked wetlands managed to optimize their seasonal wetland functions (Goals Project 1999). Actions include managing some ponds to optimize waterbird habitat and restoring others to tidal marsh and enhancing and protecting tributary streams and riparian vegetation (Goals Project 1999, 2015). Since the Goals Project was initiated, thousands of acres in the North Bay Have been restored (Goals Project 2015, EcoAtlas 2022). **Figure 2-10** shows projects listed in EcoAtlas (2022), a database of restoration projects throughout the state, while **Figure 2-11** shows landscape changes in the North Bay since 1998 and planned restoration as reported in the Goals Project Update (2015). Thousands of acres of tidal wetland restoration have been implemented through projects such as Hamilton Wetlands, Sears Point, and the Napa-Sonoma Marshes Restoration Project and restoration is planned. These restoration projects often have multiple benefits, including flood risk reduction and public access in addition to ecological benefits.

Completed projects include (SLT 2020; Goals Project 2015):

- Multiple years – Lower Tubbs Island, 249 acres
- 1996 – Sonoma Baylands, 305 acres
- 1999 – Tolay Creek, 435 acres
- 2002 – Tubbs Setback, 71 acres
- 2003 – Camp 2, 608 acres
- 2004 – Ringstrom Bay, 313 acres
- 2006 – Napa-Sonoma Marshes, Ponds 2A, 3, 4, 5, 3,500 acres
- 2006 – Napa-Sonoma Marshes, Ponds 1/1A and 2, 1,800 acres
- 2007 – Petaluma Marsh Expansion Project, 100 acres
- 2008 – Bahia Phase 1, 60 acres
- 2009 –Lower Tubbs Island/Lower Tolay Creek Enhancement Project, 65 acres
- 2010 – Napa Plant Site, 1,360 acres
- 2013 – Bahia Phase 2, 305 acres
- 2014 – Novato Baylands (Hamilton Wetlands), 648 acres
- 2015 – West Cullinan Ranch, 1,250 acres
- 2015 – Sears Point (Dickson unit), 960 acres
- 2019 – Napa-Sonoma Marshes, Ponds 6/6A, 7/7A, and 8, 2,000 acres
- 2019 – Haire Ranch, 752 acres (interim to the Skaggs Island and Haire Ranch Restoration below)
- 2020 – Sonoma Creek Tidal Marsh Enhancement Project 660 acres

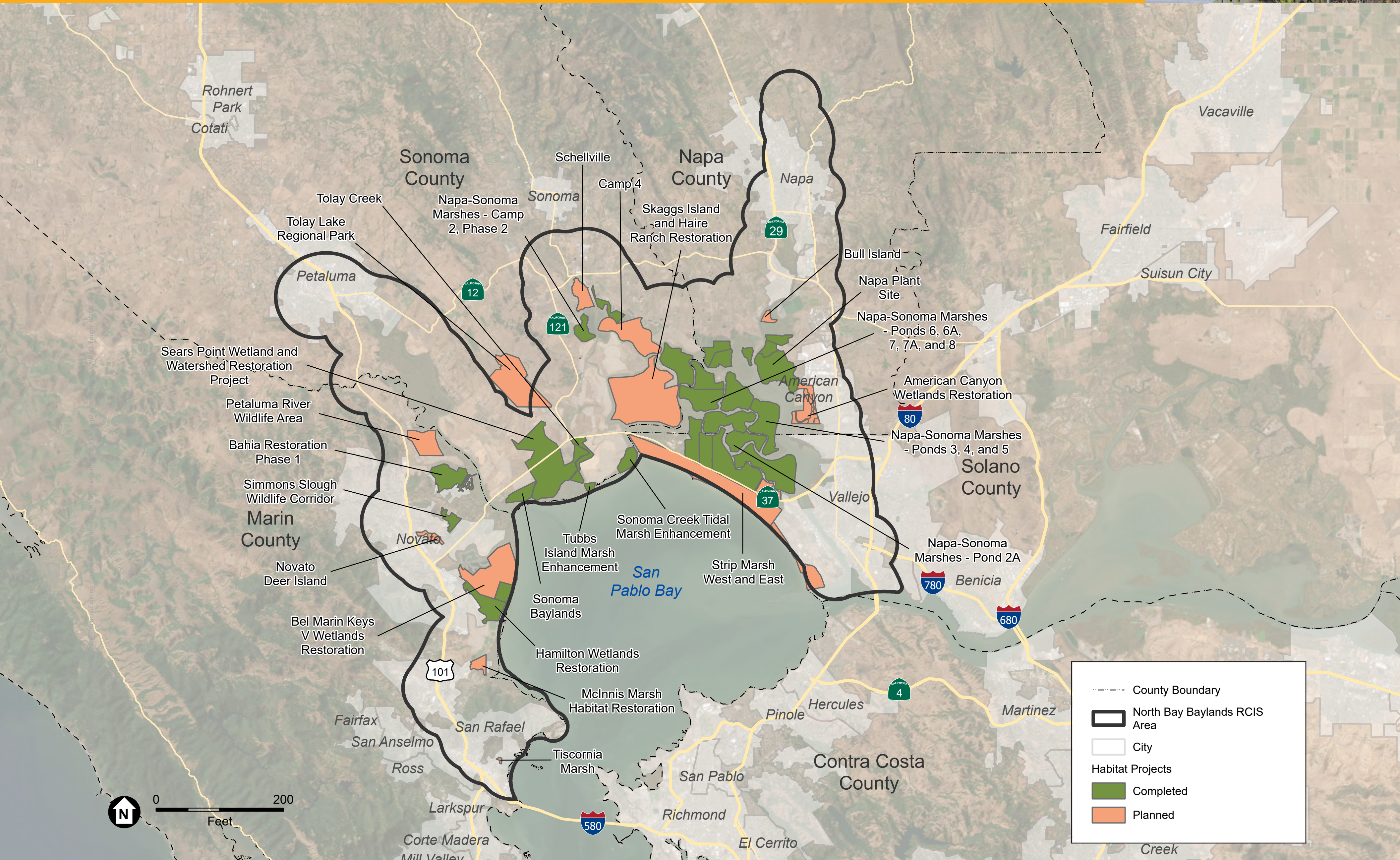
- 2021 – Novato Baylands (Bel Marin Keys Phase 1 Site), 1,904 acres
- 2022 – Simmons Slough Water Management and Seasonal Wetlands Enhancement Project, 136 acres

Planned projects include (SLT 2020; EcoAtlas 2022):

- Sonoma Creek Baylands Restoration Planning Project, Phase 1[4]
  - Camp 4 Ranch Restoration Project
  - Camp 5 Ranch Acquisition and Restoration Project
  - Hudeman Wetlands Tidal Restoration Project
  - Skaggs Island and Haire Ranch Restoration
- East Cullinan Ranch
- Schellville
- Novato Baylands (Bel Marin Keys Project, Phase 2)
- Petaluma River Wildlife Area, Burdell Unit
- Deer Island Basin Tidal Wetlands Restoration Project
- McInnis Marsh Habitat Restoration
- Tiscornia Tidal Marsh and Sea Level Rise Adaptation
- American Canyon Wetlands Restoration
- Mare Island Tidal Marsh Enhancement
- Strip Marsh West and East
- Lakeville Creek Restoration Project
- Tolay Lake Regional Park
- Tolay Creek Restoration Project

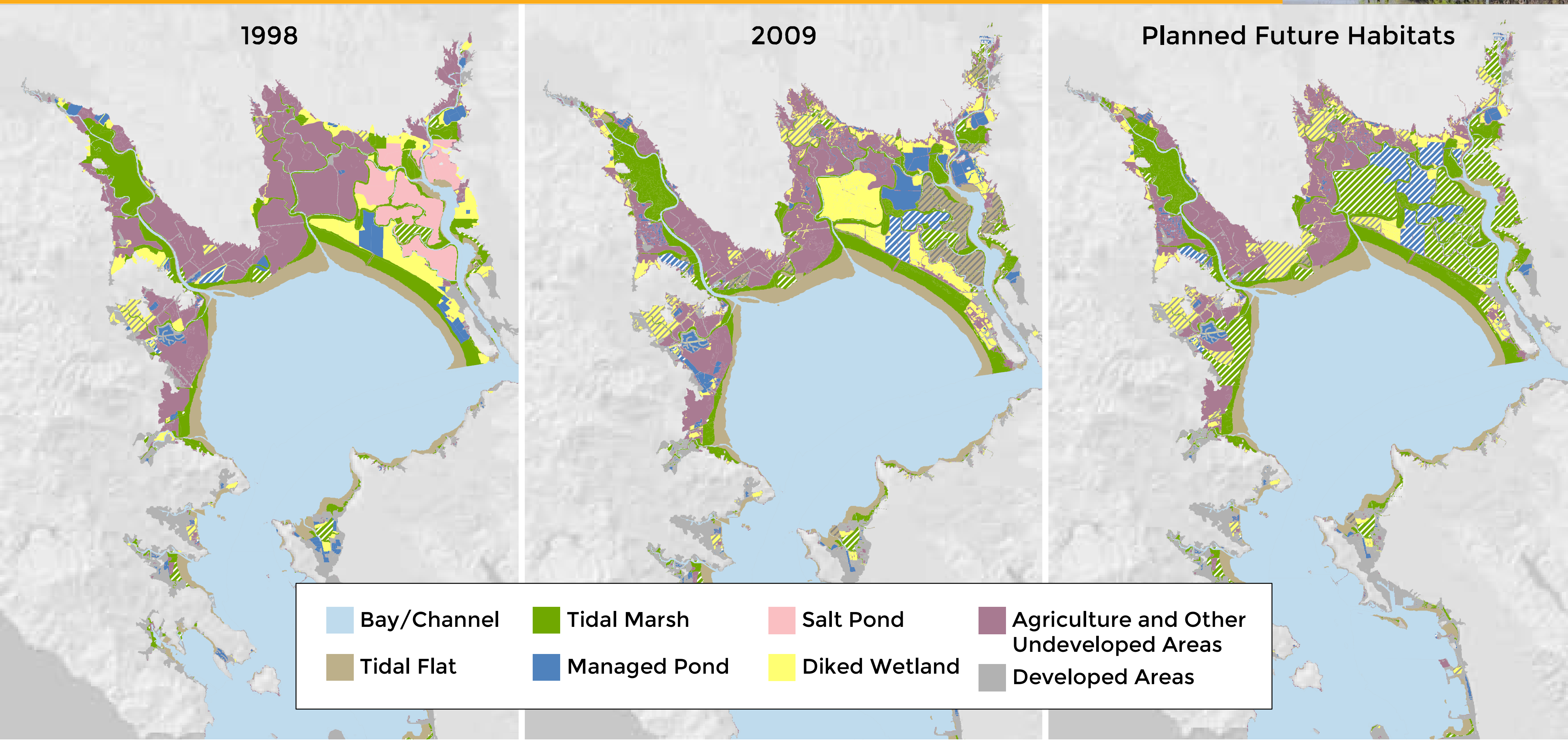
Individually and collectively, these projects are proposing to restore thousands of acres of historic wetlands and transitionary habitat and are an important part of the future of the North Bay Baylands landscape. The North Bay Baylands are a dynamic landscape. New projects may also be identified, planned, and implemented. Ambitious goals are identified in several regional plans (SFBJV 2022; SLT 2020; SLT 2023) that should be reviewed for more detail. When implementing actions identified in this RCIS, it is important that project proponents carefully consider these planned restoration projects, in addition to climate change and identifying new projects in an overall process, to understand and anticipate potential future landscape conditions.

4 Building on the work of the Sonoma Creek Baylands Strategy, this project will develop an integrated design for the restoration of Skaggs Island, Haire Ranch, Camp 4, Camp 5, and Hudeman Wetlands.



SOURCE: ESA, 2023; EcoAtlas, 2022

Figure 2-10
San Francisco Baylands Habitat Restoration Projects



Hatching indicates areas where restoration activities had occurred as of 1998. For managed ponds this included habitat enhancement.

By: San Francisco Estuary Institute

Data: Wetland data from SFEI includes EcoAtlas Modern Baylands, NLCD 2001, and wetland tracker data.

Hatching indicates areas where restoration activities had occurred as of 2009. For managed ponds this included habitat enhancement.

By: San Francisco Estuary Institute

Data: Wetland data from SFEI includes BAARI (v1, 2009) Baylands and Wetlands, NLCD 2006, and wetland tracker data.

Hatching indicates areas where restoration activities have occurred or are planned. For managed ponds this includes habitat enhancement. Habitats shown represent projected restoration endpoints (in contrast to 1998 and 2009 maps).

By: San Francisco Estuary Institute

Data: Wetland data from SFEI includes BAARI (v1, 2009) Baylands and Wetlands, NLCD 2006, and wetland tracker data.

SOURCE: Baylands Ecosystem Habitat Goals Science Update, 2015

Figure 2-11
North Bay Landscape Changes Over Time
(from Goals Project Update 2015)

2.5.5 Public Access and Restoration

Public access, in the form of walking/biking trails, water trails, and environmental education centers currently exist throughout the North Bay Baylands RCIS area, and more access is planned. The San Francisco Bay Trail (Bay Trail) and the San Francisco Bay Water Trail (Water Trail) are designated Priority Conservation Areas (PCAs) (MTC 2022a). The Bay Trail is a 500-mile regional trail that, upon completion, will circumnavigate the bay, connecting communities and open spaces (MTC 2022b). Segments of the Bay Trail along with other regional trails have been completed throughout the RCIS area, but the trails are not yet fully connected (Team Common Ground 2020). The Water Trail is a network of launching and landings sites for non-motorized watercrafts (e.g., kayaks, stand-up paddleboards, wind, and kite surf) around the San Francisco Bay and its major tributaries, including the Napa and Petaluma Rivers (Water Trail 2023). A comprehensive look at trails in the San Pablo Bay region, which covers the RCIS, was described in the SR 37 Public Access Scoping Report (Team Common Ground 2020). Trails that connect underserved communities to public access and habitat can have positive outcomes on future stewardship and protection. Public access can also impact the quality of habitats and use by wildlife. Trail networks, along with existing and planned environmental education centers, can benefit educational outreach; these include Sonoma Land Trust's Bay Camp, the planned American Canyon Wetlands Ecology Center (https://www.acparks.org/wetlands-eco-center), and the planned Petaluma River Park (https://www.petalumariverpark.org/).

2.6 Land Conservation

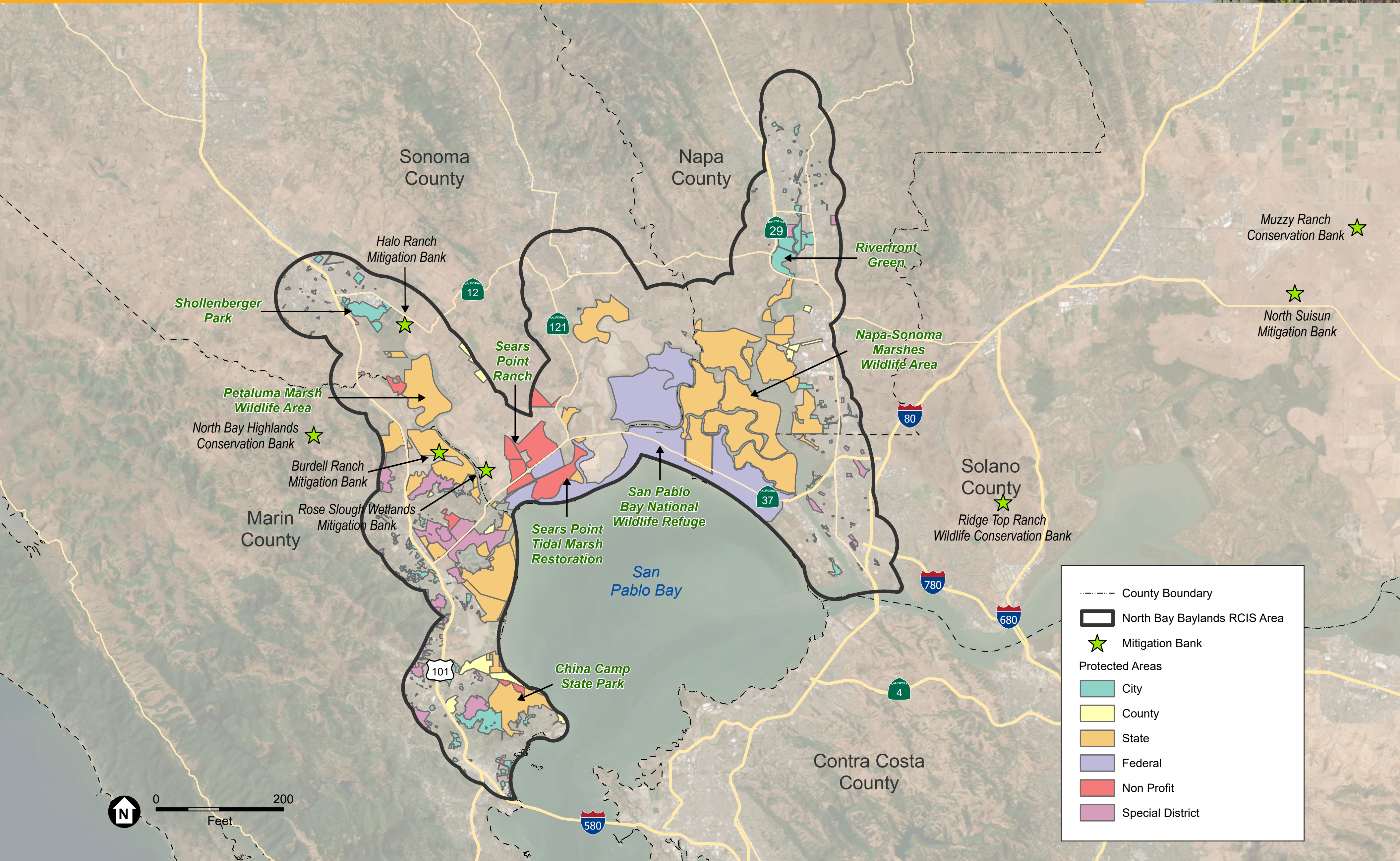
Approximately 30 percent of the RCIS area is owned by a recreation or conservation organization, and 4 percent is protected by a conservation easement (**Appendix D**; California Protected Area Database (CPAD), CPAD 2022). This section describes protected lands, including those that are publicly managed and protected by easement, as well as mitigation and conservation banks in the region and PCAs.

2.6.1 Publicly Managed Lands

A sample of publicly managed lands within the RCIS, and the agencies that manage them, are listed below:

- San Pablo Bay National Wildlife Refuge (USFWS)
- Napa-Sonoma Marshes Wildlife Area (CDFW)
- Petaluma Marsh Wildlife Area (CDFW)
- Novato Baylands (California State Coastal Conservancy)
- China Camp State Park (California Department of Parks and Recreation)
- Rush Creek Open Space Preserve (Marin County Open Space District)
- Ghisletta Wetlands and Open Space (Napa County Flood Control and Water Conservation District)
- Dan Foley Park (Greater Vallejo Recreation and Park District)
- Petaluma Wetlands (Shollenberger Park, Alman Marsh, Ellis Creek Wastewater Treatment Facility ponds and habitat, Gray's Marsh) (City of Petaluma)

Publicly managed lands listed in the CPAD are shown in **Figure 2-12** and **Table 2-6**.



SOURCE: ESA, 2023; CPAD, 2022

Figure 2-12
Currently Protected Lands (2022)

2.6.2 Lands Protected by Fee

Lands protected by fee or easement have permanent limitations on development, preventing their conversion to intensive human uses. Permanent protection typically comes in the form of fee title ownership by a conservation or park entity (e.g., land trust, open space district, regional/state/ federal park agency) or via a conservation easement established by the property owner. Examples of land protected by fee title ownership include dedicated parkland or nature preserves (CPAD 2022). Conservation easements, which permanently limit uses of land to protect its conservation values, may be established on public or private lands. Privately managed lands protected by fee or easement are shown in Figure 2-12. and acreages within the RCIS area are summarized below (**Table 2-6**).

TABLE 2-6: ACREAGE OF PROTECTED AREAS WITHIN THE RCIS AREA BY OWNERSHIP AND ACCESS

Owner	No Public Access	Open Access	Restricted Access	Total
City	175.36	3,660.41	259.99	4,095.76
City Agency	175.36	3,660.41	259.99	4,095.76
County	240.51	1,179.97	--	1,420.48
County Agency	240.51	293.90	--	534.41
County Agency – Parks	--	886.07	--	886.07
Federal	3,092.97	2.81	8,520.53	11,616.31
Federal Agency	3,092.97	2.81	8,520.53	11,616.31
Non-Profit	907.63	1,323.44	1,165.95	3,397.02
Non-Profit – Conservation	355.35	168.47	--	523.82
Non-Profit - Land Trust	552.28	1,149.09	1,165.95	2,867.32
Non-Profit – Other	--	5.88	--	5.88
Special District	196.80	3,842.78	374.11	4,413.69
Community Services District	--	91.04	--	91.04
Conservation District	--	36.37	--	36.37
Flood District	--	1,295.15	--	1,295.15
Recreation/Parks District	--	2,404.17	--	2,404.17
Sanitation District	--	0.15	303.05	303.20
Transportation Agency	--	2.30	--	2.30
Water District	196.80	13.60	71.06	281.46
State	634.48	22,254.22	655.10	23,543.80
State Agency	634.48	22,254.22	655.10	23,543.80
Total	**5,247.75**	**32,263.63**	**10,975.68**	**48,487.06**

2.6.3 Mitigation and Conservation Banks

Mitigation and conservation banks are lands that are protected, and often restored, for the purpose of conserving species (conservation bank) or aquatic resources (mitigation bank). Banks approved by regulatory agencies can be used to offset project impacts as part of the permitting process. After a review of mitigation and conservation banks approved by CDFW, USFWS, National Marine Fisheries Service (NMFS), Environmental Protection Agency, and/or U.S. Army Corps of Engineers (USACE 2022), two mitigation banks are within the RCIS area and six mitigation/conservation banks have some species service areas that overlap the RCIS area, as shown in **Table 2-7** and Figure 2-12.

TABLE 2-7: MITIGATION AND CONSERVATION BANKS IN THE RCIS AREA (AS OF 2023)

Mitigation Bank (County)	Species and/or Resource	Brief Description
Halo Ranch Mitigation Bank (Sonoma)[1]	• Seasonal wetlands • Tidal wetlands • Non-perennial stream • Non-wetland riparian	• Pending approval by USACE • Potentially available for Clean Water Act and Porter-Cologne Water Quality Control Act advanced mitigation for transportation projects • 175-acre ranch that provides wetland and wildlife benefits
Burdell Ranch Mitigation Bank (Marin)	• Non-tidal wetlands (sold out)	• Approved by CDFW, USACE • 83-acre ranch
North Bay Mitigation Bank (Marin)[1]	• Seasonal wetland	• Potentially available for Clean Water Act and Porter-Cologne Water Quality Control Act advance mitigation for transportation projects • Will reconnect 22.5 acres of floodplain along San Antonio Creek and Corda Creek
Burke Ranch Conservation Bank (Solano)[2]	• Vernal pool preservation • Vernal pool fairy shrimp • Vernal pool tadpole shrimp • California tiger salamander • Swainson's hawk (sold out) • Burrowing owl foraging habitat (sold out)	• Approved by CDFW, USFWS • Only Swainson's hawk and burrowing owl service areas overlap the RCIS area, and all credits are sold out
Elsie Gridley Mitigation Bank (Solano)[2]	• Wetlands • Vernal pool fairy shrimp • Conservancy fairy shrimp • California tiger salamander • Swainson's hawk foraging habitat • Burrowing owl overwintering and foraging habitat	• Approved by CDFW, USFWS, and USACE • 1,837-acre grassland and riparian preserve in eastern Solano County • Only Swainson's hawk and burrowing owl credits are available in RCIS area
North Suisun Mitigation Bank (Solano)[2]	• Vernal pool (sold out) • Vernal pool fairy shrimp • Vernal pool tadpole shrimp • Contra Costa goldfields • California tiger salamander	• Approved by CDFW, USFWS, USACE • Only California tiger salamander service area overlaps with the RCIS area • 612 acres preserving existing vernal pools, swales, and other seasonal habitats

TABLE 2-7: MITIGATION AND CONSERVATION BANKS IN THE RCIS AREA (AS OF 2023)

Mitigation Bank (County)	Species and/or Resource	Brief Description
Ridge Top Ranch Wildlife Conservation Bank (Solano)[2]	• California red-legged frog • Callippe silverspot butterfly†	• Approved by USFWS • California red-legged frogs were translocated to habitat, which is being enhanced by native wetland plantings • Uplands support extensive nectar and larval host plants for callippe silverspot butterfly
Muzzy Ranch Conservation Bank (Solano)[2]	• Stream preservation • California tiger salamander • Conservancy fairy shrimp • Vernal pool fairy shrimp • Vernal pool tadpole shrimp • San Joaquin Orcutt grass • Swainson's hawk • Burrowing owl	• Approved by CDFW, USFWS • Only Burrowing owl and Swainson's hawk have service areas overlapping the RCIS area

NOTES:
1. Bank located within the RCIS Area.
2. Bank located outside of RCIS Area. Portions of some species/resource service areas overlap RCIS Area.

2.6.4 Priority Conservation Areas

The PCAs were nominated by local jurisdictions and adopted by the Association of Bay Area Governments, and 12 occur in the RCIS area (MTC 2022), as shown in **Table 2-8**. PCAs are locations designated for the protection of natural habitats and the preservation of open space for future generations.[5] This includes farming, ranching, recreational and resource lands. PCAs are areas that could be prioritized for RCIS habitat enhancement and conservation actions implementation.

TABLE 2-8: PRIORITY CONSERVATION AREAS IN THE RCIS AREA

Lead Nominating Agency	Priority Conservation Area
City of Novato	• Carmel Open Space • Davidson Hill Area • Hill Recreation and Arroyo Avichi Creek Area
Marin Audubon Society	• Central Marin Bayfront, Canalways
Marin Audubon Society/Marin Baylands	• St. Vincent's and Silveira Properties
City of Vallejo	• Mare Island Open Space • Napa-Sonoma Marshes Wildlife Area • White Slough Wetlands
Marin County Parks and Open Space District	• North County Gateway
California State Coastal Conservancy	• San Francisco Bay Area Water Trail
Sonoma Land Trust	• Sonoma Baylands
Sonoma County Agricultural Preservation and Open Space District	• Sonoma County Gateway

5 MTC and the Association of Bay Area Governments launched a revision of the PCA framework in June 2022.

2.7 Existing Conservation Plans, Studies, Policies, and Compliance

The North Bay Baylands have been intensively studied, and one objective of this RCIS is to build upon these existing studies. As such, the RCIS will reference existing plans, strategies, and policies, as applicable. **Appendix G** provides a summary of reviewed reference materials. This section provides an overview of some of the key plans, strategies, and regulatory requirements that exist in the region.

2.7.1 Natural Community Conservation Plans and Habitat Conservation Plans

There are no CDFW-approved Natural Community Conservation Plans (NCCPs) that overlap with the RCIS area.

The draft Solano County Multispecies Habitat Conservation Plan (Solano Habitat Conservation Plan [HCP]) overlaps with a small portion of the RCIS area in Solano County, namely the city of Vallejo (SCWA 2012). The draft Solano HCP was developed following a permit for the Solano Project Water Service Contract Renewal between the United States Department of the Interior Bureau of Reclamation and the Solano County Water Agency. There are 36 species covered by the draft Solano HCP in addition to grassland, vernal pool, riparian, stream, freshwater, inner coast range, and coastal marsh habitats and agricultural lands (SCWA 2012).

The North Bay Baylands RCIS is compatible with the draft Solano HCP, because it includes conservation strategies to protect species covered by the plan and their habitats. The draft Solano HCP's Conservation Strategy, like the RCIS, is a mix of habitat-level strategies aimed to benefit multiple species and species-specific strategies. Habitat-level strategies, relevant to the species in this RCIS, are provided for riparian, stream, and freshwater marsh and coastal marsh. All the North Bay Baylands RCIS focal species are included as covered species in the draft HCP except for western bumble bee (*Bombus occidentalis*)and Crotch bumble bee (*B. crotchii*) (listing status changed since the writing of the HCP), and Marin western flax (*Hesperolinon congestum*) (not in the HCP coverage area). Species-specific strategies are included in the draft Solano HCP for California red-legged frog (*Rana draytonii*), burrowing owl (*Athene cunicularia*), coastal marsh (tidal habitats in this RCIS), and riparian, stream, and freshwater marsh (riparian corridors and freshwater marsh in this RCIS) as well as callippe silverspot butterfly (*Speyeria callippe callippe*), Swainson's hawk (*Buteo swainsoni*), and grassland (non-focal species and co-benefited natural resources).

The North Bay Baylands RCIS identifies specific threats to covered species and provides strategies to avoid impacts from loss of habitat, non-native species, and anthropogenic disturbance that are consistent with the draft Solano HCP. The RCIS also includes goals for enhancement and restoration of habitats to allow population expansion, and these goals are consistent with the goals in the draft Solano HCP. **Appendix G** provides a summary of the strategies within the draft Solano HCP and notes consistencies and inconsistencies between the draft HCP strategy and the RCIS.

PG&E holds an approved HCP for the nine-county Bay Area (PG&E HCP), including the RCIS area, for the operation and maintenance of their infrastructure. This HCP contains 32 covered species, including four RCIS focal species: California red-legged frog, California Ridgway's rail (*Rallus obsoletus obsoletus*), salt marsh harvest mouse (*Reithrodontomys raviventris halicoetes*), and Marin western flax (referred to as Marin dwarf flax). Additionally, the RCIS' non-focal species California freshwater shrimp (*Syncaris pacifica*) and callippe silverspot butterfly are covered in the PG&E HCP. Overall goals and objectives of the PG&E HCP conservation strategy involve habitat preservation, enhancement, and restoration, and are consistent with the goals and objectives in this RCIS. None of the advance mitigation lands identified in the PG&E HCP are within the RCIS area. More information on the PG&E HCP can be found in **Appendix G**.

Sonoma County recently received a grant from USFWS to develop an HCP/NCCP for Sonoma County, which could overlap with the RCIS area, but the HCP/NCCP is not yet developed or approved.

2.7.2 Baylands Ecosystem Habitat Goals Project Report (1999) and Update (2015)

A guiding goal of the Baylands Ecosystem Habitat Goals Project is to restore large areas of tidal marsh and to enhance seasonal wetlands in the North Bay Baylands (Goals Project 1999). In total, the goals for the North Bay subregion call for increasing the area of tidal marsh from the existing 16,000 acres to approximately 38,000 acres and creating about 17,000 acres of diked wetlands managed to optimize their seasonal wetland functions. This includes managing inactive salt ponds to maximize their habitat function and restoring some to tidal marsh. It noted that tributary streams (primarily along Napa River, Sonoma Creek, and Petaluma River) and riparian vegetation should be protected and enhanced, and shallow subtidal habitats should be preserved or restored.

The 2015 Update to the Baylands Ecosystem Habitat Goals Project report (Goals Project 2015) recommends restoring and managing tidal marsh along the North Bay shoreline to sustain high marsh as sea levels rise; reconnecting major tributaries to existing tidal wetlands; restoring riparian corridors and floodplains to connect the baylands to the lower watersheds; protecting wetlands in the lowlands adjacent to the baylands; working with willing landowners to conserve areas of low-intensity agriculture adjacent to tidal areas to create opportunities marsh retreat and transitionary habitat; and elevating SR 37 and modifying or realigning rail lines and other infrastructure to allow full passage of water, sediment, and wildlife. It acknowledges the urgency of restoration actions considering climate change and projected sea level rise.

This RCIS builds on the Baylands Ecosystem Habitat Goals Project report and the 2015 Update to the Baylands Ecosystem Habitat Goals Project report by describing strategies to benefit specific focal species and other conservation elements rather than focusing on large landscape units and habitats. The RCIS presents regional objectives and actions aimed at addressing key themes of the Goals Project reports, such as overall landscape protection, tidal marsh habitat restoration, and improvement to hydrology and water quality. The RCIS area is larger than the Baylands Goals boundary, and the RCIS expands the discussion further into the uplands (described further in the Conservation Lands Network 2.0 report, Appendix D; BAOSC 2019) to better describe landscape connectivity, hydrological processes, and habitat transitions, particularly in the context of sea level rise. Priorities and actions from the Goals Project reports are carried over into the RCIS. **Appendix G** provides a summary of other relevant plans.

2.7.3 Policies and Ordinances

The RCIS area covers four counties and six cities. Each of these entities maintain their own policies and ordinances. Examples of types of policies and ordinance at the county/city level include:

- Policies to conserve land, including streams and native habitat
- Policies on the types and process for new development, including residential development
- Policies to protect cultural resources

- Policies for climate adaptation and resilience
- Policies for improving equity and environmental justice
- Policies to reduce soil erosion and protect water quality

The North Bay Baylands RCIS is not a regulatory document. It does not create or modify regulatory requirements, regulate land use, establish land use designations, or affect or preempt the land use authority of a public agency to implement infrastructure and urban development in local general plans. The RCIS is in compliance with all applicable federal, state, and local requirements. A list of local land use policies relevant to this RCIS sourced from the Bay Area Greenprint (2022; **Appendix D**) are summarized in **Appendix H**.

2.7.4 Other Studies and Plans

Numerous studies and plans have been prepared for planning the future of the North Bay Baylands. These documents range from statewide or regionwide guidelines for conservation to local conservation strategies developed by land-owning agencies in the region. Most of the documents are voluntary guidance documents as opposed to regulatory documents.

The following recovery plans have been published for focal species covered habitats covered in this North Bay Baylands RCIS:

- Recovery Plan for the California Red-legged Frog (USFWS 2002)
- Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013)
- Recovery Plan of the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of the California Central Valley Steelhead (NMFS 2014)
- Final Coastal Multispecies Recovery Plan for California Coastal Chinook Salmon, Northern California Steelhead and Central California Coast Steelhead (NMFS 2016)
- Final Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (*Acipenser medirostris*) (NMFS 2018)

Other important conservation documents prepared by regulatory agencies that guide conservation in the region, include:

- Napa-Sonoma Marshes Wildlife Area Land Management Plan (CDFW 2011)
- San Pablo Bay National Wildlife Refuge Final Comprehensive Conservation Plan (USFWS 2011a)
- Natural Resource Management Plan for the San Francisco Bay National Wildlife Refuge Complex (USFWS 2019b)
- San Francisco Bay Plan (BCDC 2011)

A summary of these plans is provided in **Appendix G**. A consistency review is included for the recovery plans. **Appendix G** also lists and summarizes a variety of other voluntary plans that overlap with the RCIS area.

2.8 Pressures and Stressors

Section 1852(c)(5) of the California Fish and Game Code and the RCIS Program Guidelines (CDFW 2023a) require that an RCIS include a summary of historic, current, and projected future pressures and stressors in the RCIS area, including a climate change vulnerability assessment, using the best available science. RCIS Program Guidelines (CDFW 2023a) define *pressure* and *stressor* as the following:

> *Pressure* is an anthropogenic (human-induced) or natural driver that could result in changing the ecological conditions of a focal species or other conservation element. Pressures can be positive or negative depending on intensity, timing, and duration. Negative or positive, the influence of pressure on the target focal species or other conservation elements is likely to be significant.
>
> S*tressor* is a degraded ecological condition of a focal species or other conservation element that resulted directly or indirectly from a negative impact of a pressure, such as habitat fragmentation.

Natural communities and species habitat are primarily affected by pressures and stressors through one of three mechanisms: loss, fragmentation, and degradation. Species can experience direct mortality, health decline, stress, or lower fecundity (reproductive success) because of changed ecological conditions, such as increased noise or light levels. As species and habitats are lost and degraded, overall resilience and genetic diversity decline.

2.8.1 Primary Pressures in RCIS Area

The State Wildlife Action Plan for the CDFW-designated Bay Delta Conservation Unit, species-specific USFWS and NMFS recovery plans, and a range of RCIS area subregional assessments helped identify the most significant regional pressures and resulting stressors that are affecting focal and non-focal species and natural resources (**Table 2-9**). Climate change already is affecting plants, wildlife, and habitats throughout California and is the primary stressor assessed in this RCIS because of the severity of its projected future stressors. Climate change stressors are also likely to exacerbate other regional pressures in the area. Detailed discussion of pressures and stressors, including climate vulnerability assessments for focal and non-focal conservation elements, is provided in **Appendix C**. Each of the key regional pressures and resulting stressors are briefly described below and then noted throughout the conservation strategy (Chapter 4) where applicable by conservation element.

TABLE 2-9: REGIONAL PRESSURES AND STRESSORS IN THE REGIONAL CONSERVATION INVESTMENT STRATEGY AREA

Pressure	Stressor
Climate Change 	• Increases in day and night temperature extremes and average annual temperature. • Altered hydrology and flow through increases in drought frequency and severity, and more frequent extreme storms • Decrease in soil moisture. • Changes in surface water, groundwater table, and sea levels • Changes in the salinity and chemistry of groundwater, surface water, and soils • Increased frequency, intensity, and severity of fire regimes • Changes in spatial distribution, phenology, compositions, and habitats of natural communities and species

TABLE 2-9: REGIONAL PRESSURES AND STRESSORS IN THE REGIONAL CONSERVATION INVESTMENT STRATEGY AREA

Pressure	Stressor
Land Conversion and Development 	• Loss of areal extent of natural communities and species habitat • Fragmentation of natural communities and species habitat • Reduction in ecosystem function and complexity • Degradation of species habitat by noise and light pollution • Increases in urban-wildland conflict and recreational impacts. • Changes in groundwater table • Increases in invasive species, disease, and predators • Increases in barriers to migration/movement • Increases in constrictions that affect water circulation and flow • Increases in incompatible land uses • Conversion of habitat types (such as high marsh to low marsh) with changes in hydrology
Water Pollutants and Discharges 	• Changes in water quality from suspended sediment • Increases in chemical pollution, nutrients, and/or algae blooms • Changes in pH and/or dissolved oxygen concentrations • Increases in ecotoxicity for species and migration of pollutants through the food web (e.g., polychlorinated biphenyls)
Disrupted Natural Hydrology and Sediment Supply Pathways 	• Disconnection of tidal flows from marshes • Disconnection of freshwater flows from Bay and marshes • Increases in erosion • Changes to bathymetry • Changes to sediment supply
Invasive Species and Pathogens 	• Changes to natural community composition and food web dynamics • Displacement of native species • Predation on native species by introduced species • Increases in competition for land and resources • Increases in disease susceptibility

TABLE 2-9: REGIONAL PRESSURES AND STRESSORS IN THE REGIONAL CONSERVATION INVESTMENT STRATEGY AREA

Pressure	Stressor
Livestock, Farming, and Ranching 	• Degradation of water quality, habitats, and species populations through application of herbicides, fungicides, pesticides, and fertilizers • Increases in water turbidity as a result of exposed soils and increased erosion • Reduced surface and groundwater resources due to increased water consumption • Fragmentation of natural communities and species habitats • Loss of areal extent of natural communities and species habitat

2.8.1.1 Land Conversion and Development

The main underlying cause of habitat loss, degradation, and fragmentation throughout the San Francisco Estuary is development due to the increasing human population and its high demand for a limited supply of land, water, and other natural resources (CDFW 2015, USGS 2017). Many historic tidal lands in the RCIS area have been converted to developed areas, uplands, and managed ponds (see the Historical Ecology section above) through human action. As described in the State Wildlife Action Plan, "Wildlife species have different tolerances for each of these conversions, with many of them unable to adapt to the more-developed land uses. Beyond direct habitat loss, converting land to more intensive human-related uses bring additional stressors, including invasive species, human disturbance, fire suppression, and insect control, that further degrade ecosystem health and wildlife viability. Growth and development fragment habitats into small patches, which cannot support as many species as larger patches. Growth and development, along with associated linear structures like roads, canals, and power lines, impede or prevent movement of a variety of animals" (CDFW 2015). Loss of habitat associated with land conversion can also cause native species to be displaced into new areas where they can predate on and compete with other native species, altering natural food web dynamics.

2.8.1.2 Water Pollutants and Discharges

Many of the species in the North Bay Baylands have evolved to live in this water-dependent ecosystem and require specific water quality conditions. Water quality is impacted by the concentration of dissolved oxygen, chemicals, suspended particles, metals, nutrients, and pH. Pollution, including chemical, stormwater, and nutrient runoff, from wastewater treatment plans, oil refineries, and agriculture continue to have marked influences on the biological resources of the San Francisco Bay Estuary (USGS 2017). Increased runoff following wildfire can also alter water quality. Poor water quality can lead to direct mortality, reduce reproductive success, and increase algae blooms and disease.

2.8.1.3 Disrupted Hydrology and Sediment Supply Pathways

As noted, streams and rivers in the RCIS play a key role in providing habitat, providing connectivity corridors, and delivering sediments to the baylands. Per the San Francisco Bay Conservation and Development Commission (BCDC), "Suspended sediment supply to the Bay has significantly declined in the past several decades. This decreased sediment supply results from several changes, including the waning pulse of sediment from the hydraulic mining during the Gold Rush, flood protection efforts that have disconnected the tributaries from the Bay and its marshes, development and impervious surfaces, better management of local runoff and land surface erosion, and the damming of many of the Bay's watersheds, which captures sediment moving downstream and prevents it from entering the Bay" (BCDC 2019). This recent reduction in supply limits the ecosystem's ability to adapt to sea level rise as there is less sediment to deposit and build elevation (BCDC 2019).

Recent sediment supply analyses for the Suisun Bay–San Pablo Bay subregion indicate that the subregion could lack the sediment supply needed to maintain elevation of existing and planned restored baylands. However, both the Petaluma River unit and Napa-Sonoma units indicate that sediment supply and demand may be relatively balanced for these watersheds (Dusterhoff et al. 2021). Ultimately, the ability to remain resilient is dependent, in part, on the future climate scenario.

In addition to sediment supply, altered hydrology has greatly changed this region. An extensive levee system, limited and undersized culverts, and land subsidence have all altered natural hydrology pathways and restricted flows, as well as altering habitat connectivity by creating barriers to movement. These changes affect how sediment, nutrients, salinity, and chemicals are transported throughout the ecosystem and can influence water quality parameters and in turn affect all the species that are interdependent on the baylands and its food webs.

2.8.1.4 Invasive Species and Pathogens

Invasive plant and animal species[6] are a substantial pressure on wildlife in the Bay Delta (CDFW 2015). Invasive plants and animals may prey on native species or directly compete with native species for habitat or resources. In the North Bay Baylands, key invasive plant species include perennial pepperweed (*Lepidium latifolium*), Pacific bentgrass (*Agrostis avenacea*), yellow starthistle (*Centaurea solstitialis*), fennel *(Foeniculum vulgare*), mustard (*Brassica* spp.), and stinkwort *(Dittrichia graveolens)* (Goals Update 2015, SLT 2020). Invasive *Spartina* species (*Spartina* spp.) also have the potential to displace native *Spartina* species, degrade habitat for endangered species, colonize mudflats used by shorebirds, create mosquito breeding areas, and reduce flood control capacity (Olofson 2021). Invasive *Spartina* species are being actively managed and controlled through the Invasive *Spartina* Project and are not as widespread in the North Bay Baylands as other areas of the San Francisco Bay. Non-native animal species affecting the North Bay Baylands include Asian mudsnail, striped bass and other nonnative predatory fish, bullfrogs, turtles, and mammalian predators such as feral cats (NERR 2018; Goals Update 2015). Pathogens and disease may also impact species, which can be exacerbated by climate change, such as rising temperatures, or poor water quality (Goals Project 2015).

2.8.1.5 Livestock, Farming, and Ranching

Approximately 40,000 acres of the RCIS area are planted with vineyards and other irrigated row crops, as well as substantial areas used for ranching. Applications of fertilizers, herbicides, fungicides, and pesticides impact water quality in the area. Exposed soils and irrigation practices make these areas more susceptible to erosion (CDFW 2015), which can degrade water quality. Agricultural water consumption pressures aquatic and riparian habitats and draws from the area's groundwater and surface water resources. The growth of agriculture, particularly in valley-bottom floodplains like the Petaluma River and Napa River, has resulted in loss of habitat (CDFW 2015). Sea level rise are likely to impact these areas. Although agriculture can have adverse effects on ecosystems, some types of practices provide important habitat for many wildlife species.

---

6 Note, native predator species can also negatively impact other native species in the baylands. Since natural food web dynamics can be altered through development and habitat loss, this stressor is discussed under the Land Conversion and Development Pressure.

2.8.2 Climate Change

Climate change encompasses a variety of changes in weather patterns, including changes in temperature, precipitation amounts and frequency, and the frequency of extreme-weather events. Climate change already is affecting plants, wildlife, and habitats throughout California, and its projected effects may continue to increase in severity (CDFW 2015). **Appendix C** provides the projections of climate change in the RCIS area, vulnerability assessments of focal/non-focal species and other conservation elements, and ecological resilience. Each species' description in Chapter 4 also details its climate change vulnerability.

Climate vulnerability is defined as the amount of evidence that climate change is projected to negatively affect a species, asset, or system (Gardali et al. 2012). Evaluations of climate vulnerability are often measured by exposure, sensitivity, and adaptive capacity:

- Exposure – the nature and degree to which a species is exposed to climate change stressors.
- Sensitivity – the degree to which the physical condition and functionality of a species is affected by climate change.
- Adaptive Capacity – the ability of a species to evolve in response to, or cope with, the impacts of climate change.

Exposure is often the primary variable measured to determine species' susceptibility to climate change stressors. Evaluating sensitivity and adaptive capacity can provide additional information regarding the degree to which a species would be affected by climate change stressors as well as help identify the inherent characteristics that allow a species to respond to these stressors. The most vulnerable species are exposed to climate change stressors and have high sensitivity and low adaptive capacity.

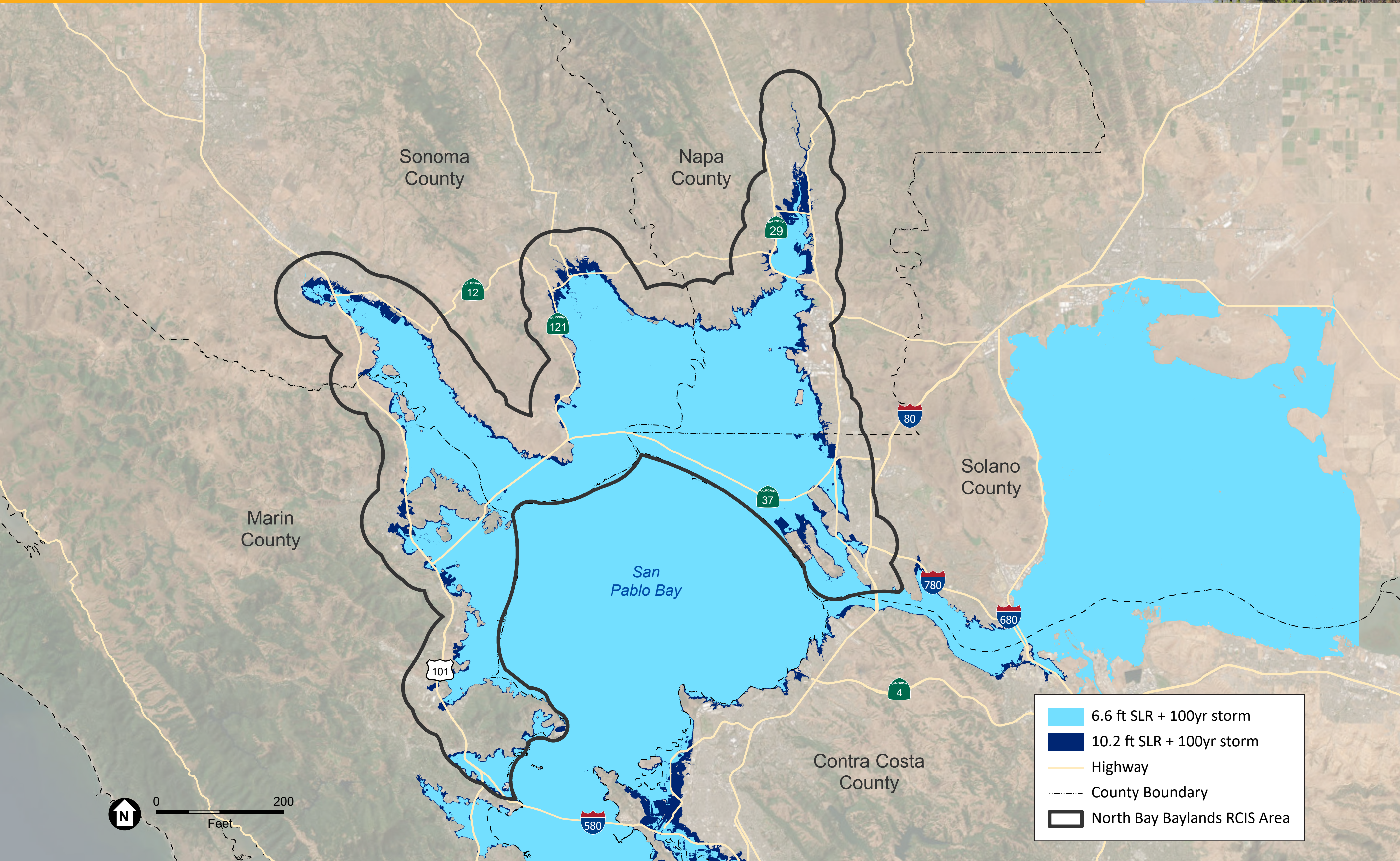
To simulate the response of increasing greenhouse gas concentrations, numerical models (global circulation models) representing physical processes in the atmosphere, ocean, cryosphere, and land surface are currently the most advanced tool available (IPCC 2022). The most recent Intergovernmental Panel on Climate Change (IPCC) report, the Sixth Assessment Report (AR6), updated its scenarios by adding social-socioeconomic pathways (SSPs) to the previously established representative concentration pathways (RCPs) to reflect the impacts of the range of human actions on future climate conditions (IPCC 2022). As the AR6 revised these scenarios (SSP-RCP)—in 2022—most climate adaptation planning guidance and published climate vulnerability assessments still use scenarios (RCPs) from the Fifth Assessment Report (AR5).

Scenarios RCP4.5 and RCP8.5 from AR5 are the primary scenarios used in climate adaptation planning. RCP8.5 is a business-as-usual scenario and represents escalating economic growth, while RCP4.5 assumes a more moderate emissions scenario with greenhouse gas emissions rising until 2040, followed by a stabilization in emissions. The moderate emissions scenario from AR6 is SSP2-RCP4.5, which updates the same RCP model as AR5. SSP2 refers to a central pathway where historical trends continue without substantial deviation (O'Neill et al. 2016). The high-emissions scenario is SSP3-RCP7.0 or SSP5-8.5. SSP3 refers to countries prioritizing regional security and SSP5 assumes energy intensive, fossil-fuel–based economies, both of which could lead to societies that are highly vulnerable to climate change (O'Neill et al. 2016).

One outcome of rising emissions is rising sea levels, which is particularly relevant in the North Bay Baylands area, where much of the land is tidally influenced or at low-lying elevations. Sea-level rise projections for the state of California indicate that valuable habitats, including tidal marshes, mudflats, and upland transition zones will experience more frequent inundation and rising average water levels (Goals Project 2015; BCDC 2019), potentially converting high marsh to low marsh and low marsh to mudflat, depending on site conditions. Sea level rise can also shift salinity gradients upstream and contribute to rising groundwater levels (Goals Project 1999, 2015). **Figure 2-13** shows 6.6 feet and 10.2 feet of sea level rise plus 100-year storm. The 6.6 feet scenario represents the National Oceanic and Atmospheric Administration high scenario for 2100 or the Ocean Protection Council medium-high scenario for 2100. The 10.2 feet scenario aligns with the H++ scenario from the Ocean Protection Council used in the Bay Conservation and Development Commission's Adapting to Rising Tides model (BCDC 2019).

In addition to sea level rise, scenarios of changing precipitation patterns (including increased risk of drought) coupled with increased temperatures may alter river flows in ways that affect migration patterns for fish and increase salinity in brackish systems. Elevated temperatures can stress many organisms, but particularly intertidal organisms (NERR 2018). Conversely, scenarios of more frequent and intense storms could result in stressful low-salinity conditions, increase episodic erosion and sedimentation, and flood habitats. Increased frequency and severity of droughts and temperature extremes may make terrestrial habitats no longer suitable for the plants and animals that use them, which could lead to population collapses and increased risk of extinction for some species.

RCIS area temperatures are expected to experience significant increases by the end of the century, coupled with increased variability in precipitation patterns (e.g., wet years will become wetter and dry years will become drier, with a dry year likely to be followed by more dry years, increasing the risk of drought) (Ackerly et al. 2018). Fog and sea breezes will affect warming in the RCIS area, but localized components of the Bay Area climate are not well understood at this time (Ackerly et al. 2018).



SOURCE: ESA, 2023; USGS CoSMoS, released 2014

Figure 2-13
Sea Level Rise Projections

CHAPTER 3

Conservation Elements Selection and Overview

3. Conservation Elements Selection and Overview

3.1 Selection Methodology

Focal species and other conservation elements for the North Bay Baylands RCIS include plant and wildlife species, as well as sensitive and unique habitats and ecological processes, that are identified as having high priority for conservation, enhancement, and restoration. These conservation elements were selected through a holistic consideration of the RCIS area's ecosystem and current/planned urban/infrastructure development, and collectively aim to represent the biodiversity and ecological functions provided by the North Bay Baylands. Implementation of the conservation strategies identified in Chapter 4 for these conservation elements is intended to benefit other species and communities beyond the conservation elements.

Selection of focal species and other conservation elements relied on the following primary key considerations:

(1) **Have high levels of protection.** Federally listed or state-listed wildlife and plant species; plants given a California Rare Plant Ranking; or natural communities that are rated rare by the State of California.

(2) **Have a high conservation value.** Wildlife and/or plant species that are tied to specific natural communities (e.g., Ridgway's rail in tidal marsh; Crotch's bumble bee in grasslands) and can act as umbrella or keystone species for conservation of a high number of other special-status or non-special-status species. These also include sensitive natural communities, such as tidal habitats, and ecological processes, such as hydrological processes, that benefit multiple species and increase climate change resiliency.

(3) **Have "high significance" to the RCIS area.** Species or communities that are endemic or nearly endemic to the RCIS area and/or have a high percentage of their global population in the North Bay Baylands (e.g., salt marsh harvest mouse northern subspecies [*Reithrodontomys raviventris halicoetes*]). These also include species and/or communities that are widespread but have populations in the Baylands that are regionally unique or critically important for the species or community to persist in the region over time.

The following sources were used to create an initial list of species for consideration as focal species in present in the RCIS area:

- Plants and wildlife species that are listed under the federal Endangered Species Act, are proposed for listing, or are a candidate for listing as endangered or threatened (USFWS 2023; NMFS 2023).
- Plants and wildlife species that are listed under the California Endangered Species Act as endangered or threatened, or are candidates for listing.
- CDFW Animal Species of Special Concern and Fully Protected Animals.
- Additional species identified by the California Natural Diversity Database (CNDDB) (CDFW 2022a) and California Native Plant Society (CNPS) Inventory of Rare Plants (CNPS 2022).
- Species of Greatest Conservation Needs lists in the current version of the State Wildlife Action Plan (CDFW 2015).
- CDFW Climate Change Vulnerability lists (CDFW 2022b).

After these sources were reviewed, a list of 122 potential candidate species was populated (Appendix I provides the full species evaluation matrix). Species were divided into their respective taxonomic classes to ensure representation by a species in each class. Species with insufficient data in the study area (fewer than five CNDDB records) were removed, unless their federal or state status was endangered or threatened, or if there was a dearth of representative candidates in a class. Species with insufficient existing protections were also removed from consideration. Species endemic or unique to the study area were prioritized for inclusion in the final list. Priority was given to species with higher protection status and a higher presence in the study area, and the original list of 122 candidates was reduced to 40.

Prioritizing the highest levels of special-status protection (e.g., endangered, threatened, rare), while ensuring that each taxon was represented, reduced the list to 19 representatives. Biologists incorporated additional landscape-level conservation elements that were not initially represented (important vegetation communities and connectivity) because of their important contributions to the regional landscape. Some species were changed to non-focal species when they shared habitat or would benefit from the conservation strategy developed for other elements on the draft list. This draft list, which contained 11 focal species, 11 non-focal species, and four other conservation elements, was presented to the North Bay Baylands Technical Working Group for input and revision. **Figure 3-1** graphically depicts the selection process.

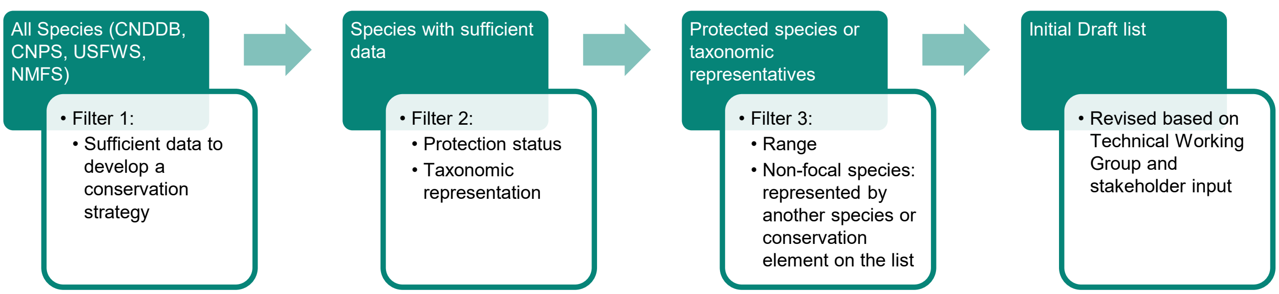


Figure 3-1
Focal Species Selection Process

The draft list of conservation elements was discussed during stakeholder meetings on April 26, 2022, and September 8, 2022, and during associated working sessions of the RCIS project's Technical Working Group. Based on this feedback, burrowing owl was added as a focal species because of active restoration efforts in the RCIS area to restore habitat at Sears Point. Soft bird's-beak was converted to a non-focal species because of its habitat associated with the Tidal Marsh conservation element. Riparian corridors and hydrological processes were added because of their high conservation value and vernal pools were removed because of their limited occurrences in the region. Tricolored blackbird and callippe silverspot butterfly were also added as non-focal species, and several natural communities were added as co-benefited natural resources.

Three conservation elements that are not considered special status by federal or state listing were selected for inclusion in the conservation strategy: working lands; habitat connectivity; and hydrological processes. These conservation elements were selected for the following reasons:

- *Working lands* are an important land use and land cover type in the RCIS area and are not well represented by a listed species.
- *Habitat connectivity* was included as another conservation element that connects habitats within the RCIS area and allows for genetic flow, migration, and climate change resilience.

- *Waterfowl and shorebird habitat* was included as the RCIS area is an important wintering stopover point for many migrating birds, thus connecting the RCIS area to the global ecosystem.
- *Hydrological processes* are an important ecosystem function that have a critical impact on habitats in the RCIS area. These processes shape the natural communities upon which many of the focal species rely. Enhancement and conservation of hydrological processes may provide resiliency for tidal and freshwater habitats threatened by changing climate conditions and sea level rise.

3.2 Focal Species and Other Conservation Elements

Table 3-1 shows the selected focal species and other conservation elements and provides rationale for inclusion in the RCIS based on process described above.

TABLE 3-1: FOCAL SPECIES AND OTHER CONSERVATION ELEMENTS AND JUSTIFICATION FOR SELECTION

Common Name	Scientific Name	Special-Status	RCIS Natural Community (modified from CWHR types)	Additional Justification for Inclusion (beyond Special-Status)
Crotch's bumble bee	*Bombus crotchii*	• State Candidate Endangered	• Annual Grassland • Perennial Grassland • Coastal Scrub • Mixed Chaparral	Umbrella species for grasslands. SWAP species. Taxonomic representative.
Green sturgeon–southern DPS[1]	*Acipenser medirostris*	• Federally Threatened	• Estuarine • Marine • Tidal Channel	Unique estuarine and riverine lifestyle. SWAP species.
Steelhead–central California coast DPS	*Oncorhynchus mykiss irideus*	• Federally Threatened	• Estuarine • Marine • Riverine • Tidal Channel • Valley Foothill Riparian	Steeply declining populations. Climate vulnerable. SWAP species. Umbrella species.
Chinook salmon–Central Valley fall/late fall-run ESU*	*Oncorhynchus tshawytscha* (population 13)	• Species of Special Concern	• Estuarine • Marine • Tidal Channel • Riverine	The RCIS area acts as a migration route and important juvenile rearing habitat.
Chinook salmon–Central Valley spring-run ESU*	*Oncorhynchus tshawytscha* (population 11)	• Federally Threatened • State Threatened	• Estuarine • Marine • Tidal Channel • Riverine	The RCIS area acts as a migration route and important juvenile rearing habitat.
Chinook salmon–Sacramento River winter-run ESU*	*Oncorhynchus tshawytscha* (population 7)	• Federally Endangered • State Endangered	• Estuarine • Marine • Tidal Channel • Riverine	The RCIS area acts as a migration route and important juvenile rearing habitat.
California red-legged frog	*Rana draytonii*	• Federally Threatened • Species of Special Concern	• Annual Grassland • Perennial Grassland • Coastal Scrub • Mixed Chaparral • Coastal Oak Woodland • Valley Oak Woodland • Freshwater Marsh • Montane Riparian • Valley Foothill Riparian • Wet Meadow	Umbrella species for freshwater wetland communities. Commonly encountered special-status species. Need to connect critical habitat near the RCIS area. Taxonomic representative.

TABLE 3-1: FOCAL SPECIES AND OTHER CONSERVATION ELEMENTS AND JUSTIFICATION FOR SELECTION

Common Name	Scientific Name	Special-Status	RCIS Natural Community (modified from CWHR types)	Additional Justification for Inclusion (beyond Special-Status)
Western pond turtle	*Emys marmorata*	• Federal Proposed Threatened • Species of Special Concern	• Freshwater Marsh • Montane Riparian • Valley Foothill Riparian • Annual Grassland • Perennial Grassland	Umbrella species for riparian and pond communities. SWAP species. Taxonomic representative.
Burrowing owl	*Athene cunicularia*	• Species of Special Concern	• Agriculture • Annual Grasslands • Perennial Grasslands • Coastal Scrub	Steeply declining. SWAP species. Routinely seen in the RCIS area during breeding season and active recovery efforts are underway.
California black rail	*Laterallus jamaicensis coturniculus*	• State Threatened • Fully Protected	• Freshwater Marsh • Tidal Channel • Tidal Marsh • Managed Ponds	SWAP species. Climate change vulnerability list.
California Ridgway's rail	*Rallus obsoletus obsoletus*	• Federally Endangered • State Endangered • Fully Protected	• Tidal Channels • Tidal Marsh	Nearly endemic to the RCIS area. Umbrella or keystone species. SWAP species. Climate change vulnerability list.
Salt marsh harvest mouse	*Reithrodontomys raviventris halicoetes*	• Federally Endangered • State Endangered • Fully Protected	• Tidal Channel • Tidal Marsh • Managed Ponds	Nearly endemic to the RCIS area. Umbrella or keystone species. SWAP species.
Marin western flax	*Hesperolinon congestum*	• Federally Threatened • State Threatened • California Native Plant Rank 1B.1	• Annual Grassland • Mixed Chaparral	Serpentine-restricted species. SWAP species.
Habitat connectivity	None	None	All	Important conservation element connecting habitats.
Bat habitat	None	None	All terrestrial communities	Includes two bat species listed as Species of Special Concern. These are keystone species.

TABLE 3-1: FOCAL SPECIES AND OTHER CONSERVATION ELEMENTS AND JUSTIFICATION FOR SELECTION

Common Name	Scientific Name	Special-Status	RCIS Natural Community (modified from CWHR types)	Additional Justification for Inclusion (beyond Special-Status)
Riparian corridors	None	• Sections 401, 402, and 404 of the Clean Water Act • Sections 1600-1607 of the California Fish and Game Code.	• Montane Riparian • Valley Foothill Riparian • Riverine	Includes three vegetation alliances with State Ranking S3 (Vulnerable) and one sensitive association.
Freshwater wetlands	None	• Sections 401, 402, and 404 of the Clean Water Act • Sections 1600-1607 of the California Fish and Game Code.	• Freshwater Marsh	Unique and sensitive land cover type. Supports numerous special-status species. Protected under Sections 1600-1607 of the California Fish and Game Code.
Tidal wetlands	None	• Sections 401, 402, and 404 of the Clean Water Act • Sections 1600-1607 of the California Fish and Game Code	• Tidal Flat • Tidal Channel • Tidal Marsh	Includes three vegetation alliances with State Ranking S3 (Vulnerable) and one sensitive association.
Shallow subtidal habitat	None	• Sections 401, 402, and 404 of the Clean Water Act	• Estuarine • Shallow Subtidal Embayment	Important for primary production and food web health. Supports numerous special-status species.
Working lands	None	• None	• Agriculture • Coastal Oak Woodland • Valley Oak Woodland • Annual Grasslands • Perennial Grasslands	Important land use regionally with potential to support habitat for focal and non-focal species in the RCIS area. Goals apply in uplands outside of historic baylands areas.
Hydrological processes	None	• None	All aquatic communities	High-impact ecological function influencing many RCIS area ecosystems.

TABLE 3-1: FOCAL SPECIES AND OTHER CONSERVATION ELEMENTS AND JUSTIFICATION FOR SELECTION

Common Name	Scientific Name	Special-Status	RCIS Natural Community (modified from CWHR types)	Additional Justification for Inclusion (beyond Special-Status)
Waterfowl and shorebird habitat	None	• None	• Freshwater Marsh • Managed Ponds • Other Marsh • Wastewater Pond • Tidal Channel • Tidal Marsh • Shallow Subtidal Embayment • Estuarine • Marine	Important land use regionally with potential to support habitat for focal and non-focal species in the RCIS area.

Notes:

CWHR = California Wildlife Habitat Relationship; DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; RCIS = Regional Conservation Investment Strategy; SWAP = State Wildlife Action Plan

1. It is acknowledged that the American Fisheries Society recommends capitalizing fish species common names; however, this recommendation is not implemented in this document for consistency with other taxa.

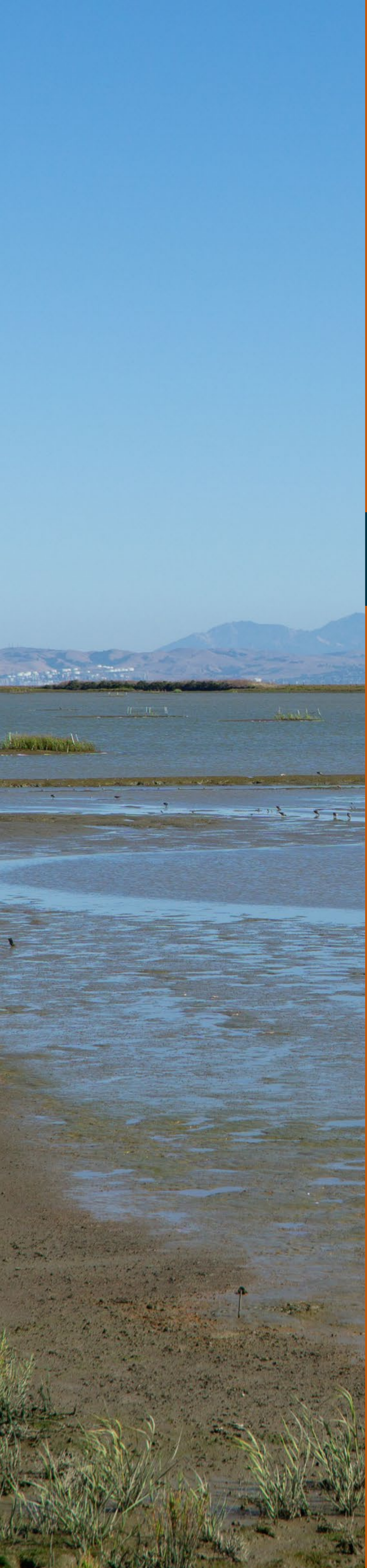
2. Although three Chinook salmon ESUs are included in this table, they are treated as one focal species for the purposes of the conservation strategy.

3.3 Non-Focal Species

Non-focal species are species that are associated with a focal species or other conservation element in an RCIS because of shared ecological needs and requirements and could benefit from the implementation of actions for the associated focal species or other conservation element. Designation as a focal or non-focal species does not indicate conservation priority; rather it is a way to streamline the document structure by reducing redundancy and focusing on those actions that have regional applicability. Because non-focal species benefit from the conservation strategies developed for the focal species and other conservation elements, they do not have their own unique goals, objectives, actions, and priorities. Non-focal species may be referred to as “associated species” (CDFW 2023a). Appendix J presents a summary of each non-focal species, their ecological needs, justifications for inclusion and association with a focal conservation element, and a crosswalk to beneficial actions in the conservation strategy. Non-focal species are eligible for creation of MCA credits through implementation of actions with associated focal species or other conservation elements.

3.4 Co-Benefited Natural Resources

Co-benefited natural resources are important habitats associated with focal species or other conservation elements and could benefit from the implementation of actions for the associated focal species or other conservation element. Co-benefited natural resources do not have their own goals, objectives, actions, and priorities and are not eligible for MCA credits. Appendix J presents a summary of each co-benefited natural resource and their ecological needs, justifications for inclusion and association with a focal conservation element, and a crosswalk to beneficial actions in the conservation strategy.



CHAPTER 4

Conservation Strategy

4. Conservation Strategy

The North Bay Baylands RCIS Conservation Strategy (Strategy) aims to further comprehension, protection, restoration, enhancement, and management of natural communities and species populations. The Strategy's goals, objectives, actions, and priorities consider historical and existing conditions, current pressures and stressors, and potential future conditions resulting from restoration, changed land uses, climate change, or other factors. Strategies are developed both at the regional level and for each focal species and other conservation elements.

4.1 How to Use This Chapter

Conservation strategies for conservation elements can be used as "stand-alone" sections that give the reader all the information needed to identify, plan, and implement habitat enhancement and conservation actions. Each strategy includes focal conservation element information, such as the following:

- Regulatory status
- Summary of ecological requirements and threats, including associated natural communities in the RCIS area, habitat components, and specific threats
- Associated non-focal species
- Summary of results of climate change vulnerability assessment
- Map of species range, modeled suitable habitat in the RCIS area, California Natural Diversity Database occurrences, and federally designated critical habitat
- Quantitative protection targets
- Goals, objectives, actions, and priorities

Background information, including the RCIS area boundary and summaries of the natural communities and aquatic resources, protected areas, biodiversity, habitat connectivity and linkages, and the planned and built environments within the RCIS area, are provided in Chapter 2. A summary of the focal and non-focal conservation element selection methodology is provided in Chapter 3. Descriptions of regional and species-specific threats and a climate change vulnerability assessment are provided in Appendix C. Non-focal species and co-benefited natural resources ecological requirements and associated focal conservation element actions are provided in Appendix J.

4.2 Development of Conservation Strategies

4.2.1 Guiding Principles and Plans

The North Bay Baylands RCIS is a vision of future conservation within the North Bay Baylands in which widespread habitat enhancement and conservation actions sustain and enhance functioning, complete ecosystems, biodiversity, and ecological processes and functions as well as promote climate change resilience of habitats, watersheds, and species populations. This vision is built on the Baylands Habitat Goals Report (Goals Project 1999) and 2015 Science Update (Goals Project 2015), which guides restoration of baylands habitats in the San Francisco Bay. The Conservation Lands Network 2.0 extends this vision into the surrounding upland habitats (BAOSC 2019). Other existing efforts that were reviewed and integrated into the RCIS Conservation Strategy include:

Federal

- Natural Resources Management Plan for the San Francisco Bay National Wildlife Refuge Complex (USFWS 2019b)
- Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013)
- San Pablo Bay National Wildlife Refuge Climate Action Plan (USFWS 2016)
- San Pablo Bay National Wildlife Refuge Final Comprehensive Conservation Plan (USFWS 2011a)

State

- California State Wildlife Action Plan (CDFW 2015)

Regional

- Novato Creek Baylands Vision (SFEI-ARC 2015)
- Petaluma River Baylands Strategy (SLT 2023)
- Petaluma Watershed Enhancement Plan (Draft) (SRCD 2015)
- San Francisco Bay Joint Venture Implementation Strategy (SFBJV 2022)
- Sonoma Creek Baylands Strategy (SLT 2020)

A summary of these and other guiding plans is provided in Appendix G.

4.2.2 Strategy Elements

The North Bay Baylands RCIS conservation strategies include goals, objectives, and habitat enhancement and conservation actions that address the pressures and stressors, including climate change, identified in Chapter 2.

Priorities include actions and/or key locations for actions based on focal conservation element goals, objectives, and threats. Specific priority locations are identified based on known existing occurrences, suitable habitat, and include locations for federally listed species from U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries (NMFS) recovery plans and 5-year reviews.

Goals represent broad, landscape-level desired outcomes. These outcomes include the continued persistence and reliance of species through protection, enhancement, restoration, and creation of habitat, and/or a reduction in causes of direct, anthropogenically caused mortality.

Objectives are measurable outcomes that, if achieved, would contribute to meeting the goals. Progress toward achieving these objectives should be measured over a 10-year approval period of the RCIS (CDFW 2023a). Qualitative protection targets are measured by acres protected. Habitat enhancement and restoration objectives are measured by the area enhanced or restored and/or occupied by focal species or other conservation elements. Mortality objectives are measured by a reduction in threat-related mortalities detected. It is recommended that 50 percent of these project target objectives be accomplished within 10 years from the approval of the RCIS.

Actions are specific activities that can be implemented to achieve the objectives. The RCIS program guidelines identify two main types of actions which are subject to different methods of crediting as part of mitigation credit agreements (CDFW 2023a):

1. *Conservation actions*: actions that would preserve or restore ecological resources, including habitat, natural communities, ecological processes, and wildlife corridors, to protect those resources permanently, and to provide for their perpetual management, to help to achieve one or more biological goals and objectives for one or more focal species. Conservation actions may include, but are not limited to, actions to offset impacts to focal species. In this RCIS, habitat protection constitutes a conservation action.

2. *Habitat enhancement actions*: actions that would improve the quality of habitat, or to address risks or stressors to wildlife, that has long-term durability but does not involve land acquisition or the permanent protection of habitat, such as improving in-stream flows to benefit fish species, enhancing habitat connectivity, or invasive species control or eradication In this RCIS, restoration and enhancement of habitat as well as enhanced management of pressures and stressors are all types of habitat enhancement actions.

Both conservation and habitat enhancement actions may be used as wildlife connectivity actions, which are defined in California Fish and Game Code 1957 as “an action that measurably improves aquatic or terrestrial habitat connectivity, or wildlife migration, recolonization, and breeding opportunities inhibited by built infrastructure or habitat fragmentation. A wildlife connectivity action may include, but is not limited to, a road overpass or underpass solely for use by wildlife.” This RCIS includes various habitat connectivity actions that may be used as wildlife connectivity actions per SB 790.

Actions address *pressures*, which are landscape-level drivers, as well as other species-specific *threats* that could result in changed ecological conditions and threaten focal species or other conservation elements. Actions are developed to promote a functioning and complete ecosystem in the North Bay Baylands and increase resilience of species and other conservation elements to identified threats. They are informed by biology, ecological requirements as identified by CDFW, NMFS, USFWS, or from information found through other relevant conservation plans. Actions are included for species that have federal (USFWS or NMFS) recovery plans or 5-year reviews, and when non-federally listed species had threats identical to those of federally listed species with a USFWS or NMFS recovery plan, similar actions were recommended to address the threats.

4.2.3 Quantitative Protection Targets

Quantitative protection targets provided in this conservation strategy were based on a conservation gap analysis for the RCIS area. Currently, 30 percent of the RCIS is already protected (California Protected Areas Database), meeting California’s target of 30 percent protection by 2030. To provide value beyond current conservation, 50 percent protection was selected as the conservation target for most vegetation communities within the RCIS area. This amount was selected to be consistent with the minimum conservation target from the Conservation Lands Network (BAOSC 2019). Four vegetation communities had 50 percent or greater protection already: coastal scrub, perennial grassland, redwood, and tidal marsh. The target for these habitats was increased to 75 percent or 90 percent. Percentage targets by habitat type are listed in **Table 4-1**. For each focal species and other conservation element, the target acreages provided in the strategies are comprised of the vegetation communities that provide potential habitat. Potential habitat is based solely on the mapped vegetation community and is not restricted based on documented species occurrence locations, species range, barriers to movement, habitat quality, or other factors that may limit habitat suitability. Habitat suitability should be confirmed through on-site evaluation.

TABLE 4-1: CONSERVATION GAP AND QUANTITATIVE TARGETS BY VEGETATION COMMUNITY

RCIS Vegetation Communities	Total Acres	% Protected	Target %	Target Acreage
Blue Oak-Foothill Pine	352.0	4%	50%	176
Blue Oak Woodland	905.7	30%	50%	452.9
Chamise-Redshank Chaparral	65.7	34%	50%	32.9
Coastal Oak Woodland	7,162.2	40%	50%	3,581.1
Coastal Scrub	563.1	40%	50%	275.1
Douglas Fir	1.3	77%	90%	0.2
Freshwater Marsh	593.9	57%	90%	539.7
Grassland (Annual and Perennial)	22,045.4	12%	50%	11,022.6
Lacustrine	647.7	14%	50%	323.8
Mixed Chaparral	18.5	57%	90%	14.9
Montane Hardwood	1,116.8	52%	90%	287.8
Montane Riparian	125.8	5%	50%	287.8
Other Marsh	14,095.7	68%	90%	12,668.1
Redwood	53.0	80%	90%	47.7
Riverine	1.2	2%	50%	0.6
Salt Pond	46.1	29%	50%	23.1
Shallow Subtidal Embayment	723.8	29%	50%	361.9
Tidal Channel	4,421.4	7%	50%	2,210.7
Tidal Flat	2,079.7	43%	50%	1,039.8
Tidal Marsh	26,206.8	78%	90%	23,580.8
Valley Foothill Riparian	390.0	9%	50%	206.5
Valley Oak Woodland	1,929.2	16%	50%	728.6
Water	227.6	3%	50%	113.8
Wet Meadow	15.8	70%	90%	14.3

4.2.4 Prioritization Guidelines

Actions that affect natural landscapes impact a variety of ecosystem services which are inextricably linked to the human landscape. Likewise, human activities have direct and indirect effects on natural communities and species. For these reasons, projects that are implemented within the RCIS area, should not only consider the RCIS goals and objectives, which have been developed for conservation purposes, but should also consider benefits and impacts shared across communities and stakeholders and how foreseeable infrastructure developments may change the land use where focal species and other conservation elements currently occur. Projects should incorporate multi-benefit objectives, such as supporting flood risk reduction, climate change adaptation, recreation, and habitat value, whenever possible, and equitably balance the needs of diverse user groups. Locations that should be prioritized for conservation and habitat enhancement actions should be guided by plans summarized in Appendix G, and include:

- Areas with existing intact resources, occurrences, or suitable habitat
- Areas specifically recommended by a federal (USFWS or NMFS) species-specific recovery plan or 5-year review and/or by habitat conservation plans
- Areas identified by ACE as having a high terrestrial or aquatic biodiversity ranking and/or high terrestrial climate change resilience (CDFW 2018a, 2018b, 2018c)
- Areas identified as potential habitat corridors and linkages
- Existing protected and open space areas and areas adjacent to these locations
- Tidal, riparian, and other aquatic habitats
- Areas that benefit multiple focal and non-focal species and other conservation elements
- Areas that are currently unprotected and warrant conservation
- Areas where the resulting habitat type/function is expected to be compatible with anticipated future sea level rise, climate, or other landscape-level changes
- Facilitation of tribal access, use, and co-management of State-owned or controlled natural lands and to work cooperatively with California tribes that are interested in acquiring natural lands more than State needs.

Proposed actions that could benefit upland species and habitats should occur outside of the historic baylands because the historic baylands areas have potential to be restored to tidal habitats and/or could be lost to sea level rise.

4.2.5 Data

Publicly available data sources were used to develop maps of habitat, range, and known occurrences in the RCIS area for focal species and other conservation elements. **Table 4-2** provides the source data information for each conservation element map. Subsequent subsections provide additional detail on these sources and analysis methods.

TABLE 4-2: HABITAT MODEL DATA SOURCES

Map Number	Conservation Element	Range Data Source	Habitat Data Source
4-1	Crotch's Bumble Bee	U.S. Fish and Wildlife Service Environmental Conservation Online System (USFWS 2023)	RCIS Natural Communities: Annual Grassland, Perennial Grassland, Coastal Scrub, Mixed Chaparral (ESA 2024)
4-2	Green Sturgeon – Southern DPS	Southern Green Sturgeon Range (CalFish 2015)	National Marine Fisheries Service West Coast Region Critical Habitat Data Archives and Maps (NMFS 2022)
4-3	Steelhead – Central California coast DPS	Central California Coast Winter Steelhead Range (CDFW 2012a)	National Marine Fisheries Service West Coast Region Critical Habitat Data Archives and Maps (NMFS 2022)
4-4	Chinook Salmon ESUs[1]	Chinook Salmon SRWR ESU Range (NMFS 2013)	National Marine Fisheries Service West Coast Region Critical Habitat Data Archives and Maps (NMFS 2022)
4-5	California Red-legged Frog	California Wildlife Habitat Relationships (CDFW 2016c)	RCIS Natural Communities: Coastal Oak Woodland, Valley Oak Woodland, Annual Grassland, Perennial Grassland, Coastal Scrub, Mixed Chaparral, Freshwater Marsh, Montane Riparian, Valley Foothill Riparian, Wet Meadow (ESA 2024)
4-6	Western Pond Turtle	California Wildlife Habitat Relationships (CDFW 2020c)	RCIS Natural Communities: Coastal Scrub, Freshwater Marsh, Riverine (ESA 2024)
4-7	Burrowing Owl	California Wildlife Habitat Relationships (CDFW 2016d)	RCIS Natural Communities: Agriculture, Annual Grassland, Perennial Grassland, Coastal Scrub (ESA 2024)
4-8	California Black Rail	California Wildlife Habitat Relationships (CDFW 2016e)	RCIS Natural Communities: Tidal Marsh, Freshwater Marsh, Tidal Channel, Managed Ponds (ESA 2024)
4-9	California Ridgway's Rail	California Wildlife Habitat Relationships (CDFW 2016f)	RCIS Natural Communities: Tidal Marsh, Tidal Channel (ESA 2024)
4-10	Salt Marsh Harvest Mouse	California Wildlife Habitat Relationships (CDFW 2016g)	RCIS Natural Communities: Tidal Marsh, Tidal Channel, Managed Ponds (ESA 2024)
4-11	Marin Western Flax	U.S. Fish and Wildlife Service Environmental Conservation Online System (USFWS 2015)	RCIS Natural Communities: Annual Grassland, Mixed Chaparral (ESA 2024) and Serpentine soil areas from Soil Survey Geographic Database (NRCC 2019)
4-12	Habitat Connectivity	Not applicable	Area of Conservation Emphasis Terrestrial Connectivity Dataset (CDFW 2019) Fish Passage Database (CDFW 2023b) California Essential Habitat Connectivity (Spencer et al. 2010)
4-13	Bat Habitat	California Wildlife Habitat Relationships (CDFW 2016h) (Range for non-focal bat species, pallid bat, used as proxy for bat habitat statewide range)	RCIS Natural Communities: All communities except urban (ESA 2024)
4-14	Riparian Corridors	Valley Foothill Riparian and Montane Riparian ranges, California Wildlife Habitat Relationships (CDFW 2021)	RCIS Natural Communities: Valley Foothill Riparian, Montane Riparian (ESA 2024) and National Hydrography Dataset (USGS 2019)

Map Number	Conservation Element	Range Data Source	Habitat Data Source
4-15	Freshwater Wetlands	Fresh Emergent Wetland ranges, California Wildlife Habitat Relationships (CDFW 2021)	RCIS Natural Communities: Freshwater Marsh (ESA 2024)
4-16	Tidal Wetlands	Saline Emergent Wetland ranges, California Wildlife Habitat Relationships (CDFW 2021)	RCIS Natural Communities: Tidal Marsh, Tidal Flats, Tidal Channel (ESA 2024)
4-17	Shallow Subtidal Habitat	California Waters (USGS 2019)	2022 Update of Modern Baylands (SFEI 2022)
4-18	Working Lands	Not applicable	California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program, 2016 (CDOC 2019)
4-19	Hydrological Processes	Not applicable	California Groundwater Basins (DWR 2022a), National Hydrography Database (USGS 2019)
4-20	Waterfowl and Shorebird Habitat	Important Bird Areas with Global and State Importance (Audubon 2008)	RCIS Natural Communities: Freshwater Marsh, Managed Ponds, Other Marsh, Wastewater Pond, Tidal Channel, Tidal Marsh, Shallow Subtidal Embayment (ESA 2023)

4.2.5.1 RCIS Natural Communities Map

ESA began the process of developing maps of modeled habitat for focal species and other conservation elements, by assembling the best available vegetation and habitat map data for the RCIS area. This consisted of fine-scale vegetation (VegCAMP) data for Marin (GGNPC 2021), Sonoma (Sonoma County Agricultural Preservation and Open Space District 2017) and Napa (CDFW 2020b) counties, and CALVEG Existing Vegetation (Eveg) for Solano County (USDA 2018), plus the updated Modern Baylands data from SFEI (SFEI 2022). The VegCAMP data provide finer scale resolution while the Modern Baylands data are not as high resolution, but are more current and more reflective of recent restoration actions in the region. VegCAMP and Eveg data sources included crosswalks to CWHR types. ESA cross-walked the Modern Baylands data to CWHR to allow for a consistent classification system across the entire RCIS area. To develop the RCIS Natural Communities classification system, ESA examined and cross-walked CWHR and NCVS classifications across all the source datasets (see Appendix E). The RCIS Natural Communities map served as the basis for identifying locations of suitable habitat for focal species and habitat range for other conservation elements.

4.2.5.2 Habitat Mapping Approach

To prepare the habitat maps, ESA acquired public data on known species occurrences from the California Natural Diversity Database (CNDDB), critical habitat from the National Marine Fisheries Service (NMFS), and species range data from the California Wildlife Habitat Relationships system for the selected focal species. Based on a methodology developed by Patrick Huber (Huber, 2017), modeled habitat for most focal species were created by placing a 2-mile buffer around each CNDDB occurrence and intersecting the occurrences with areas of suitable habitat in the RCIS Natural Communities Map. Suitable habitat for each species were determined by review of recovery and conservation plans and other species-specific scientific literature. Each species habitat map includes the full area of associated suitable habitats, not restricted by the extent of species occurrence locations, barriers to movement, habitat quality, or other factors that may ultimately limit habitat suitability.

Data also were not constrained to the CWHR range maps for these species, but where applicable, range maps are included as inserts on the habitat maps.

For fish focal species (Green Sturgeon, Central California Coast Steelhead, Chinook Salmon ESUs), model habitats were mapped using NMFS-designated critical habitat data. As with other focal species, the maps were not restricted by barriers to movement, habitat quality, or other factors. Habitat maps for other conservation elements were derived from selecting the associated habitat types in the RCIS Natural Communities map. For example, Tidal Habitat consists of areas of the RCIS Natural Communities map classified as Tidal Marsh, Tidal Flats or Tidal Channel as shown in Table 4-2. Additional maps of habitat connectivity, working lands, and hydrological processes were created by directly displaying the data from the sources as listed in Table 4-2.

4.2.5.3 Data Limitations

Modeled species habitat maps are based on coarse resolution satellite imagery and do not incorporate finer-scale habitat details. Several restoration projects have been completed that are not included in this dataset; thus, suitable habitat may not be represented accurately. Habitat models created by ESA (2023) are based only on the natural communities in which the species occurs and CNDDB occurrences, and do not consider species' life history, dispersal barriers, and other ecological requirements.

The VegCAMP data provides high-resolution data for the RCIS area, but because the mapping is several years old, it contains large areas of outdated habitat mapping. The 2022 Update of Modern Baylands data is the most current dataset for the baylands, but lacks the resolution of the VegCAMP dataset.

Maps can be used to help inform locations that could be prioritized for preservation or enhancement of existing habitat. These maps reflect current mapped conditions and do not represent suitable habitat that might develop in the future as a result of restoration projects (see Figure 2-10). All locations should be ground-truthed before implementation of conservation and habitat enhancement actions. Before implementing any actions, future landscape characteristics, including climate, tidal regime, and sea level rise extent, should be considered to ensure that proposed actions are compatible with the projected future landscape.

Some focal species and other conservation elements do not have species-specific climate change vulnerability assessments. A statewide vulnerability assessment for the natural communities (Thorne et al. 2016a) in which the focal species occurs has been used as proxy for potential projected climate change vulnerability. However, the vulnerability of natural communities does not incorporate species' life history and ecological requirements, regional significance, current range, and specific threats, so may not accurately represent the actual vulnerability.

Additional data limitation and gaps are addressed in the specific conservation element strategies.

4.3 Regional Conservation Strategies

In determining conservation and habitat enhancement actions to implement, implementers should consider and prioritize, when feasible, actions that:

- Are consistent with other regional and subregional conservation planning documents, including proposed restoration projects that could affect the area's future habitat types, hydrology, or ecosystem functions (see Appendix G).

- Protect and enhance irreplaceable landscapes (as defined in Bay Area Open Space Council [BAOSC] 2019) and large landscape blocks with intact ecosystem functions.
- Provide multiple benefits, such as flood control, habitat connectivity, and tidal circulation.
- Are nature-based and inclusive of sustainable traditional Indigenous land management practices.
- Anticipate and prepare for future climate conditions (e.g., projected sea level rise, changes in temperature and precipitation patterns) to enhance landscape resilience to projected climate exposure.
- Facilitate the access of California Native Americans to sacred sites and cultural resources.
- Improve the ability of California Native Americans to engage in traditional and sustenance gathering, hunting, and fishing.
- Partner with California tribes on land management and stewardship utilizing Traditional Ecological Knowledges.

4.3.1 Regional Landscape

The regional landscape strategy (RL 1 below and associated objectives and actions) applies throughout the RCIS area. **Table 4-3** provides objectives and actions to support Regional Landscape Goal 1.

Regional Landscape Goal (RL) 1: Sustain a functioning landscape that supports a mosaic of native species and habitats, intact ecological services and processes, resilience to climate change stressors, and healthy ecosystem functions in the RCIS area.

RL Objective 1.1: Protect land that provides existing habitat and ecosystem values; transitional habitat and ecosystem processes; terrestrial and aquatic connectivity; and land that may provide habitat and ecosystem function in the future because of landscape changes. Measure progress toward achieving this objective by the number of acres of habitat or linear miles/feet protected, as appropriate. This may include parcels with:

- Historical, existing, or potentially restorable transitional habitat
- High ACE Terrestrial Climate Change Resilience rankings (CDFW 2018c)
- High native species diversity
- Presence of special-status and/or focal/non-focal species
- Complex habitat structure (e.g., number of canopy layers, percent cover)

RL Objective 1.2: Restore and enhance land to improve ecological function and habitat value. Measure progress toward achieving this objective by number of historical or existing acres of habitat enhanced and/or restored that improve climate resilience (e.g., transitional or refugia habitat), the number of observed special-status species and/or population size compared to present day, increased habitat structure complexity, and/or increased number/distribution of key resources (e.g., nesting trees, ponds, host plants) (number per acres). Enhancement actions should be consistent with Baylands Ecosystem Habitat Goals Project (1999) and Climate Update (2015), and other subregional plans, such as the Sonoma Creek Baylands Strategy (2020), Novato Creek Baylands Vision (2015), San Francisco Bay Joint Venture: Restoring the Estuary (2022), and the Petaluma River Baylands Strategy (2023).

RL Objective 1.3: Improve understanding of the distribution, abundance, and condition of species and communities in the landscape. Measure progress towards achieving this objective by the number of study publications and partnerships across a diverse collection of private, public, tribal, and non-profit organizations.

TABLE 4-3: ACTIONS AND PRESSURES ASSOCIATED WITH REGIONAL GOAL AND OBJECTIVES

Actions Associated with RL Goal and Objectives	Pressures
RL 1.1.1: Acquire parcels through fee title purchase or conservation easement. Focus on parcels with habitats that are critical for climate change adaptation and resilience (e.g., diked baylands, ecotone transition habitat) which are currently unprotected by other means. Priorities include lands and coastal waters consistent with the San Francisco Bay Conservation Lands Network (50% by 2050; BAOSC 2019), California's 30x30 initiative (30% by 2030; CNRA 2022), San Francisco Bay Joint Venture's Restoring the Estuary (2022), Petaluma River Baylands Strategy (2023), Sonoma Creek Baylands Strategy (2020), and goals in the Baylands Goals Report (Goals Project 1999, 2015).	• Climate Change • Land Conversion and Development • Livestock, Farming, and Ranching
RL 1.1.2: Promote zoning and urban planning policies that restrict inappropriate development of natural lands. Target natural lands include: • Irreplaceable landscapes (CLN 2019) • Diverse network of natural community and species habitat types • Lands rated by ACE to have high terrestrial climate change resilience (CDFW 2018c) that advance principles of functioning ecosystems (Goals 2015). • Working lands (i.e., rangelands, farms, and forestlands that provide livelihoods) that provide ecological value	• Climate Change • Land Conversion and Development • Livestock, Farming, and Ranching
RL 1.1.3: Plan for long-term stewardship, funding, management, and monitoring of conserved lands. Integrate historical ecology, current conditions, and future climate change scenarios into planning and design decisions (e.g., transportation, utility, municipality projects).	• Climate Change • Land Conversion and Development • Livestock, Farming, and Ranching
RL 1.1.4: Protect wildlife and plant species populations and habitats from construction, vegetation management, and/or maintenance activities, by surveying areas and implementing species/habitat-appropriate protection measures (e.g., seasonal work windows, work buffers around sensitive resources).	• Land Conversion and Development • Water Pollutants and Discharges
RL 1.1.5: Prioritize land acquisition on valleys and plains with low-intensity agriculture adjacent to tidal areas to create space for future marsh and transition zone habitat migration in response to sea level rise (Goals Project 2015).	• Climate Change
RL1.2.1: Restore ecosystem functions by removing barriers that disrupt sediment transport, hydrological processes, and/or fish, wildlife, and habitat migration and movement.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
RL 1.2.2: Control priority and emerging priority non-native invasive species in occupied and/or suitable focal conservation element habitats, and areas designated by the USFWS or NMFS as critical habitat.	• Invasive Species and Pathogens • Land Conversion and Development
RL 1.2.3: Manage current and future anthropogenic impacts through methods such as installing signage, environmental education, fencing, security, or other deterrents to reduce anthropogenic impacts including recreation access, vandalism, illegal dumping, arson, to reduce impacts on and disturbance to sensitive species and habitats. Ensure these methods do not have an impact to species movement and connectivity.	• Water Pollutants and Discharges • Land Conversion and Development

TABLE 4-3: ACTIONS AND PRESSURES ASSOCIATED WITH REGIONAL GOAL AND OBJECTIVES

Actions Associated with RL Goal and Objectives	Pressures
RL 1.2.4: Implement rangeland management practices that promote ecosystem health, including resilience to drought and wildfire (e.g., appropriate grazing levels, fencing, seasonal timing, stocking rate).	• Climate Change • Livestock, Farming, and Ranching
RL 1.2.5: Implement agricultural land management practices demonstrated to improve carbon management and sequestration processes.	• Climate Change • Livestock, Farming, and Ranching
RL 1.2.6: Restore and enhance landscapes to prepare for rising sea levels. Any fill material needed to raise subsided or low elevation lands or create transition zones should be free of containments that could pollute waters and placed in a way that mimics natural accretion processes when possible (Goals Project 2015).	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
RL 1.3.1: Implement local and regional resource monitoring programs. Share knowledge and results to further the goals of regional monitoring efforts and scientific databases, such as California Natural Diversity Database and the Wetlands Regional Monitoring Program.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Invasive Species and Pathogens • Water Pollutants and Discharges
RL 1.3.2: Conduct scientific research, biological inventories, habitat assessments, and surveys, focusing on focal species and habitats, as well as other sensitive species and habitats in the region, where prior research is limited. Partner with local communities, including tribes, for citizen science and stewardship opportunities when possible.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens • Water Pollutants and Discharges
RL 1.3.3: Conduct monitoring of climate change stressors (e.g., sea level rise, before and after natural extreme events) to increase knowledge of climate change impacts to species, habitats, and ecosystems functions (e.g., sediment accretion) throughout the RCIS area and to inform adaptive management.	• Climate Change

4.3.2 Regional Water Quality

The regional strategy for WATER benefits water resources throughout the RCIS area. Regional Landscape objectives RL 1.1, 1.2, and 1.3 also benefit regional water quality. **Table 4-4** provides actions to support the regional water goal and objective.

WATER Goal 1: Improve water quality conditions, aquatic and riparian habitats, and connectivity throughout the RCIS area through enhancement and restoration.

WATER Objective 1.1: Protect and improve water conditions, from upper stream reaches to San Pablo Bay. Measure progress toward achieving this objective by the improvement and restoration of aquatic and riparian conditions (e.g., inundation duration, water depth, water temperature and chemical composition [dissolved oxygen, etc.], stream substrate composition and/or stream characterization, habitat structure, native species diversity, percent cover), water quality (through water agencies monitoring and reporting efforts), and connectivity of water resources.

TABLE 4-4: ACTIONS AND PRESSURES ASSOCIATED WITH REGIONAL WATER GOAL AND OBJECTIVE

Actions Associated with WATER Goal and Objective	Pressures
WATER 1.1.1: Implement policies that reduce water pollutants, such as pesticides, herbicides, sewage effluent, and other non-point source waste discharges, by development and implementation of stormwater policy and infrastructure, and through partnerships with landowners to identify pollution management solutions.	• Climate Change • Water Pollutants and Discharges • Disrupted Natural Hydrology and Sediment Supply Pathways • Livestock, Farming, and Ranching
WATER 1.1.2: Increase/restore fluvial connectivity and improve water exchange, temperature profiles, and dissolved oxygen concentrations through landscape restoration or installation of pumps or aerators, where necessary.	• Climate change • Land Conversion and Development • Water Pollutants and Discharges • Disrupted Natural Hydrology and Sediment Supply Pathways
WATER 1.1.3: Enhance and restore historical connections of major perennial tributaries (Napa and Petaluma Rivers, and Sonoma, Novato, and Tolay Creeks), intermittent waterways, and the sediment loads they carry, to wet meadows, freshwater wetlands, and tidal wetlands. Determine how other freshwater sources, like treated wastewater effluent and stormwater, may be safely reconnected to the baylands through carefully monitored pilot projects (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
WATER 1.1.4: Manage water in ways that decrease harmful water quality issues such as methyl mercury, extreme pH, or mosquito populations, including methods that increase water circulation, control algae, manage timing and duration of flood control actions.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
WATER 1.1.5: Manage metal bioaccumulation in sediments by planting/harvesting vegetation to improve water quality.	• Water Pollutants and Discharges
WATER 1.1.6: Create treatment wetlands or bioswales to filter nutrients.	• Land Conversion and Development • Water Pollutants and Discharges

TABLE 4-4: ACTIONS AND PRESSURES ASSOCIATED WITH REGIONAL WATER GOAL AND OBJECTIVE

Actions Associated with WATER Goal and Objective	Pressures
WATER 1.1.7: Create conservation agreements with agriculturalists and ranchers to encourage water capture that benefits species (e.g., wetlands, ponds, groundwater recharge), and management of water conveyance structures, roadsides, and field margins.	• Livestock, Farming, and Ranching • Land Conversion and Development • Water Pollutants and Discharges
WATER 1.1.8: Install trash racks or other catchment systems to arrest trash and prevent discharges into water ways.	• Water Pollutants and Discharges
WATER 1.1.9: Inventory baseline groundwater quality conditions and support monitoring of current and future conditions to facilitate mitigation of saltwater intrusion.	• Climate Change

4.3.3 Regional Anadromous Fish

The regional strategy for anadromous fish (FISH) benefits anadromous fish throughout the RCIS area. RL and WATER goals, objectives, and actions also benefit anadromous fish resources. **Table 4-5** provides objectives and actions to support the regional anadromous fish goal (FISH Goal 1).

FISH Goal 1: Promote persistence of anadromous fish populations occurring in the RCIS area through habitat enhancement, and restoration.

FISH Objective 1.1: Enhance known occupied waterways and suitable freshwater and estuarine habitat for focal anadromous fish species. Measure progress toward achieving this objective by the number of acres or linear miles/feet, as appropriate, of riparian, riverine, and estuarine habitat enhanced with increased detections of anadromous fish compared to present day.

FISH Objective 1.2: Restore historically occupied waterways and suitable freshwater and estuarine habitat for focal anadromous fish species. Measure progress toward achieving this objective by the number acres or linear miles/feet, as appropriate, of riparian, riverine, and estuarine habitat restored and occupied by anadromous fish.

TABLE 4-5: ACTIONS AND PRESSURES ASSOCIATED WITH REGIONAL ANADROMOUS FISH GOAL AND OBJECTIVES

Actions Associated with FISH Goal and Objectives	Pressures
FISH 1.1.1: Work with water resource managers to develop and implement fish-friendly water operations to improve water temperatures and stream flows reaching San Pablo Bay.	• Climate Change • Land Conversion and Development
FISH 1.2.1: Modify or remove known fish passage barriers and collaborate with surveys for unknown barriers. Focus removal and modification on barriers with NMFS and CDFW priority rankings (NMFS 2014). This may include collaboration with CDFW, Caltrans, and county transportation departments with oversight on road practices, to reduce or remove transportation related barriers to upstream and downstream passage (including railroad bridges, abutments, and similar structures).	• Disrupted Natural Hydrology and Sediment Supply Pathways • Land Conversion and Development • Climate Change

4.3.4 Regional Herpetofauna

The regional strategy for herpetofauna (HERP) benefits amphibian and reptile species throughout the RCIS area. RL and WATER goals, objectives, and actions also benefit herpetofauna. **Table 4-6** provides objectives and actions to support the regional herpetofauna goals (HERP Goal 1 and 2).

HERP Goal 1: Promote persistence of herpetofauna populations occurring in the RCIS area through habitat enhancement.

HERP Objective 1.1: Enhance occupied and suitable aquatic, dispersal, and upland habitat for focal herpetofauna throughout the RCIS area. Measure progress toward achieving this objective by the number of acres of habitat enhanced with increased detections of herpetofauna compared to present day.

HERP Goal 2: Support stability and recovery of herpetofauna populations in the RCIS area through measures to reduce direct mortality.

HERP Objective 2.1: Reduce vehicle-related mortality factors. Measure progress toward achieving this objective by the number of wildlife connectivity crossings installed and the reduction of vehicle-related herpetofauna deaths detected compared to present day.

TABLE 4-6: ACTIONS AND PRESSURES ASSOCIATED WITH REGIONAL HERPETOFAUNA GOALS AND OBJECTIVES

Actions Associated with HERP Goals and Objectives	Pressures
HERP 1.1.1: Manage flood control infrastructure to reduce negative impacts on herpetofauna breeding and dispersal habitat.	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways
HERP 1.1.2: Manage aquatic pond vegetation, physical conditions, and hydroperiod to support suitable aquatic habitat. This may include grazing management practices.	• Land Conversion and Development • Livestock, Farming, and Ranching
HERP 1.1.3: Manage upland vegetation structure and density to support suitable dispersal habitat. This may include grazing management practices.	• Land Conversion and Development • Livestock, Farming, and Ranching
HERP 1.1.4: Enhance climate resilience of breeding habitat by reducing potential for sea water inundation to freshwater waterways connected to coastal marshes and sloughs (USFWS 2002).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HERP 1.1.5: Remove non-native aquatic species such as bullfrogs (*Lithobates catesbeianus*), mosquitofish (*Gambusia affinis*), other non-native predatory fish, and non-native turtles from breeding ponds, stream segments, and artificial ponds (USFWS 2002). This includes managing hydrology to decrease suitability for non-native species. Removal of non-native upland species, such as trapping of feral pigs (*Sus scrofa*), will protect ponds/wetlands and listed amphibian species (Seward et al. 2004).	• Land Conversion and Development • Livestock, Farming, and Ranching
HERP 2.1.1: Promote wildlife movement through roadways with the installation of infrastructure (e.g., wildlife crossing structures, directional fencing, exclusion fencing along roads and other linear infrastructure), to reduce road mortality in transportation corridors with high numbers of vehicle-related herpetofauna mortality. Focus on areas adjacent to known breeding locations and protected habitats. Long-term funding for maintenance of structures should be included.	• Climate Change • Land Conversion and Development

4.3.5 Regional Tidal Communities

The regional strategy for tidal communities can benefit invertebrates, birds, mammals, plants, and habitats that live in or are impacted by tidal action throughout the RCIS area. RL and WATER goals, objectives, and actions also benefit tidal communities. **Table 4-7** provides objectives and actions to support the regional tidal communities' goal (TIDE Goal 1).

TIDE Goal 1: Promote persistence of tidal species and their habitats occurring in the RCIS area through enhancement, and restoration of complete tidal communities with interconnected habitat types, including adjacent upland transition zones, and the physical processes that connect them.

TIDE Objective 1.1: Enhance suitable habitat for tidal wetland-associated species. Measure progress toward achieving this objective by the number of acres of tidal habitat and upland transition zones enhanced and occupied by focal/non-focal species.

TIDE Objective 1.2: Restore historical, existing, and potentially restorable tidal habitats. Measure progress toward achieving this objective by the number of acres of tidal habitat and upland transition zones restored and/or occupied by focal/non-focal species.

TABLE 4-7: ACTIONS AND PRESSURES ASSOCIATED WITH TIDAL COMMUNITIES REGIONAL GOAL AND OBJECTIVES

Actions Associated with TIDE Goal and Objectives	Pressures
TIDE 1.1.1: Manage flood control infrastructure to reduce negative impacts and increase climate resilience of tidal habitats.	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.1.2: Modify/remove dikes and/or levees that hinder normal circulation of tidal flows (USFWS 2013). Enhance diked wetlands through realigning levees and drainage ditches and connecting historic sloughs (Goals Project 2015).	• Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.1.3: Control predator access to levees to reduce predation (USFWS 2013).	• Invasive Species and Pathogens • Climate Change • Land Conversion and Development
TIDE 1.1.4: Identify lands adjacent to the existing and future Bay Trail and other public access areas where human-related disturbance encourages predation (USFWS 2013). Manage recreational activities in tidal habitats to reduce recreation impacts on sensitive species and habitats (Goals Project 1999, SLT 2020). This may include public outreach on the effects of recreation, installation of signage, conduction of patrols, and usage of enforcement where needed.	• Invasive Species and Pathogens • Land Conversion and Development
TIDE 1.1.5: Install water control structures in managed ponds to manage for salinity appropriate for tidal wildlife and plant species (USFWS 2013).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.1.6: Conduct range-wide surveys and monitoring for special-status species.	• All
TIDE 1.1.7: Manage cattle grazing in baylands agricultural areas and projected transition zones to minimize negative impacts and promote regeneration of habitat.	• Livestock, Farming, and Ranching

TABLE 4-7: ACTIONS AND PRESSURES ASSOCIATED WITH TIDAL COMMUNITIES REGIONAL GOAL AND OBJECTIVES

Actions Associated with TIDE Goal and Objectives	Pressures
TIDE 1.1.8: Manage perennial pepperweed (*Lepidium latifolium*) populations and other Refuge-prioritized invasive species (e.g., invasive *Spartina* sp.) using the San Pablo Bay NWR pepperweed control plan as a template for implementation (USFWS 2019a).	• Invasive Species and Pathogens • Land Conversion and Development
TIDE 1.2.1: When planning for tidal marsh restoration, include a variety of depths (e.g., tidal flats) and focus on connecting suitable habitat through restoration of parcels to create large blocks of suitable habitat (USFWS 2013). Focus on the broad areas of tidal marsh along the shore of San Pablo Bay, the widest marshes in the Napa-Sonoma Marsh, and the baylands of Petaluma River, Sonoma Creek, and Novato Creek (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.2.2: Support interdisciplinary review panels that coordinate and review the design of tidal marsh restoration projects throughout San Francisco Bay. Include recommendations in the design of projects.	• All
TIDE 1.2.3: Transition from diked wetlands to restored or enhanced tidal marsh habitat, where feasible.	• Climate Change • Land Conversion and Development
TIDE 1.2.4: Address habitat fragmentation through restoration designs that include functional connections for dispersal between habitat patches and changes in habitat composition from climate change impacts.	• Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.2.5: Reconnect major tributaries and watersheds (Napa River, Sonoma Creek, Novato Creek, Gallinas Creek, Tolay Creek, and Petaluma River) to downstream extant tidal wetlands (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.2.6: Work with adjacent landowners to conserve valleys, plains, and areas with small intermittent and/or seasonal creeks with low-intensity agriculture adjacent to tidal areas for future marsh and transition zone migration (Goals Project 2015).	• Livestock, Farming and Ranching • Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.2.7: Restore the natural transition zone, focusing on tidal marsh transitions, incorporating protective buffers wherever possible, particularly around the base of alluvial fans to provide sediment to the terrestrial side of marshes (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE 1.2.8: Create ecotone transition habitats where suitable for species (e.g., small shorebirds) use as escape refugia from high tides and sea level rise (USFWS 2013).	• Climate Change • Land Conversion and Development

4.4 Crotch's Bumble Bee (*Bombus crotchii*)

Adult Crotch's bumble bee, photo credit Dylan Winkler, CDFW

4.4.1 Regulatory Status

- State Candidate Endangered

4.4.2 Ecological Requirements and Threats

- RCIS Natural Communities: Grassland (annual and perennial), Coastal Scrub Mixed Chaparral (Xerces Society et al. 2018) (See **Figure 4-1** for range and modeled habitat)
- Basic habitat requirements include presence of suitable nesting sites (e.g., abandoned rodent burrows) for colonies, available pollen and nectar throughout their colony period, and suitable overwintering sites (e.g., soft, disturbed soil or under leaf litter or other debris) for their queens.
- Most active during spring and summer (Xerces Society et al. 2018).
- Primarily nest in underground cavities; typically abandoned burrows of small mammals such as ground squirrels (Xerces Society et al. 2018). May include abandoned small mammal burrows, under perennial bunch grasses or thatched annual grasses, underbrush piles, in old bird nests and in dead trees or hollow logs, though nests in these conditions have not yet been observed.
- Generalist forager which feeds on pollen and nectar from a wide array of floral species (including plants in the Fabaceae, Apocynaceae, Asteraceae, Lamiaceae, and Boraginaceae families). A short-tongued bee, Crotch's bumble bee mostly forages at open flowers with short corollas (Xerces Society et al. 2018).
- Threatened by habitat alterations, agrochemical plant protection products, pathogens from introduced European honey bees and *B. impatiens*, and competition with honey bees (Cameron et al. 2016; Iwasaki et al. 2022); Zarevúcka 2013).
    - All agrochemical plant protection products (e.g., insecticides, fungicides, herbicides, and pesticides) have some degree of lethal or sublethal effect to bumble bee communities by contaminating their floral food resources with varying levels of toxicity, with insecticides being the most harmful (Potts et al. 2016). Adjuvants have also been found to negatively impact bumble bees and other bees (Straw et al. 202, Mullin 2015, Mesnage and Antoniou 2018, Straw and Brown 2021).
- Using goats or sheep for vegetation management can eliminate floral resources for bumble bees, especially if grazing occurs during a bloom (Kimoto et al. 2012).
- Full species account available: *A Petition to the State of California Fish and Game Commission to List: Crotch's bumble bee (Bombus crotchii), Franklin's bumble bee (Bombus franklini), Suckley cuckoo bumble bee (Bombus suckleyi), and western bumble bee (Bombus occidentalis occidentalis) as Endangered under the California Endangered Species Act* (Xerces Society et al. 2018)

4.4.3 Associated Non-focal Species and Co-benefited Natural Resources

- Callippe silverspot butterfly (*Speyeria callippe callippe*)
- Western bumble bee (*Bombus occidentalis*)
- Pallid bat (*Antrozous pallidus*)
- Townsend's big-eared bat (*Corynorhinus townsendii*)
- Swainson's hawk (*Buteo swainsoni*)
- Tricolored blackbird *(Agelaius tricolor*)
- Grasslands

4.4.4 Climate Change Vulnerability Assessment

No specific climate change vulnerability assessment exists for Crotch's bumble bee. Exposure variables projected to significantly affect bumble bee populations include increased temperature and precipitation, increased drought, increased variability in temperature and precipitation extremes, early snow melt, late frost events, and changes in availability of floral resources (Jackson et al. 2022; Xerces Society et al. 2018). Shifts in the phenology of food resources (i.e., earlier and longer flowering seasons) cause disruptions to the life cycle of new bumble bee colonies (Ogilvie et al. 2017). Stressors include increased pesticide and pathogen exposure, decreased resource availability (both floral and hibernacula), and a decrease in nesting habitat availability due to changes in rodent abundance or distribution (Xerces Society et al.2018). Climate change will also exacerbate other threats listed in Table 4-8.

The goal and objectives for Crotch's bumble bees, and the associated actions shown in Table 4-8 aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address population stability, such as increasing presence of host plants and reducing non-native plants, which may outcompete native plants, may allow individuals to move to newly suitable habitats in the future. **Figure 4-1** shows the range and modeled habitat for Crotch's bumble bee.

4.4.5 Conservation Strategy

Table 4-8 summarizes specific actions and pressures associated with the goal and objectives for Crotch's bumble bee (BEE). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions

BEE Goal 1: Promote the persistence of sustainable Crotch's bumble bee populations occurring in the RCIS area through protecting, restoring, and enhancing Crotch's bumble bee suitable habitat.

BEE Objective 1.1: Protect known occurrences and allow for expansion of Crotch's bumble bee populations by protecting 11,304 acres of suitable overwintering, nesting, and/or foraging habitat. Measure progress toward achieving this objective by the number of acres of suitable foraging, nesting, and/or overwintering habitat protected.

BEE Objective 1.2: Enhance occupied and/or suitable Crotch's bumble bee overwintering, nesting and/or foraging habitat. Measure progress toward achieving this objective by the number of acres of suitable foraging, nesting, and/or overwintering habitat enhanced and/or increased detection of Crotch's bumble bee presence compared to present day.

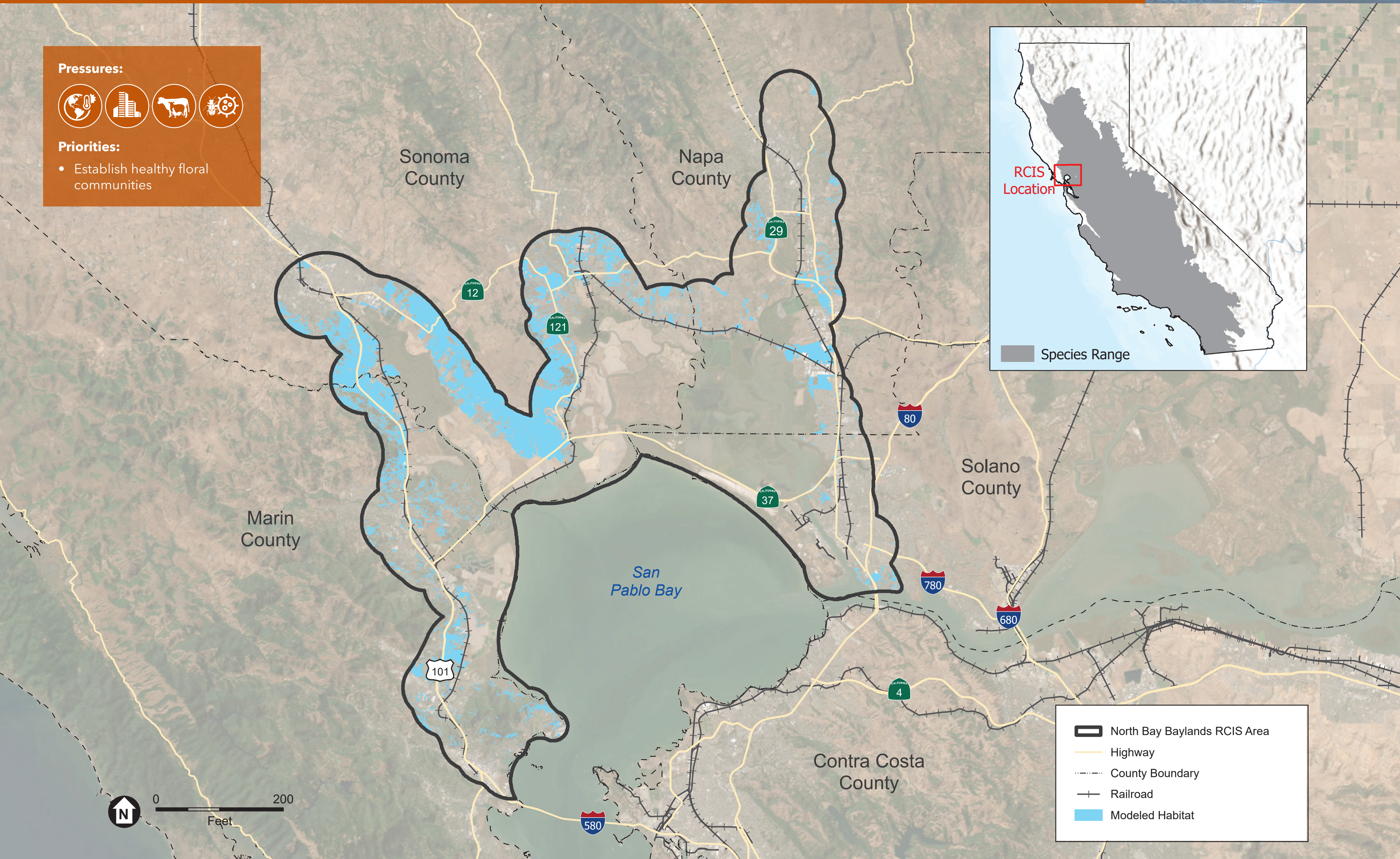
BEE Objective 1.3: Restore historical, present day, and potentially restorable suitable overwintering, nesting, and/or foraging habitat for Crotch's bumble bee. Measure progress toward achieving this objective by the number of acres of suitable foraging, nesting, and/or overwintering habitat restored and/or increased detection of Crotch's bumble bee presence.

TABLE 4-8: ACTIONS AND PRESSURES ASSOCIATED WITH CROTCH'S BUMBLE BEE GOAL AND OBJECTIVES

Actions Associated with BEE Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
BEE 1.1.1: Survey grassland (annual and perennial), mixed chaparral, and coastal scrub habitats for suitable nesting habitat and protect areas significant to establishing new Crotch's bumble bee nests.	• Land Conversion and Development
BEE 1.2.1: Manage for native plant communities in habitat suitable for Crotch's bumble bee. Ensure included species have a wide range of blooming periods, including early spring and late summer, to provide for foraging habitat throughout the year.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens • Livestock, Farming, and Ranching
BEE 1.2.2: Conduct surveys in Crotch's bumble bee occupied and suitable overwintering, nesting, and foraging habitat to evaluate population shifts.	• Climate Change • Land Conversion and Development
BEE 1.2.3: Reduce/manage use of pesticides on floral communities that function as food sources for Crotch's bumble bees.	• Livestock, Farming, and Ranching • Land Conversion and Development
BEE 1.2.4: Consider distance to suitable Crotch's bumble bee habitat and/or occurrences when placing non-native bumble bees and/or honeybees for agricultural usage to avoid introduction or exposure to outside pathogens and diseases (Xerces Society et al. 2018). Ensure non-native colonies are disease free before placement.	• Land Conversion and Development • Invasive Species and Pathogens
BEE 1.2.5: Implement compatible grazing practices during highly active periods (late spring and summer) to avoid blooming floral resources.	• Livestock, Farming, and Ranching
BEE 1.2.6: Support and collaborate with studies into basic life history of Crotch's bumble bee, including nesting preferences, overwintering needs, and important host plants in California. (Xerces Society et al. 2018).	• Climate Change • Land Conversion and Development
BEE Action 1.3.1: Manage and reduce fire loads and remove non-native plant species that alter the plant communities occupied by Crotch's bumble bees to reduce high-intensity fires that negatively impact plant communities (Graves et al. 2020).	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens
BEE Action 1.3.2: Restore annual and perennial grasslands with native flowering plant species, such as through planting of preferred plant species.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens

4.4.6 Conservation Priorities

- Re-establish healthy floral communities with minimal invasive species, minimal pesticide exposures, and minimal disturbance at sites occupied by Crotch's bumble bees. Ensure these areas practice compatible grazing activities (BEE 1.2.3 and 1.2.5).



SOURCE: ESA, 2024; U.S. Fish and Wildlife Service Environmental Conservation Online System (USFWS 2023).

Notes: RCIS Natural Community: Annual Grassland, Perennial Grassland, Coastal Scrub, Mixed Chaparral using Huber (2017) methodology.

Figure 4-1
Crotch's Bumble Bee Range and Modeled Habitat

4.5 Green Sturgeon – Southern DPS (*Acipenser medirostris*)

Adult Green sturgeon, photo credit Mike Healey

4.5.1 Regulatory Status

- Federally Threatened

4.5.2 Ecological Requirements and Threats

- RCIS Natural Communities: Estuarine, Marine, Tidal Channel (CDFW 2022a, NMFS 2018) (See **Figure 4-2** for range and modeled habitat).
- Primary Constituent Elements of critical habitat are based on water depth, food, water flow, passage, substrates, sediment quality, and water quality (NMFS 2009).
- San Pablo Bay and tidally influenced waters in the RCIS area function as important year-round rearing habitat for juveniles, as well as foraging habitat for non-spawning adults and sub-adults in the summer months (CDFW 2022a, NMFS 2018). Sub-adults have been reported in the Napa River (NMFS 2018).
- Pre-spawning adults enter San Pablo Bay in late winter through early spring with peaks of activity influenced by factors including water flow and temperature (CDFW 2022a, NMFS 2018).
- Nearshore reefs provide habitat and foraging for green sturgeon (Beagle et al. 2019). Non-spawning adults forage intermittently during the summer (through August) while juveniles are present year-round (NMFS 2018).
- Little is known about movement patterns and habitat use within the San Francisco Bay (NMFS 2018). Studies suggest a greater number of adult green sturgeon may be in the San Francisco estuary in winter, early spring, and July-September (Chapman et al. 2019).
- Threatened by altered water flow, prey base, increased water temperatures, water quality (including turbidity and pesticides) and depth, and sedimentation, barriers to adult migration, insufficient flow, juvenile entrainment, predation by nonnative fishes, and illegal harvest (NMFS 2018; Ulaski and Quist 2021). The southern DPS faces additional threats including barriers to adult migration, insufficient flow, juvenile entrainment, predation by nonnative fishes, illegal harvest, and water contamination.
- Full species account available: *Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris)* (NMFS 2018).

4.5.3 Associated Non-focal Species

- Delta smelt[1] (*Hypomesus transpacificus*)
- Longfin smelt – San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)
- Sacramento splittail (*Pogonichthys macrolepidotus*)

[1] It is acknowledged that the American Fisheries Society recommends capitalizing fish species common names; however, this recommendation is not implemented in this document for consistency with other taxa.

4.5.4 Climate Change Vulnerability Assessment

Green sturgeon – southern DPS are vulnerable to direct effects from climate change from increasing water temperatures and decreased water flows (NMFS 2018). Changes in flow regime, especially from flooding and low flow events, are also likely to affect behavior and survival. A climate change vulnerability assessment conducted by Quiñones and Moyle (2014) ranked green sturgeon's present-day vulnerability as Highly Vulnerable, meaning the "species is currently approaching extinction and is likely to be re-categorized as critically vulnerable if their populations are diminished further." Its climate change vulnerability is Less Vulnerable, meaning the "species likely to decline or become more limited in distribution but extinction is unlikely by 2100. Given its present day and climate change vulnerability scores, the green sturgeon's combined vulnerability score is Highly Vulnerable (**Table 4-9**).

TABLE 4-9: GREEN STURGEON – SOUTHERN DPS CLIMATE CHANGE VULNERABILITY ASSESSMENT

Present Day Vulnerability	Climate Change Vulnerability	Combined Vulnerability Score
Highly Vulnerable	Less Vulnerable	Highly Vulnerable

SOURCE: Quiñones and Moyle (2014)

Climate change will also exacerbate other threats listed in Table 4-10.

The goal and objectives for green sturgeon, and the associated actions shown in Table 4-10 supporting goals and objectives aim to protect, enhance, and restore present day habitats, as well as habitats that may become suitable in the future because of climate change. Actions address enhancing and restoring estuarine foraging estuarine habitat. **Figure 4-2** shows the range and modeled habitat of green sturgeon – sDPS.

4.5.5 Conservation Strategy

Table 4-10 summarizes specific actions and pressures associated with the goal and objectives for green sturgeon (GRST). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- All Water Quality goals, objectives, and actions
- All Anadromous Fish goals, objectives, and actions
- Tidal Communities actions 1.1.1, 1.1.6, 1.2.1, 1.2.2, 1.2.4, 1.2.5, and 1.2.6
- Habitat Connectivity Objective 1.1
- BAY 1.2.3
- Hydrological Processes actions 1.1.1, 1.1.2, 1.1.4, 1.1.5, and 1.1.7

GRST Goal 1: Promote the persistence of sustainable and resilient green sturgeon – sDPS populations occurring in the RCIS area through protecting, restoring, and enhancing green sturgeon – sDPS suitable habitat.

GRST Objective 1.1: Protect existing habitat. and promote expansion of green sturgeon populations, by protecting 2,210 acres of suitable tidal channel habitat. Measure progress by the number of acres or linear miles/feet, as appropriate, suitable habitat protected.

GRST Objective 1.2: Enhance suitable green sturgeon estuarine, tidal channel, riverine, marine, and riparian habitat. Measure progress by the number of acres or linear miles/feet, as appropriate, of estuarine, tidal channel, riparian, marine, and riverine habitat enhanced and/or increased detection of green sturgeon presence compared to present day.

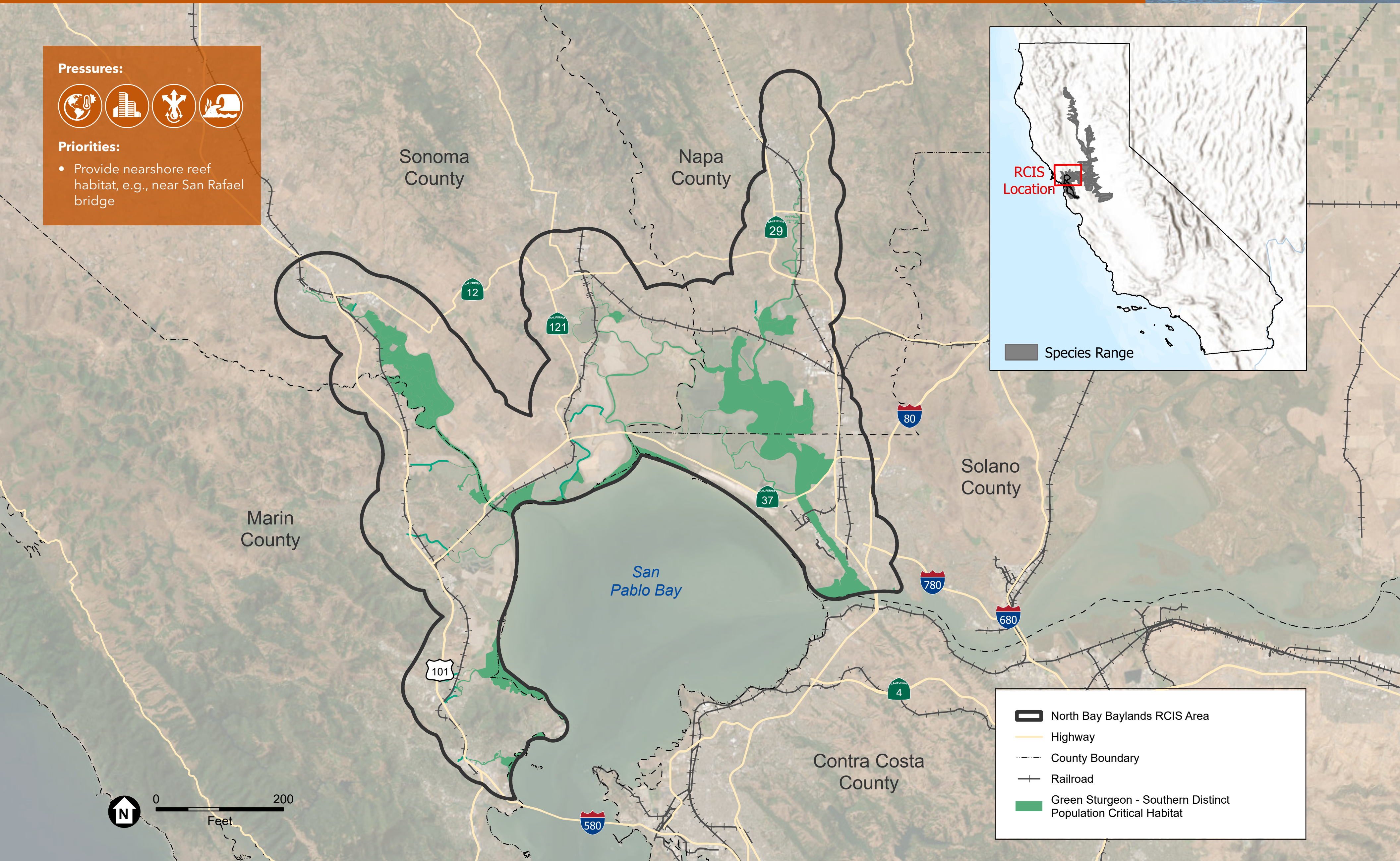
GRST Objective 1.3: Restore historical, present day, and potentially restorable green sturgeon habitat. Measure progress by the number of acres or linear miles/feet, as appropriate, of historical, present day, and potentially restorable estuarine, tidal channel, riparian, marine, and riverine habitat restored and/or increased detection of green sturgeon presence compared to present day.

TABLE 4-10: ACTIONS AND PRESSURES ASSOCIATED WITH GREEN STURGEON – SOUTHERN DPS GOAL AND OBJECTIVES

Actions Associated with GRST Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE (Enhancement) actions 1.1.1 and 1.1.6 WATER Objective 1.1 (Water Quality) actions	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
GRST 1.2.1: Conduct surveys to better understand how green sturgeon use freshwater waterways and nature-based restoration (e.g., areas of dredge or biosolids placement) in the RCIS area (Chapman et al. 2019).	• All
TIDE (Restoration) actions 1.2.1, 1.2.2, 1.2.4, 1.2.5, and 1.2.6	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
GRST 1.3.1: Construct nearshore reefs with high sea floor complexity to provide habitat heterogeneity, reduce water current speeds, trap sediment and increase diversity of marine invertebrates and prey sources (Beagle et al. 2019; Huff et al. 2011).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways

4.5.6 Conservation Priorities

- Provide nearshore reef habitat at suitable locations, such as around the San Rafael bridge, to increase habitat heterogeneity and forage (Beagle et al. 2019; Huff et al. 2011) (GRST 1.3.1).



SOURCE: ESA, 2024; Southern Green Sturgeon Range (CalFish 2015).

Note: National Marine Fisheries Service West Coast Region Critical Habitat Data Archives and Maps (NMFS 2022).

Figure 4-2

Green Sturgeon - Southern DPS Range and Modeled Habitat

4.6 Steelhead – Central California Coast DPS (*Oncorhynchus mykiss irideus*)

Steelhead, photo credit Taylor Spaulding

4.6.1 Regulatory Status

- Federally Threatened

4.6.2 Ecological Requirements and Threats

- RCIS Natural Communities: Valley Foothill Riparian, Riverine, Estuarine, Tidal Channel, Marine (NMFS 2016) (See **Figure 4-3** for range and modeled habitat)
- Highly migratory, adults spawn in coastal watersheds and juveniles rear in freshwater or estuarine habitats prior to migrating to the sea (NMFS 2016).
- Prefer cool, clear streams with abundant cover and well-vegetated banks, with stable flows. Spawning habitat includes pool and riffle complexes and cold, gravelly streambeds (NMFS 2013). Known to spawn in Sonoma Creek (SLT 2020).
- Abundance of juveniles in tributaries positively correlated with elevation, stream gradient, dominant substrate size, and percent native species (Leidy 2007).
- Juvenile abundance negatively correlated with stream order, average and maximum depth, wetted channel width, water temperature, water clarity, percent open canopy, conductivity, percent pool habitat, and total number of fish species (Leidy 2007).
- Threats include agriculture, ranching, channel modification, residential and commercial development, roads and railroads, and water diversions and impoundments (NMFS 2016).
- Full species account available: *Final Coastal Multispecies Recovery Plan* (NMFS 2016)

4.6.3 Associated Non-focal Species

- Delta smelt (*Hypomesus transpacificus*)
- Longfin smelt – San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)
- Sacramento splittail (*Pogonichthys macrolepidotus*)
- California freshwater shrimp (*Syncaris pacifica*)
- Western ridged mussel (*Gonidea angulate*)

4.6.4 Climate Change Vulnerability Assessment

Several climate change vulnerability assessments have been conducted for the steelhead central California coast (CCC) DPS. Quiñones and Moyle (2014) assessed this DPS as “highly vulnerable” to climate change due to low population abundance, reduced and fragmented stream flows, and highly altered watersheds (Quiñones and Moyle 2014) (**Table 4-11**). Steelhead CCC DPS’s present-day vulnerability is ranked as Highly Vulnerable, meaning the species is currently approaching extinction and is likely to be re-categorized as critically vulnerable if their populations are diminished further. Its climate change vulnerability is ranked as Highly Vulnerable, meaning the species is on the path toward extinction as the result of climate change.

TABLE 4-11: STEELHEAD - CENTRAL CALIFORNIA COAST CLIMATE CHANGE VULNERABILITY ASSESSMENT

Present Day Vulnerability	Climate Change Vulnerability	Combined Vulnerability Score
Highly Vulnerable	Highly Vulnerable	Highly Vulnerable

SOURCE: Quiñones and Moyle (2014)

Crozier et al. (2019) assessed exposure and sensitivity factors and concluded the steelhead CCC DPS's climate change vulnerability was Moderate. Factors assessed by Crozier et al. (2019) with High vulnerability rankings include sea surface temperature, sea level rise, flooding, and ocean acidification. Sea level rise is an important threat because of the species' dependence on healthy, freshwater watershed for spawning. Tidal marshes may convert to lagoons, increasing the amount of important juvenile rearing habitat.

Climate change will also exacerbate other threats listed in Table 4-12.

The goal and objectives for steelhead CCC DPS, and the associated actions shown in Table 4-12, aim to protect, enhance, and restore present day habitats, as well as habitats that may become suitable in the future because of climate change. Actions focusing on increasing habitat complexity and riparian vegetation, estuarine juvenile rearing habitat, enhancing migration pathways may allow individuals to move to newly suitable habitats in the future. **Figure 4-3** shows the range and modeled habitat of steelhead CCC DPS.

4.6.5 Conservation Strategy

Table 4-12 summarizes specific actions and pressures associated the goal and objectives for steelhead (STEEL). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- All Water Quality goals, objectives, and actions
- All Anadromous Fish goals, objectives, and actions
- Tidal Communities actions 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.2.1, 1.2.2, 1.2.3, 1.2.4, 1.2.5, 1.2.6, and 1.2.7
- Habitat Connectivity Objective 1.1
- BAY 1.2.3
- Hydrological Processes actions 1.1.1, 1.1.2, 1.1.4, 1.1.5, and 1.1.7

STEEL Goal 1: Promote the persistence of sustainable and resilient steelhead populations in the RCIS area through enhancement and restoration of riparian, riverine, and tidal estuarine habitat.

STEEL Objective 1.1: Protect known occupied waterways and allow for expansion into new waterways by protecting 2,429 acres of suitable steelhead habitat. Measure progress by the number acres or linear miles/feet, as appropriate, of suitable valley foothill riparian, riverine, tidal channel, marine, and estuarine habitat protected supporting or potentially supporting spawning populations.

STEEL Objective 1.2: Enhance historical, current, and potentially suitable in the future reaches of steelhead spawning and rearing habitat. Measure progress toward achieving this objective by the number of valley foothill riparian, riverine, tidal channel, marine, and estuarine acres, or linear miles/feet, as appropriate, of spawning and rearing habitat enhanced and/or supporting or potentially supporting spawning steelhead populations.

STEEL Objective 1.3: Restore historical, present day, and potentially restorable steelhead habitat. Measure progress toward achieving this objective by the number of acres or linear miles/feet, as appropriate, of valley foothill riparian, riverine, tidal channel, marine, and estuarine enhanced and/or supporting or potentially supporting spawning steelhead populations.

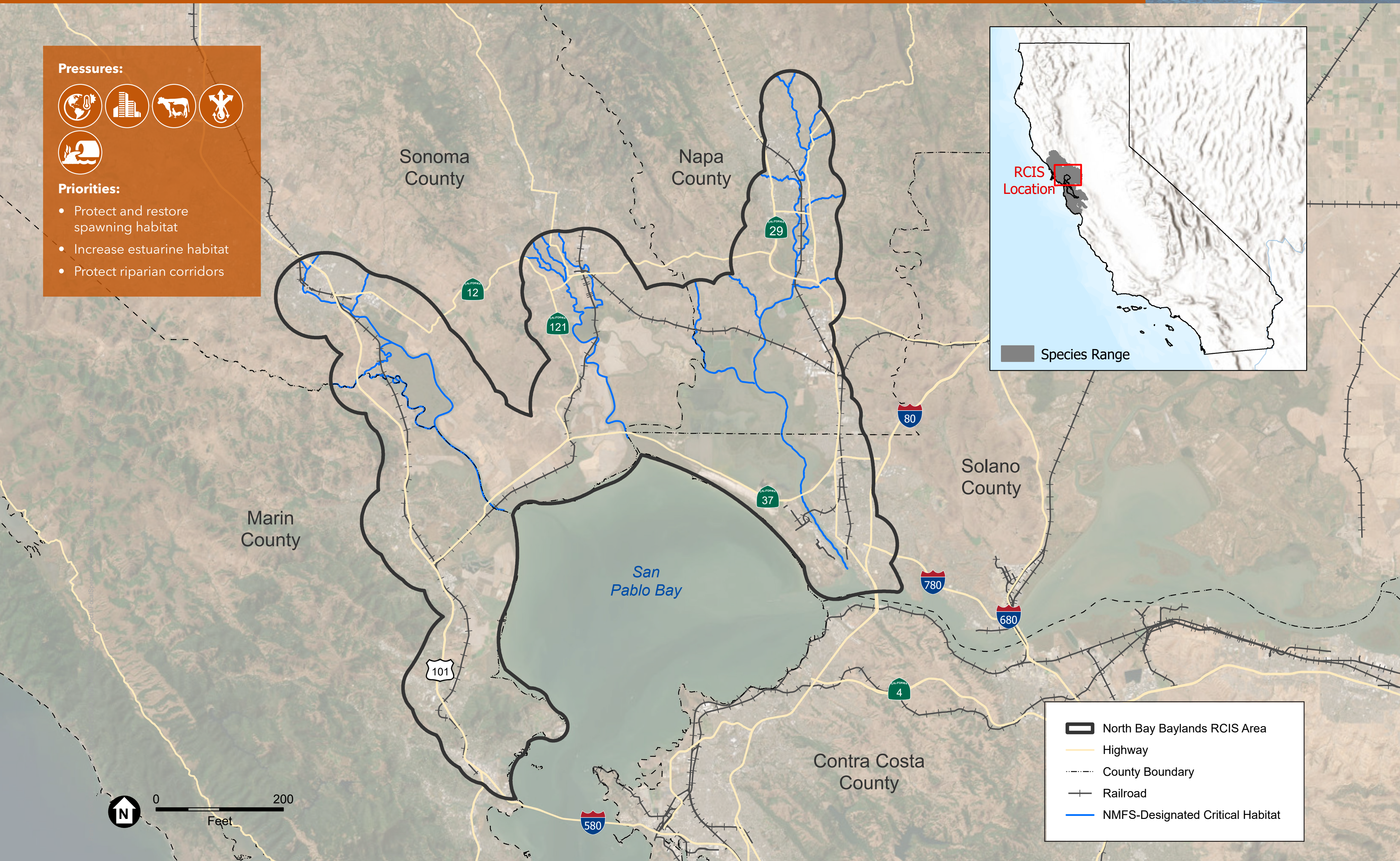
TABLE 4-12: ACTIONS AND PRESSURES ASSOCIATED WITH STEELHEAD GOAL AND OBJECTIVES

Actions Associated with STEEL Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE (Enhancement) actions 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.6, and 1.1.7 WATER Objective 1.1 (Water Quality) actions	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Livestock, Farming, and Ranching • Water Pollutants and Discharges
STEEL 1.2.1: Improve floodplain and surface-groundwater connectivity, riparian canopy cover, composition, and structure, and increase large woody debris recruitment (NFMS 2016).	• Land Conversion and Development • Livestock, Farming, and Ranching
STEEL 1.2.2: Include riparian buffers in County and City general plans and ordinances. Also include these buffers when determining transportation right of ways (NMFS 2016).	• Land Conversion and Development • Water Pollutants and Discharges
STEEL 1.2.3: Enhance quality of habitat at mouth of tributary waterways to promote migration upstream (NMFS 2016).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
TIDE (Restoration) actions 1.2.1, 1.2.2, 1.2.3, 1.2.4, 1.2.5, 1.2.6, and 1.2.7	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
STEEL 1.3.1: Install wood/boulder structures to degraded reaches of streams to increase pool frequency and volume and increase stream channel heterogeneity (NMFS 2016).	• Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Livestock, Farming, and Ranching

Actions Associated with STEEL Goal and Objectives	Pressures
STEEL 1.3.2: Increase the bulk, quality, quantity, and distribution of streambed gravel (NMFS 2016).	• Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
STEEL 1.3.3: Monitor restored waterways to determine if/when steelhead are present.	• All
STEEL 1.3.4: Support and conduct surveys to identify appropriate locations to add large wood debris and bulk sediment.	• Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways

4.6.6 Conservation Priorities

- Focus on protecting, enhancing, and restoring parcels in and adjacent to waterways designated by NMFS as supporting or potentially supporting spawning populations (i.e., Novato Creek, Sonoma Creek, Petaluma River, and Napa River) (NFMS 2016) (RL Objective 1.1).
- Increase quality and physical extent of estuarine habitat (i.e., Novato Creek Marsh, Petaluma Marsh, Napa-Sonoma Marshes) (NMFS 2016) (STEEL 1.2.3)
- Discourage counties from rezoning forestlands and along riparian corridors (NMFS 2016) (STEEL 1.2.2).
- Increase distribution of suitable spawning substrates throughout suitable watersheds (NMFS 2016) (STEEL 1.3.2).



SOURCE: ESA, 2024; Central California Coast Winter Steelhead Range (CDFW 2012a).

Note: National Marine Fisheries Service West Coast Region Critical Habitat Data Archives and Maps (NMFS 2022).

Figure 4-3
Steelhead - Central California Coast DPS

4.7 Chinook Salmon ESUs

Chinook Salmon, photo credit Tom Taylor

4.7.1 Regulatory Status

- Chinook salmon – Sacramento River Winter-run ESU (*Oncorhynchus tshawytscha* pop. 70) – Federally Endangered, State Endangered

- Chinook salmon – Central Valley Spring-run ESU (*Oncorhynchus tshawytscha* pop. 11) – Federally Threatened, State Threatened

- Chinook salmon – Central Valley Fall/Late Fall-run ESU (*Oncorhynchus tshawytscha* pop.13) – State Species of Special Concern

4.7.2 Ecological Requirements and Threats

- RCIS Natural Communities: Estuarine, Marine, Tidal Channel, Riverine (Moyle et al. 2017) (See **Figure 4-4** for range and modeled habitat)

- Threats include small population size and quality of estuarine rearing habitat (Moyle et al. 2017, NMFS 2014).

- Full species account available: *State of the Salmonids: Status of California's Emblematic Fishes* (Moyle et al. 2017)

Chinook Salmon – Sacramento River Winter-run ESU

- Adults spawn in Sacramento River during summer months (NMFS 2014).

- Tidal marshes in RCIS area may be used as rearing habitat for juveniles from January to April (Moyle et al. 2017).

Chinook Salmon – Central Valley Spring-run ESU

- Adults spawn in Central Valley rivers and creeks April through June (Moyle et al. 2017).

- Tidal marshes in the RCIS area may be used as rearing habitat for juveniles, though use of estuarine habitats by this ESU is not well understood (Moyle et al. 2017).

- Threats include small population size and quality of estuarine rearing habitat (Moyle et al. 2017).

Chinook Salmon – Central Valley Fall/Late Fall-run ESU

- Adults travel through estuarine portions of the RCIS area in late summer to late fall and move quickly to freshwater spawning areas in the Central Valley (Moyle et al. 2017).

- Tidal marshes in RCIS area may be used as rearing habitat for juveniles in February-June (Moyle et al. 2017).

4.7.3 Associated Non-focal Species

- Delta smelt (Hypomesus transpacificus)
- Longfin smelt – San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)

- Sacramento splittail (*Pogonichthys macrolepidotus*)

4.7.4 Climate Change Vulnerability Assessment

Chinook Salmon – Sacramento River Winter-run ESU

The winter-run life history of the Sacramento River winter-run (SRWR) ESU is dependent on access to year-round, spring-fed, cold-water stream reaches in the headwaters of the Sacramento River watershed, access to which was cut off with the installation of Shasta Dam (Moyle et al. 2017). SRWR Chinook are among the most 'at-risk' salmonids because of their unique ecological requirements for spawning and incubation take place at the most "thermally challenging time of year" (Moyle et al. 2017). Given their present-day elevated risk of extinction, catastrophic events such as drought or wildfire could have severe impacts on the viability of populations.

Several climate change vulnerability assessments have been conducted for the SRWR ESU. Quiñones and Moyle (2014) assessed this ESU as Critically Vulnerable (**Table 4-13**). A ranking of Critically Vulnerable for present day vulnerability means that the species "is at an imminent risk of extinction." A ranking of Critically Vulnerable for climate change vulnerability means the species is "extremely likely to be driven to extinction by the year 2100 without conservation measures."

TABLE 4-13: CHINOOK SALMON SRWR ESU CLIMATE CHANGE VULNERABILITY RANKING

Present Day Vulnerability	Climate Change Vulnerability	Combined Vulnerability Score
Critically Vulnerable	Critically Vulnerable	Critically Vulnerable

SOURCE: Quiñones and Moyle (2014)

Crozier et al. (2019) assessed exposure and sensitivity factors and concluded its climate change vulnerability was Very High. Factors with Very High vulnerability rankings include cumulative life-cycle effects, other stressors (e.g., habitat loss), and population viability.

Chinook Salmon – Central Valley Spring-run ESU

The reliance of cold spring water and snowmelt to sustain Central Valley spring-run (CVSR) ESU during the summer months increases the risk of going extinct in the next 50 years (Moyle et al. 2017). Given their present-day elevated risk of extinction, catastrophic events such as drought or wildfire could have severe impacts on the viability of populations.

Several climate change vulnerability assessments have been conducted for the CVSR ESU. Quiñones and Moyle (2014) assessed this ESU as Critically Vulnerable **Table 4-14**). A ranking of Critically Vulnerable for present day vulnerability means that the species "is at an imminent risk of extinction." A ranking of Critically Vulnerable for climate change vulnerability means the species is "extremely likely to be driven to extinction by the year 2100 without conservation measures."

TABLE 4-14: CHINOOK SALMON CVSR ESU CLIMATE CHANGE VULNERABILITY RANKING

Present Day Vulnerability	Climate Change Vulnerability	Combined Vulnerability Score
Critically Vulnerable	Critically Vulnerable	Critically Vulnerable

SOURCE: Quiñones and Moyle (2014)

Crozier et al. (2019) assessed exposure and sensitivity factors and concluded that its climate change vulnerability was Very High. Factors with “Very High” vulnerability rankings include sensitivity in adult freshwater stage, cumulative life-cycle effects, other stressors (e.g., altered systems of the California Central Valley and the Sacramento-San Joaquin delta), hatchery influence, and population viability.

Chinook Salmon – Central Valley Fall/Late Fall-run ESU

Projected larger proportions of annual precipitation falling as rain, rather than snow, may run off more quickly and earlier in the season leading to lower water availability for fishery releases, and even small increases in summer water temperatures could result in lethal conditions for the Central Valley fall/late fall (CVFLF) ESU (Moyle et al. 2017).

Several climate change vulnerability assessments have been conducted for the CVFLF ESU. Quiñones and Moyle (2014) assessed this ESU as Critically Vulnerable (**Table 4-15**). A ranking of Critically Vulnerable for present day vulnerability means that the species “is at an imminent risk of extinction.” A ranking of Critically Vulnerable for climate change vulnerability means the species is “extremely likely to be driven to extinction by the year 2100 without conservation measures.”

TABLE 4-15: CHINOOK SALMON CVFLF ESU CLIMATE CHANGE VULNERABILITY RANKING

Present Day Vulnerability	Climate Change Vulnerability	Combined Vulnerability Score
Critically Vulnerable	Critically Vulnerable	Critically Vulnerable

SOURCE: Quiñones and Moyle (2014)

Crozier et al. (2019) assessed exposure and sensitivity factors and concluded that its vulnerability was Very High. Factors with “Very High” vulnerability rankings include cumulative life-cycle effects and other stressors (e.g., altered systems of the California Central Valley and the Sacramento-San Joaquin delta). Populations are already low and the access to historical Central Valley spawning regions have been constricted by dams (Quiñones and Moyle 2014).

Climate change will also exacerbate other threats listed in Table 4-16 for all Chinook Salmon ESUs.

The actions shown in Table 4-16, and their associated goal and objectives for Chinook salmon ESUs, aim to protect, enhance, and restore present day habitats, as well as habitats that may become suitable in the future because of climate change. Actions addressing the quality of estuarine rearing habitat may help increase populations that have many critical upstream threats outside of the RCIS area. **Figure 4-4** shows the range and modeled habitat of all Chinook salmon ESUs.

4.7.5 Conservation Strategy

Table 4-16 summarizes specific actions and pressures associated with the goal and objectives for Chinook salmon ESUs (CHIN). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- All Water Quality goals, objectives, and actions
- All Anadromous Fish goals, objectives, and actions

- Tidal Communities actions 1.1.1, 1.1.2, 1.1.4, 1.1.6, 1.1.7, 1.2.1, 1.2,2, 1.2.4, 1.2.5, 1.2.6, and 1.2.7
- Habitat Connectivity Objective 1.1
- BAY 1.2.3
- Hydrological Processes actions 1.1.1, 1.1.2, 1.1.4, 1.1.5, and 1.1.7

CHIN Goal 1: Promote the persistence of sustainable Chinook Salmon juvenile rearing habitat in the RCIS area through enhancement and restoration of tidal estuarine habitat.

CHIN Objective 1.1: Protect suitable and potentially suitable tidal juvenile Chinook Salmon rearing habitats and allow expansion by protecting 2,211 acres of suitable habitat. Measure progress by the number of acres of tidal channel, riverine, marine, and estuarine habitat protected.

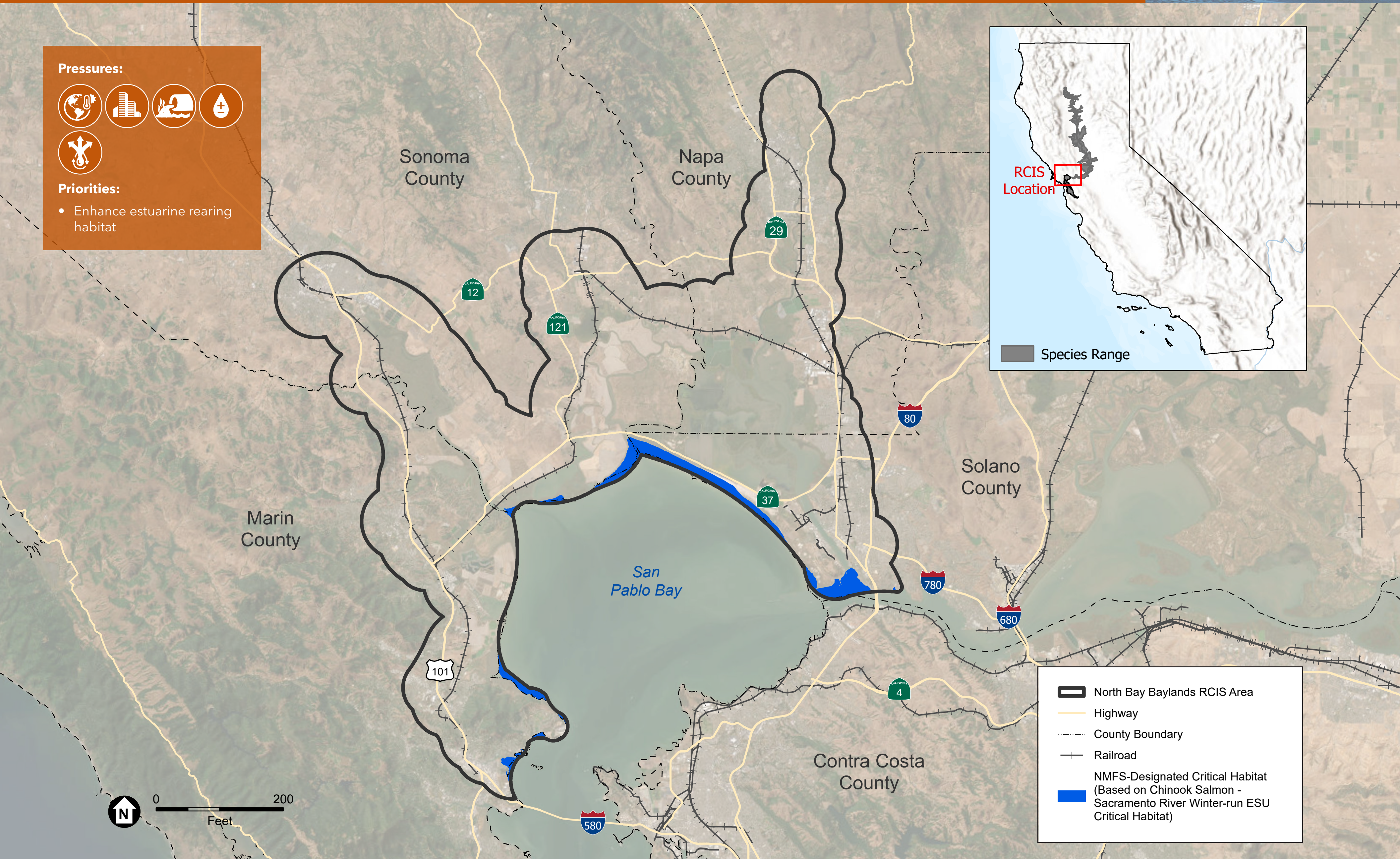
CHIN Objective 1.2: Enhance/restore historical, present day, and potentially restorable Chinook salmon habitat. Measure progress toward achieving this objective by the number of acres of tidal channel, riverine, marine, and estuarine habitat enhanced and/or restored and/or increased detection of Chinook salmon presence compared to present day.

TABLE 4-16: ACTIONS AND PRESSURES ASSOCIATED WITH CHINOOK SALMON ESUS GOAL AND OBJECTIVES

Actions Associated with CHIN Goal and Objectives	Pressures
• RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development • Degraded Water Quality
• TIDE (Enhancement) actions 1.1.1, 1.1.2, 1.1.4, 1.1.6, and 1.1.7 • TIDE (Restoration) actions 1.2.1, 1.2,2, 1.2.4, 1.2.5, 1.2.6, and 1.2.7 • WATER Objective 1.1 (Water quality) actions	• Climate Change • Land Conversion and Development • Water Pollutants and Discharges • Disrupted Natural Hydrology and Sediment Supply Pathways
• CHIN 1.2.1: Evaluate species use of estuarine habitats and response to land use changes and restoration actions.	• Climate Change • Land Conversion and Development • Water Pollutants and Discharges • Disrupted Natural Hydrology and Sediment Supply Pathways

4.7.6 Conservation Priorities

- Enhancement of estuarine rearing habitat through increasing the extent of high-quality habitat (TIDE 1.2).



SOURCE: ESA, 2024; NMFS, 2013.

Note: National Marine Fisheries Service West Coast Region Critical Habitat Data Archives and Maps (NMFS 2022).

Figure 4-4
Chinook Salmon ESUs Range and Critical Habitat

4.8 California Red-legged Frog (*Rana draytonii*)

Adult California red-legged frog, photo credit Brian Pittman

4.8.1 Regulatory Status

- Federally Threatened, State Species of Special Concern

4.8.2 Ecological Requirements and Threats

- RCIS Natural Communities: Coastal Oak Woodland, Valley Oak Woodland, Grassland (annual and perennial, Coastal Scrub, Mixed Chaparral, Freshwater Marsh, Montane Riparian, Valley Foothill Riparian, Wet Meadow (CDFW 2022a, USFWS 2002) (See **Figure 4-5** for range and modeled habitat).
- *Breeding aquatic habitat*: Freshwater streams, deep pools, and backwaters within streams and creeks, ponds, marshes, sag ponds, stock ponds, dune ponds, and lagoons. Habitat often deep ponds (greater than 2 feet), still, or slow-moving water and dense, shrubby riparian or emergent vegetation. Requires 11 to 20 weeks of permanent water for larval development (CDFW 2022a, USFWS 2002).
- *Upland habitat:* Will often disperse from aquatic habitat if ponds dry out. Suitable habitat includes spaces under rocks and organic debris, agricultural features, small mammal burrows, incised stream channels, and moist leaf litter (USFWS 2002).
- *Dispersal:* During the wet season, some individuals may disperse (up to 2 miles) through upland habitats to return to breeding sites (USFWS 2002).
- Non-native species may be impacted due to competition and predation, also threatened by fungal diseases (Padgett-Flohr 2008, USFWS 2002).
- Threatened by incompatible land uses on private lands, incidental impacts of fire suppression practices, and mortality due to vehicle impacts and disease (USFWS 2002).
- Full species account available: *Recovery Plan for the California Red-legged Frog (Rana aurora draytonii)* (USFWS 2002).

4.8.3 Associated Co-Benefited Natural Resources

- Grasslands

4.8.4 Climate Change Vulnerability Assessment

The USFWS Recovery plan (2002) for California red-legged frog lists climate stressors that may impact the species (e.g., direct impacts or indirect by exacerbating other threats) which include:

- Increased drought and severity
- Extreme precipitation events
- Early drying of breeding habitat leading to mortality of eggs, larvae, and decreased adult survival

- Decreased flows, coupled with agricultural and urban water demands, resulting in increased water salinity

According to modelling by Wright et al. (2013), California red-legged frog (CRLF) is at “neutral risk” from climate change its statewide range (**Table 4-17**). Most of the climatically suitable habitat in the RCIS area is likely to remain suitable in 2050 (Wright et al. 2013). However, model anomaly scores suggest that although current distribution and habitat suitability is likely to persist, projected climate conditions may reduce habitat suitability on average to make this species a high conservation priority (Wright et al. 2013). It is important to note that this analysis was on a statewide scale, and local conditions in the RCIS area may vary.

TABLE 4-17: CALIFORNIA RED-LEGGED FROG CLIMATE CHANGE VULNERABILITY RANKING

Type of Analysis	Low Emissions (RCP4.5)	High Emissions (RCP8.5)
Current Distribution	Slightly Reduced	Slightly Reduced
Habitat Suitability	Neutral	Neutral

SOURCE: Wright et al. 2013

Climate change will also exacerbate other threats listed in Table 4-18.

The goal and objectives for California red-legged frog, and the associated actions shown in Table 4-18, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address population stability, such as monitoring for disease and sources of road mortality, which may allow individuals to move to newly suitable habitats in the future. **Figure 4-5** shows the range and modeled suitable habitat for the California red-legged frog.

4.8.5 Conservation Strategy

All RL, WATER, and HERP goals, objectives, and actions apply to California red-legged frog (CRLF). **Table 4-18** summarizes actions and pressures associated with the goals and objectives for the species. Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.2, 1.1.4, 1.1.5, and 1.1.7
- All Herpetofauna goals, objectives, and actions
- Habitat Connectivity Objective 1.1
- Hydrological Processes actions 1.1.1, 1.1.5, 1.1.7, and 1.1.9

CRLF Goal 1: Promote persistence of sustainable and resilient California red-legged frog populations in the RCIS area through protection, restoration, and enhancement of California red-legged frog habitat.

CRLF Goal 2: Support stability and recovery of California red-legged frog populations through measures to reduce direct mortality.

CRLF Objective 1.1: Protect suitable and potentially suitable aquatic and upland habitats and allow expansion by protecting 16,422 acres of suitable habitat. Measure progress toward achieving this objective by the number of acres of breeding, dispersal, and upland habitat and/or the number of breeding creeks and ponds protected.

CRLF Objective 1.2: Enhance occupied and suitable habitat for California red-legged frog, especially in the USFWS-designated Core Area (Petaluma Creek – Sonoma Creek) (USFWS 2002). Measure progress toward achieving this objective by the number of acres of breeding, dispersal, and upland habitat and/or the number of breeding creeks and ponds and acres of adjacent upland habitat enhanced, and/or increased detection of California red-legged frog presence compared to present day.

CRLF Objective 1.3: Restore historical, present day, and potentially restorable suitable habitat. Measure progress toward achieving this objective by the number of acres of breeding, dispersal, and upland habitat and/or the number of breeding creeks and ponds and acres of adjacent upland habitat restored, and/or increased detection of California red-legged frog presence compared to present day.

CRLF Objective 2.1: Reduce disease-related mortality. Measure progress toward achieving this objective by the reduction of disease-related California red-legged frog deaths detected, compared to present day (USFWS 2002).

TABLE 4-18: ACTIONS AND PRESSURES ASSOCIATED WITH CALIFORNIA RED-LEGGED FROG GOALS AND OBJECTIVES

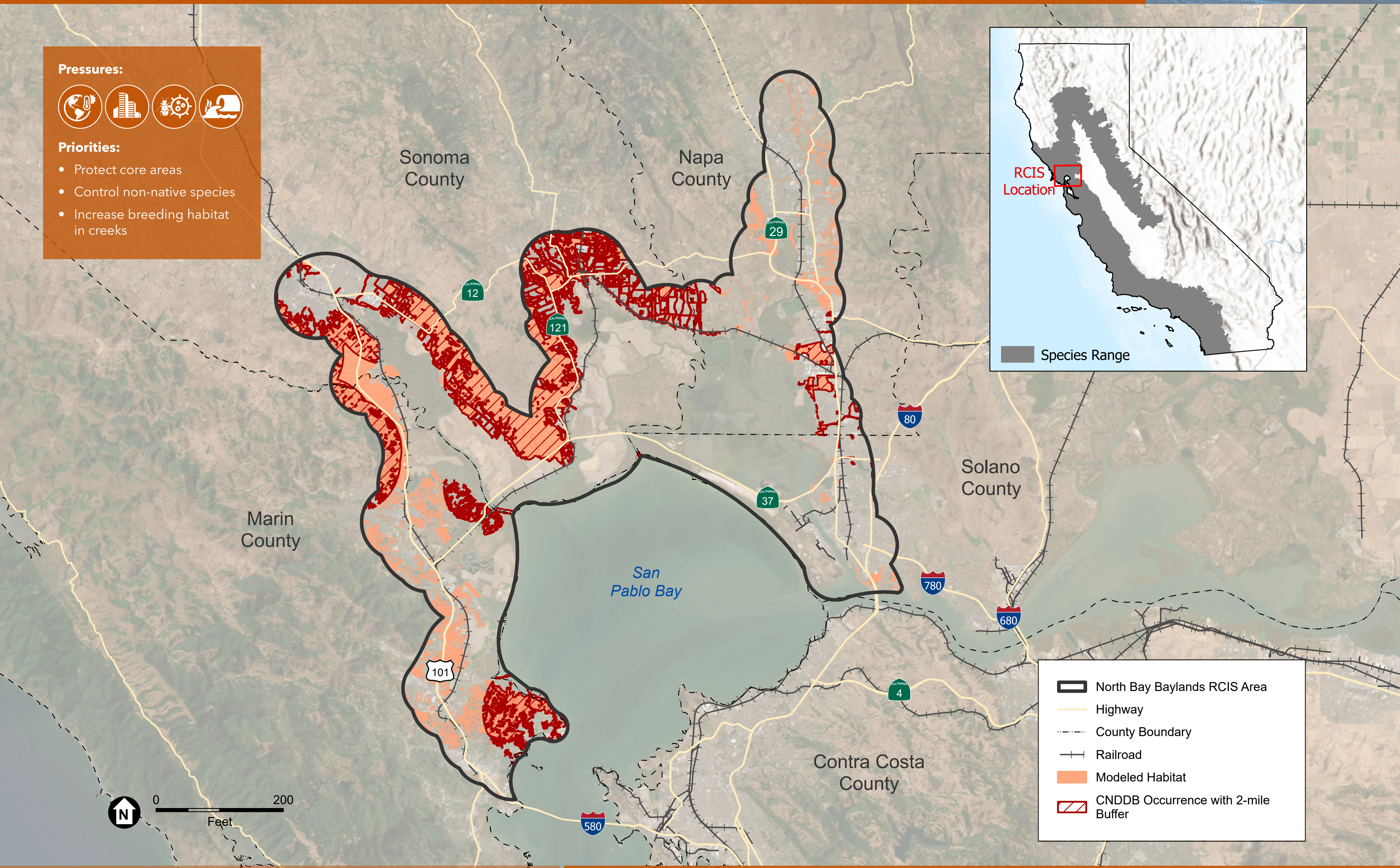
Actions Associated with CRLF Goals and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
CRLF 1.2.1: Promote California red-legged frog habitat and populations through development and implementation of fire management guidelines (USFWS 2002).	• Climate Change • Land Conversion and Development • Water Pollutants and Discharges
CRLF 1.2.2: Develop and implement a watershed protection plan for USFWS-designated Core Area Petaluma Creek – Sonoma Creek (USFWS 2002).	• Land Conversion and Development • Water Pollutants and Discharges t
CRLF 1.2.3: Remove non-native invasive species at sites where they are known to occur by making changes to pond hydrology or by temporarily draining ponds (USFWS 2002).	• Land Conversion and Development • Invasive Species and Pathogens
CRLF 1.2.4: Improve hydroperiod and water quality of breeding habitat by clearing dense stands of non-native vegetation, repair eroding dams and spillways, and removing sediment.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
CRLF 1.3.1: Restore and/or create breeding and dispersal habitat through creation of plunge pools and slow-water habitats, by incorporating these features in restoration designs in breeding habitat in creeks, as well as by creation of artificial ponds in areas with suitable upland habitat. Promote natural water flow regimes and vegetative cover in streams and creeks (USFWS 2002). Focus on the USFWS-designated Core Area Petaluma Creek – Sonoma Creek (USFWS 2002).	• Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
CRLF 1.3.2: Relocate California red-legged frog egg masses at suitable sites to establish metapopulations in coordination with scientific advisors, land managers, universities, and/or regulatory agencies to inform the location and methods.	• Land Conversion and Development
CRLF 1.3.3: Survey suitable habitat to locate opportunities for habitat restoration.	• All

TABLE 4-18: ACTIONS AND PRESSURES ASSOCIATED WITH CALIFORNIA RED-LEGGED FROG GOALS AND OBJECTIVES

Actions Associated with CRLF Goals and Objectives	Pressures
CRLF 2.1.1: Implement management actions to reduce pathogen transmission and impact on California red-legged frog, such as through sterilization of all equipment entering known or suitable breeding habitat.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens
CRLF 2.1.2: Survey occupied habitat for presence of known pathogens, such as the chytrid fungus (*Batrachochytrium dendrobatidis*).	• Invasive Species and Pathogens

4.8.6 Conservation Priorities

- Acquire and protect habitat in USFWS-designated Core Area (Petaluma Creek – Sonoma Creek) to encourage habitat connectivity between occupied and suitable but unoccupied habitat (USFWS 2002) (RL Objective 1.1).
- Control non-native species (USFWS 2002) to promote population sustainability for all life stages of the species (CRLF 1.2.3).
- Increase the amount of California red-legged frog breeding habitat in creeks through creation of more plunge pools and slow-water habitats by incorporating these features in restoration designs in breeding habitat in creeks, as well as creation of breeding ponds with appropriate hydroperiod in areas with suitable upland habitat. Promote natural water flow regimes and vegetative cover in streams and creeks (USFWS 2002) (CRLF 1.3.1).



SOURCE: ESA, 2024; California Wildlife Habitat Relationships (CDFW 2021); CDFW 2023c

Note: RCIS Vegetation Communities: Annual Grassland, Perennial Grassland, Coastal Scrub, Mixed Chaparral, Coastal Oak Woodland, Valley Oak Woodland, Freshwater Marsh, Montane Riparian, Valley Foothill Riparian, Wet Meadow using Huber (2017) methodology.

Figure 4-5
California Red-Legged Frog Range and Modeled Habitat

4.9 Western Pond Turtle (*Emys marmorata*)

Two Adult Western pond turtles, photo credit Keith Kohl, ODFW

4.9.1 Regulatory Status

- Federal Proposed Threatened
- State Species of Special Concern

4.9.2 Ecological Requirements and Threats

- RCIS Natural Communities: Freshwater Marsh, Montane Riparian, Valley Foothill Riparian, Annual Grassland, Perennial Grassland (CDFW 2022a; WPTRWCC 2020) (See **Figure 4-6** for range and modeled habitat)
- *Aquatic Habitat*: Permanent and seasonal ponds, marshes (freshwater and brackish), rivers, streams, sloughs, and irrigation ditches, usually with aquatic vegetation (CDFW 2000a, 2022a; WPTRWCC 2020).
- Requires partially submerged logs, rocks, mats of floating vegetation, suitable artificial substitutes, or open mud banks for basking (CDFW 2000a, 2022a; WPTRWCC 2020).
- *Upland Habitat*: Use upland habitats for nesting, overwintering, dispersal, and aestivation (WPTRWCC 2020)
- Nesting typically occurs within approximately 320 feet of aquatic habitat in open areas along trails, levees, roadbeds, fields, grasslands, and streambanks. Require well-drained soils for egg-laying, sparse vegetation, and good solar exposure (CDFW 2000a, 2022a; WPTRWCC 2020).
- Overwinter up to 1640 feet from aquatic habitat in deep layers of duff or leaf litter under trees or shrubs (WPTRWCC 2020)
- Threats include predation and competition by invasive aquatic species, agricultural runoff, water diversions, water quality, and road mortality (Center for Biological Diversity 2022; WPTRWCC 2020).
- Full species account available: *Western Pond Turtle Range-wide Management Strategy* (WPTRWCC 2020)

4.9.3 Associated Non-focal Species and Co-Benefited Natural Resources

- Tricolored blackbird *(Agelaius tricolor*)
- Grasslands[2]

[2] While grasslands habitat near western pond turtle aquatic habitat could benefit from the conservation and habitat enhancement actions identified herein, grasslands are not mapped as part of the habitat modeling for this species to more clearly emphasize the value of aquatic habitat for this species.

4.9.4 Climate Change Vulnerability Assessment

Climate stressors could impact western pond turtle sex ratios and result in skewed population and population decline (WPTRWCC 2020). Some of these stressors include (WPTRWCC 2020):

- Increased drought and severity
- Extreme precipitation events
- Altered hydrology
- Early drying of breeding habitat leading to mortality of juveniles, and decreased adult survival
- Decreased flows, coupled with agricultural and urban water demands, resulting in increased water salinity

According to modelling by Wright et al. (2013), western pond turtle is at “neutral risk” from climate change across its statewide range (**Table 4-19**). These projections indicate that in 2050, more than 80 percent of the current distribution of western pond turtle will remain and there will be no greater than a 20 percent change in available suitable habitat under low and high emission scenarios, thus, most of the climatically suitable habitat in the RCIS area is likely to remain suitable in 2050. It is important to note that this analysis was on a statewide scale, and local conditions in the RCIS area may vary.

TABLE 4-19: WESTERN POND TURTLE CLIMATE CHANGE VULNERABILITY RANKING

Type of Analysis	Low Emissions (RCP4.5)	High Emissions (RCP8.5)
Current Distribution	Slightly Reduced	Slightly Reduced
Habitat Suitability	Neutral	Neutral

SOURCE: Wright et al. 2013

Climate change will also exacerbate other threats listed in Table 4-20.

The goal and objectives for western pond turtle, and the associated actions shown in Table 4-20, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address population stability, such as sources of road mortality and habitat creation, which may allow individuals to move to newly suitable habitats in the future. Other pressures can result because of climate change or be exacerbated by climate change. **Figure 4-6** shows the range and modeled suitable habitat for the western pond turtle.

4.9.5 Conservation Strategy

Table 4-20 summarizes specific actions and pressures associated with the goal and objectives for western pond turtle (WPT). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.2, 1.1.4, 1.1.5, and 1.1.7
- All Herpetofauna goals, objectives, and actions

- Habitat Connectivity Objective 1.1
- Hydrological Processes actions 1.1.1, 1.1.5, 1.1.7, and 1.1.9

WPT Goal 1: Promote the persistence of sustainable and resilient western pond turtle populations occurring in the RCIS area through protecting, restoring, and enhancing western pond turtle suitable habitat.

Objective WPT 1.1: Protect suitable and potentially suitable aquatic and upland habitats and allow expansion by protecting 555 acres of suitable habitat. Measure progress toward achieving this objective by increasing the number of acres of suitable and/or potentially suitable aquatic habitat and adjacent upland habitat and associated/equivalent acres protected.

Objective WPT 1.2: Enhance and restore occupied, suitable, and/or potentially suitable habitat and create new habitat. Measure progress towards achieving this objective by the number of acres of breeding, dispersal, and upland habitat and/or the number of breeding creeks and ponds and acres of adjacent upland habitat enhanced and/or restored, and/or increased detection of western pond turtle presence compared to present day.

TABLE 4-20: ACTIONS AND PRESSURES ASSOCIATED WITH WESTERN POND TURTLE GOAL AND OBJECTIVES

Actions Associated with WPT Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
WPT 1.2.1: Install rocks and logs, where ecologically compatible, in suitable aquatic habitat to increase the number of basking sites and cover.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
WPT 1.2.2: Where agriculture is present, promote agricultural uses that are compatible with western pond turtle habitat requirements and provide habitat (patches of freshwater marsh or upland basking or breeding areas) within the agricultural matrix where turtles occur in association with irrigation channels.	• Land Conversion and Development • Livestock, Farming, and Ranching • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
WPT 1.2.3: Construct new freshwater marshes and ponds that provide suitable aquatic habitat adjacent or within dispersal distance to suitable upland breeding habitat.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
WPT 1.2.4: Identify locations where linear infrastructure (e.g., SMART train) bisects or fragments suitable and/or occupied habitat and implement crossing enhancements.	• Land Conversion and Development
WPT 1.2.5: Collaborate with studies investigating genetic diversity within the RCIS area watersheds to assess potential for inbreeding depression (WPTRWCC 2020).	• Land Conversion and Development

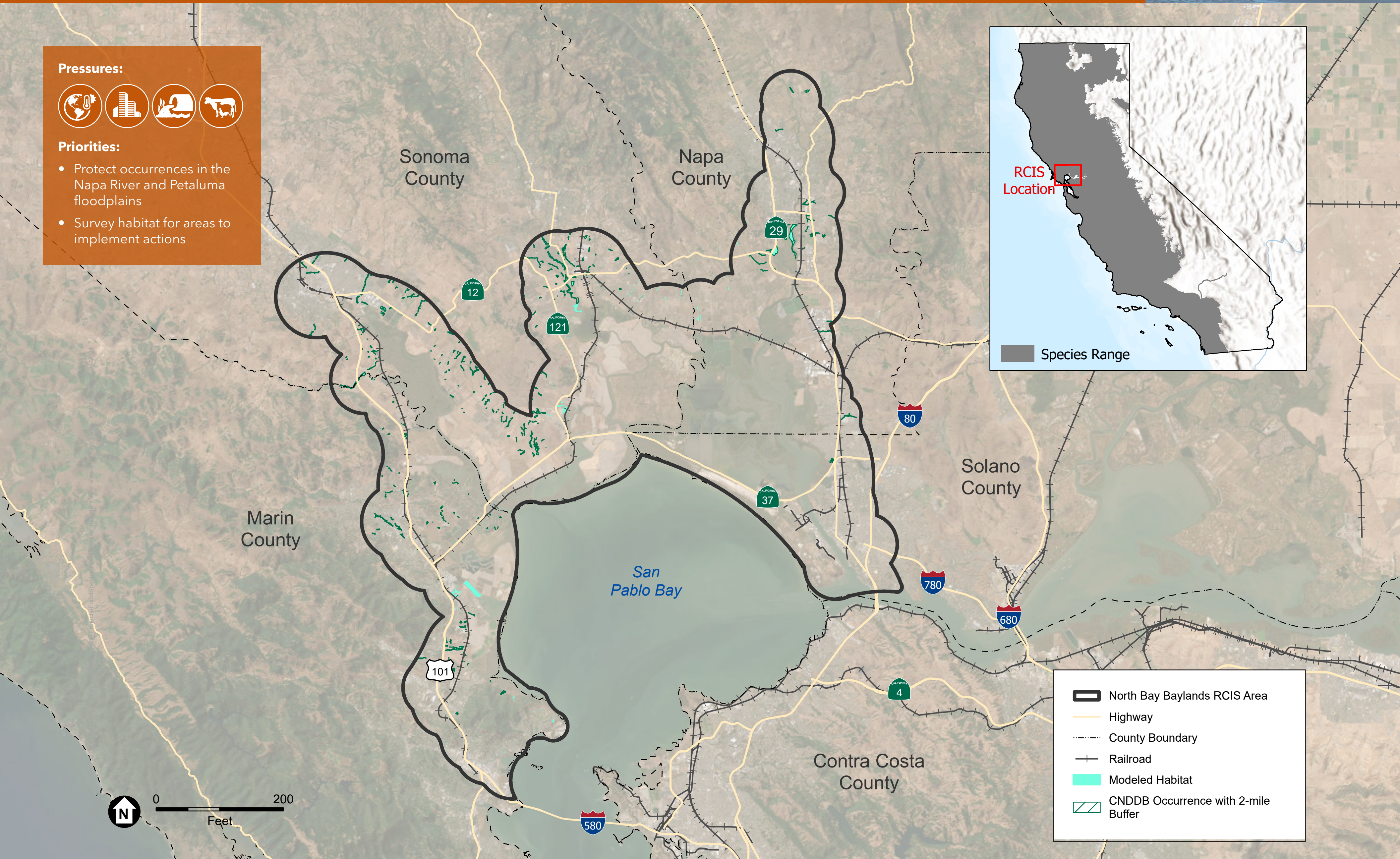
4.9.6 Conservation Priorities

- Protect known occurrences of western pond turtle in the RCIS area. Priority areas include grassland and agricultural areas in the Napa River and Petaluma River floodplains outside of historic baylands.
- Work with willing landowners to survey habitat for western pond turtles to identify areas to implement conservation and habitat enhancement actions to benefit this species.

Pressures:

Priorities:

- Protect occurrences in the Napa River and Petaluma floodplains
- Survey habitat for areas to implement actions



SOURCE: ESA, 2024; California Wildlife Habitat Relationships (CDFW 2021); CDFW 2023c

Note: RCIS Natural Communities: Freshwater Marsh, Montane Riparian, Valley Foothill Riparian using Huber (2017) methodology.

Figure 4-6
Western Pond Turtle Range and Modeled Habitat

4.10 Burrowing Owl (*Athene cunicularia*)

Adult Burrowing owl, photo credit Gerrit Platenkamp

4.10.1 Regulatory Status

- State Species of Special Concern

4.10.2 Ecological Requirements and Threats

- RCIS Natural Communities: Agriculture, Annual Grassland, Perennial Grassland, Coastal Scrub (CDFW 2022a) (See **Figure 4-7** for range and modeled habitat)
- *Wintering, foraging, and breeding habitat:* Open, well drained terrain; short, sparse vegetation generally lacking trees; and underground burrows or artificial burrows (Klute et al. 2003).
- Suitable refugia, such as small mammal burrows, can be created within a few hours or days meaning they are transient, reflecting the need for broad protection measures across a landscape (CDFW 2012b).
- Will perch on raised burrow mounds or other topographic relief, such as rocks, tall plants, fence posts, and debris piles, to attain good visibility. Forages on insects and small mammals (Klute et al. 2003; Poulin et al. 2011).
- Dependent on burrows at all times of the year for survival or reproduction, therefore eviction from nesting, roosting, overwintering, and satellite burrows or other sheltering features may lead to indirect impacts on the species (CDFW 2012b).
- Often considered sedentary and have strong nest site fidelity (CDFW 2012b).
- Threats include small mammal eradication, habitat conversion, and pesticide/insecticide usage.
- Full species account available: *Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States* (Klute et al. 2003)

4.10.3 Associated Non-focal Species and Co-benefited Natural Resources

- Callippe silverspot butterfly (*Speyeria callippe callippe*)
- Western bumble bee (*Bombus occidentalis*)
- Pallid bat (*Antrozous pallidus*)
- Townsend’s big-eared bat (*Corynorhinus townsendii*)
- Swainson’s hawk (*Buteo swainsoni*)
- Tricolored blackbird (*Agelaius tricolor*)
- Grasslands

4.10.4 Climate Change Vulnerability Assessment

Statewide and larger regional climate change vulnerability assessments have been conducted for the burrowing owl. As part of a national assessment, Wisley et al. (2019) projected that summer and winter ranges in the RCIS area are likely to remain stable and potentially even increase under different warming scenarios). The species-specific statewide climate change vulnerability assessment conducted by Gardali et al. (2012) ranked vulnerability to exposure and sensitivity factors. Burrowing owls had low vulnerability to all exposure factors and some of the sensitivity factors. The species ranked as having high sensitivity to change in habitat as they only use specific habitat types, and moderately sensitive to impacts to migration as their movements are restricted to North America. Though burrowing owls require specific habitat types and often have high site fidelity, their ability to disperse long distances may allow them to move to newly suitable habitats (Gardali et al. 2012). As they are also able to successfully use some urbanized habitats, burrowing owls are not included on the Climate Change Vulnerability Priority list (top 25 percent of highest assessed scores) (Gardali et al. 2012).

These assessments may not reflect local RCIS area conditions in the future. Cruz-McDonnell and Wolf (2015) found that burrowing owls breeding in arid zones may be highly vulnerable to climate change due to projected increases in temperature and drought frequency. Projected climate threats under 3°C increase in global temperatures include increased frequency and intensity of wildfires, increases in spring heat waves, and drought (Wilsey et al. 2019). Prey availability during drought years is limited, and there is increased competition for this resource (SCVHA 2022).

Climate change will also exacerbate other threats listed in Table 4-21.

The goal and objectives for burrowing owl, and the associated actions shown in Table 4-21, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address population stability, such as available nesting burrows and sustainable prey availability, which may allow burrowing owls to adapt and move to newly suitable habitats in the future. **Figure 4-7** shows the range and modeled suitable habitat for the burrowing owl.

4.10.5 Conservation Strategy

Table 4-21 summarizes actions and pressures associated with the goal and objectives for species. Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Habitat Connectivity Objective 1.1

BUOW Goal 1: Promote persistence of sustainable and resilient burrowing owl populations occurring through protecting, restoring, and enhancing burrowing owl suitable habitat.

Objective BUOW 1.1: Protect known occurrences, and allow expansion of habitat, by protecting 6,106 acres of suitable breeding, wintering, and foraging burrowing owl habitat. Measure progress toward achieving this objective by the number of breeding and wintering locations and/or acres of adjacent foraging habitat protected.

Objective BUOW 1.2: Enhance occupied and/or suitable burrowing owl breeding, wintering, and foraging habitat. Measure progress toward achieving this objective by the number of breeding and wintering locations, acres of adjacent foraging habitat enhanced and/or increased evidence of presence (occupied burrows) compared to present day.

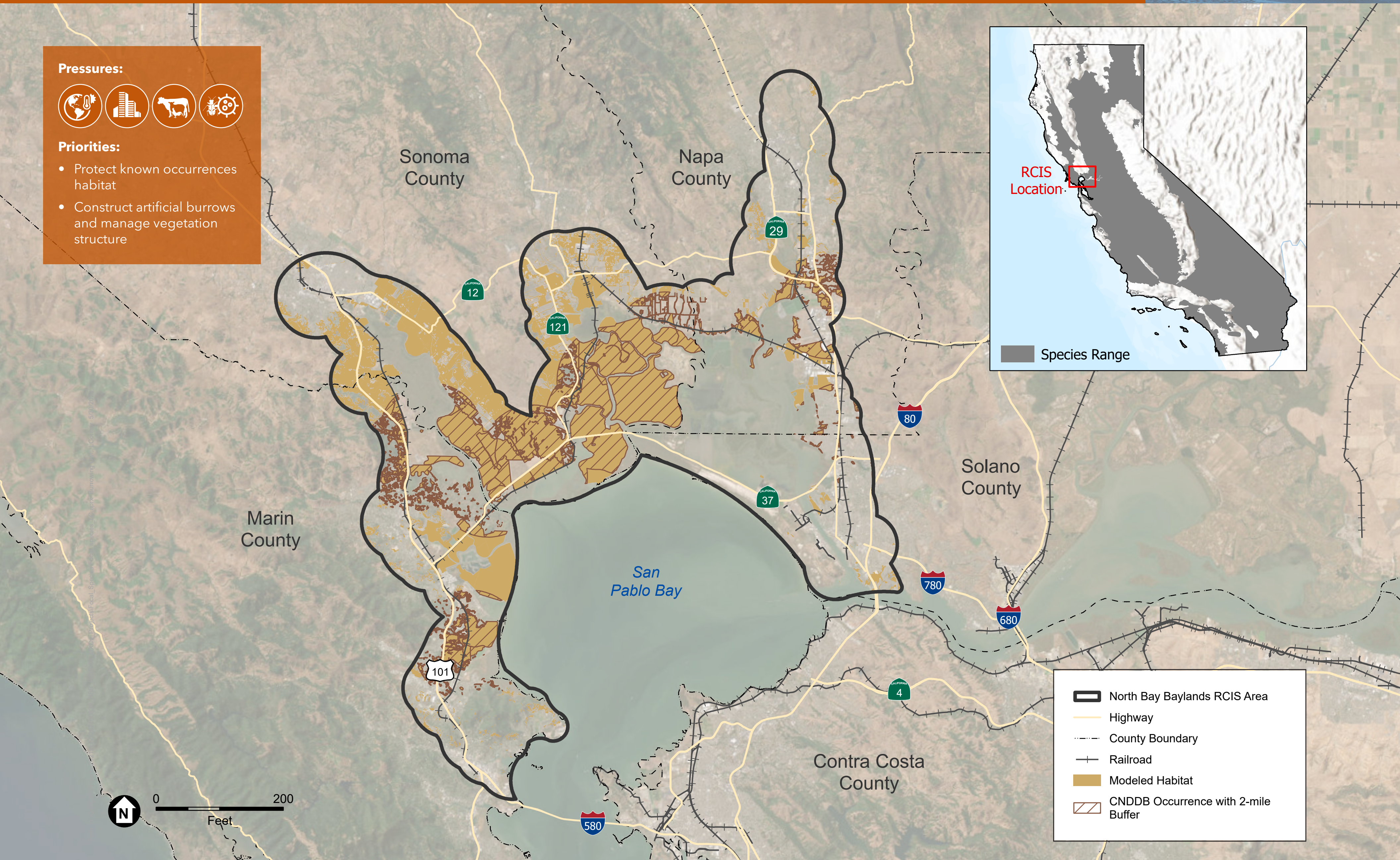
Objective BUOW 1.3: Restore occupied, and suitable burrowing owl breeding, wintering, and foraging habitat and create new habitat. Measure progress toward achieving this objective by acres of breeding, wintering, and foraging habitat and adjacent/equivalent acres restored or created and/or by increased evidence of presence (occupied burrows) compared to present day.

TABLE 4-21: ACTIONS AND PRESSURES ASSOCIATED WITH BURROWING OWL GOAL AND OBJECTIVES

Actions Associated with BUOW Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
BUOW 1.2.1: Enhance and manage suitable vegetation structure (e.g., revegetation with low-growing and less dense native plants, mowing, controlled grazing) to encourage burrowing owl wintering and breeding occupancy (Shuford and Gardali 2008; Klute et al. 2003).	• Climate Change • Land Conversion and Development • Livestock, Farming, and Ranching • Invasive Species and Pathogens
BUOW 1.2.2: Promote reduction/elimination of small mammal control efforts. Implement programs to increase small mammals in areas where they have been eradicated.	• Livestock, Farming, and Ranching
BUOW 1.2.3: Implement agricultural methods that minimize impacts to nesting and wintering burrows (e.g., avoid chaining and disking, place visible markers near burrows to ensure agricultural equipment does not collapse burrows) (CDFW 2012b).	• Livestock, Farming, and Ranching
BUOW 1.2.4: Promote the reduction or elimination of insecticide use. If use is necessary, use insecticides with the lowest toxicity to non-target organisms. Implement no-spray zones within 400 to 600 meters of burrowing owl nest burrows during the breeding season (Klute et al. 2003).	• Livestock, Farming, and Ranching • Invasive Species and Pathogens
BUOW 1.2.5: Implement supplemental feeding at known occurrences during drought years when prey populations are depressed (Wellicome et al. 2013).	• Climate Change
BUOW 1.3.1: Install artificial burrows or encourage presence of California ground squirrels in potentially suitable upland breeding habitat (Klute et al. 2003).	• Climate Change • Land Conversion and Development • Livestock, Farming, and Ranching
BUOW 1.3.2: Maintain constructed burrows by clearing entrances of sediment as needed.	• Climate Change • Livestock, Farming, and Ranching
BUOW 1.3.3: Conduct occupancy surveys in restored habitat to determine when/if breeding and/or wintering burrowing owls start using habitat.	• All

4.10.6 Conservation Priorities

- Acquire and protect privately held lands surrounding known occurrences with suitable habitat (RL Objective 1.1).
- Construct artificial burrows and manage suitable vegetation structure in potentially suitable upland breeding areas (BUOW 1.2.1 and 1.3.1).



SOURCE: ESA, 2024; California Wildlife Habitat Relationships (CDFW 2021); CDFW 2023c

Note: RCIS Natural Communities: Agriculture, Annual Grassland, Perennial Grassland, Coastal Scrub using Huber (2017) methodology.

Figure 4-7
Burrowing Owl Range and Modeled Habitat

4.11 California Black Rail (*Laterallus jamaicensis coturniculus*)

California black rail, photo credit Laurie Hall

4.11.1 Regulatory Status

- State Threatened, State Fully Protected

4.11.2 Ecological Requirements and Threats

- RCIS Natural Communities: Tidal Marsh, Freshwater Marsh, Managed Ponds, Tidal Channel (CDFW 2022a) (See **Figure 4-8** for range and modeled habitat)
- Occurs in freshwater, brackish, and tidal marshes (CDFW 1999, 2022a).
- Requires water depths of about 1 inch that do not fluctuate during the year in non-tidal habitats and tall, dense vegetation for nesting habitat (CDFW 2022, Spautz et al. 2006).
- Sensitive to disturbance during breeding season and avian predators during high tide (CDFW 1999).
- Full species account available: *California Black Rail Life History Account* (CDFW 1999).

4.11.3 Associated Non-focal Species

- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- San Pablo song sparrow (*Melospiza melodia samuelis*)
- Soft bird's-beak (*Chloropyron molle* ssp. *molle*)

4.11.4 Climate Change Vulnerability Assessment

California black rail is ranked among the top 25 percent of most vulnerable avifauna in California and is listed as High on the Climate Change Vulnerability Priority List (Gardali et al. 2012). Climate threats that are likely to impact this species include sea level rise, inundation from storm events, increased frequency of storm events, coastal erosion, and increased wave action (Goals Project 2015). The species-specific climate change vulnerability assessment conducted by Gardali et al. (2012) ranked vulnerability to exposure and sensitivity factors. Exposure factors ranked as high include habitat suitability, which is "expected to decrease by greater than 50 percent," and extreme weather, as California black rail is "very likely to be exposed to major increases in the number and duration of extreme weather events." The species ranked as having high sensitivity to change in habitat as they only use specific habitat types, and highly sensitive to impacts to dispersal as they have a low dispersal ability. Hutto et al. (2015) also assessed exposure, sensitivity, and adaptive capacity factors and concluded that this species had an overall climate change vulnerability of Moderate-High.

California black rail does not disperse large distances and have high site fidelity, so may not always move into more suitable habitats when such movement would be beneficial (Goals Project 2015). Since they are at risk for exposure to extreme weather (e.g., storm surges) coupled with the impacts of projected sea level rise, they are included on the Climate Change Vulnerability Priority list (top 25 percent of highest assessed scores) (Gardali et al. 2012, Hutto et al. 2015). While the amount of suitable habitat may increase under a high sea level rise scenario by 2050, by 2100 total habitat suitability is projected to decrease by 83 percent (Rosencranz et al. 2019).

Climate change will also exacerbate other threats listed in Table 4-22.

The goal and objectives for California black rail, and associated actions shown in Table 4-22, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address increasing transitional and refugia habitat, which may allow California black rail to adapt and move to newly suitable habitats in the future. **Figure 4-8** shows the range and modeled suitable habitat for the California black rail.

4.11.5 Conservation Strategy

Table 4-22 summarizes specific actions and pressures associated with the goal and objectives for California black rail (BLRA). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, and 1.1.8
- All Tidal Communities goals, objectives, and actions
- Steelhead action 1.2.3
- Habitat Connectivity Objective 1.1
- Hydrological Processes actions 1.1.1, 1.1.4, 1.1.7, and 1.1.8

BLRA Goal 1: Promote persistence of sustainable and resilient California black rail populations occurring in the RCIS area through protecting, restoring, and enhancing California black rail suitable habitat.

Objective BLRA 1.1: Protect known occurrences and allow expansion by protecting 7,348 acres of suitable California black rail breeding and foraging habitat. Measure progress toward achieving this objective in acres of breeding and foraging habitat protected.

Objective BLRA 1.2: Enhance occupied and/or suitable California black rail breeding and foraging habitat. Measure progress toward achieving this objective by acres of breeding and foraging habitat enhanced and/or increased detection of California black rail presence compared to present day.

Objective BLRA 1.3: Restore occupied, and suitable California black rail breeding and foraging habitat and create new habitat. Measure progress toward achieving this objective by acres of breeding and foraging habitat and adjacent/equivalent acres restored/created and/or occupied by California black rail compared to present day.

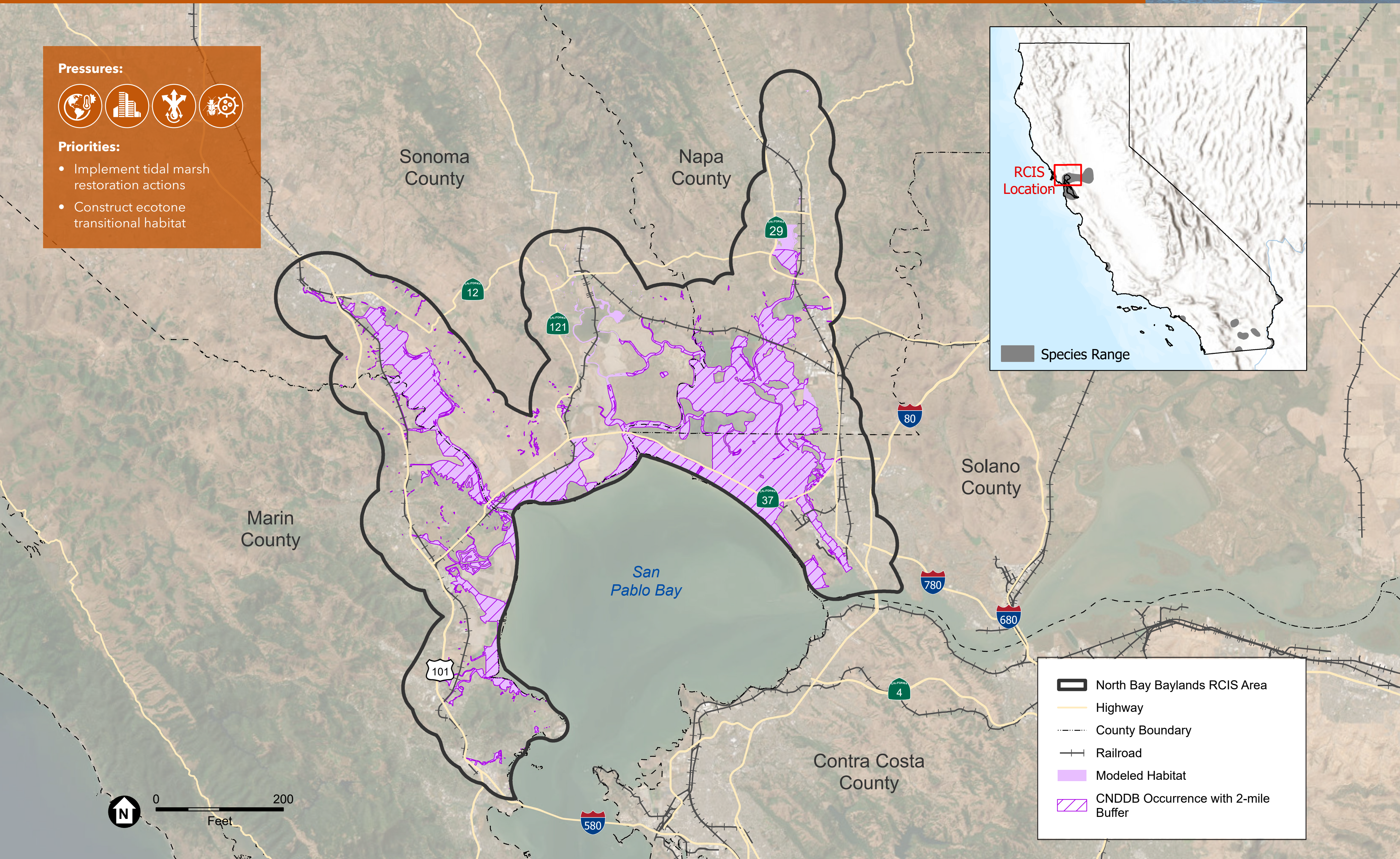
TABLE 4-22: ACTIONS AND PRESSURES ASSOCIATED WITH CALIFORNIA BLACK RAIL GOAL AND OBJECTIVES

Actions Associated with BLRA Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions. Focus acquisitions and protection on currently unprotected high marsh and ecotonal habitat, as well as lands that could be restored to high marsh and ecotonal habitat (USFWS 2013).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE Objective 1.1 (Enhancement) actions TIDE Objective 1.2 (Restoration) actions	• All

Actions Associated with BLRA Goal and Objectives	Pressures
BLRA 1.2.1: Survey potentially suitable habitat for areas not previously known to be occupied by black rail.	• All
BLRA 1.2.2: Develop and implement a predator management plan at sites with significant predation issues.	• Land Conversion and Development • Invasive Species and Pathogens
BLRA 1.3.1: Monitor restored tidal marsh areas to determine when/if California black rail begin using the area to help inform future restoration designs.	• All

4.11.6 Conservation Priorities

- Implement tidal marsh restoration actions throughout the North Bay Baylands consistent with the Baylands Ecosystem Habitat Goals Project and Science Update Goals Project 1999, 2015), Sonoma Creek Baylands Strategy (SLT 2020), Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013), Petaluma River Baylands Strategy (SLT 2023), and Restoring the Estuary (SFBJV 2022).
- Construct ecotone transitional habitat for marsh migration and high tide refugia consistent with the San Francisco Bay Adaptation Atlas (Beagle et al. 2019) and other regional planning documents.



SOURCE: ESA, 2024; California Wildlife Habitat Relationships (CDFW 2021); CDFW 2023c

Note: RCIS Natural Communities: Freshwater Marsh, Tidal Channel, Tidal Marsh, Managed Ponds using Huber (2017) methodology.

Figure 4-8
California Black Rail Range and Modeled Habitat

4.12 California Ridgway's Rail (Clapper rail) (*Rallus obsoletus obsoletus*)

Adult California Ridgway's Rail, photo credit Rick and Nora Bowers/ Alamy Stock Photo

4.12.1 Regulatory Status

- Federally Endangered, State Endangered, and State Fully Protected

4.12.2 Ecological Requirements and Threats

- RCIS Natural Communities: Tidal Marsh, Tidal Channel (CDFW 2022a, USFWS 2013) (See **Figure 4-9** for range and modeled habitat)
- Occurs in tidal and brackish marshes with unrestricted tidal flows, well developed tidal channel networks, and suitable nesting and escape cover during high tides (USFWS 2013).
- Threatened by avian and mammalian predators (USFWS 2013).
- Full species account available: *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (USFWS 2013)

4.12.3 Associated Non-focal Species

- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- San Pablo song sparrow (*Melospiza melodia samuelis*)
- Soft bird's-beak (*Chloropyron molle* ssp. *molle*)

4.12.4 Climate Change Vulnerability Assessment

California Ridgway's rail is ranked among the top 25 percent of most vulnerable avifauna in California and is listed as High on the Climate Change Vulnerability Priority List (Gardali et al. 2012). Climate threats that are likely to impact this species include sea level rise, inundation from storm events, increased frequency of storm events, coastal erosion, and increased wave action (Goals Project 2015). The species-specific climate change vulnerability assessment conducted by Gardali et al. (2012) ranked vulnerability to exposure and sensitivity factors. Exposure factors ranked as high include habitat suitability, which is "expected to decrease by greater than 50 percent," and extreme weather, as California Ridgway's rail is "very likely to be exposed to major increases in the number and duration of extreme weather events." The species ranked as having high sensitivity to change in habitat as they only use specific habitat types, and high sensitivity to impacts to dispersal as they have a low dispersal ability.

California Ridgway's rail does not disperse large distances and have high site fidelity, so may not always move into more suitable habitats when such movement would be beneficial (Gardali et al. 2012). Since they are at risk for exposure to extreme weather (e.g., storm surges) coupled with the impacts of projected sea level rise, they are included on the Climate Change Vulnerability Priority list (top 25 percent of highest assessed scores) (Gardali et al. 2012). While the amount of suitable habitat may increase under a high sea level rise scenario by 2050, by 2100 total habitat suitability is projected to decrease by 83 percent (Rosencranz et al. 2019).

Climate change will also exacerbate other threats listed in Table 4-23.

The goal and objectives for California Ridgway's rail, and the associated actions shown in Table 4-23, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Other pressures can result because of climate change or be exacerbated by climate change. Actions also address increasing transitional and refugia habitat, which may allow California Ridgway's rail to adapt to climate change and move to newly suitable habitats in the future. **Figure 4-9** shows the range and modeled suitable habitat for the California Ridgway's rail.

4.12.5 Conservation Strategy

Table 4-23 summarize actions and pressures associated with the goal and objectives for California Ridgway's rail (RIRA). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, and 1.1.8
- All Tidal Communities goals, objectives, and actions
- Steelhead action 1.2.3
- California Black Rail action 1.2.2
- Habitat Connectivity Objective 1.1
- Hydrological Processes actions 1.1.1, 1.1.4, 1.1.7, and 1.1.8

RIRA Goal 1: Promote persistence of sustainable and resilient California Ridgway's rail populations occurring in the RCIS area through protecting, restoring, and enhancing California Ridgway's rail suitable habitat.

Objective RIRA 1.1: Protect known occurrences and allow expansion by protecting 6,904 acres of suitable California Ridgway's rail breeding and foraging habitat. Measure progress toward achieving this objective in acres of suitable breeding and foraging habitat and adjacent/equivalent acres protected.

Objective RIRA 1.2: Enhance occupied and suitable California Ridgway's rail breeding and foraging habitat. Measure progress toward achieving this objective by acres of breeding and foraging habitat enhanced and/or increased detection of California Ridgway's rail compared to present day.

Objective RIRA 1.3: Restore occupied and suitable Ridgway's rail breeding and foraging habitat and create new habitat. Measure progress toward achieving this objective by acres of breeding and foraging habitat restored or created and/or increased detection of California Ridgway's rail compared to present day.

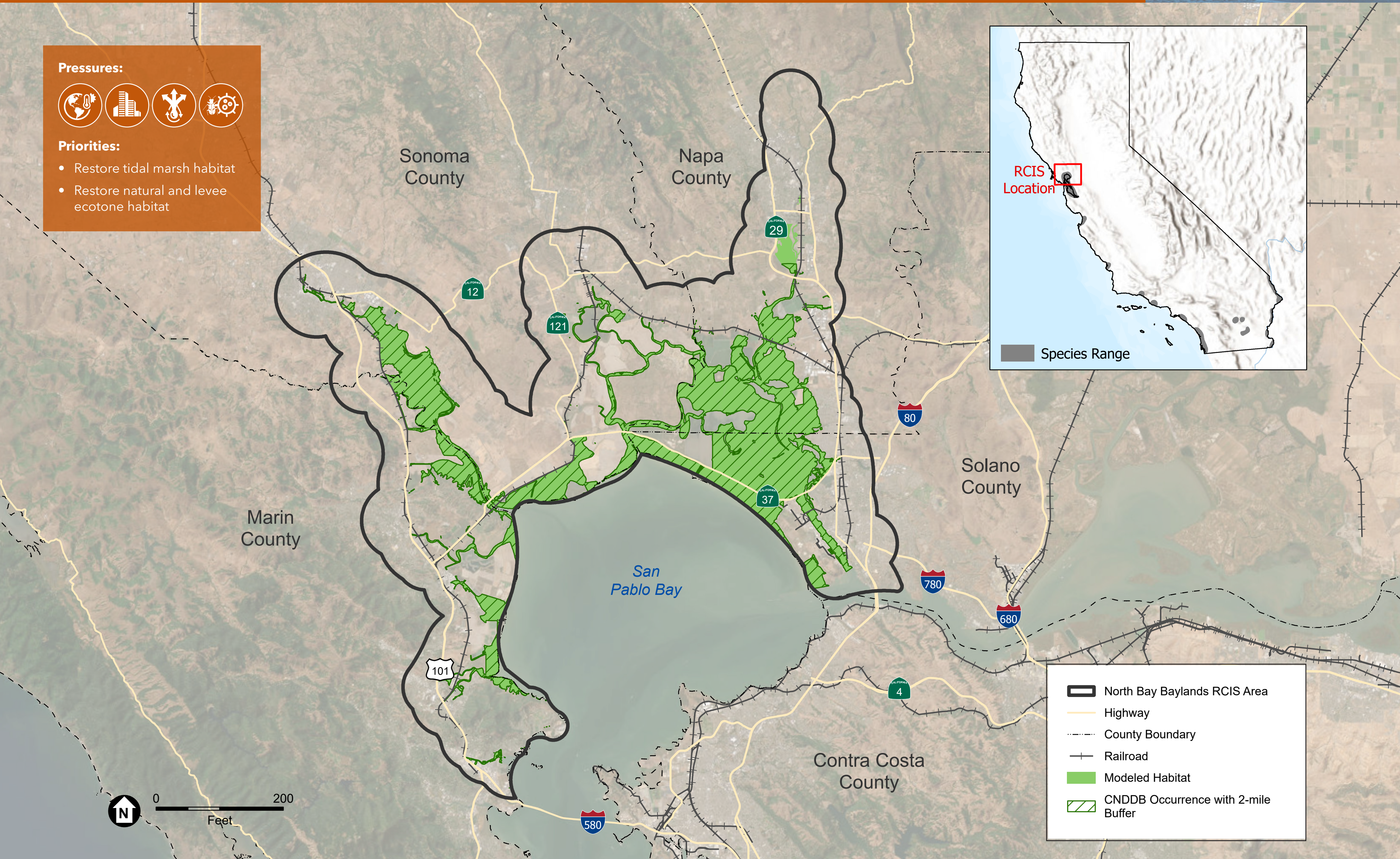
TABLE 4-23: ACTIONS AND PRESSURES ASSOCIATED WITH CALIFORNIA RIDGWAY'S RAIL GOAL AND OBJECTIVES

Actions Associated with RIRA Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions. Focus acquisitions and protection on currently unprotected low marsh, high marsh, and ecotonal habitat, as well as lands that could be restored to low marsh, high marsh, and ecotonal habitat (USFWS 2013)	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE Objective 1.1 (Enhancement) actions TIDE Objective 1.2 (Restoration) actions RL Objective 1.2 (Restore and Enhance) actions	• All
RIRA 1.2.1: Develop and implement a predator management plan at sites with significant predation issues.	• Land Conversion and Development • Invasive Species and Pathogens
RIRA 1.3.1: Monitor restored tidal marsh areas to determine when/if Ridgway's rail begin using the area to help inform future restoration designs.	• All

4.12.6 Conservation Priorities

- Restore tidal marsh habitat throughout the RCIS area consistent with the Baylands Ecosystem Habitat Goals and Science Update (Goals Project 1999, 2015), Sonoma Creek Baylands Strategy (SLT 2020), Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013), Petaluma River Baylands Strategy (SLT 2023), and Restoring the Estuary (SFBJV 2022).

- Restore natural and levee ecotone habitat to support transitional, refugia, and other high tide habitat consistent with the Baylands Ecosystem Habitat Goals (2015) and San Francisco Bay Adaptation Atlas (Beagle et al. 2019).



SOURCE: ESA, 2024; California Wildlife Habitat Relationships (CDFW 2021); CDFW 2023c

Note: RCIS Natural Communities: Tidal Channels, Tidal Marsh using Huber (2017) methodology.

Figure 4-9
California Ridgway's Rail Range and Modeled Habitat

4.13 Salt Marsh Harvest Mouse – northern subspecies (*Reithrodontomys raviventris halicoetes*)

Salt marsh harvest mouse, photo credit Erika Walther

4.13.1 Regulatory Status

- Federally Endangered, State Endangered, and State Fully Protected

4.13.2 Ecological Requirements and Threats

- RCIS Natural Communities: Tidal Marsh, Managed Ponds, Tidal Channel (CDFW 2022a, USFWS 2013) (See **Figure 4-10** for range and modeled habitat)
- Typically associated with tall, dense, continuous stands of pickleweed (Goals Project 1999). Also known to occur in marshes dominated by alkali bulrush (*Schoenoplectus maritimus*) (Shellhammer and Duke 2010), in mixed vegetation not dominated by pickleweed (Sustaita et al. 2011).
- Likely remain in their home ranges during high tide immersion of marsh vegetation, and swim or cling to taller emergent portions of vegetation, such as marsh gumplant (*Grindelia stricta*) or floating debris (USFWS 2013).
- Have limited dispersal opportunities and are often limited by small narrow marsh connections (USFWS 2013).
- Full species account available: *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (USFWS 2013)

4.13.3 Associated Non-focal Species

- Soft bird's-beak (*Chloropyron molle* ssp. *molle*)
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa)*
- San Pablo song sparrow (*Melospiza melodia samuelis*)

4.13.4 Climate Change Vulnerability Assessment

No specific climate change vulnerability assessment exists for salt marsh harvest mice. While the amount of suitable tidal habitat in this species range may increase under a high sea level rise scenario by 2050, by 2100 total habitat suitability is projected to decrease by 83 percent (Rosencranz et al. 2019). The USFWS 5-year review (2010) included a discussion of climate change threats to the species. Factors identified by USFWS (2010) include:

- Habitat loss due to landward migration of tidal marsh habitat or where sea level rise or erosion exceeds sedimentation
- Increased salinity gradients
- Increased heat and desiccation extremes
- Potential loss and/or decreased fecundity

- High mortality associated with extreme weather events

High mortality due to extreme storm events is likely to have the greatest negative impact on populations (USFWS 2010). Climate threats that are likely to impact this species include sea level rise, inundation from storm events, increased frequency of storm events, coastal erosion, and increased wave action (Goals Project 2015).

Climate change will also exacerbate other threats listed in Table 4-24.

The goal and objectives for salt marsh harvest mouse, and the associated actions shown in Table 4-24, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address population stability, increasing transitional and refugia habitat, which may allow individuals to move to newly suitable habitats in the future. **Figure 4-10** shows the range and modeled suitable habitat for the salt marsh harvest mouse.

4.13.5 Conservation Strategy

Table 4-24 summarizes actions and pressures associated with the goal and objectives for salt marsh harvest mouse (SMHM). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, and 1.1.8
- All Tidal Communities goals, objectives, and actions
- Steelhead action 1.2.3
- Habitat Connectivity Objective 1.1
- Hydrological Processes actions 1.1.1, 1.1.4, 1.1.7, and 1.1.8

SMHM Goal 1: Promote persistence of sustainable and resilient salt marsh harvest mouse populations occurring in the RCIS area through protecting, restoring, and enhancing salt marsh harvest mouse suitable habitat.

Objective SMHM 1.1: Protect known occurrences and allow expansion by protecting 7,153acres of suitable salt marsh harvest mouse habitat. Measure progress toward achieving this objective by the number of acres of suitable salt marsh harvest mouse habitat and adjacent/equivalent acres protected.

Objective SMHM 1.2: Enhance occupied and suitable salt marsh harvest mouse habitat. Measure progress toward achieving this objective by the number of acres of habitat and associated/equivalent acres of salt marsh harvest mouse habitat enhanced and/or increased detection of salt marsh harvest mouse compared to present day.

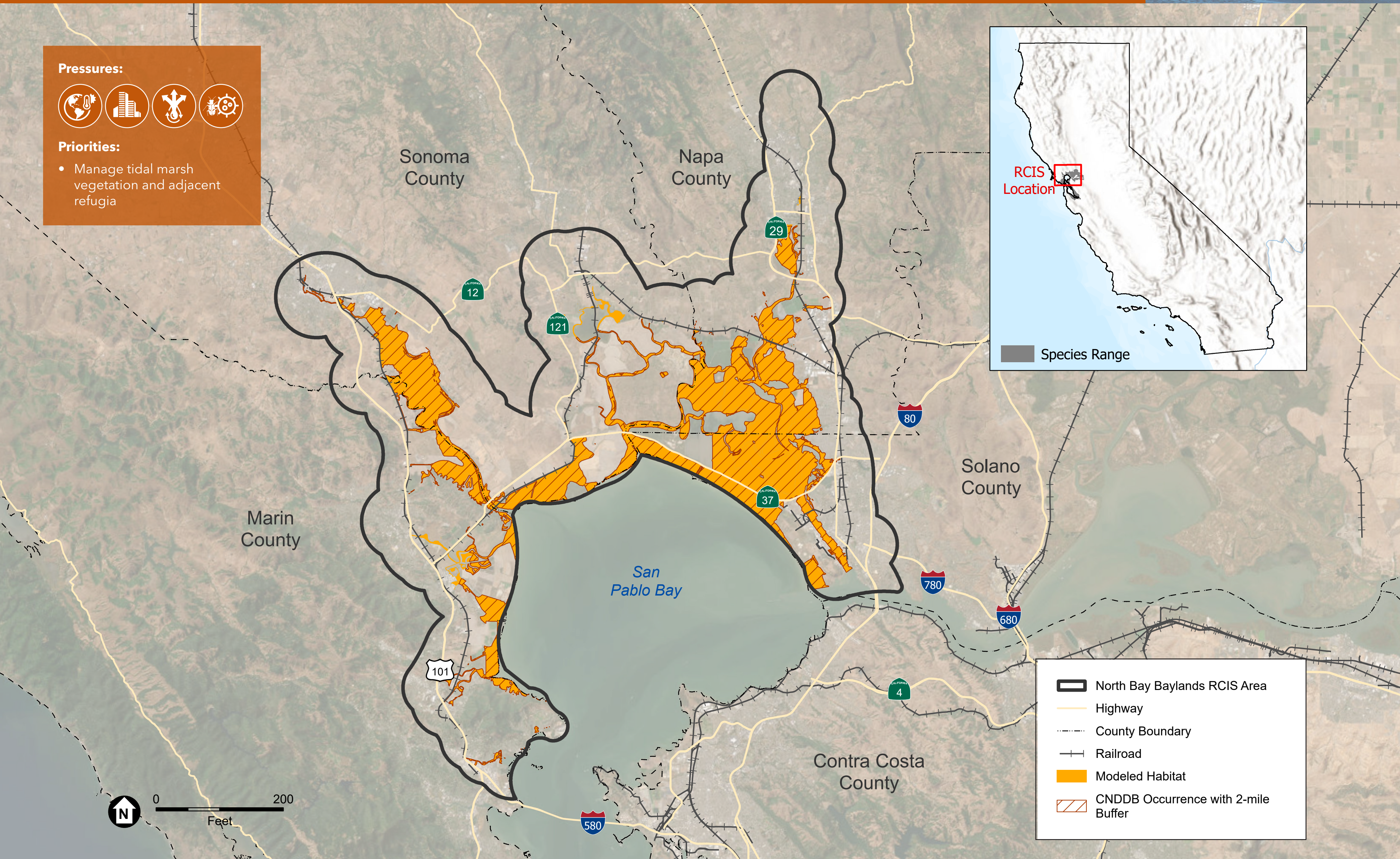
Objective SMHM 1.3: Restore occupied and suitable salt marsh harvest mouse habitat. Measure progress toward achieving this objective by the number of acres of salt marsh harvest mouse habitat restored created and/or increased detection of by salt marsh harvest mouse compared to present day.

TABLE 4-24: ACTIONS AND PRESSURES ASSOCIATED WITH SALT MARSH HARVEST MOUSE GOAL AND OBJECTIVES

Actions Associated with SMHM Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions. Focus acquisitions and protection on currently unprotected mid marsh, high marsh, and ecotonal habitat, as well as lands that could be restored to mid marsh, high marsh, and ecotonal habitat (USFWS 2013).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TIDE Objective 1.1 (Enhancement) actions TIDE Objective 1.2 (Restoration) actions	• All
SMHM 1.2.1: Continue research into the genetics and biology of species to fill in gaps in knowledge about life history.	• All
SMHM 1.2.2: Develop and implement a predator management plan at sites with significant predation issues.	• Land Conversion and Development • Invasive Species and Pathogens
SMHM 1.2.3: Manage tidal marsh habitat, including muted tidal marsh and managed marsh, to promote development of thatch-filled bulrush and mature, dense pickleweed plains with deep, high marsh and adjacent grassland for refugia during annual flooding and continued sea level rise.	• Climate Change
SMHM 1.3.1: Monitor restored tidal marsh areas to determine when/if saltmarsh harvest mice begin using the area to help inform future restoration designs.	• All

4.13.6 Conservation Priorities

- Restore tidal marsh habitat throughout the RCIS area consistent with the Baylands Ecosystem Habitat Goals and Science Update (Goals Project 1999, 2015), Sonoma Creek Baylands Strategy (SLT 2020), Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2013), Petaluma River Baylands Strategy (SLT 2023), and Restoring the Estuary (SFBJV 2022).
- Restore natural and levee ecotone habitat to support transitional, refugia, and other high tide habitat consistent with the Baylands Ecosystem Habitat Goals (2015) and San Francisco Bay Adaptation Atlas (Beagle et al. 2019).



SOURCE: ESA, 2024; California Wildlife Habitat Relationships (CDFW 2021); CDFW 2023c

Note: RCIS Natural Communities: Tidal Channel, Tidal Marsh, Managed Ponds using Huber (2017) methodology.

Figure 4-10
Salt Marsh Harvest Mouse Range and Modeled Habitat

4.14 Marin Western Flax (*Hesperolinon congestum*)

Marin western flax, photo credit Aaron Schusteff

4.14.1 Regulatory Status

- Federally Threatened, State Threatened, California Native Plant Rank 1B.1

4.14.2 Ecological Requirements and Threats

- RCIS Natural Communities: Annual Grassland, Mixed Chaparral (CDFW 2022a, USFWS 1998) (See **Figure 4-11** for range and modeled habitat)
- Blooms April to July and is endemic to serpentine soils with chaparral, bunchgrass, or other dry grasslands (USFWS 1998, 2011b).
- Sensitive to disturbance from recreational activities (USFWS 1998).
- Full species account available: Recovery Plan for the Serpentine Soil Species of the San Francisco Bay Area (USFWS 1998)

4.14.3 Associated Co-benefited Natural Resources

- Grasslands

4.14.4 Climate Change Vulnerability Assessment

Analysis by Anacker and Leidholm (2012) ranked Marin western flax as “Not Vulnerable/Presumed Stable.” This means that available evidence does not suggest abundance and/or range extent within the geographical area assessed will increase/decrease substantially by 2050, although actual range boundaries may change. Variables that had higher vulnerability scores include indirect exposure anthropogenic barriers which was scored as *Greatly Increased*. Sensitivity to changes in temperature of historical thermal niche was scored as *Increased*. The impacts of other sensitivity and exposure variables were scored as either neutral or unknown. The species is already affected by year-to-year variations in precipitation, thus changes to these patterns may negatively impact Marin western flax (USFWS 2011b).

Climate change will also exacerbate other threats listed in Table 4-25.

The goal and objectives for Marin western flax, and the associated actions shown in Table 4-25, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address population stability, such as controlling recreational activities near known populations, which may allow populations to expand and become more resilient to climate change. Other pressures can result because of climate change or be exacerbated by climate change. **Figure 4-11** shows the range and modeled habitat for Marin western flax.

4.14.5 Conservation Strategy

Table 4-25 summarizes specific actions and pressures associated with the goal and objectives for Marin western flax (MWF). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Habitat Connectivity action 1.1.4

MWF Goal 1: Promote the persistence of sustainable and resilient Marin western flax populations occurring in the RCIS region through protecting, restoring, and enhancing Marin western flax suitable habitat.

MWF Objective 1.1: Protect known occurrences and allow expansion by protecting 763 acres of suitable serpentine habitat. Measure progress toward achieving this objective by the number of known occurrences, acres of suitable or potentially suitable serpentine habitat protected.

MWF Objective 1.2: Enhance occupied and suitable Marin western flax habitat. Measure progress toward achieving this objective by the number of acres of serpentine habitat enhanced and/or increased detection of Marin western flax compared to present day.

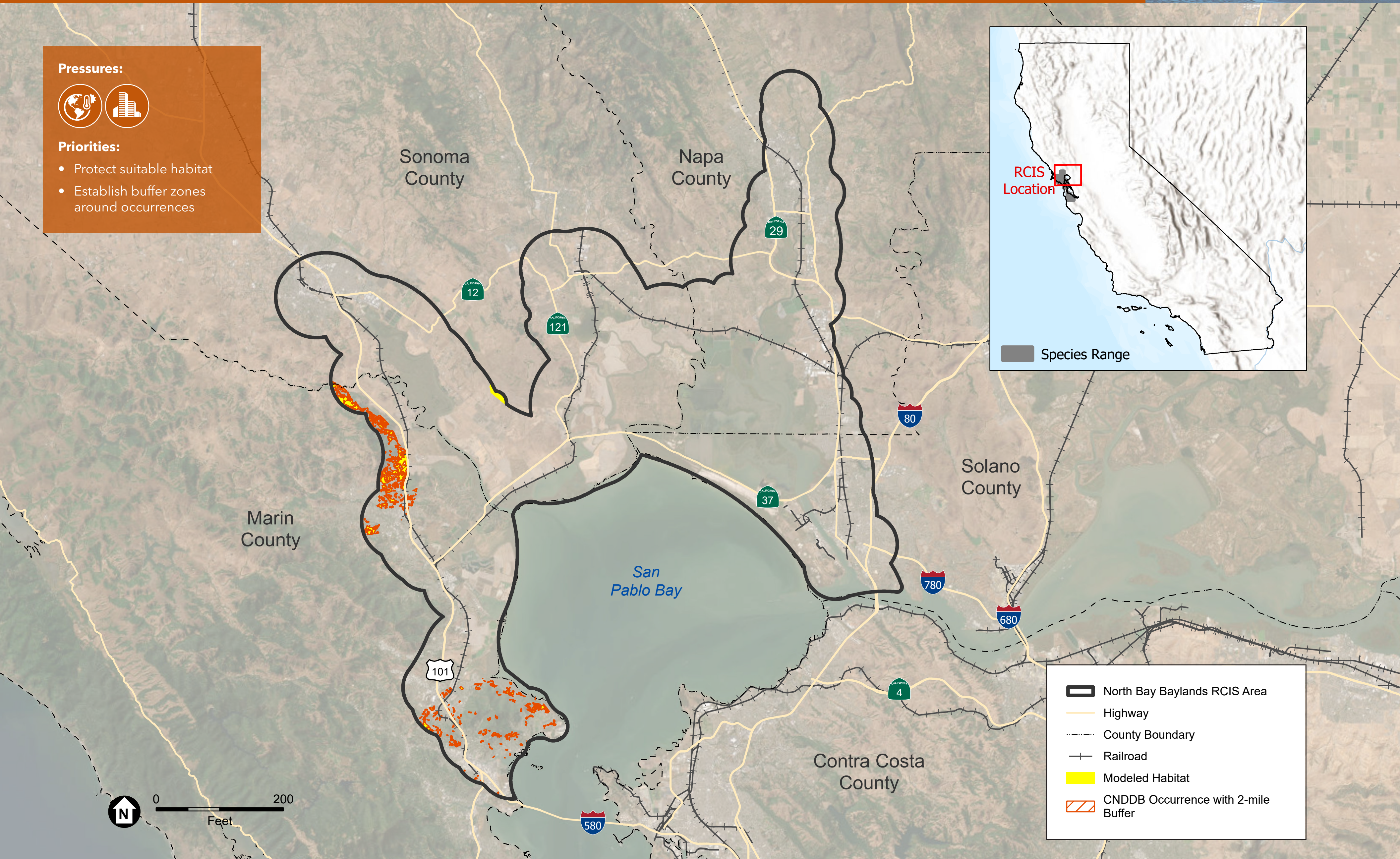
MWF Objective 1.3: Restore potentially suitable habitat for Marin western flax. Measure progress toward achieving this objective by the number of acres of serpentine habitat restored and/or increased detection of Marin western flax compared to present day.

TABLE 4-25: ACTIONS AND PRESSURES ASSOCIATED WITH MARIN WESTERN FLAX GOAL AND OBJECTIVES

Actions Associated with MWF Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
MWF 1.2.1: Create 150-meter buffer zones around occurrences to minimize impacts from recreational activities and allow for population growth (USFWS 2011b). Focus enhancement actions on the Mount Burdell population Group (USFWS 2011b).	• Climate Change • Land Conversion and Development
MWF 1.3.1: Improve/research propagation methods to improve establishment of new populations.	• Climate Change • Land Conversion and Development
MWF 1.3.2: Store and maintain seeds collected along maternal lines from multiple generations in the RCIS area, to promote genetic diversity for later use in research, restoration, and other conservation and habitat enhancement actions.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens
MWF: 1.3.3: Support public outreach and education programs directed to reduce human caused disturbance in areas with known occurrences and/or suitable habitat (USFWS 2011b).	• Land Conversion and Development

4.14.6 Conservation Priorities

- Protect existing habitat suitable for Marin western flax in the Mt. Burdell Open Space (USFWS 2011b).
- Create 150-meter buffer zones around occurrences to minimize external influence and allow for population growth (MWF 1.2.1).



SOURCE: ESA, 2024; U.S. Fish and Wildlife Service Environmental Conservation Online System (USFWS 2023); CDFW 2023c

Note: RCIS Natural Communities: Annual Grassland, Mixed Chaparral using Huber (2017) methodology.

Figure 4-11
Marin Western Flax Range and Modeled Habitat

4.15 Habitat Connectivity

Habitat connectivity is an overarching conservation element that interacts with all regional, focal species, and other conservation strategies. Habitat connectivity includes terrestrial connectivity, aquatic and hydrological connectivity, and the intersection of these.

Levee Breach at Napa Sonoma Wildlife Area, photo credit California Department of Fish and Wildlife

4.15.1 Terrestrial and Aquatic Connectivity

- CDFW's Areas of Conservation Emphasis (ACE)[3] identified priority areas of terrestrial connectivity (CDFW 2019) (**Figure 4-12**)
- ACE Rank 5, also referred to as Irreplaceable and Essential Corridors, areas include:
  - Napa-Sonoma Marshes
  - Napa Valley–Napa River Corridor
  - Southern portions of Sonoma Creek Baylands (includes Skaggs Island, Camp 1 unit, and West End unit) (CDFW 2019, SLT 2020)
  - Petaluma Valley–Petaluma River Corridor (includes Neils Island, Burdell Island, and connecting marshes)(CDFW 2019)
- ACE Rank 4, also referred to as Conservation Planning Linkages (ACE Rank 4), areas include:
  - Northern portions of Sonoma Creek Baylands (includes Camp 2-4 units and Ringstrom Bay) (CDFW 2019, SLT 2020)
- California Essential Habitat Connectivity (CEHC) dataset identified areas of natural landscape blocks and includes the Sonoma Creek Baylands, Petaluma Valley west of the Petaluma River, San Pablo Bay National Wildlife Refuge, bayside strip along Mare Island, and China Camp State Park (Spencer et al. 2010) (**Figure 4-12**)

o Identified the Napa River as a potential riparian corridor that could provide access to Landscape Blocks (Spencer et al. 2010).

- Critical upland linkage includes the Marin Coast to Blue Ridge corridor south of Petaluma (Penrod et al. 2013).
- 105 miles of key riparian corridor for linear passage of riverine and riparian dependent species (BAOSC 2019).
- RCIS area includes wetland, upland, and transitionary habitats that provide essential habitat connectivity as refugia habitat for tidal species. Additional and expanded ecotone transitions are needed with sea level rise (Beagle et al. 2019).

---

3 The CDFW ACE Terrestrial Connectivity dataset summarizes information on terrestrial connectivity by ACE hexagon including the presence of mapped corridors or linkages and the juxtaposition to large, contiguous, natural areas. Hexagons are given ranked 1-5 (with 5 being the highest scores and 1 being the lowest) (CDFW 2019).

- Natural landscape blocks that facilitate wildlife movement through connectivity corridors also provide ecosystem services such as groundwater recharge, runoff retention, flood water retention, sequestration of harmful air pollutants, and carbon storage (BCDC 2020).
- Streams and riparian areas provide species habitat, but also serve a critical function in linking upland and baylands processes, such as transporting and depositing sediments and nutrients.

4.15.2 Barriers to Habitat Connectivity

As shown on **Figure 4-12,** there are numerous dams, water diversions, flood and grade control structures, and non-structure fish passage barriers (CDFW 2023b). Additionally, several major roadways, including SR 121, SR 37, and U.S. 101, and railways serve as barriers to habitat connectivity (CDFW 2023b). Dikes and levees throughout the region can also act as barriers to tidal habitat connectivity.

4.15.3 Associated Non-focal Species and Co-benefited Natural Resources

- California freshwater shrimp (*Syncaris pacifica*)
- Western ridged mussel (*Gonidea angulata*)
- Delta smelt (*Hypomesus transpacificus*)
- Longfin smelt - San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)
- Sacramento splittail (*Pogonichthys macrolepidotus*)
- Pallid bat (*Antrozous pallidus*)
- Townsend’s big-eared bat (*Corynorhinus townsendii*)
- Swainson’s hawk (*Buteo swainsoni*)
- Tricolored blackbird (*Agelaius tricolor*)
- San Pablo song sparrow (*Melospiza melodia samuelis*)
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- Soft bird’s-beak (*Chloropyron molle* ssp*. molle*)
- Diked wetlands
- Rookeries

4.15.4 Climate Change Vulnerability Assessment

Reduction of habitat connectivity and increased habitat fragmentation will impact how wildlife, plants, and natural communities respond to climate change in the RCIS area. Continued urban developments, especially installation of new linear features (e.g., roads, railways, and utilities), will impact how habitats transition in response to projected sea level rise. Existing development also restricts the ability for habitats to migrate to higher elevations as sea levels rise. This can impact plant and wildlife dispersal and predator-prey relationships, leading to increased genetic isolation and potential extirpation of populations.

The ecotone levee locations and places for habitat migration identified by the San Francisco Bay Adaptation Atlas (Beagle et al. 2019) fall within area classified as Irreplaceable and Essential Corridors (ACE Rank 5) and Conservation Planning Linkages (ACE Rank 4). Ecotone transitions are gentle gradations in elevation from wetland to upland habitat, which allow short-term species movement and long-term habitat migration with tidal fluctuation or sea level rise. Maintaining and increasing healthy connectivity between terrestrial and aquatic habitats is important for maintaining hydrological regimes, water quality, and sediment balances, and may improve climate change resilience. Land conversion and development in these areas can have greater impacts on species with restricted ranges and habitat requirements that are likely to be exasperated by climate change impacts.

Climate change will also exacerbate other threats listed in Table 4-26.

The goal and objective for habitat connectivity, and the associated actions shown in Table 4-26 aim to protect, enhance, and restore present day habitat connectivity corridor, as well as areas that may provide connectivity in the future because of projected climate changes. Actions also address infrastructure connectivity and ecotone transitions. Other pressures can result because of climate change or be exacerbated by climate change. **Figure 4-12** shows modeled habitat connectivity.

4.15.5 Conservation Strategy

Table 4-26 summarizes specific actions and pressures associated with the goal and objective for Habitat Connectivity (HC). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- FISH 1.2.1
- Tidal Communities actions 1.1.1, 1.1.2, 1.2.1, 1.2.4, 1.2.5, 1.2.6, 1.2.7, and 1.2.8

HC Goal 1: Protect, establish, and improve habitat connectivity and linkages.

HC Objective 1.1: Establish and improve connectivity between landscape blocks/suitable habitat and along elevational gradients to allow species and habitats to migrate over space and time. Measure progress towards achieving this objective by the number of connectivity corridors enhanced or created and/or the number of acres of habitat connected through enhancement/creation of crossings through identified barriers.

TABLE 4-26: ACTIONS AND PRESSURES ASSOCIATED WITH HABITAT CONNECTIVITY GOAL AND OBJECTIVE

Actions Associated with HC Goal and Objective	Pressures
RL Objective 1.1 (Protection) actions Focus on connecting existing protected areas to create contiguous landscape blocks. Plan for potential changes in species distribution and pathways due to projected future climate scenarios by including a diverse mosaic of interconnected habitats.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HC 1.1.1: Improve connectivity across infrastructure features (e.g., by adding large culverts, wildlife crossing structures, directional fencing, scuppers, barrier breaks, roadside wildlife detection systems, exclusion fencings along roads and other linear barriers, sound barriers), limiting lighting at constructed or natural linkages, and removing existing barriers to promote wildlife movement and reduce road mortality (Yap and Rose 2019). Focus on areas with high numbers of vehicle-related mortality, areas with high Area of Conservation Emphasis Terrestrial Connectivity ranking and include areas to create corridor redundancy. Design of connectivity structures should consider species-specific requirements and may include post-construction monitoring of impacts on vehicle-related mortality and usage of crossing. Long-term funding for maintenance of structures should be included.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways

Actions Associated with HC Goal and Objective	Pressures
HC 1.1.2: Create habitat transitions between aquatic and upland systems to support estuarine transition and flood water dispersal/storage as sea levels rise. Focus on linear infrastructure barriers such as railways.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HC 1.1.3: Remove barriers and constrictions, expand culverts, and breech levees to restore tidal and fluvial connectivity. Long-term funding for maintenance of structures should be included.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HC 1.1.4: Acquire, protect, and/or restore key migration corridors. Include habitat and adjacent areas on either side of crossing structures and areas that allow species to adapt to projected changes in habitat suitability.	• Climate Change • Land Conversion and Development
HC 1.1.5: Support monitoring of the performance of wildlife crossings to understand the appropriate designs to increase usability and decrease the potential for mortality from flooding, overheating and/or predation.	• Climate Change • Land Conversion and Development
HC 1.1.6: Collaborate and support new studies and/or us existing data (e.g., roadkill, camera traps) to identify additional connectivity barriers.	• Climate Change • Land Conversion and Development

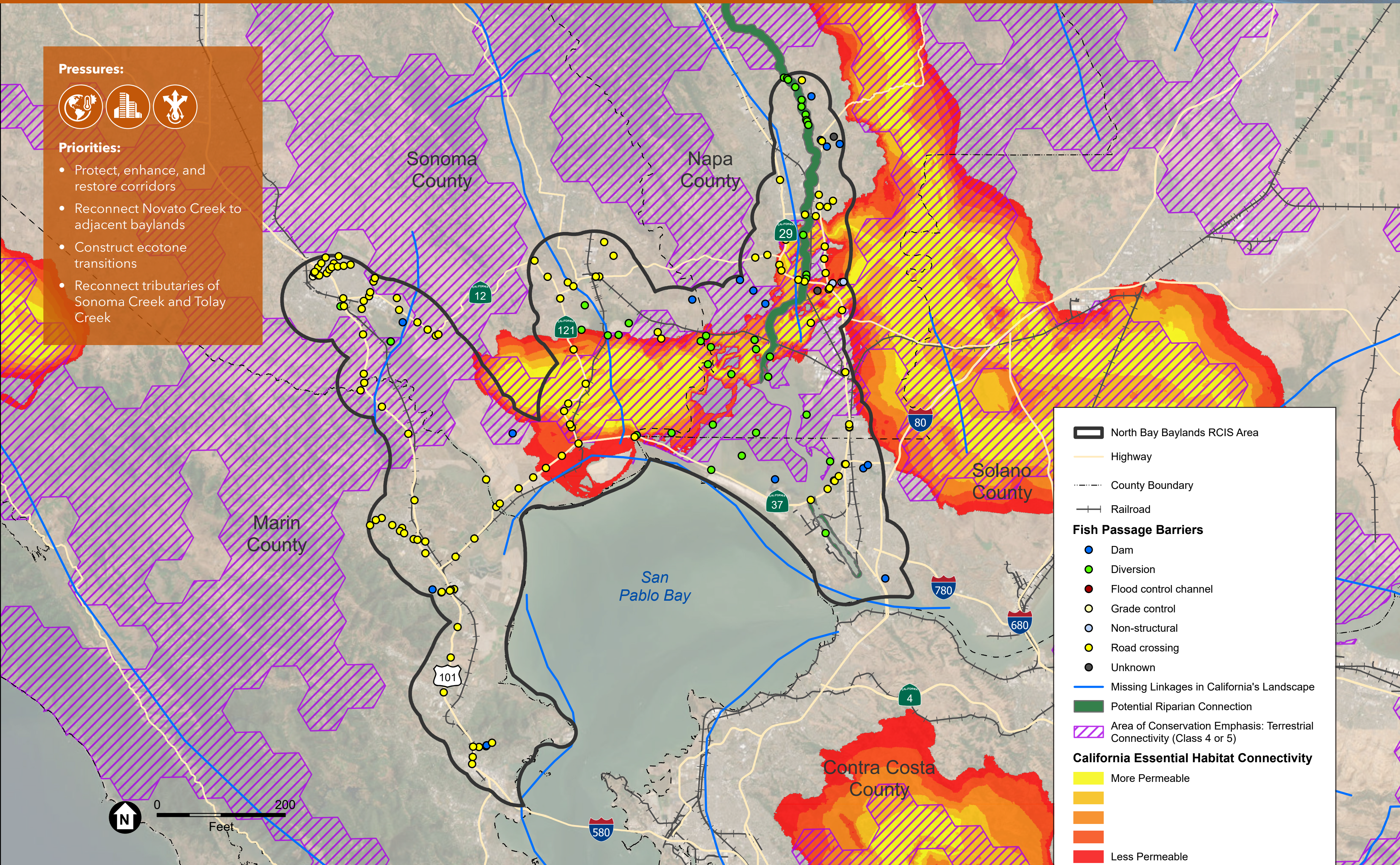
4.15.6 Conservation Priorities

- Protect, enhance, and restore habitat along irreplaceable and important terrestrial corridors including Napa-Sonoma Marshes, Napa Valley–Napa River Corridor, Southern portions of Sonoma Creek Baylands (includes Skaggs Island, Camp 1 unit, and West End unit), Petaluma Valley–Petaluma River Corridor including Neils Island, Burdell Island, and connecting marshes.
- Remove levees and reconnect lower Novato Creek to adjacent baylands (SFEI-ARC 2015).
- Construct ecotone transitions (see San Francisco Bay Adaptation Atlas) to improve connectivity between tidal marsh and adjacent undeveloped uplands (Beagle et al. 2019).
- Reconnect tributaries and their alluvial deposition to the landward side of our restored baylands at Sonoma Creek and Tolay Creek (SLT 2020).

Pressures:

Priorities:

- Protect, enhance, and restore corridors
- Reconnect Novato Creek to adjacent baylands
- Construct ecotone transitions
- Reconnect tributaries of Sonoma Creek and Tolay Creek



SOURCE: CDFW 2019; Spencer et al. 2010; Penrod et al. 2001; Penrod et al. 2013; ESA, 2024; CDFW 2023b

Figure 4-12
Habitat Connectivity

4.16 Bat Habitat

Bats within Bridge Expansion Joint, photo credit US Fish and Wildlife Service

4.16.1 Regulatory Status

Several bat species (included as non-focal species) have special regulatory status.

4.16.2 Ecological Requirements and Threats

- RCIS Natural Communities: All communities (See **Figure 4-13** for range and modeled habitat)
- *Roosting habitat:* Includes trees and structures such as bridges, buildings, and barns. Some species use these structures for roosting all year while others use them seasonally as diurnal or nocturnal roosts, hibernations sites, and as maternity colonies.
- *Foraging habitat:* Open areas, with concentrations along riparian corridors, waterways, and ecotones transitions (CDFW 1988, 2000b).
- Ecological services include pollination and vector control.
- Roost site sensitivities include human disturbance and spread of pathogens (Langwig et al. 2015).
- Full habitat account available: *Pallid Bat Life History Account* (CDFW 1988) and *Townsend's Big-eared Bat Life History Account* (CDFW 2000b).

4.16.3 Associated Non-focal Species

- Pallid bat (*Antrozous pallidus*)
- Townsend's big-eared bat (*Corynorhinus townsendii*)
- Tricolored blackbird (*Agelaius tricolor*)

4.16.4 Climate Change Vulnerability Assessment

Hilberg and Kershner (2019) prepared a climate change vulnerability assessment for northern California bat species. Overall, bats are sensitive to climate stressors that decrease water availability, increase energy expenditures, decrease prey availability, and interfere with hibernation (Hilberg and Kershner 2019). Exposure factors include increased temperature and more frequent waves, changes in precipitation patterns and increase drought, and altered wildfire regimes (Hilberg and Kershner 2019). Increasing temperatures may cause some species to move farther north and threaten species with direct and mass mortality.

Climate change will exacerbate all the threats listed in Table 4-27.

The goal and objectives for bats, and the associated actions shown in Table 4-27, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address threats to population stability, such as monitoring for pathogens, which may assist in identifying disease risks and allow populations to move to newly suitable habitats in the future. **Figure 4-13** shows the modeled suitable habitat for bat species.

4.16.5 Conservation Strategy

Table 4-27 summarizes specific actions and pressures associated with the goals and objectives for bats (BAT). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.4, and 1.1.5
- Crotch's Bumble Bee action 1.2.3
- Hydrological Processes action 1.1.1, 1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.1.7, 1.1.9

BAT Goal 1: Promote persistence of sustainable and resilient bat habitat through protection, enhancement, and restoration of habitat.

Objective BAT 1.1: Protect present-day habitat by protecting 62,017 acres of suitable bat foraging and roosting habitat. Measure progress toward achieving this objective by acres of bat foraging and roosting habitat protected.

Objective BAT 1.2: Enhance and restore suitable bat foraging and roosting habitat. Measure progress toward achieving this objective by the number of acres of foraging and roosting habitat enhanced and restored, and/or increased detection of roosting locations compared to present day.

BAT Goal 2: Support stability and recovery of bat populations in the RCIS through measures to reduce direct mortality.

Objective BAT 2.1: Reduce prevalence of pathogens in suitable bat habitat. Measure progress toward achieving this objective by the reduction of pathogen-related bat deaths detected compared to present day.

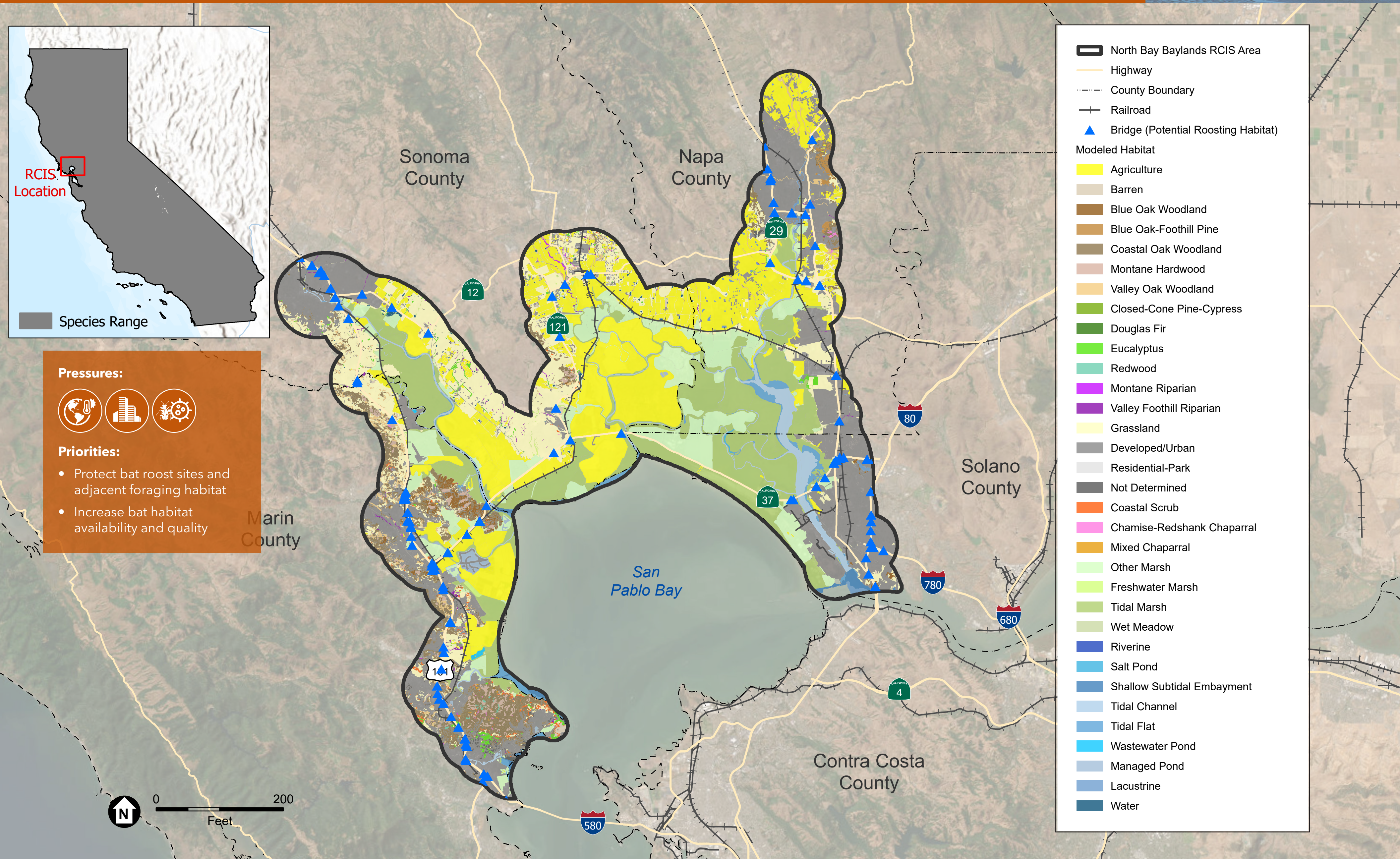
TABLE 4-27: ACTIONS AND PRESSURES ASSOCIATED WITH BAT GOALS AND OBJECTIVES

Actions Associated with BAT Goals and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
BAT 1.2.1: Include designs in infrastructure projects, including culverts and bridges, to encourage roosting and ensure project are compatible with bats.	• Climate Change • Land Conversion and Development
BAT 1.2.2: Limit recreational activities near potential roosting sites, including culverts and other transportation infrastructure.	• Land Conversion and Development
BAT 1.2.3: Collaborate with or conduct surveys and long-term monitoring to increase understanding of bat population trends and climate change impacts to inform bat conservation, management, and to determine potential enhancement and restoration location opportunities. Prioritize projects that (1) increase understanding of the distribution, abundance, and habitat use by bats and (2) monitor populations to examine trends and the effects of climate change.	• Climate Change • Land Conversion and Development

Actions Associated with BAT Goals and Objectives	Pressures
BAT 1.2.4 Conduct public and partner outreach to increase awareness of valuable ecosystem services and the need for reduced contaminants. Prioritize projects that (1) include public and partner outreach and education to combat negative public perception that bats are pests and (2) reduce pesticide use and facilitate use of bat-mediated pest control in agricultural systems.	• Climate Change • Land Conversion and Development • Livestock, Farming, and Ranching
BAT 2.1.1: Implement sanitization protocols for pathogen-caused diseases (such as white-nosed syndrome) before entering transportation infrastructure, including culverts, occupied by bats to reduce pathogen prevalence in suitable bat habitat.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens
BAT 2.1.2: Fund disease monitoring surveillance, testing of bat carcasses for cause of death, and education on spread of bat diseases.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens

4.16.6 Conservation Priorities

- Locate and permanently protect bat roosting sites and adjacent foraging habitat (RL Objective 1.1).
- Focus on projects that increase bat habitat availability and quality.



SOURCE: ESA, 2024; California Wildlife Habitat Relationships (CDFW 2021).

Note: All RCIS Natural Communities (excluding urban).

Figure 4-13
Bat Range and Modeled Habitat

4.17 Riparian Corridors

Sonoma Creek riparian corridor, photo credit Katie Dudney

4.17.1 Regulatory Status

There are three sensitive riparian vegetation alliances with a State Ranking of S3 (Vulnerable) with known occurrences in the RCIS area:

- Black willow thickets – *Salix gooddingii* Alliance
- Bigleaf maple – *Acer macrophyllum* Alliance
- Gooding's willow-Red willow – *Salix gooddingii- Salix laevigata* Alliance

Fremont cottonwood forest – *Populus fremontii* Association occurs in the RCIS area and is a sensitive community.

Riparian and riverine habitats are protected under Sections 401, 402, and 404 of the Clean Water Act, and Sections 1600-1607 of the California Fish and Game Code.

4.17.2 Riparian Habitat Ecological Requirements and Threats

- RCIS Natural Communities: Montane Riparian, Valley Foothill Riparian (See **Figure 4-14** for range and modeled habitat)
- Riparian natural communities provide food, water, migration, and dispersal corridors, and cover for many wildlife species (Mayer and Laudenslayer 1988).
- Dominated by species with large water requirements.
- Transition to adjacent non-riparian vegetation usually abrupt (Mayer and Laudenslayer 1988).
- Impacted by excessive sedimentation, and flooding impacts such as excess debris and uprooting of plants (Mayer and Laudenslayer 1988).
- Full habitat account available: Montane Riparian Habitat Description and Valley Foothill Riparian Habitat Description (Mayer and Laudenslayer 1988)

4.17.3 Riverine Ecological Requirements and Threats

- RCIS Natural Communities: Riverine (See **Figure 4-14** for range and modeled habitat)
- Includes all aquatic habitats contained within a channel except for (1) wetlands dominated by vegetation, and (2) habitats with water with salinities of 0.5 ppt or greater.
- Characterized by intermittent or continually running water in a natural or artificial conduit (CDFW 2005, FGDC 2013)
- Impacted by water diversions and impoundments, increased sedimentation, and decreased water quality.

- Full habitat account available: Classification of Wetlands and Deepwater Habitats of the United States (FGDC 2013)

4.17.4 Associated Non-focal Species and Co-benefited Natural Resources

- Pallid bat (*Antrozous pallidus*)
- Townsend's big-eared bat (*Corynorhinus townsendii*)
- Swainson's hawk (*Buteo swainsoni*)
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- California freshwater shrimp (*Syncaris pacifica*)
- Western ridged mussel (*Gonidea angulata*)
- Rookeries

4.17.5 Climate Change Vulnerability Assessment

Table 4-28 summarizes the climate change exposure, spatial distribution, and vulnerability of riparian corridor natural vegetation communities statewide under two general circulation models with high emissions (Thorne et al. 2016a). Montane riparian communities could experience a 25 to 39 percent reduction in areas that are climatically suitable for the suite of species that make up these communities. Valley foothill riparian communities statewide could experience a 20 to 24 percent reduction in areas that are climatically suitable. Valley foothill riparian communities are projected to experience higher levels exposure than montane riparian communities.

TABLE 4-28: RIPARIAN CORRIDOR NATURAL COMMUNITY CLIMATE CHANGE VULNERABILITY RANKING

RCIS Natural Community	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Warm and Wet*	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Hot and Dry*	Combined Vulnerability Rank High Emissions (RCP8.5)
Montane Riparian	Moderate	Moderate	Moderate
Valley Foothill Riparian	Mid-high	Mid-high	Moderate to Mid-high

Additional impacts may include:

- Rising groundwater and salinity
- Erosion from increased flooding
- Increased mortality of riparian vegetation from severe droughts, wildfires, and flooding
- Changes in species composition and water quality due to changes to temperature and precipitation patterns

Climate change will exacerbate all the threats listed in Table 4-29.

The goal and objectives for riparian corridors, and the associated actions shown in Table 4-29, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address sustaining complex, healthy riparian corridors, such as controlling excessive sedimentation and flooding impacts, which may increase resiliency to climate impacts future. **Figure 4-14** shows the range and modeled riparian corridors.

4.17.6 Conservation Strategy

Table 4-29 summarizes specific actions and pressures associated with the goal and objectives for riparian corridors (RIP). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- All Water Quality goals, objectives, and actions
- Anadromous Fish action 1.1.1
- Herpetofauna actions 1.1.1, 1.1.4, and 1.1.5
- Tidal Communities action 1.2.6
- Steelhead actions 1.2.1, 1.2.2, 1.3.1, and 1.3.2
- California Red-legged Frog actions 1.2.1, 1.2.2, 1.2.3, and 1.3.1
- Western Pond Turtle actions 1.2.1 and 1.2.2
- Habitat Connectivity actions 1.1.2, 1.1.3, and 1.1.4
- Hydrological Processes actions 1.1.1, 1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.1.7, 1.1.9

RIP Goal 1: Promote persistence of sustainable and resilient riparian corridors through protection, enhancement, and restoration of habitat.

Objective RIP 1.1: Protect present-day habitat by protecting 480 acres of historical, present day, and potentially restorable riparian corridors. Measure progress toward achieving this objective by the number of acres or linear miles/feet, as appropriate, of historical, present day, and potentially restorable riparian corridors protected.

Objective RIP 1.2: Enhance and restore riparian corridors. Measure progress toward achieving this objective by the number of acres or linear miles/feet, as appropriate, of riparian corridors enhanced or restored.

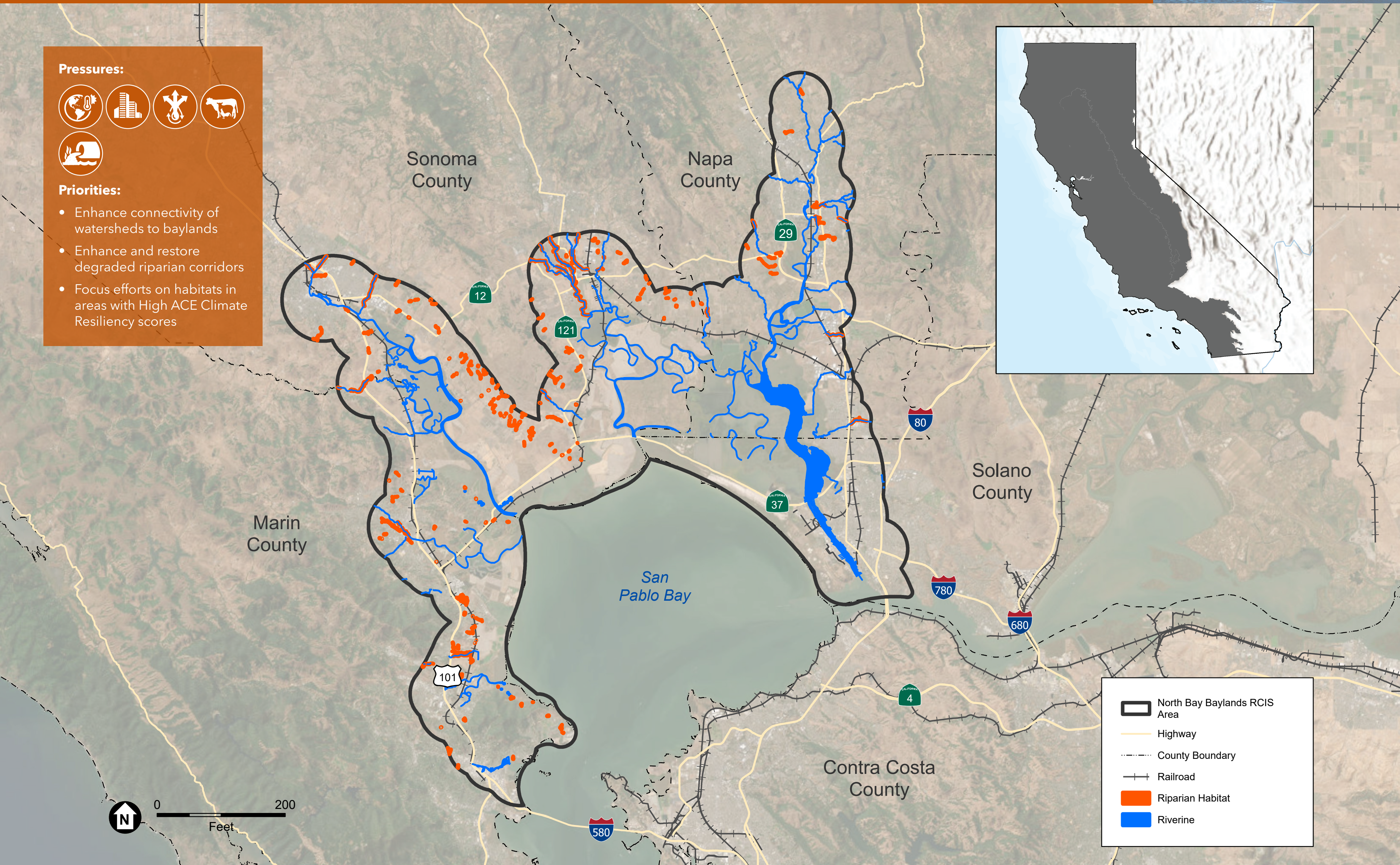
TABLE 4-29: ACTIONS PRESSURES ASSOCIATED WITH RIPARIAN CORRIDORS GOAL AND OBJECTIVES

Actions Associated with RIP Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
WATER Objective 1.1 (Water Quality) actions	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges • Livestock, Farming, and Ranching

Actions Associated with RIP Goal and Objectives	Pressures
RIP 1.2.1: Maintain and enhance plant and wildlife species diversity and richness.	• Climate Change • Land Conversion and Development • Invasive Species and Pathogens
RIP 1.2.2: Remove built up debris to reduce negative flooding impacts, where ecologically suitable, and consider reuse for restoration projects. Coordinate with scientific advisors, land managers, universities, and/or regulatory agencies to ensure the removal of debris results in ecological uplift.	• Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
RIP 1.2.3: Continue existing research and develop/implement new long-term research to better understand population and range dynamics for riparian and riverine species.	• All
RIP 1.2.4: Inventory riparian corridors suitable for enhancement or restoration.	• All

4.17.7 Conservation Priorities

- Enhance connectivity of watersheds to baylands, especially to transition zones, to ensure complete ecosystems.
- Enhance and restore degraded riparian corridors, especially Conservation Lands Network Priority 1 and 2 Stream Targets (Appendix D) (RIP 1.2.2, WATER Goal 1).
- Focus efforts on habitats in areas with High ACE Terrestrial Climate Change Resilience rankings (CDFW 2019).



SOURCE: ESA, 2024; Valley foothill riparian and Montane riparian ranges, California Wildlife Habitat Relationships (CDFW 2021).

Note: RCIS Natural Communities: Montane Riparian, Valley Foothill Riparian, Riverine and National Hydrography Dataset (USGS 2019).

Figure 4-14
Riparian Corridors Range and Habitat

4.18 Freshwater Wetlands

Freshwater Wetland, photo credit Katie Dudney

4.18.1 Regulatory Status

Freshwater wetlands may be protected under Sections 401, 402, and 404 of the Clean Water Act, and Sections 1600-1607 of the California Fish and Game Code.

4.18.2 Ecological Requirements and Threats

- RCIS Natural Communities: Freshwater Marsh (See **Figure 4-15** for range and modeled habitat)
- Areas covered by fresh surface or groundwater with enough frequency and duration to support plants adapted to saturated soil conditions (USACE 1987)
- Ecosystems services include floodwater attenuation and increased water quality.
- Threatened by increased agricultural conversion, introduction of invasive species, and water diversions.
- Full habitat account available: Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987)

4.18.3 Associated Non-focal Species and Co-benefited Natural Resources

- Tricolored blackbird (*Agelaius tricolor*)
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- Rookeries

4.18.4 Climate Change Vulnerability Assessment

Table 4-30 summarizes the climate change exposure, spatial distribution, and vulnerability of freshwater wetlands statewide under two general circulation models with high emissions (Thorne et al. 2016a). Freshwater wetland communities could experience a 93 to 97 percent reduction in areas that are climatically suitable for the suite of species that make up these communities . Additionally, 100 percent of communities are projected to be climatically stressed.

TABLE 4-30: FRESHWATER WETLAND CLIMATE CHANGE VULNERABILITY RANKING

RCIS Natural Community	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Warm and Wet*	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Hot and Dry*	Combined Vulnerability Rank High Emissions (RCP8.5)
Freshwater Marsh	High	High	High

Additional impacts may include:

- Rising groundwater and salinity
- Erosion from increased flooding

- Altered hydrology
- Increased mortality of wetland vegetation from severe droughts, wildfires, and flooding
- Changes in species composition and water quality due to changes to temperature and precipitation patterns

Climate change will exacerbate all the threats listed in Table 4-31.

The goal and objectives for freshwater wetlands, and the associated actions shown in Table 4-31, aim to protect, enhance, and restore historic and present day suitable habitats, as well as areas that may become suitable in the future because of projected climate changes. Actions to limit fragmentation and increase water quality may help this habitat better adapt to future climate changes. **Figure 4-15** shows the range and modeled suitable freshwater wetland habitats.

4.18.5 Conservation Strategy

Table 4-31 summarizes specific actions and pressures associated with the goal and objectives for this other conservation element. Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.6, and 1.1.7
- Herpetofauna actions 1.1.1, 1.1.4, and 1.1.5
- Tidal Communities action 1.2.6
- California Red-legged Frog actions 1.2.1, 1.2.2, 1.2.3, and 1.3.1
- Western Pond Turtle actions 1.2.2 and 1.2.3
- Habitat Connectivity actions 1.1.2, 1.1.3, and 1.1.4
- Hydrological Processes actions 1.1.1, 1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.1.7, 1.1.9

Goal FW 1: Promote persistence of sustainable and resilient freshwater marsh habitats through protection, enhancement, and restoration of habitat.

Objective FW 1.1: Protect present-day habitat and allow for expansion by protecting 105 acres of historical, present day, and potentially restorable suitable freshwater wetland habitat. Measure progress toward achieving this objective by acres of historical, present day, and potentially restorable freshwater wetland habitat and adjacent acres protected.

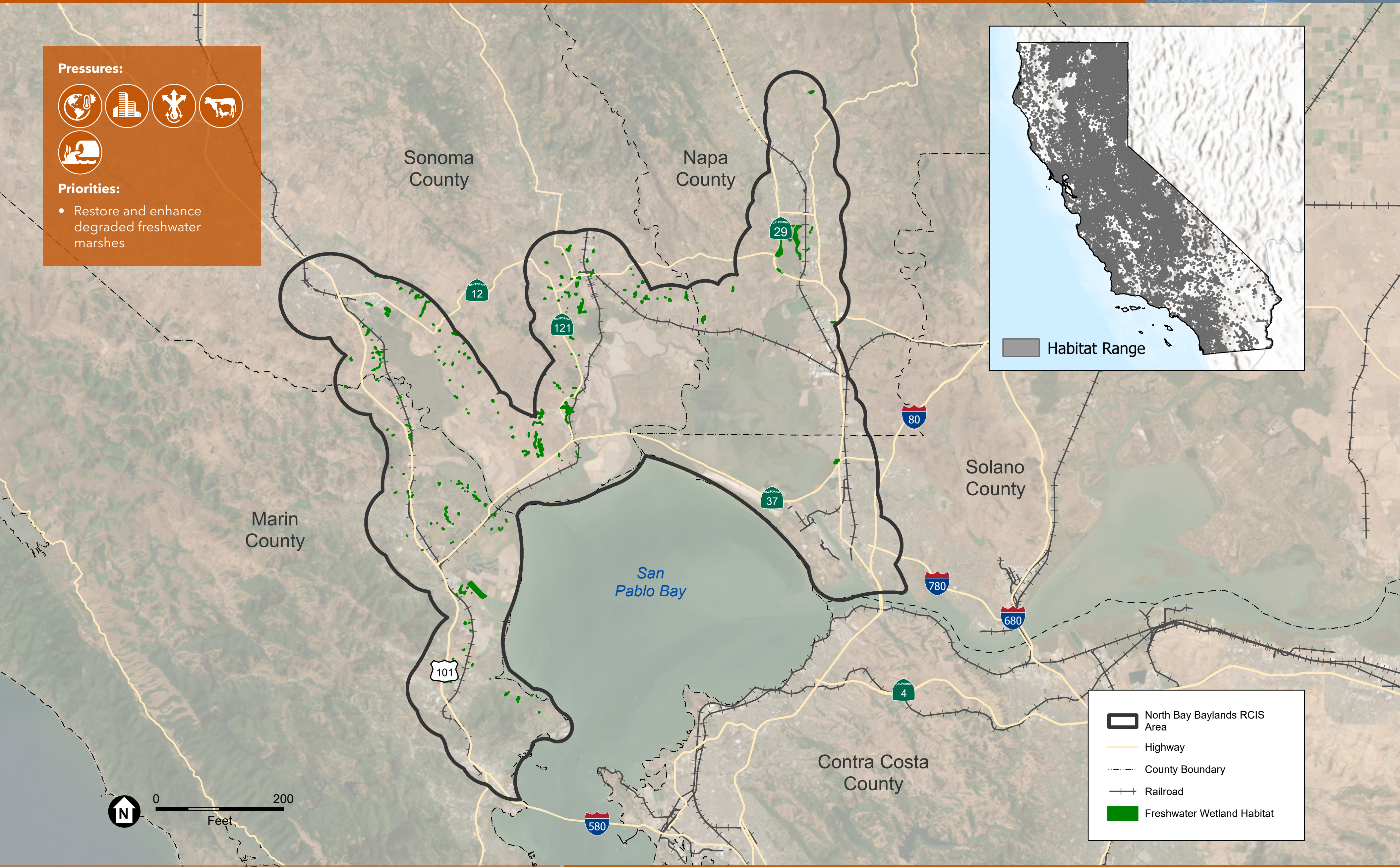
Objective FW 1.2: Enhance and restore suitable freshwater wetland habitat. Measure progress toward achieving this objective by the number of acres of habitat enhanced or restored.

TABLE 4-31: ACTIONS AND PRESSURES ASSOCIATED WITH FRESHWATER WETLAND HABITAT GOAL AND OBJECTIVES

Actions Associated with FW Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
WATER Objective 1.1, actions 1.1.1, 1.1.2, 1.1.4, 1.1.6, and 1.1.7 TIDE Objective 1.2 (Restoration), action 1.2.6	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges • Livestock, Farming, and Ranching
FW 1.2.1: Limit recreational activities in and adjacent to freshwater wetlands to reduce impacts and disturbance. Ensure that authorized recreation is compatible with current and potentially future habitat suitability.	• Climate Change • Land Conversion and Development • Water Pollutants and Discharges
FW 1.2.2: Include topography, vegetation, and hydrology components when designing restoration and enhancement projects.	• Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
FW 1.2.3. Restore and enhance habitat degraded by prior land uses (e.g., development, agriculture, ranching).	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges • Livestock, Farming, and Ranching
FW 1.2.4. Support conservation and recycling programs that increase water supply.	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways
FW 1.2.5: Monitor use of freshwater marshes by focal and non-focal species, as well as other marsh plant and animal species, to track the health of freshwater marshes and potential for providing ecosystem services.	• Climate Change • Land Conversion and Development • Livestock, Farming, and Ranching • Water Pollutants and Discharges

4.18.6 Conservation Priorities

- Focus restoration and enhancement on freshwater marshes degraded by prior land uses (FW 1.2.3).



SOURCE: ESA, 2024; Fresh Emergent Wetland range, California Wildlife Habitat Relationships (CDFW 2021).

Note: RCIS Natural Communities: Freshwater Marsh.

Figure 4-15
Freshwater Wetlands Range and Habitat

4.19 Tidal Wetlands

4.19.1 Regulatory Status

There are three sensitive tidal vegetation alliances with a State Ranking of S3 (Vulnerable) with known occurrences in the RCIS area:

- California cordgrass marsh – *Spartina foliosa* Association
- Pickleweed mats – *Sarcocornia pacifica (Salicornia depressa)* Alliance
- Salt marsh bulrush marshes – *Bolboschoenus maritimus* Alliance

Napa-Sonoma Wildlife Area, photo credit Katie Dudney

One sensitive vegetation association with a State Ranking of S2S3 (Imperiled to Vulnerable), Gum plant patches – *Grindelia stricta* Provisional Association, also occurs in the RCIS area.

Tidal wetlands are protected under Sections 401, 402, and 404 of the Clean Water Act, and Sections 1600-1607 of the California Fish and Game Code.

4.19.2 Tidal Flats Ecological Requirements and Threats

- RCIS Natural Communities: Tidal Flat (See **Figure 4-16** for range and modeled habitat)
- Defined by elevation in relation to tidal height and occur between mean tide level, or the lower elevation of cordgrass (*Spartina* sp.), to about 2.5 feet below mean lower low water (Goals Project 1999)
- Can include various combinations of clay, silt, shell fragments, and organic debris (Goals Project 1999).
- Daily tidal cycles submerge and expose twice a day, where subjected to fluctuating wave action, current velocities, and nutrient supply (Goals Project 1999).
- Important food source for migrating and wintering shorebirds and waterfowl.
- Strongly influenced by suspended sediments (Goals Project 1999)
- Full habitat account available: *Plants of Shallow Subtidal Habitat and Tidal Flats* in Baylands Ecosystem Habitat Goals (Goals Project 1999)

4.19.3 Tidal Marsh Ecological Requirements and Threats

- RCIS Natural Communities: Tidal Marsh, Tidal Channel (See **Figure 4-16** for range and modeled habitat)
- Occur in three elevation zones:
- Low marsh zone occurs from mean sea level to mean high water;
- Middle marsh zone occurs from mean high water to mean higher high water; and,
- High marsh zones occur at elevations flood by 3 to 25 percent of all high tides, which flood at least twice per month but less than once every other day on average (Thorne et al. 2016b).

- Transition zone marsh is flooded by 0.14 to 3 percent of all high tides, and flooding occurs at least once annually but no more than twice per month on average (Thorne et al. 2016b.)

- Persist through balancing processes that increase marsh elevation, such as sediment accretion, and those that decrease marsh elevation, such as erosion and subsidence, relative to sea level (USFWS 2019a).

- Invasive perennial pepperweed (*Lepidium latifolium*) forms monocultures and alters the habitat of tidal marsh-dependent species (USFWS 2019a).

- Extents of tidal marshes reduced due to construction of roads, railways, and levees (USFWS 2019a).

- Full habitat account available: *Tidal Marsh Plants of the San Francisco Estuary in Baylands Ecosystem Habitat Goals* (Goals Project 1999)

4.19.4 Associated Non-focal Species

- Delta smelt (*Hypomesus transpacificus*)
- Sacramento splittail (*Pogonichthys macrolepidotus*)
- Longfin smelt - San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)
- California least tern (*Sternula antillarum browni*)
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- San Pablo song sparrow (*Melospiza melodia samuelis*)
- Western snowy plover (*Charadrius nivosus nivosus*)
- Soft bird's-beak (*Chloropyron molle* ssp. *molle*)

4.19.5 Climate Change Vulnerability Assessment

Due to tidal wetlands' continuous elevational balancing act, tidal ecosystems are very susceptible to negative impacts from sea level rise. If sea level rise outpaces sediment accretion rates, tidal wetlands will be inundated for longer periods of time (USFWS 2019b). This eventually leads to conversion from marsh to tidal flats to open water, as well as the possible expansion of marsh due to increasing inundation with salt water into upland areas (USFWS 2019b). Modeling has shown that marshes in the San Pablo baylands will not likely keep pace with sea level rise in the long term in their present form, and much of the current tidal wetlands will transition to lower elevational habitats by 2100 (USFWS 2019b). Marshes will transgress inland, particularly where there is elevation capital such as alluvial fans.

Climate change will exacerbate all the threats listed in Table 4-32.

The goal and objectives for tidal wetlands, and the associated actions shown in Table 4-32, aim to protect, enhance, and restore historic and present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions to limit fragmentation and the establishment and persistence of invasive species may help this habitat better adapt to future climate changes. **Figure 4-16** shows the range and modeled suitable tidal wetlands.

4.19.6 Conservation Strategy

Table 4-32 summarizes specific actions and pressures associated with the goal and objectives for this other conservation element. Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- Water Quality actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, and 1.1.8
- All Tidal Communities goals, objectives, and actions
- Green Sturgeon action 1.3.1
- Steelhead action 1.2.3
- Habitat Connectivity actions 1.1.2, 1.1.3, and 1.1.4
- Hydrological Processes actions 1.1.1, 1.1.2, 1.1.4, 1.1.7, and 1.1.8

Goal TW 1: Promote persistence of sustainable and resilient tidal flat and tidal marsh habitats through protection, enhancement, and restoration of habitat.

Objective TW 1.1: Protect present-day habitat and allow for expansion by protecting 7,883 acres of historical, present day, and potentially restorable tidal wetlands. Measure progress toward achieving this objective by acres of historical, present day, and potentially restorable tidal habitat and adjacent acres protected.

Objective TW 1.2: Enhance and restore tidal wetlands. Measure progress toward achieving this objective by the number of acres of habitat enhanced or restored.

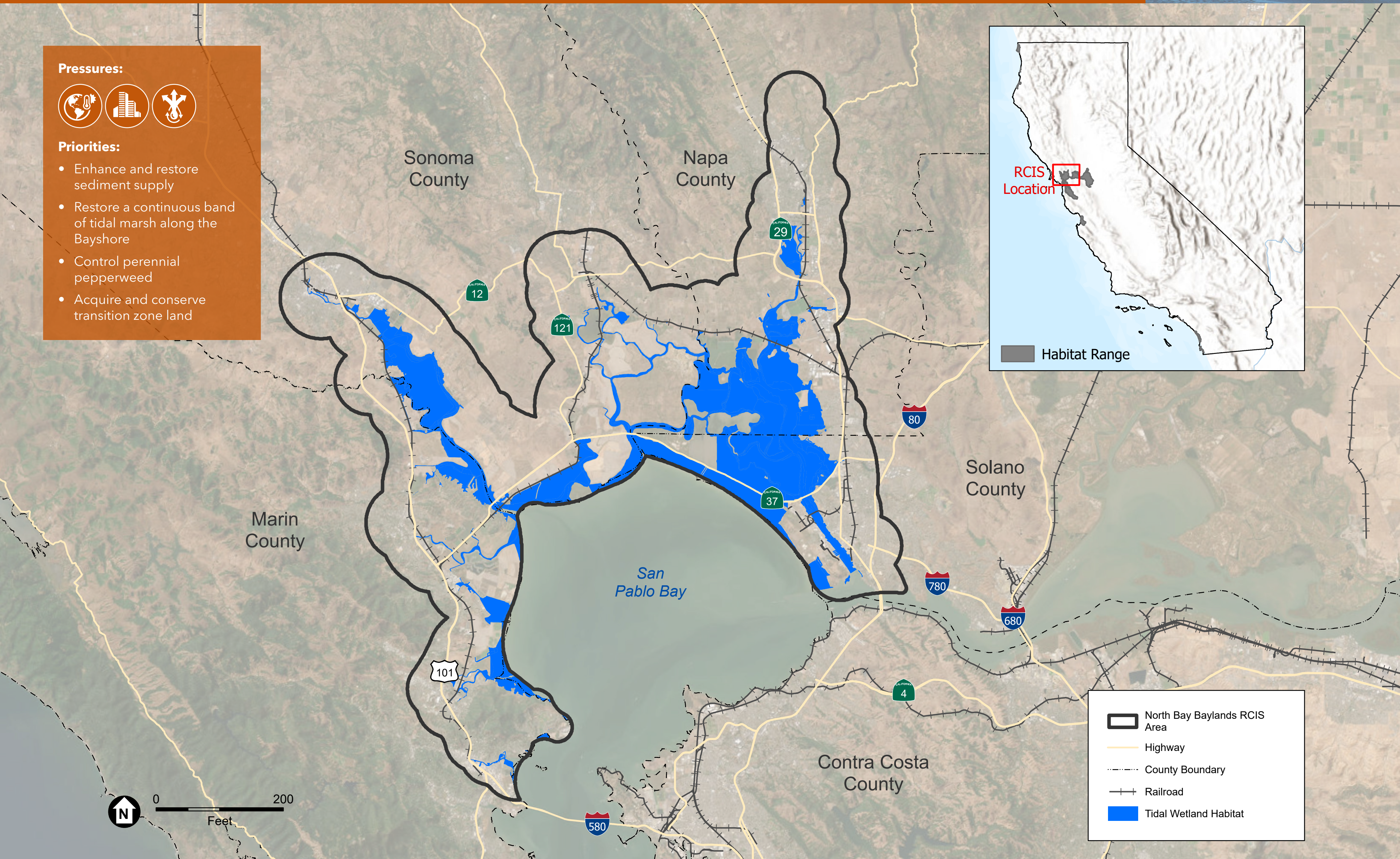
TABLE 4-32: ACTIONS AND PRESSURES ASSOCIATED WITH TIDAL WETLANDS GOAL AND OBJECTIVES

Actions Associated with TW Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
TIDE Objective 1.1 (Enhancement) actions TIDE Objective 1.2 (Restoration) actions Water Quality actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, and 1.1.8	• All
TW 1.2.1: When planning tidal flat and tidal marsh restoration and enhancement projects, include required elevations for tidal flats, low marsh, mid marsh, and high marsh components in anticipated of projected sea level rise scenarios.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
TW 1.2.2: Develop strategic plan for use of dredge sediment in restoration, such as at Skaggs Island.	• Climate Change
TW 1.2.3. Install gravel beaches, offshore reefs, or other nature-based solutions where appropriate, to manage marsh erosion.	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways
TW 1.2.4. Evaluate potential of biomass accretion and other nature-based solutions to raise marsh plain elevations prior to breaching to reduce risk of flooding and reduce sediment demand. If biosolids used, include an assessment and monitoring of chemistry and the potential sublethal impacts to wildlife and plant species, as well as the likelihood of increasing pollution of regulated and unregulated chemicals.	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways

Actions Associated with TW Goal and Objectives	Pressures
TW 1.2.5: Include interior tidal ponds suitable for widgeon grass and pond weed in restoration designs (Goals Project 2015).	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways
TW 1.2.6: Collaborate with efforts to improve understanding of morphology, drainage, and geomorphic processes occurring at high marsh terrace along SR 37 (Goals Project 2015).	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways

4.19.7 Conservation Priorities

- Enhance and restore sediment supply, including connections to upland watersheds. Focus on Tolay Creek, Napa River, Sonoma Creek, Rush Creek, Novato Creek, and Petaluma River, as well as their respective tributaries.
- Restore a continuous band of tidal marsh along the Bayshore and enhance existing marsh patches, such as Strip Marsh East, Figueras Tract, Cemetery Marsh, and Detjen-Prati, by improving tidal circulation (Goals Project 1999).
- Focus perennial pepperweed control (as well as other prioritized weed species [i.e., USFWS prioritization, Cal-IPC, BAEDN, or other sources] in established treatment areas and expand control efforts into completed and planned restored tidal marsh-upland transition zones (USFWS 2019a) (TIDE 1.1.11).
- Accelerate conservation and restoration of habitats as identified in the Novato Creek Baylands Vision (SFEI-ARC 2015), Petaluma River Baylands Strategy (SLT 2023) and Sonoma Creek Baylands Strategy (SLT 2020).
- Acquire and conserve transition zone land and adjacent uplands that are located near present or future marshes, or are located along or near the historic Baylands margin, such as along the Napa River, Lower Sonoma Creek, Dickson Unit, Petaluma River, and Novato Creek.



SOURCE: ESA, 2024; Saline Emergent Wetland range, California Wildlife Habitat Relationships (CDFW 2021).

Note: RCIS Natural Communities: Tidal Flat, Tidal Channel, Tidal Marsh and 2022 Update of Modern Baylands (SFEI 2022).

Figure 4-16
Tidal Wetlands Range and Habitat

4.20 Shallow Subtidal Habitat

Shallow subtidal habitat at Black Point Boat Launch, photo credit Katie Dudney

4.20.1 Regulatory Status

Shallow subtidal habitats are protected under Sections 401, 402, and 404 of the Clean Water Act.

4.20.2 Ecological Requirements and Threats

- RCIS Natural Communities: Estuarine, Shallow Subtidal Embayment (See **Figure 4-17** for range and modeled habitat)
- Defined as elevations entirely between 18 feet below mean lower low water and below mean lower low water with primarily mud sediments (Goals Project 1999).
- Eelgrass is an important plant species (Goals Project 1999).
- Important food source for migrating and wintering shorebirds and waterfowl.
- Full habitat account available: *Bay Habitats* in Baylands Ecosystem Habitat Goals (Goals Project 1999)

4.20.3 Associated Non-focal Species

- California least tern (*Sternula antillarum browni*)
- Delta smelt (*Hypomesus transpacificus*)
- Longfin smelt - San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)
- Sacramento splittail (*Pogonichthys macrolepidotus*)

4.20.4 Climate Change Vulnerability Assessment

Sea level rise may increase the rate of shoreline erosion and increase salinity (Hutto et al. 2015). The alteration of tidal flux, including timing and extent of tides, will may have an impact on the species that rely on shallow subtidal habitats. Increased storm activity, including wave action, may also contribute to shoreline erosion and may increase adjacent flooding (Hutto et al. 2015). Relatively acidic water from the Pacific Ocean will flow into the estuary, though it is unclear how the overall pH shift will affect plants and animals that live in shallow subtidal habitats and other adjacent habitats (Goals Project 2015; Hutto et al. 2015). Recent patterns in ocean upwelling have shown a persistent upward trend (Goals Project 2015). Upwelling brings cool, nutrient rich, low-oxygen, and low pH water to the surface which promotes phytoplankton blooms. Low oxygen events have the potential to negatively impact the balance of shallow subtidal ecosystems. Hutto et al. (2015) assessed multiple climate sensitivity and climate factors and found the overall climate vulnerability of shallow subtidal habitats was Moderate-High.

Climate change will exacerbate all the threats listed in Table 4-33.

The goal and objectives for shallow subtidal habitats, and the associated actions shown in Table 4-33, aim to protect, enhance, and restore historic and present-day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions to increase migration space may help this habitat better adapt to future climate changes. **Figure 4-17** shows the range and modeled suitable shallow subtidal habitats.

4.20.5 Conservation Strategy

Table 4-33 summarizes specific actions and pressures associated with the goal and objectives for this other conservation element. Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- All Water Quality goals, objectives, and actions
- Tidal Communities actions 1.1.2, 1.1.5, 1.2.1, 1.2.2, 1.2.5, 1.2.7, and 1.2.8
- Green Sturgeon action 1.3.1
- Steelhead action 1.2.3
- Habitat Connectivity actions 1.1.1, 1.1.2, and 1.1.3
- Hydrological Processes actions 1.1.1, 1.1.2, and 1.1.4

Goal SUBTIDAL 1: Promote persistence of sustainable and resilient shallow subtidal habitats through protection, enhancement, and restoration of habitat.

Objective SUBTIDAL 1.1: Protect present-day habitat and allow for expansion by protecting 361 acres of historical, present day, and potentially restorable shallow subtidal habitat. Measure progress toward achieving this objective by acres of historical, present day, and potentially restorable shallow subtidal habitat and adjacent acres protected.

Objective SUBTIDAL 1.2: Enhance and restore shallow subtidal habitat. Measure progress toward achieving this objective by the number of acres of habitat enhanced or restored.

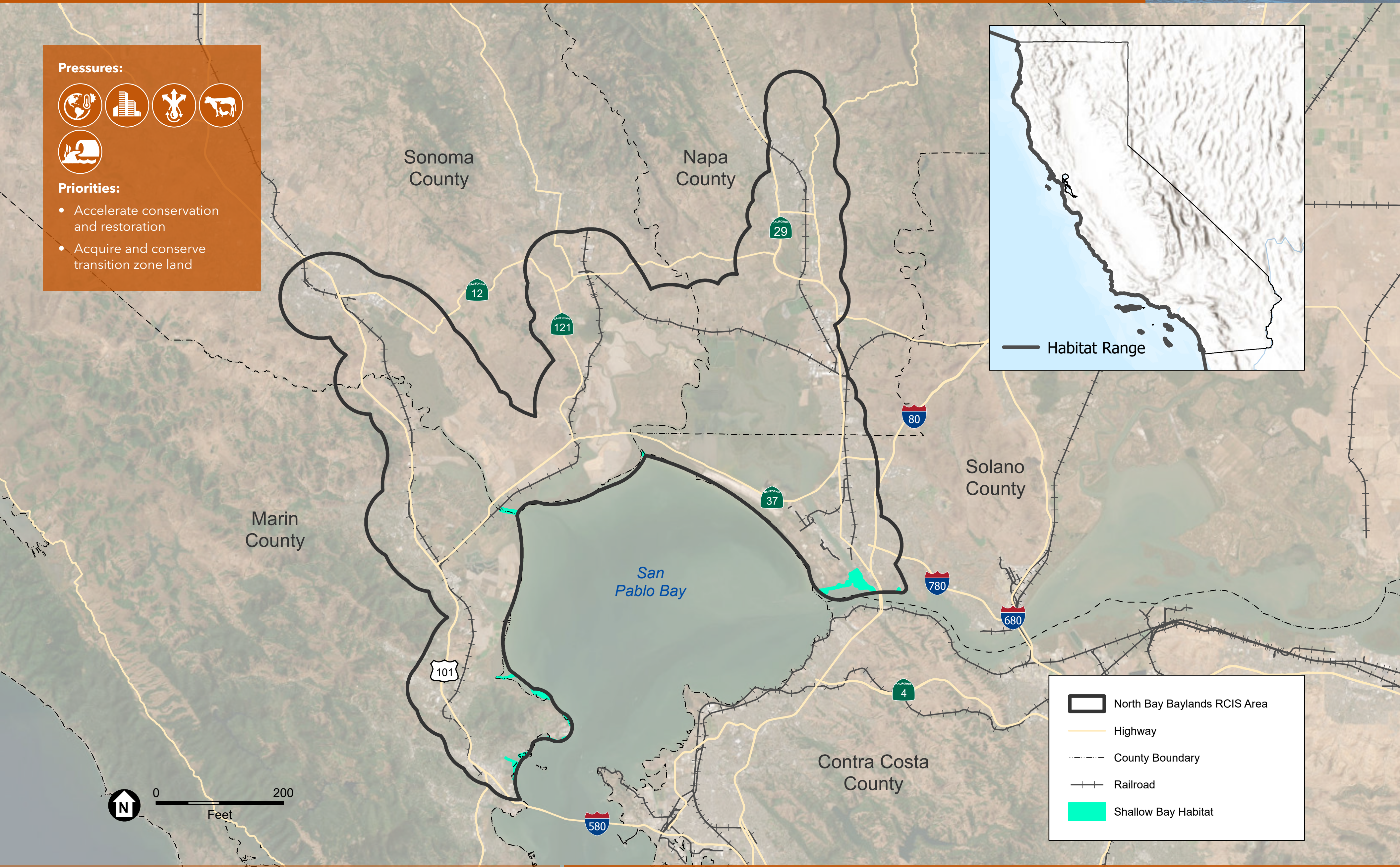
TABLE 4-33: ACTIONS AND PRESSURES ASSOCIATED WITH SHALLOW SUBTIDAL HABITAT GOAL AND OBJECTIVES

Actions Associated with SUBTIDAL Goal and Objectives	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
TIDE (Enhancement) actions 1.1.2 and 1.1.5 TIDE (Restoration) actions 1.2.1, 1.2.2, 1.2.5, 1.2.7, and 1.2.8	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges
SUBTIDAL 1.2.1: Assess need, and implement as necessary, for removal of development and unused infrastructure that is prone to flooding or coastal erosion to allow for shallow subtidal habitat to expand/migrate in response to climate change.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways • Water Pollutants and Discharges • Livestock, Farming, and Ranching
SUBTIDAL 1.2.2: Identify coastal armoring that exacerbates erosion and evaluate the applicability of including living shorelines and nature-based solutions in restoration designs.	• Climate Change • Land Conversion and Development • Water Pollutants and Discharges

Actions Associated with SUBTIDAL Goal and Objectives	Pressures
SUBTIDAL 1.2.3: Enhance native submerged aquatic shellfish and vegetation beds (e.g., native oysters, eelgrass). Turbidity declines may provide opportunities for enhancement (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways

4.20.6 Conservation Priorities

- Accelerate conservation and restoration of shallow subtidal habitats identified in the Novato Creek Baylands Vision (SFEI 2015), Petaluma River Baylands Strategy (SLT 2023) and Sonoma Creek Baylands Strategy (SLT 2020).



SOURCE: ESA, 2024; Shallow Subtidal Embayment without SAV, Modern Baylands 2022.

Note: RCIS Natural Community: Estuarine, Shallow Subtidal Embayment and 2022 Update of Modern Baylands (SFEI 2022).

Figure 4-17
Shallow Subtidal Wetlands Range and Habitat

4.21 Working Lands

Working lands,
photo credit Katie Dudney

4.21.1 Regulatory Status

- No Status

4.21.2 Ecological Requirements and Threats

- RCIS Natural Communities: Agriculture, Coastal Oak Woodland, Valley Oak Woodland, Annual and Perennial Grassland
- Farmland Mapping and Monitoring Program (CDOC 2019) distinguishes different farmland types (See **Figure 4-18** for farmland types in the RCIS area):
  - Prime Farmland: Physical and chemical features able to sustain long-term agricultural production. Must have used irrigated agricultural production in the last 4 years.
  - Farmland of Statewide Importance: Similar to Prime Farmland but with minor shortcomings.
  - Unique Farmland: Lesser quality soil and is usually irrigated but may include non-irrigated crops.
  - Grazing Land: Existing vegetation suitable for grazing livestock.
- Several cultivation practices provide ecosystem services such as habitat and floodplain protection, carbon sequestration, lower greenhouse gas levels on farmland when compared to urban land, and permeable land and groundwater recharge (CDFW 2016).
- Full account available: Farmland Mapping and Monitoring Program (CDOC 2019).

4.21.3 Associated Non-focal Species and Co-benefited Natural Resources

- Callippe silverspot butterfly (*Speyeria callippe callippe*)
- Western bumble bee (*Bombus occidentalis*)
- Pallid bat (*Antrozous pallidus*)
- Townsend’s big-eared bat (*Corynorhinus townsendii*)
- Swainson’s hawk (*Buteo swainsoni*)
- Tricolored blackbird (*Agelaius tricolor*)
- Grasslands

4.21.4 Climate Change Vulnerability Assessment

Productivity of working lands is projected to be affected by climate change impacts such as water supply changes because of drought, saltwater intrusion, more frequent climate extremes (including elevated temperatures or drought) (CDFW 2016, Gowda et al. 2018). Risks will depend on the rate and severity of the change, and the ability of working lands to adapt to changes (Gowda et al. 2018).

Increased precipitation extremes increase the risk of surface runoff, soil erosion, and the loss of soil carbon, which has the potential to negatively impact habitats surrounding working lands (Gowda et al. 2018).

Climate change will exacerbate all the threats listed in Table 4-34.

The goal and objectives for working lands and the associated actions shown in Table 4-34 aim to protect, enhance, and restore present day working lands to create and increase resiliency to projected climate changes. **Figure 4-18** shows working lands in the RCIS area.

4.21.5 Conservation Strategy

Table 4-34 summarizes specific actions and pressures associated with the goal and objective for Working Lands (WL). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- All Water Quality goals, objectives, and actions
- Herpetofauna actions 1.1.1, 1.1.2, 1.1.3, and 1.1.5
- Tidal Communities action 1.1.7
- All Crotch's Bumble Bee goals, objectives, and actions
- All Burrowing Owl goals, objectives, and actions
- California Red-legged Frog actions 1.2.3, 1.3.1, Goal 2
- All Western Pond Turtle goals, objectives, and actions
- Bat Habitat action 1.2.1, Goal 2
- Hydrological Processes actions 1.1.1, 1.1.3, 1.1.5, 1.1.6, and 1.1.7

WL Goal 1: Integrate resilient working lands and natural communities for the full range of native species, habitats, and ecological functions in the RCIS area, where feasible, through enhancement and restoration of important habitat types, supporting sensitive species.

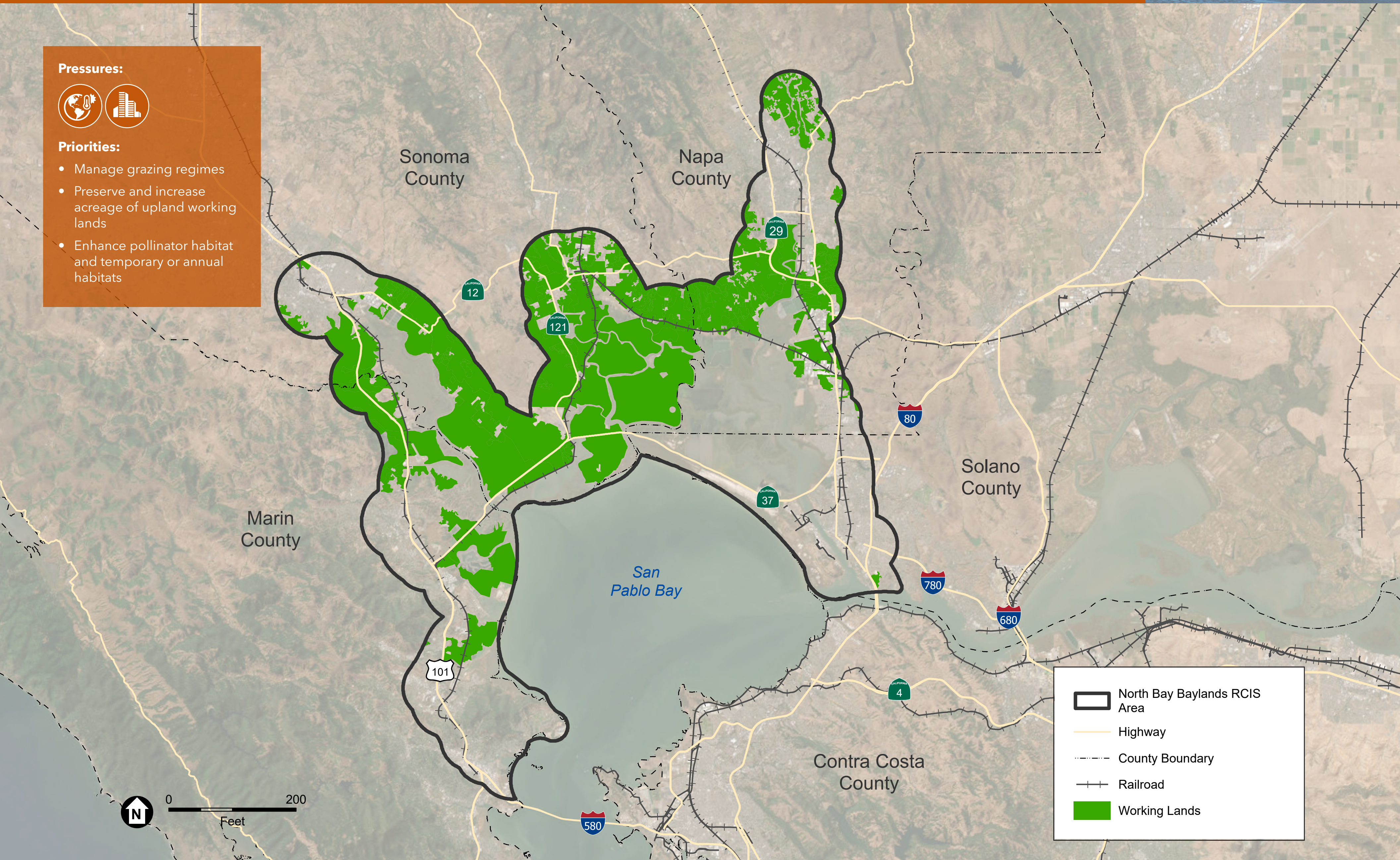
Objective WL 1.1: Implement and support stewardship of habitats and ecological processes in croplands and grazing lands to maintain, enhance, and restore species populations and ecological functions. Measure progress toward achieving this objective by the number of landowners protecting, enhancing, and/or restoring habitats that support a broad mosaic of species and ecological functions.

TABLE 4-34: ACTIONS AND PRESSURES ASSOCIATED WITH WORKING LANDS GOAL AND OBJECTIVE

Actions Associated with WL Goal and Objective	Pressures
WL 1.1.1: Enhance pollinator habitat and temporary or annual habitats throughout working land parcels (CDFW 2016).	• Climate Change • Land Conversion and Development
WL 1.1.2: Promote and implement more wildlife/native plant-friendly practices, by planting cover crops, conducting controlled burns, creating secondary channels to improve flow, and removing overcrowded vegetation (CDFW 2016).	• Climate Change • Land Conversion and Development
WL 1.1.3: Manage grazing regimes to promote native wildlife and plant species, including through targeted removal of non-native plant species, reducing vegetation cover to promote ground squirrel colonization. Implement grazing regimes that maximize water and soil retention.	• Land Conversion and Development
WL 1.1.4: Incorporate climate change considerations (e.g., sea level rise, salinity increases in groundwater) into protection, easement, and lease plans for low-elevation coastal agricultural areas (CDFW 2016).	• Climate Change • Land Conversion and Development

4.21.6 Conservation Priorities

- Manage grazing regimes to support native wildlife and plant species, through the target removal of non-native plant species and grazing methods that maximize soil and water retention (WL 1.1.3).
- Enhance pollinator habitat and temporary or annual habitats on productive agricultural lands (WL 1.1.1).



SOURCE: ESA, 2024; California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program, 2016 (CDOC 2019)

Figure 4-18
Working Lands in RCIS Area

4.22 Hydrological Processes

4.22.1 Ecological Requirements and Threats

- RCIS Natural Communities: All aquatic communities (See **Figure 4-19** for hydrological processes in RCIS area)
- Hydrological processes include sediment scouring, erosion and deposition, and prolonged floodplain inundation.
- Disturbances allow early successional riparian vegetation to establish (DWR 2016).
- Results in diverse sediment sizes and irregular banks that provide increased habitat diversity for species (DWR 2016).

Sediment Accreditation Contributing to Rising Marsh Elevations, phot credit Dusterhoff et al. 2021

- Ecosystem function: Water storage, groundwater recharge, maintenance of soil moisture regimes, freshwater and sediment delivery
- Drastically impacted throughout RCIS area due to land conversion and development, disrupted hydrology and sediment supply pathways, and anthropomorphic water use

4.22.2 Associated Non-focal Species and Co-benefited Natural Resources

- California freshwater shrimp (*Syncaris pacifica*)
- Western ridged mussel (*Gonidea angulata*)
- Delta smelt (*Hypomesus transpacificus*)
- Longfin smelt – San Francisco Bay-Delta DPS (*Spirinchus thaleichthys*)
- Sacramento Splittail (*Pogonichthys macrolepidotus*)
- California least tern (*Sternula antillarum browni*)
- Western snowy plover (*Charadrius nivosus nivosus*)
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- San Pablo song sparrow (*Melospiza melodia samuelis*)
- Soft bird's-beak (*Chloropyron molle* ssp*. molle*)
- Diked wetlands
- Rookeries

4.22.3 Climate Change Vulnerability Assessment

Hydrological processes, such as precipitation, tidal action, and severity of storm events, are projected to be impacted by climate change. Sea level rise is likely to cause saltwater intrusion into freshwater areas, having large-scale impacts on the species and natural communities that occur there. Increasing sediment supply and hydrological connectivity may increase the resilience of habitats vulnerable to sea level rise impacts.

Climate change will exacerbate all the threats listed in Table 4-35.

The goal and objective for hydrological processes, and the associated actions shown in Table 4-35, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address groundwater recharge. **Figure 4-19** shows the range and modeled suitable habitat for the hydrological processes.

4.22.4 Conservation Strategy

Table 4-35 summarizes specific actions and pressures associated with the goal and objective for hydrological processes (HYDRO). Other applicable conservation and habitat enhancement actions include:

- Regional Landscape actions 1.1.2, 1.1.3, 1.2.1, 1.2.6, and 1.3.1
- Water Quality actions 1.1.2, 1.1.3, and 1.1.9
- Habitat Connectivity actions 1.1.2 and 1.1.3
- Riparian Corridor action 1.2.2

HYDRO Goal 1: Promote increased resiliency to climate change-induced impacts of aquatic resources by encouraging sustainable hydrological processes to maintain communities for focal and non-focal species.

Objective HYDRO 1.1: Promote physical processes that contribute to hydrological functions with a focus on locations with high resilience to projected climate changes. Measure progress toward achieving this objective by the improvement and restoration of aquatic and riparian conditions including acre-feet of groundwater recharge capacity, sediment supply, stream flow (cubic feet per second), inundation duration (consecutive days), and hydrological connectivity.

TABLE 4-35: ACTIONS AND PRESSURES ASSOCIATED WITH HYDROLOGICAL PROCESSES GOAL AND OBJECTIVE

Actions Associated with HYDRO Goal and Objective	Pressures
HYDRO 1.1.1: Restore and protect local stream hydrology to supply the flow regimes necessary to move fine sediments to the bay while protecting stream health. Evaluate ways of accessing sediment trapped behind dams (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HYDRO 1.1.2: Develop and implement a comprehensive regional sediment-management plan (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HYDRO 1.1.3: Manage ground water pumping to reduce subsidence of ground surface (USFWS 2013).	• Climate Change • Land Conversion and Development • Livestock, Ranching, and Farming • Disrupted Natural Hydrology and Sediment Supply Pathways
HYDRO 1.1.4: Manage the fringing marsh bordering northern San Pablo Bay (e.g., Strip Marsh East and West) to sustain high marsh minimizing artificial drainage obstruction and maximizing wave processes that deposit coarser sediment (Goals Project 2015).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways

Actions Associated with HYDRO Goal and Objective	Pressures
HYDRO 1.1.5: Evaluate and purchase, where appropriate, water rights to enhance streamflow.	• Climate Change • Disrupted Natural Hydrology and Sediment Supply Pathways
HYDRO 1.1.6: Implement groundwater recharge methods, redirecting water across land surfaces through canals, infiltration basins, or ponds, adding irrigation furrows or sprinkler systems, or adding injection wells (USGS 2020). Consultation with CDFW about impacts to focal species and other conservation elements should be taken into consideration if in suitable and/or occupied habitat. Focus efforts within SGMA Priority 1 groundwater basins (Sonoma Valley, Napa-Sonoma Lowlands, and Petaluma Valley) (DWR 2022b).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HYDRO 1.1.7: Support implementation of conservation and recycling strategies and programs that increase water supply. This may include monitoring the impacts of water use on groundwater dependent ecosystems.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HYDRO 1.1.8: Identify anticipated hydrological conditions throughout the RCIS area in consideration of management actions and climate change and update mapping of meander migration potential to support restoration project planning.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
HYDRO 1.1.9: Identify suitable locations where beaver relocations or installation beaver dam analogs could create more ecologically beneficial flow rates.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways

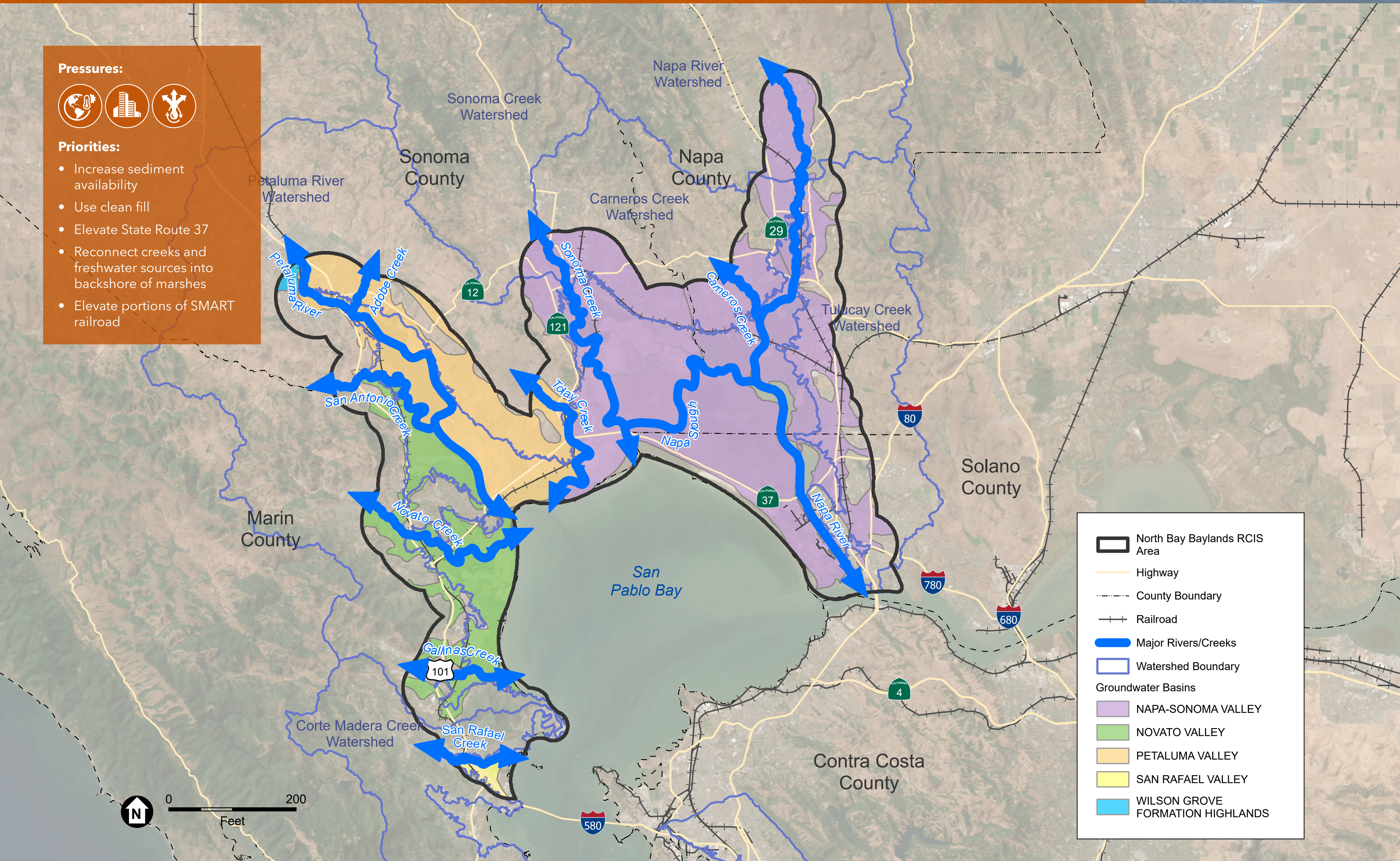
4.22.5 Conservation Priorities

- Increase sediment availability in baylands habitats compatible with restoration goals in consideration of future climate scenarios (HYDRO 1.1.2 and 1.1.4).
- Any fill material needed to raise subsided or low elevation lands or create transition zones should be free of containments that could pollute waters and placed in a way that mimics natural accretion processes when possible (Goals Project 2015) (RL 1.2.6).
- Elevate all of State Route 37 and increase the size of creek crossings such as Tolay Creek, to improve hydrological connectivity.
- Reconnect creeks and freshwater sources into backshore of marshes to capture fresh water and sediment.
- Elevate portions of SMART railroad to enable watershed-bayland connections and travel corridors.

Pressures:

Priorities:

- Increase sediment availability
- Use clean fill
- Elevate State Route 37
- Reconnect creeks and freshwater sources into backshore of marshes
- Elevate portions of SMART railroad



SOURCE: ESA, 2024; National Hydrography Database (USGS 2019)

Figure 4-19
Hydrological Processes in RCIS Area

4.23 Waterfowl and Shorebird Habitat

4.23.1 Ecological Requirements and Threats

Napa-Sonoma Wildlife Area, photo credit CDFW

- RCIS Natural Communities: Freshwater Marsh, Managed Ponds, Other Marsh, Wastewater Pond, Tidal Channel, Tidal Marsh, Tidal Flat, Shallow Subtidal Embayment, Estuarine, Marine (See **Figure 4-20** for modeled habitat in RCIS area)
- Critical habitats include tidal flats, sparsely vegetated wetland elements (levees, islets, beaches), managed wetlands, and large, persistent seasonal ponds with open water (Goals Project 1999).
- San Francisco Estuary used as an important wintering and breeding habitat for many species of shorebirds and waterfowl. Recognized as a Western Hemisphere Shorebird Reserve Network site of international importance (Goals Project 1999).
- San Francisco Bay is a Level I Ducks Unlimited conservation priority area and the second-most important and threatened waterfowl habitat in North America, providing an important wintering habitat for migrating waterfowl (Ducks Unlimited 2022).
- RCIS area is an important stop for birds of the Pacific Flyway, which is a migration corridor extending from the Arctic to South America used by at least a billion birds each year (Audubon 2022; Goals Project 1999). The San Pablo Bay Wetlands and San Pablo Bay Marine area are Global Priority Important Bird Areas (Audubon 2008).

Shorebirds

- Aquatic birds with cylindrical bills and includes 31 species (e.g., western sandpiper [*Caladris mauri*], marbled godwit [*Limosa fedoa*], red knot [*Calidris canutus*], long-billed dowitcher [*Limnodromus scolopaceus*], black turnstone [*Arenaria melanocephala*], Wilson's phalarope [*Phalaropus tricolor*]) (Goals Project 1999).
- Ranging in size, feed on invertebrates in tidal flats, managed ponds, and other habitats (Goals Project 1999).
- Require barren to sparsely vegetated sites above high tide line for roosting/breeding (Goals Project 1999).

Waterfowl

- More than 30 species of dabbling and diving ducks, as well as swans and geese found in area (e.g., northern pintail [*Anas acuta*], mallard [*Anas platyrynchos*], canvasback [*Aythya valisineria*], ruddy duck

[*Oxyura jaimaicensis*], surf scoter [*Melanitta perspicillata*], tule greater white-fronted goose [*Answer albrifrons elgasi*]) (Goals Project 1999).

- Depending on species, will forage at the surface or shallow water, underwater up to 15 feet, or in wetlands or fields (Goals Project 1999).

4.23.2 Associated Non-focal Species and Co-benefited Natural Resources

- California least tern (*Sternula antillarum browni*)
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)
- San Pablo song sparrow (*Melospiza melodia samuelis*)
- Western snowy plover (*Charadrius nivosus nivosus*)
- Diked wetlands
- Rookeries

4.23.3 Climate Change Vulnerability Assessment

Precipitation pattern changes, sea level rise, declining snowpack, and increased severity and frequency of severe weather could change when wetlands are wet, which could lead to northward expansion of invasive species and greater water management challenges (Ducks Unlimited 2023). Increased existing stresses on wetlands (e.g., nutrient loading, filling, drainage, soil erosion) and uplands (e.g., overgrazing, intensive agricultural practices) would be exacerbated by increased climatic impacts (Ducks Unlimited 2023). Projected sea level rise in coastal shorebird habitats will have increased negative impacts in areas with high tidal amplitudes in shallow lagoons and broad estuaries (Galbraith et al. 2014). A major loss of coastal wintering habitat for waterfowl shorebirds is anticipated. Many species that breed and/or winter in the RCIS area are projected to lose 10–50 percent or more of their suitable habitat (Galbraith et al. 2014).

Climate change will exacerbate all the threats listed in Table 4-36.

The goal and objectives for waterfowl and shorebird habitat, and the associated actions shown in Table 4-36, aim to protect, enhance, and restore present day suitable habitats, as well as habitats that may become suitable in the future because of projected climate changes. **Figure 4-20** shows the range and modeled suitable habitat for the waterfowl and shorebirds.

4.23.4 Conservation Strategy

Table 4-35 summarizes specific actions and pressures associated with the goal and objective for waterfowl and shorebird habitats (BIRD). Other applicable conservation and habitat enhancement actions include:

- All Regional Landscape goals, objectives, and actions
- All Water Quality goals, objectives, and actions
- Herpetofauna actions 1.1.4, and 1.1.5
- All Tidal Communities goals, objectives, and actions
- Green Sturgeon action 1.3.1
- Steelhead action 1.2.1 and 1.2.3

- California Red-legged Frog actions 1.2.3, and 1.3.1
- Habitat Connectivity actions 1.1.2, and 1.1.3
- All Freshwater Wetland habitat goals, objectives, and actions
- All Tidal Wetland goals, objectives, and actions
- All Shallow Subtidal Habitat goals, objectives, and actions
- All Hydrological Processes actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, and 1.1.8

Goal BIRD 1: Promote persistence of sustainable and resilient waterfowl and shorebird habitats through protection, enhancement, and restoration of habitat

Objective BIRD 1.1: Protect present-day habitat and allow for expansion by protecting 12,016 acres of historical, present day, and potentially restorable waterfowl and shorebird habitat. Measure progress toward achieving this objective by acres of historical, present day, and potentially restorable waterfowl and shorebird habitat and adjacent acres protected.

Objective BIRD 1.2: Enhance and restore waterfowl and shorebird habitat. Measure progress toward achieving this objective by the number of acres of habitat enhanced or restored.

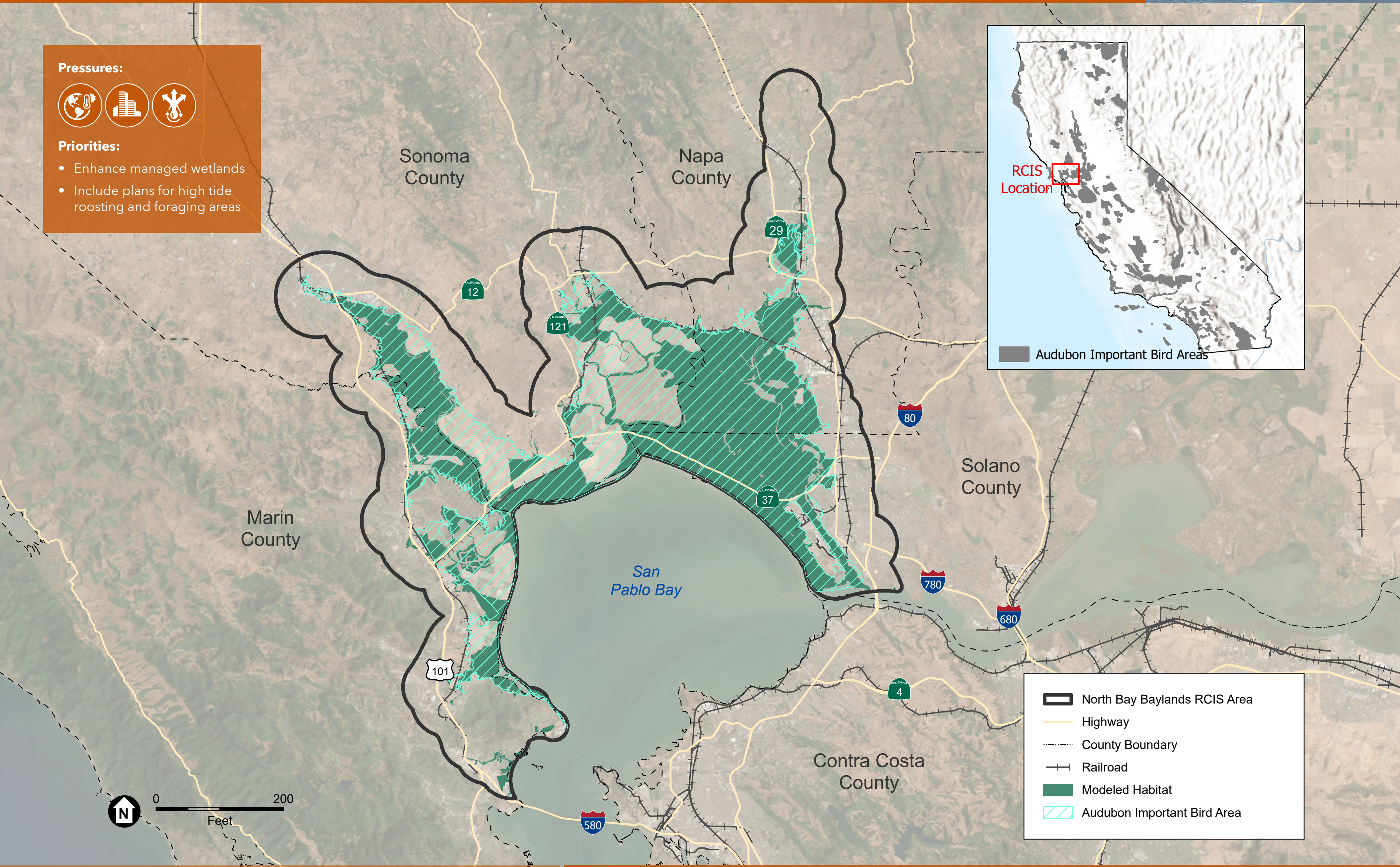
TABLE 4-36: ACTIONS AND PRESSURES ASSOCIATED WITH WATERFOWL AND SHOREBIRD HABITAT GOAL AND OBJECTIVE

Actions Associated with BIRD Goal and Objective	Pressures
RL Objective 1.1 (Protection) actions	• Climate Change • Land Conversion and Development
BIRD 1.2.1: Reduce disturbances and flight obstructions (e.g., power lines) between feeding and roosting areas (Goals Project 1999).	• Land Conversion and Development
BIRD 1.2.2: Reconstruct suitable barren to sparsely vegetated roosting sites above high tide line (Goals Project 1999). This could include unvegetated levees and islets with gradual slops and bare areas.	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
BIRD 1.2.3: Include a diverse mix of tidal pans and ponds in marsh plains restoration to provide for high tide roosting and foraging areas (Goals Project 1999).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
BIRD 1.2.4: Provide for muted tidal action in management plans to provide temporal diversity in water levels (Goals Project 1999).	• Climate Change • Land Conversion and Development • Disrupted Natural Hydrology and Sediment Supply Pathways
BIRD 1.2.5: Enhance or create managed marsh or seasonal pond habitat where feasible on agricultural baylands near tidal flats that are not restored to tidal marsh to provide high tide roosting habitat (Goals Project 2015).	• Climate Change • Land Conversion and Development • Livestock, Ranching, and Farming • Disrupted Natural Hydrology and Sediment Supply Pathways

4.23.5 Conservation Priorities

- Focus enhancement on managed wetlands (water control, predator control, muting tidal flows) (Goals Project 1999) (RL actions, BIRD 1.2.4)

- Include plans for high tide roosting and foraging areas (BIRD 1.2.3)



SOURCE: ESA, 2024; Audubon, 2008, California Wildlife Habitat Relationships (CDFW 2021), and Modern Baylands 2022

Note: RCIS Natural Communities: Freshwater Marsh, Managed Ponds, Other Marsh, Wastewater Pond, Tidal Channel, Tidal Marsh, Shallow Subtidal Embayment, Estuarine, Marine using Huber (2017) methodology.

Figure 4-20
Waterfowl and Shorebird Range and Modeled Habitat

CHAPTER 5

RCIS Implementation and Adaptive Management

5. RCIS Implementation and Adaptive Management

The North Bay Baylands RCIS is a voluntary, non-binding, nonregulatory guidance document that aims to improve conservation outcomes through strategic and targeted investment. The development of an RCIS does not create, modify, or impose regulatory requirements or standards; regulate land use; establish land use designations; or affect the land use authority of a public agency.

Implementation of the RCIS is not the purview or responsibility of any one entity; rather, the strategy will be implemented through the actions of many agencies, organizations, and individuals seeking to conduct conservation projects through a variety of mechanisms. Projects in the region should aim to provide multiple benefits and align with other existing regional planning efforts when possible.

Coordinated implementation of the RCIS can enhance the effectiveness of the strategy at achieving its goals. Implementation should leverage and expand coordination among various proponents: conservation partners, mitigating entities, resource agencies, transportation agencies, funders, decision-makers, and stakeholders. The following are some existing collaboratives that can facilitate implementation of the RCIS:

- U.S. Army Corps of Engineers' San Francisco District Interagency Review Team
- Bay Restoration Regulatory Integration Team
- Resilient State Route 37 Partnership—Interagency Regulatory, Baylands, Tribal, and Technical Advisory Groups
- San Francisco Estuary Partnership
- San Francisco Bay Joint Venture
- Napa Sonoma Marshes Restoration Group
- Bay Area Climate Adaptation Network
- Bay Area Regional Collaborative
- Together Bay Area

These organizations represent partnerships and collaboratives of regulatory, governmental, nonprofit, tribal, and private organizations working together to achieve conservation goals in the region.

5.1 RCIS Approval and Implementation Process

Because an RCIS is a non-binding, voluntary document, CDFW approval does not trigger any specific implementation actions. However, an approved RCIS can be used and referenced by a variety of stakeholders (see Section 1.3, *Users' Guide*). Project proponents may develop mitigation credit agreements (MCAs), which can be used in whole or in part to fulfill compensatory mitigation requirements.

5.2 Advance Mitigation Planning

Advance mitigation, as defined by CDFW, is "compensatory mitigation for impacts on ecological resources (species and/or habitats) and other natural resources that is implemented prior to impacts occurring" (CDFW 2023a). In the planning of any project, efforts should first be made to avoid and minimize impacts to species and habitats. When mitigation is necessary, mitigation that is considered early in the planning process (before the design and permitting phases) and aligned with identified regional priorities has the potential to result in higher quality conservation and restoration outcomes. It also can accelerate the approval of projects and project delivery.

Figure 5-1 identifies the decision-making processes for mitigation strategies in the RCIS area. If establishing new mitigation solutions, projects should be compatible with the goals and objectives of state and local conservation plans, including the Baylands Habitat Goals Report (Goals Project 1999), 2015 Baylands Goals Science Update (Goals Project 2015), Conservation Lands Network 2.0 (BAOSC 2019), Sonoma Creek Baylands Strategy (SLT 2020), Petaluma River Conservation Strategy (SLT 2023), and/or the Novato Creek Baylands Strategy (SFEI-ARC 2015), as applicable.

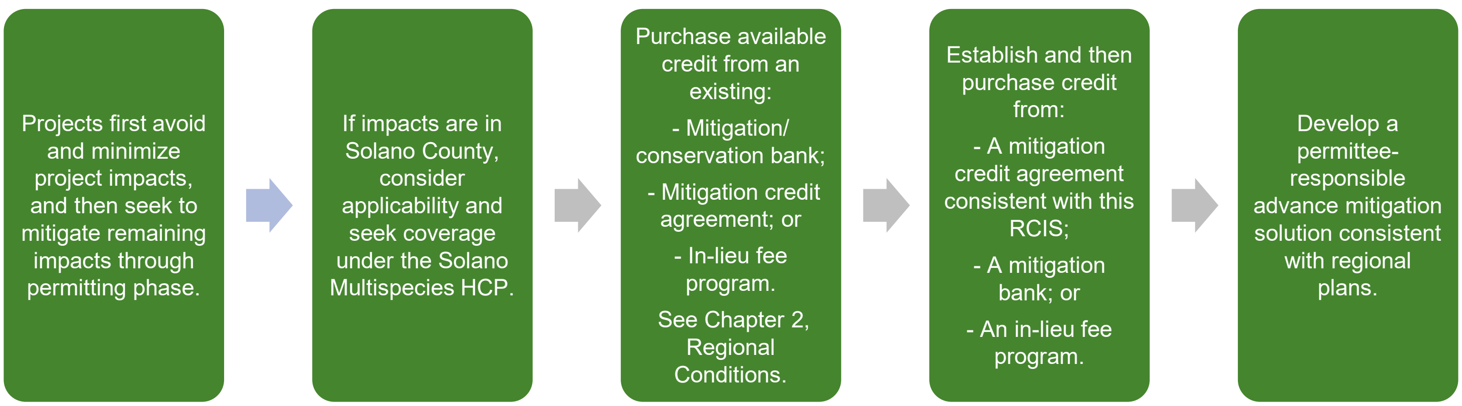
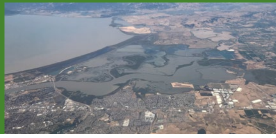


Figure 5-1
Decision Making Processes for Mitigation Strategies in the RCIS Area

An advance mitigation strategy is developed in consultation with natural resource agencies and may consider the following criteria (SCC and MTC 2019):

- Fulfills the compensatory mitigation needs (in whole or in part) of the anticipated project.
- Contributes to regional conservation priorities and complements ongoing mitigation/restoration efforts.
- Maintains consistency with the existing compensatory mitigation policies of applicable federal and state resource agencies.
- Is cost-effective to implement.

By authorizing projects that can be used as advance mitigation, regulatory agencies provide assurances to project proponents that enable the proponents to implement important restoration and conservation actions more quickly and effectively. Programmatic consultation processes, which allow the permitting or approval of multiple projects at once, can result in permitting and implementation efficiencies. For example, framework MCAs under an approved RCIS, and other new permitting options developing under California's Cutting the Green Tape initiative, have the potential to help speed up the regulatory process and allow for quicker project implementation.



5.2.1 Caltrans Advance Mitigation Program

Caltrans's Advance Mitigation Program (AMP) was created to accelerate project delivery and protect natural resources through project mitigation. The AMP implements a multi-step advance mitigation planning process, which starts with an assessment of needs (Caltrans 2021a). Caltrans has developed the Statewide Advance Mitigation Needs Assessment (SAMNA), which considers potential impacts of Caltrans activities statewide, and the Regional Advance Mitigation Needs Assessment (RAMNA) for the Gualala-Salmon, San Pablo Bay, and Tomales–Drake Bays subbasins, which covers the North Bay Baylands RCIS area. With the completion of the SAMNA and RAMNA, Caltrans has an estimate of potential project impacts over the next 10 years and can begin identifying advance mitigation solutions to meet these needs. The RAMNA is a required step in Caltrans advance mitigation planning, before an advance mitigation project is scoped, funded, or delivered. It has similar requirements to the RCIS Program in considering existing data.

To responsibly spend State funds, the AMP will prioritize funding advance mitigation projects that are aligned with multiple natural resource regulatory agencies [See AMP Guidelines (Caltrans 2021a) and 2021 Statewide Advance Mitigation Initiative MOU (Caltrans 2021b)]. The AMP includes a revolving Advance Mitigation funding account, where advance funding can be applied to acquisition and restoration actions and then the paid-back through credit purchases.

Table 5-1 summarizes the estimated impacts of State Highway Operation and Protection Program (SHOPP) projects (for fiscal years 2019–2020 through 2028–2029) on aquatic and fisheries resources in the San Pablo Bay watershed (Hydrologic Unit Code [HUC]-8), as reported in the RAMNA (Caltrans 2022b). Although this watershed boundary does not align perfectly with the RCIS area, it is a good approximation. Species impacts were estimated by ecoregion, which do not align as closely to the RCIS area, and therefore are not reported herein; however, species impacts from SHOPP projects ranged from 0 to 250 acres and are generally less than 10 acres.

TABLE 5-1: ESTIMATED IMPACTS ON THE SAN PABLO BAY AREA FROM STATE HIGHWAY OPERATION AND PROTECTION PROGRAM PROJECTS, PER THE REGIONAL ADVANCE MITIGATION NEEDS ASSESSMENT ANALYSIS

Species or Resource	Acres[1]
Steelhead – central California coast DPS	1.9
Longfin smelt[2]	3.7
Green sturgeon – southern DPS	1.8
Chinook salmon	0.9
Estuarine and marine wetland	1.8
Freshwater emergent wetland	0.1
Freshwater forested/shrub wetland	0.3
Stream/river	3.0
Riparian	81.3

NOTES: DPS = Distinct Population Segment

1 This analysis considered the San Pablo Bay area, which has similar boundaries as the Regional Conservation Investment Strategy (RCIS) area, but is not exactly the same. The RCIS area likely has fewer potential impacts, but this is intended to provide an approximate assessment.

2 Delta smelt and Sacramento splittail are included in the RAMNA impacts assessment. As they share many of the same habitats as longfin smelt, these species are likely to experience similar impacts.

5.2.2 Habitat Conservation Plans/Natural Community Conservation Plans

Habitat conservation plans (HCPs) (federal) and natural community conservation plans (NCCPs) (state) are documents that meet the requirements of the federal Endangered Species Act of 1973 (FESA) and the California Endangered Species Act (CESA), respectively, and allow local agencies to implement projects and activities to occur in endangered species' habitat. These are regulatory documents, approved by the U.S. Fish and Wildlife Service (USFWS) and CDFW, respectively, that grant a permit, also known as *take authorization*. HCPs and NCCPs have prescribed measures to avoid, minimize, or compensate for the adverse effect of covered projects on natural communities and endangered species that projects must follow.

There are no NCCPs in the RCIS area, although there are two HCPs: the Solano Multispecies HCP, which covers all of Solano County, including Vallejo; and the Pacific Gas and Electric Company (PG&E) Bay Area Operations and Maintenance HCP. The PG&E HCP covers only operations and maintenance for PG&E facilities, rights-of-way, and lands. Proposed projects in the RCIS area that are covered projects under either of these HCPs should follow the requirements of the HCP for FESA authorization. However, because these plans are not associated with an NCCP, additional consultation with CDFW may be necessary. The RCIS can be used to guide state consultation and mitigation processes for these projects and to help guide any future HCPs and NCCPs proposed for the region, such as the one being considered for Sonoma County.

5.2.3 Mitigation/Conservation Banks

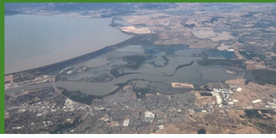
Mitigation banks and *conservation banks* are privately or publicly owned lands protected and managed for their natural resource values. In exchange for permanently protecting, managing, and monitoring the land, the bank sponsor can sell or transfer habitat credits to compensate for the impacts of development projects. Conservation banks generally protect endangered species and habitats while mitigation banks protect, restore, create, and/or enhance wetlands, stream, or other aquatic habitats (CDFW 2022c). There are three mitigation banks in the RCIS area, and several others that have overlapping service areas (see Chapter 2).

The RCIS provides voluntary guidance for establishing new mitigation or conservation banks in the region. By implementing the identified conservation and habitat enhancement actions, bank proponents would be helping contribute to regional goals and objectives. Bank proponents can use this consistency with the RCIS to gain regulatory agency support for the bank's establishment. Consistency with regional mitigation need, such as determined through the RAMNA process, can also support a bank's application and approval process.

5.2.4 In-Lieu Fee Programs

Under in-lieu fee programs, funds are paid to a government or nonprofit natural resources management entity (the mitigation sponsor) to satisfy compensatory mitigation requirements (33 Code of Federal Regulations [CFR] 332.2). The mitigation sponsor uses pooled funds from multiple permittees (often after the permitted impacts) to implement restoration, establishment, enhancement, and/or preservation actions.

Currently, there are no in-lieu fee programs in the RCIS area; however, Ducks Unlimited is seeking to establish a program with the U.S. Army Corps of Engineers (USACE) and San Francisco Bay Regional Water Quality Control Board (Regional Water Board) to provide estuarine wetland and freshwater wetland credits. The RCIS provides voluntary guidance for others looking to establish an in-lieu fee program in the region by identifying actions that would support regional and species conservation goals and objectives.



5.2.5 Mitigation Credit Agreements

An MCA is an agreement developed in collaboration with CDFW to implement one or more conservation actions and/or habitat enhancement actions identified in an approved RCIS to create credits, including credits for wildlife connectivity actions (California Fish and Game Code 1957). These credits can be used, sold, or transferred. Once the North Bay Baylands RCIS is approved, MCAs can be developed in the RCIS area to generate credits that can be used to fulfill mitigation requirements of the California Environmental Quality Act (CEQA), CESA, and the Lake and Streambed Alteration Program. Other federal, state, and local regulatory resource agencies may integrate the MCA process with their own regulatory processes to authorize advance mitigation proposed through an MCA. The requirements for developing MCAs are provided in California Fish and Game Code Section 1856(f-g) and described as part of CDFW's RCIS Program. Only entities that are a party to an MCA will be required to implement the RCIS goals, objectives, and actions that form the basis for the MCA (CDFW 2023a).

An entity wishing to develop an MCA must prepare a package of required information and payment and submit it to CDFW for official review as described in the RCIS Program Guidelines (CDFW 2023a). A complete MCA package includes the MCA template and all applicable exhibits and any necessary letters, the MCA checklist, and the required MCA review fees. MCAs must be deemed complete by CDFW and then undergo a public review period and a substantive review period, similar to an RCIS approval. Once established, CDFW will establish MCA credits and release information available on CDFW's website. Performance-based reporting and monitoring is required. Project proponents wishing to use MCA credits as compensatory mitigation for project impacts would identify this mitigation approach and receive regulatory approval during project permitting.

5.2.6 Project-Specific/Permittee Responsible Mitigation

Project-specific/permittee responsible mitigation is a mitigation strategy in which the permit applicant implements and is responsible for the success of the mitigation. The mitigation projects could preserve, restore, enhance, or establish habitats on-site (where the project impacts occur) or at an off-site location in the project region. When feasible, regulatory agencies prefer compensatory mitigation through established preapproved, advance options, such as those described in previous sections. However, for large projects or those with unique impacts, an existing solution may not be available, and it may be more effective to develop a project-specific mitigation project. RCIS conservation strategies can help maximize the regional benefit of such individual mitigation projects, by helping project proponents to site, design, evaluate, and otherwise implement permittee-responsible mitigation that can benefit the regional strategies.

5.2.7 Regulatory Processes

The RCIS will be in compliance with all applicable laws and does not preempt the authority of federal, state, or local agencies to implement infrastructure and urban development in local general plans. Unavoidable natural resource impacts from projects may be regulated under federal, state, and local environmental laws and regulations including but not limited to the following:

- National Environmental Policy Act (NEPA) (42 U.S. Code [USC] 4321 et seq.)
- FESA (16 USC 1531–1543), as amended
- Federal Clean Water Act, Sections 401 and 404 (33 USC 1251–1376)
- CEQA (Public Resources Code Section 21000 et seq.)

- CESA (Fish and Game Code 2050 et seq.)
- Porter-Cologne Water Quality Control Act (California Water Code Section 13000 et seq.)
- California Fish and Game Code Section 1600 et seq. and 2081
- Federal Coastal Zone Management Act of 1972 (16 USC 1451–1464), as amended
- California Coastal Act of 1976
- McAteer-Petris Act (Government Code Sections 66650–66661)

Projects implemented within the RCIS area may be subject to these regulations, requiring consultation with regulatory agencies for project approval. The RCIS does not provide project authorization or allow for take of species or habitats protected under any of these regulations; rather, it provides voluntary guidance for conservation and habitat actions that could benefit the region. Regulatory agencies may use information in the RCIS to make decisions about project permitting and mitigation requirements.

Although the RCIS Program is administered by CDFW, the Project Team intends for this document to be beneficial to all regional natural resource regulatory agencies. The Project Team has sought to include regulatory input during development of the RCIS by including agency staff in stakeholder meetings, meeting with regulators as part of a Caltrans interagency meeting, and presenting to regulators who are members of the Bay Area Regional Advance Mitigation Planning Technical Advisory Committee. Feedback was provided by USFWS, the National Marine Fisheries Service (NMFS), USACE, and the San Francisco Bay Regional Water Board and included to the extent feasible, with the aim of supporting multiagency consultation processes and approvals.

One piece of feedback from other regulatory agencies, particularly those with jurisdiction over aquatic resources, is that projects should take watershed approaches. The RCIS area uses the San Pablo Bay HUC-10 watershed boundary with a buffer. The conservation strategies consider the interconnectedness of habitats and processes within and adjacent to the San Pablo Bay watershed. The RCIS also includes strategies for several natural communities, in addition to focal species, including water and wetland resources.

Regulators can use the RCIS to support project permitting in the following ways:

- To prioritize projects that contribute to advancing a long-term conservation and sustainable development vision for the region.
- To evaluate whether sensitive resources are present in a project’s vicinity.
- To identify whether development projects or proposed mitigation sites are sited within geographies identified as having high conservation value.
- To evaluate whether mitigation proposals implement identified conservation and habitat enhancement actions and are aligned with regional goals and objectives.

Table 5-2 lists the programmatic permits that currently exist that could help expedite implementation of restoration projects consistent with the identified actions in this RCIS.

TABLE 5-2: PROGRAMMATIC PERMITS THAT MAY BE SUITABLE FOR RESTORATION PROJECTS IN THE RCIS AREA

Agency	Permit	Applies	Conditions/Applicability	Website for Additional Information
State Water Board	401 Water Quality Certification General Order for Small Habitat Restoration Projects (SHRP) (Order No. SB12006GN, 2013)	Statewide	≤ 5 acres and 500 cumulative linear feet of stream segment or coastline	https://www.waterboards.ca.gov/water_issues/programs/cwa401/generalorders.html
State Water Board	401 Water Quality Certification Statewide Restoration General Order (SRGO) (Order No. WQ-2022-0048-DWQ, 2022)	Statewide	For projects exceeding size limits for the SHRP General Order. No size limit; must meet definition of a restoration project.	https://www.waterboards.ca.gov/water_issues/programs/cwa401/generalorders.html
CDFW	Habitat Restoration and Enhancement Act	Statewide	Provides Fish and Game Code Section 1600 and CESA approval for projects ≤ 5 acres and 500 cumulative linear feet of stream segment or coastline (linked to State Water Board SHRP permit)	https://www.wildlife.ca.gov/Conservation/Environmental-Review/HRE-Act
CDFW	Restoration Consistency Determinations	Statewide	Provides take coverage for species that are both FESA and CESA listed for restoration projects. No fees or mitigation requirements.	https://wildlife.ca.gov/Conservation/Watersheds/Cutting-Green-Tape/CD
CDFW	Restoration Management Permit	Statewide	Provides CESA and Fully Protected species "take" authorizations for restoration projects. No size limit, no permit fees.	https://wildlife.ca.gov/Conservation/Watersheds/Cutting-Green-Tape/RMP
USACE	2021 Nationwide Permit Program, Permit Numbers 27, 33, and 54	Statewide	2021 NWPs expire on March 14, 2026. No size limits for NWPs 27 and 33. NWP 54—no more than 500 linear feet.	https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Nationwide-Permits/
USFWS	California Restoration Programmatic Biological and Conference Opinion (FWS: 2022-0005149-S7)	Statewide	No size limit, but includes annual incidental take limits for species.	https://suscon.org/wp-content/uploads/2022/09/USFWS-Statewide-Restoration-Final-PBO_2022.08.31.pdf

TABLE 5-2: PROGRAMMATIC PERMITS THAT MAY BE SUITABLE FOR RESTORATION PROJECTS IN THE RCIS AREA

Agency	Permit	Applies	Conditions/Applicability	Website for Additional Information
NMFS	NMFS Biological Opinions for the North Coast (NMFS No.: WCRO-2021-02830) (Also available for the Central Coast, Central Valley, and South Coast. The San Francisco Bay estuary is not yet covered.)	Areas of anadromy	Salmonid habitat and related upland restoration. No size limits, but see limitations on dewatering length/timing.	https://suscon.org/wp-content/uploads/2022/04/2022-Arcata-Restoration-PBO-FINAL.pdf
BCDC	Permits issued for work in and along the shoreline of San Francisco Bay and Suisun Marsh	San Francisco Bay, certain waterways, managed wetlands, salt ponds, and shoreline band	BCDC has not yet established permits specifically for restoration projects.	https://www.bcdc.ca.gov/permits/types_of_permits.html

NOTES: BCDC = San Francisco Bay Conservation and Development Commission; CCC = California Coastal Commission; CDFW = California Department of Fish and Wildlife; CESA = California Endangered Species Act; FESA = Federal Endangered Species Act; HREA = Habitat Restoration and Enhancement Act; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; NWP = Nationwide Permit; RCIS = Regional Conservation Investment Strategy; SHRP = Small Habitation Restoration Projects; SRGO = Statewide Restoration General Order; State Water Board = State Water Resources Control Board; USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service

Much of the information in this table is from Sustainable Conservation 2022.

5.2.8 Advance Mitigation Funding

The implementation of advance mitigation requires funding for planning, implementation of actions, and long-term maintenance and stewardship. The RAMP program document explores different potential funding sources for advance mitigation documents (SCC and MTC 2019). These include a variety of transportation funds (at the federal, state, regional, and local levels), conservation funds, private philanthropy, and other funds. Some of the funding sources identified may be applicable to establishing advance mitigation projects within the RCIS area. For example, Caltrans's Advance Mitigation Program has RAMP funding from Senate Bill 1. This can help provide start-up funding for mitigation projects in advance of their reimbursement by projects purchasing mitigation credits.

Conservation funding (often provided as grants) typically cannot be used for funding mitigation; however, projects can potentially be jointly funded using mitigation and conservation funds when the conservation benefit exceeds the mitigation need. Projects can benefit from a diversity of funding sources but require transparent accounting to ensure that mitigation funds are spent on mitigation needs (SCC and MTC 2019). A number of conservation grant programs, such as ones administered by the San Francisco Bay Restoration Authority, State Coastal Conservancy, CDFW, NMFS, or the U.S. Environmental Protection Agency, apply in the RCIS area and may be used to fund conservation and habitat enhancement actions identified in this plan.

5.3 Adaptive Management and Monitoring Program

This section provides a framework that can be used to inform adaptive management and monitoring used in developing an MCA in the RCIS area, consistent with California Fish and Game Code Section 1856(b)(1). Monitoring and adaptive management aim to ensure that the implemented actions achieve RCIS goals and objectives. If monitoring indicates that objectives are not being met, the action or management is adjusted in response (**Figure 5-2**). Adaptive management processes can also enhance long-term effectiveness by integrating scientific information that is newly developed during the course of management.

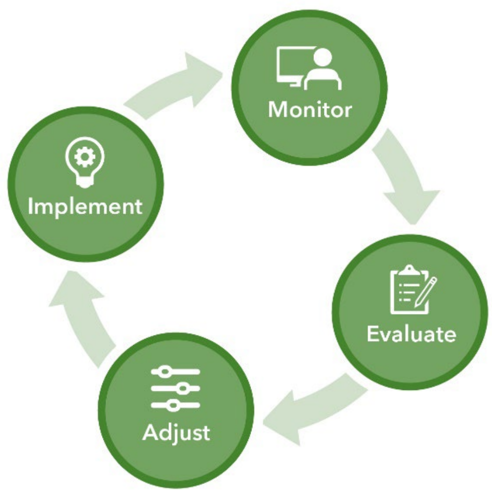


Figure 5-2
Cycle of Implementation, Monitoring, and Response

Monitoring and adaptive management includes a baseline inventory, a management and monitoring plan, and interim and long-term monitoring and adaptive management. The level of detail and application of the monitoring and adaptive management strategy will vary depending on the size and complexity of the site or sites, the resources monitored, and the nature of implementation of the conservation or enhancement actions.

5.3.1 Baseline Inventory

It is recommended that a baseline inventory be conducted within two years after the commitment to implement conservation and habitat enhancement actions. The baseline inventory should be conducted before the implementation of conservation and habitat enhancement actions. Quantitative and qualitative information collected will be used to document the baseline conditions of habitat and other natural resources, and to assess the effectiveness of conservation and habitat enhancement actions.

5.3.2 Management and Monitoring Plan

After the baseline inventory, a management and monitoring plan will be developed and will describe conservation or habitat enhancement actions, desired outcomes, adaptive management, a monitoring protocol, criteria for success, reporting, and other activities. Elements of the plan include:

- Specific goals and objectives that are consistent with the goals and objectives for the conservation strategy in the RCIS.
- A description of the condition of habitat and other natural resources.
- A description of the specific strategies that will be used to achieve the goals and objectives.
- The requirements and schedule for the overall management of the site, including adaptive management strategies, maintenance tasks, monitoring methodologies, an implementation schedule, and a discussion of any constraints that may impede implementation.
- Performance standards for evaluating the effectiveness of the action should utilize one or more of the metrics identified for this RCIS.
- A monitoring plan to assess the effectiveness of the action toward achieving the performance standards.
- A framework for adjusting the action, as needed and where feasible, including by implementing remedial actions, based on the results of monitoring and other relevant scientific information, to enhance its effectiveness at achieving the goals and objectives.

If the implementation of an action is associated with an MCA, CDFW will review and approve the adaptive management and monitoring plan.

5.3.3 Interim and Long-Term Monitoring and Adaptive Management

Whether actions are implemented under an MCA or not, monitoring periods can be separated into interim and long-term periods.

For MCAs, the interim monitoring period begins when the MCA is established and continues until performance-based milestones and standards have been met and the third anniversary of the full funding of the endowment amount has occurred. (See the MCA portion of CDFW's RCIS Program Guidelines for more details.) The long-term monitoring period begins upon the conclusion of the interim management period and continues in perpetuity. During the long-term monitoring period, the MCA site is to be managed, monitored, and maintained pursuant to the Long-Term Management and Monitoring Plan.

For other projects, not implemented under an MCA, interim monitoring typically begins at the completion of construction and extends for a specified establishment period (often three, five, or 10 years, depending on habitat type). Long-term monitoring would begin once interim performance metrics are met and continue in perpetuity or as specified in the Long-Term Management and Monitoring Plan.

The quantitative and qualitative information gathered during monitoring will be used to evaluate the progress of the conservation and habitat enhancement actions. This evaluation will determine whether unforeseen challenges are threatening the success of the actions and will identify specific problems. Management and monitoring should occur for the length of time specified in the Management and Monitoring Plan and will include the following elements:

- Monitoring of response to the conservation and habitat enhancement actions described in the Management and Monitoring Plan.
- Determination of success according to the performance standards established in the Management and Monitoring Plan.
- Implementation of management actions identified in the Management and Monitoring Plan. Examples include management of invasive species, property inspections, and infrastructure or structural management needed to ensure hydrological and/or ecological restoration and functionality.
- Routine monitoring and effectiveness monitoring to determine progress toward achieving the goals of the RCIS.

If the identified ecological performance standards are not met, an adjustment of conservation and habitat enhancement actions and/or habitat enhancement actions will be required and implemented.

5.3.4 Evaluating Progress toward the Goals and Objectives

If an MCA is being implemented under an approved RCIS, MCA sponsors must follow a process to track the progress of, and evaluate the effectiveness of, the RCIS actions in achieving the RCIS goals and objectives. Tracking and evaluation shall be based on relevant, current, best available information and analyses (CDFW 2023a). This evaluation will include the extent to which the actions offset the effects of identified pressures and stressors.

The objectives in this RCIS include metrics for tracking progress toward achieving the goals of the RCIS. Metrics are intended to measure the net change of habitat area or habitat quality. The following metrics are acceptable in this RCIS for measuring the net change in habitat area and habitat quality resulting from habitat restoration actions:

- Acreage
- Linear feet
- Vigor index (health of plant on a scale of 1–4)
- Percent cover (native vs. nonnative species)
- Native species diversity
- Number of individuals
- Number of populations
- Gene pool/genetic diversity
- Evidence of presence and abundance (e.g., presence/absence, number of nests, calls, scat)
- Habitat structure (e.g., number of canopy layers, percent cover, snags)
- Distribution of key resources (e.g., nesting trees, ponds, host plants) (number per acre)
- Inundation duration (consecutive days)

- Water depth (feet)
- Streamflow (cubic feet per second)
- Water temperature and chemical composition (e.g., dissolved oxygen)
- Stream substrate composition (e.g., percent cover, gravel size)
- Stream characterization (pool, riffle, run; length and width)

When implementing conservation actions and habitat enhancement actions, an MCA sponsor shall select, and submit for CDFW's approval, appropriate metric(s) from the metrics indicated in this RCIS to measure the net change in habitat area and habitat quality. The MCA sponsor may make a written request to the RCIS Proponent and CDFW to consider approving that alternative metric instead of, or in addition to, one or more metrics in this RCIS. CDFW will consider the proposed alternative metric and the RCIS Proponent's recommendation, if any, when determining whether to approve the alternative metric. If monitoring has already begun, the determination to approve an alternative metric will be based, in part, on whether that new metric can be compared with the original baseline data.

5.3.5 Reporting

MCA sponsors will report on relevant RCIS metrics for corresponding conservation actions and habitat enhancement actions implemented through an MCA. The MCA sponsor is required to submit information to the RCIS proponent, who will report to CDFW, as noted in Section 4.3.8(b) of the RCIS Guidelines (CDFW 2023a). For this RCIS, MTC is the RCIS proponent, unless and until MTC transfers the requirement to another entity with CDFW's approval, as noted in Section 4.3.8(c) of the RCIS Guidelines (CDFW 2023a).

If MCAs are implemented, the RCIS proponent would prepare an evaluation report and submit it to CDFW at the end of the 10-year term (i.e., 10 years after approval of the MCA). CDFW can renew the RCIS as long as the strategy continues to meet the requirements of California Fish and Game Code Section 1852 and Section 4.7 of the RCIS Guidelines (CDFW 2023a). The report will document the status of RCIS habitat enhancement and conservation actions associated with approved MCAs in achieving goals and objectives for focal species and other conservation elements, including how these actions have offset the effects of identified pressures and stressors.

5.4 Regional Conservation Investment Strategy Maintenance and Responsibilities

5.4.1 Responsible Parties

Implementation of RCIS conservation and habitat enhancement actions is voluntary for all RCIS users. It is envisioned that partnerships will be key in implementing actions toward achieving the vision, goals, and objectives of the RCIS.

MTC is identified as the RCIS proponent. Beginning with the creation of the first MCA, MTC is responsible for tracking, evaluation, and reporting as described above. In the event that MTC is not available for these tasks, another entity, with approval from CDFW, can elect to take responsibility.

5.4.2 RCIS Updates and Extensions Amendments

The RCIS has a 10-year term, after which CDFW cannot approve new MCAs unless the RCIS term is extended. Updates to the RCIS may be appropriate during the 10-year approval period to reflect best available scientific information, geographic information system data, minor changes to numbers or text, and minor changes to RCIS goals, objectives, or actions. An update does not include updates or amendments to the geographic area, focal species, or other conservation elements.

These minor updates to the RCIS should occur as data are available and no less than every 10 years. These updates could be submitted to CDFW in the 10-year progress report or in a stand-alone document. CDFW may extend the duration of an approved RCIS for additional periods of up to 10 years after scientific information has been updated. If a more substantial update—such as a change to the fundamental aspects of the RCIS—is determined to be required, then the RCIS should be amended to address these changes.

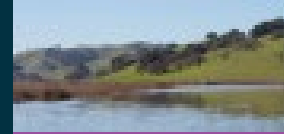
5.4.3 RCIS Amendments

Changes to the RCIS within the 10-year term that go beyond updating scientific information require an amendment process as described in California Fish and Game Code Section 1854(a). Reasons for amending an RCIS may include:

- A change in the RCIS geographic area.
- The addition or removal of focal species.
- Substantial changes in the best available science.
- Substantial changes in goals, objectives, and actions.

There are two types of amendments: simple and complex. The processes required for these amendments are described in detail in the Section 4.6 of the RCIS Guidelines (CDFW 2023a).

References



References

Ackerly, D., A. Jones, M. Stacey, and B. Riordan. 2018. California's Fourth Climate Change Assessment: San Francisco Bay Area Region Report. Publication Number: CCCA4-SUM-2018-005. Coordinating agencies: Governor's Office of Planning and Research, California Energy Commission, and California Natural Resources Agency.

American Community Survey (ACS), 2022. 5-year estimates, 2016-2022. Released March 31, 2022. Available: data.census.gov.

Anacker, B., and K. Leidholm. 2012. *Climate Change Vulnerability Assessment of Rare Plants in California*. Sacramento: California Department of Fish and Wildlife.

Association of Bay Area Governments (ABAG). 2021. Final Regional Housing Needs Allocation (RHNA) Plan: San Francisco Bay Area, 2023-2031. Available: https://abag.ca.gov/sites/default/files/documents/2021-12/Final_RHNA_Allocation_Report_2023-2031-approved_0.pdf

Association of Bay Area Governments and Metropolitan Transportation Commission (ABAG and MTC). 2021. Plan Bay Area 2050: A Vision for the Future. Final Plan adopted October 2021.

Audubon 2008. Important Bird Area - San Pablo Bay Wetlands. Available: https://netapp.audubon.org/iba/Reports/155.

———. 2022. Pacific Flyway. https://www.audubon.org/pacific-flyway. Accessed December 2022.

Bay Area Clean Water Agencies (BACWA). 2022. Biosolids in the Baylands: Exploring compatibility of biosolids use with wetland restoration in the San Francisco Baylands. Developed in coordination with SF Bay Joint Venture, Bay Area Biosolids Coalition, SF Estuary Institute, Ducks Unlimited and Sonoma Land Trust. Available: https://sonomalandtrust.org/wp-content/uploads/2022/04/Biosolids-in-the-Baylands.pdf.

Bay Area Greenprint. 2022. Disadvantaged Communities. Sourced from California Office of Environmental Health Hazard Assessment. Updated September 7, 2022. Available: www.bayareagreenprint.org.

Bay Area Open Space Council (BAOSC). 2019. Conservation Lands Network database. Last updated May 2019.

Beagle, J., Lowe, J., McKnight, K., Safran, S. M., Tam, L.; Szambelan, S. Jo. 2019. San Francisco Bay Shoreline Adaptation Atlas: Working with Nature to Plan for Sea Level Rise Using Operational Landscape Units. SFEI Contribution No. 915. SFEI & SPUR: Richmond, CA. p 255.

Bay Conservation and Development Commission (BCDC). 2011. San Francisco Bay Plan. San Francisco Bay Conservation and Development Commission. Available: https://www.bcdc.ca.gov/plans/sfbay_plan.html

———. 2019. Bay Fill for Habitat Restoration, Enhancement, and Creation in a Changing Bay. Staff report. May 24, 2019. Available: https://bcdc.ca.gov/BPAFHR/20190524ChangingBay.pdf.

———.2023. Adapting to Rising Tides Program. Bay Shoreline Flood Explorer. Accessed February 2023. Available: https://explorer.adaptingtorisingtides.org/home.

Bay Conservation and Development Commission (BCDC) and Metropolitan Transportation Commission/Association of Bay Area Governments (MTC/ABAG). 2020. Adapting to Rising Tides Bay Area: Regional Sea Level Rise Vulnerability and Adaptation Study. San Francisco CA.

Beagle, J., Lowe, J., McKnight, K., Safran, S.M., Tam, L., Szambelan, S. J. 2019. San Francisco Bay Shoreline Adaptation Atlas: Working with Nature to Plan for Sea Level Rise Using Operational Landscape Units. SFEI Contribution No. 915, San Francisco Estuary Institute, Richmond, CA.

Binder, D. L., A. Dobermann, D. H. Sander, and K. G. Cassman. 2002. Biosolids as nitrogen source for irrigated maize and rainfed sorghum. Soil Science Society of America Journal 66:531–543.

Brown, S., K. Kurtz, A. Barry, and C. Cogger. 2011. Quantifying benefits associated with land application of organic residuals in Washington State. Environmental Science and Technology 45:7451–7458.

Bumblebee Conservation Trust. 2017. Managing wildflower pastures… for bumblebees [Fact sheet] Available: https://www.bumblebeeconservation.org/wp-content/uploads/2017/08/ BBCT_Land_Factsheet_3_Managing_wildflower_pastures.pdf.

Byrd, Brian, Adrian Whitaker, Patricia Mikkelsen, and Jeffery Rosenthal. 2017. San Francisco Bay-Delta Regional Context and Research Design for Native American Archaeological Resources Far Western Anthropological Research Group, Inc., Davis, California. Prepared for the California Department of Transportation District 4, Oakland, California.

CalFish. 2015. CalFish: A California Cooperative Anadromous Fish and Habitat Data Program. Available: https://www.calfish.org/DataandMaps/CalFishDataExplorer.aspx.

———. 2019. CalFish: California Fish Passage Assessment Database. Available: https://www.calfish.org/ProgramsData/HabitatandBarriers/CaliforniaFishPassageAssessmentDatabase.aspx.

California Air Resources Board (CARB). 2023. California Climate Investments Priority Populations 2022 CES 4.0. Accessed February 2023. Available: https://webmaps.arb.ca.gov/Priority Populations/.

California Department of Conservation (CDOC). 2019. Farmland Mapping and Monitoring Program: Important Farmland Categories. Available: https://www.conservation.ca.gov/dlrp/fmmp/ Pages/Important-Farmland-Categories.aspx. Accessed December 2022.

California Department of Fish and Wildlife (CDFW). 1988. Pallid Bat Life History Account. California Wildlife Habitat Relationships System. California Department of Fish and Wildlife. California Interagency Wildlife Task Group. Based on an account of *Antrozous pallidus*, written by J. Harris, reviewed by P. Brown, and edited by D. Alley and R. Duke. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=2349&inline=1. Accessed December 2022.

———. 1999. California Black Rail Life History Account. Wildlife Habitat Relationships System. California Department of Fish and Wildlife. California Interagency Wildlife Task Group. Based on an account of Laterallus jamaicensis, written by T. Harvey, reviewed by S. Bailey, and edited by G. Ahlborn. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=1711&inline=1. Accessed November 2022.

———. 2000a. Western Pond Turtle Life History Account. Wildlife Habitat Relationships System. California Department of Fish and Wildlife. California Interagency Wildlife Task Group. Based on an account of Actinemys marmorata, written by S. Morey, reviewed by T. Papenfuss, and edited by R. Duke. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=2657&inline=1. Accessed November 2022

———. 2000b. Townsend's Big-Eared Bat Life History Account. Wildlife Habitat Relationships System. California Department of Fish and Wildlife. California Interagency Wildlife Task Group. Based on an account of Corynorhinus townsendii, written by J. Harris, reviewed by P. Brown, and edited by D. Alley and R. Duke. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=2347&inline=1. Accessed December 2022.

———. 2005. *California Wildlife Habitat Relationships System: Riverine*. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=67396&inline. Accessed February 1, 2023.

———. 2011. Napa-Sonoma Marshes Wildlife Area Land Management Plan. California Department of Fish and Game, Napa-Sonoma Marshes Wildlife Area, Bay Delta Region (3).

———. 2012a. Winter Steelhead Range [ds699]. CDFS Northern Region Environmental Resource Information Services. Available: Coalfish, https://www.calfish.org/DataandMaps/CalFishDataExplorer.aspx.

———. 2012b. Staff Report of Burrowing Owl Mitigation. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83843&inline. Accessed March 2023.

———. 2014. Department of Fish and Wildlife Departmental Bulletin. To: All Department of Fish and Wildlife Staff. Subject: Tribal Communication and Consultation Policy. Number 2014-07. Issued October 2, 2014. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=122905&inline.

———. 2015. California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. Edited by A. G. Gonzales and J. Hoshi. Prepared with assistance from Ascent Environmental, Inc., Sacramento, CA. Available: https://www.wildlife.ca.gov/SWAP/Final.

———. 2016a. California State Wildlife Plan, Agriculture Companion Plan. Prepared with assistance from Blue Earth Consultants, LLC. Oakland, CA. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=136122&inline. Accessed December 2022.

———. 2016b. Vegetation – Napa County. Produced by Thorne, James H. et al., Department of Environmental Science and Policy, UC Davis for Napa County Planning, Building, & Environmental Services Department.

———. 2016c. California Red-legged frog Range [ds587]. California Wildlife Habitat Relationships.

———. 2016d. Burrowing Owl Range [ds907]. California Wildlife Habitat Relationships.

———. 2016e. California Black Rail Range [ds595]. California Wildlife Habitat Relationships.

———. 2016f. California Ridgway's Rail Range [ds928]. California Wildlife Habitat Relationships.

———. 2016g. Salt-Marsh Harvest Mouse Range [ds943]. California Wildlife Habitat Relationships.

———. 2016h. Pallid Bat Range [ds1833]. California Wildlife Habitat Relationships.

———. 2018a. Area of Conservation Emphasis (ACE). Terrestrial Biodiversity dataset [ds2739] Available: https://apps.wildlife.ca.gov/ace/.

———. 2018b. Area of Conservation Emphasis (ACE). Aquatic Biodiversity dataset [ds2768] Available: https://apps.wildlife.ca.gov/ace/.

———. 2018c. Area of Conservation Emphasis (ACE). Terrestrial Climate Change Resilience dataset [ds2738] Available: https://apps.wildlife.ca.gov/ace/.

———. 2019. Area of Conservation Emphasis (ACE). Terrestrial Connectivity dataset [ds2734] Available: https://apps.wildlife.ca.gov/ace/.

———. 2020a. California Natural Diversity Database (CNDDB – Commercial version dated October 4, 2022. Available: https://map.dfg.ca.gov/rarefind/view/RareFind.aspx. Accessed October 2022.

———. 2020b. Vegetation – Napa County Update 2016 [ds2899]. Produced by Thorne, James H. et al., Department of Environmental Science and Policy, UC Davis for Napa County Planning, Building, & Environmental Services Department. https://map.dfg.ca.gov/metadata/ds2899.html.

———. 2020c. Western Pond Turtle Range [ds598]. California Wildlife Habitat Relationships.

———. 2021. California Wildlife Habitat Relationship System, Version 10.1.29. California Department of Fish and Wildlife, Biogeographic Data Branch. Available: https://apps.wildlife.ca.gov/cwhr/index.shtml

———. 2022a. California Natural Diversity Database (CNDDB) RareFind. Available: https://apps.wildlife.ca.gov/rarefind/view/RareFind.aspx.

———. 2022b. Climate Change Vulnerability lists. Available: https://wildlife.ca.gov/Science-Institute/Climate-Change/Vulnerability. Accessed December 2022.

———. 2022c. Conservation and Mitigation Banking. https://wildlife.ca.gov/Conservation/Planning/Banking. Accessed November 2022.

———. 2023a. Regional Conservation Investment Strategies Program Guidelines. June 2023. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=213325&inline.

———. 2023b. Passage Assessment Database [ds69]. December 2023.

———. 2023c. California Natural Diversity Database (CNDDB) Management Framework. Sacramento, CA. Downloaded January 2023.

California Department of Transportation (Caltrans). 2021a. Statewide Advance Mitigation Needs Assessment. April 2021.

———. 2021b. Memorandum of Understanding Between California Department of Transportation, California Department of Fish and Wildlife, California State Water Resources Control Board, U.S. Army Corps of Engineers, South Pacific Division, U.S. Environmental Projection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Coastal Commission Regarding the Development and Implementation of the Statewide Advance Mitigation Initiative for California Department of Transportation Projects throughout the State of California. Available:

https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/ser/2021-sami-mou-a11y.pdf

———. 2022a. State Highway Operation and Protection Program (SHOPP) and Minor Program. Accessed May 13, 2022.

———. 2022b. Advance Mitigation Program. Gualala-Salmon, San Pablo Bay, and Tomales–Drake Bays Sub-basins. Regional Advance Mitigation Needs Assessment, Version 1.0. Establishing Caltrans' Need for Advance Mitigation for Caltrans District 4 and Surroundings Forecast Fiscal Years 2019/20 to 2028/29. California Department of Transportation–District 4. June 2022.

California Department of Water Resources (DWR). (2016). Central Valley Flood Protection Plan Conservation Strategy. Central Valley Flood Management Planning Program, Sacramento, California. Available: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Flood-Management/Flood-Planning-and-Studies/Central-Valley-Flood-Protection-Plan/Files/CVFPP-Updates/Files/2016-CVFPP-Conservation-Strategy_ay11.pdf

———. 2022a. California Groundwater Basins Data Layer. Available: https://gis.water.ca.gov/arcgis/rest/services/Geoscientific/i08_B118_CA_GroundwaterBasins/MapServer/0

———. 2022b. Statewide Groundwater Management. Available: https://water.ca.gov/programs/groundwater-management. Accessed February 2022.

California Native Plant Society (CNPS). 2022. CNPS Inventory of Rare Plants. Accessed November 2022. Available at: https://www.cnps.org/rare-plants/cnps-inventory-of-rare-plants

California Natural Resources Agency (CNRA). 2018. California Biodiversity Initiative: A Roadmap for Protecting the State's Natural Heritage. September 2018. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=174236&inline.

———. 2022. Pathways to 30x30 California: Accelerating Conservation of California's Nature. April 22, 2022. Available: californianature.ca.gov

California Ocean Protection Council (OPC). 2018 (March 14). State of California Sea-Level Rise Guidance, 2018 Update. Available: https://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf.

California Office of Environmental Health Hazard Assessment (OEHHA). 2022. CalEnvironScreen, SB 535 Disadvantaged Communities Map. Available: https://oehha.ca.gov/calenviroscreen/sb535.

California Office of the Governor. 2020. Statement of Administration Policy, Native American Ancestral Lands. September 25, 2020. Available: https://www.gov.ca.gov/wp-content/uploads/2020/09/9.25.20-Native-Ancestral-Lands-Policy.pdf.

California Protected Areas Database (CPAD). 2022. Maintained and published by GreenInfo Network. Available: https://www.calands.org/.

California State Coastal Conservancy and Metropolitan Transportation Commission (SCC and MTC). 2019. Bay Area RAMP Program Document.

Cameron, S. A., Lim, H. C., Lozier, J. D., Duennes, M. A., and Thorp, R. 2016. Test of the invasive pathogen hypothesis of bumble bee decline in North America. PNAS (113)16 4386-4391. DOI: https://doi.org/10.1073/pnas.1525266113.

California Public Utilities Commission (CPUC). 2023. Disadvantaged Communities Website. Available: https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/disadvantaged-communities. Accessed February 2023.

Center for Biological Diversity. 2022. Western Pond Turtles: Natural History. Available: https://www.biologicaldiversity.org/species/reptiles/western_pond_turtles/natural_history.html. Accessed November 2022.

Chapman, E.D., Miller, E.A., Singer, G.P. Hearn, A. r., Thomas, M. J., Brostoff, W. N, LaCivita, P. E., and Klimley, A. P. 2019. Spatiotemporal occurrence of green sturgeon at dredging and placement sites in the San Francisco estuary. Environ Biol Fish 102, 27–40 (2019). https://doi.org/10.1007/s10641-018-0837-9

City of Napa Water Division. 2022. Available: https://www.cityofnapa.org/362/Water-Division. Accessed May 6, 2022.

Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. Gen. Tech. Report WO-76D Map on CD-ROM (A.M. Sloan, cartographer). Washington, DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored.

Conservation Lands Network (CLN). 2019*. Bay Area Conservation Lands Network 2.0: NBB RCIS Area Report.* San Francisco Bay Area Upland Habitat Goals Project. Available: https://www.bayarealands.org/.

Crozier, L. G., M. M. McClure, T. Beechie, S. J. Bograd, D. A. Boughton, M. Carr, T. D. Cooney, J. B. Dunham, C. M. Greene, M. A. Haltuch, E. L. Hazen, D. M. Holzer, D. D. Huff, R. C. Johnson, C. E. Jordan, I. C. Kaplan, S. T. Lindley, N. J. Mantua, P. B. Moyle, J. M. Myers, M. W. Nelson, B. C. Spence, L. A. Weitkamp, T. H. Williams, and E. Willis-Norton. 2019. Climate Vulnerability Assessment for Pacific Salmon and Steelhead in the California Current Large Marine System. *PloS ONE* 14(7): e021771. Available: https://doi.org/10.1371/journal.pone.0217711.

Cruz-McDonnell, K. K., and Wolf, B. O. 2015. Rapid warming and drought negatively impact population size and reproductive dynamics of an avian predator in the arid southwest. Glob Chang Biol. 2016 Jan;22(1):237-53. doi: https://doi.org/10.1111/gcb.13092. Epub 2015 Nov 18. PMID: 26367541.

Ducks Unlimited. 2022. https://www.ducks.org/conservation/where-ducks-unlimited-works/central-valley-coastal-california. Accessed December 2022.

———. 2023. Ducks in a Changing Climate. Available: https://www.ducks.org/conservation/public-policy/climate-change-and-waterfowl/ducks-in-a-changing-climate. Accessed January 2023.

Dusterhoff, S.; McKnight, K.; Grenier, L.; Kauffman, N. 2021. Sediment for Survival: A Strategy for the Resilience of Bay Wetlands in the Lower San Francisco Estuary. SFEI Contribution No. 1015. San Francisco Estuary Institute: Richmond, CA. Available: https://www.sfei.org/documents/sediment-for-survival.

EcoAtlas. 2022. San Francisco Bay Restoration Authority Eligible Projects Group. Available: https://www.ecoatlas.org/groups/63. Accessed May 2022.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. Available: https://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf

Environmental Law Foundation v. State Water Resources Control Board., 26 Cal.App.5th 844, 237 Cal. Rptr. 3d 393 (Cal. Ct. App. 2018)

Environmental Science Associates 2024. Geographical Information System data for North Bay Baylands Regional Conservation Investment Strategy. Oakland, CA. 2024

Federal Geographic Data Committee (FGDC). 2013 Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, DC. Available: https://www.fws.gov/sites/default/files/documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States-2013.pdf

Galbraith, H., D. W. DesRochers, S. Brown, and J. M. Reed. 2014. Predicting Vulnerabilities of North American Shorebirds to Climate Change. *PLoS ONE* 9(9): e108899. Available: https://doi.org/10.1371/journal.pone.0108899.

Gardali, T., N. E. Seavy, R. T. DiGaudio, and L. A. Comrack. 2012. A Climate Change Vulnerability Assessment of California's At-Risk Birds. PLoS ONE 7(3): e29507. Available: doi: https://doi.org/10.1371/journal.pone.0029507.

Goals Project. 1999. Baylands Ecosystem Habitat Goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency, San Francisco, Calif./S.F. Bay Regional Water Quality Control Board, Oakland, CA.

Goals Project. 2015. The Baylands and Climate Change: What We Can Do. Baylands Ecosystem Habitat Goals Science Update 2015 prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. California State Coastal Conservancy, Oakland, CA.

Golden Gate National Parks Conservancy (GGNPC), Tukman Geospatial & Aerial Information Systems. (2021). 2018 Marin County Fine Scale Vegetation Map, v. 9/30/21. Tamalpais Lands Collaborative (One Tam). https://tukmangeospatial.egnyte.com/dl/uQhGjac1zw.

Gowda, P., J.L. Steiner, C. Olson, M. Boggess, T. Farrigan, and M.A. Grusak, 2018: Agriculture and Rural Communities. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 391–437. doi: https://doi.org/10.7930/NCA4.2018.CH10.

Greenbelt Alliance, 2019. At Risk: The Bay Area Greenbelt Report using 2017 dataset. Available through the Bay Area Greenprint. Data methodology available on the Greenbelt Alliance website. https://www.greenbelt.org/at-risk-2017-gis-data/. Accessed February 2023.

Graves, T.A., W.M. Janousek, S.M. Gaulke, A.C. Nicholas, D.A. Keinath, C.M. Bell, S. Cannings, R.G. Hatfield, J.M. Heron, J.B. Koch, H.L. Loffland, L.L. Richardson, A.T. Rohde, J. Rykken, J.P. Strange, L.M. Tronstad, and C.S. Sheffield. 2020. Western bumble bee: declines in the continental United States and range-wide information gaps. Ecosphere 11(6): e03141. 10.1002/ecs2.3141.

Hilberg L.E., Kershner J.M. 2019. Bats: Northern California Climate Change Vulnerability Assessment Summary. Version 1.0. EcoAdapt, Bainbridge Island, WA. https://www.cakex.org/sites/default/files/documents/Nor%20Cal%20VA%20Summary_Bats_20Mar2020.pdf.

Huber, P.R. 2017. Bay Area Regional Advanced Mitigation (RAMP): Impacts and Mitigation Needs Assessment. Agricultural Sustainability Institute, Information Center for the Environment, University of California Davis. March 2017.

Huff, D. D., Lindley, S.T., Rankin, P.S., and Mora, E.A. 2011. Green Sturgeon Physical Habitat Use in the Coastal Pacific Ocean. PLoS ONE 6(9): e25156. https://doi.org/10.1371/journal.pone.0025156

Hutto, S.V., K.D. Higgason, J. M. Kershner, W.A. Reynier, and D.S. Gregg. Climate Change Vulnerability Assessment for the North-Central California Coast and Ocean. Marine Sanctuaries Conservation Series ONMS-15-02. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD.

Intergovernmental Panel on Climate Change (IPCC). 2022. Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the IPCC. Cambridge, UK, and New York: Cambridge University Press. Available: doi: https://doi.org/10.1017/9781009157926.

Iwasaki, J. M., and Hogendoorn K. 2022. Mounting evidence that managed and introduced bees have negative impacts on wild bees: an updated review. Curr Res Insect Sci. 2022 Jul 22;2:100043.

Jackson, H. M., Johnson, S. A., Morandin, L. A., Richardson, L. L., Guzman, L. M., and M'Gonigle, L. K. 2022. Climate Change Winners and Losers among North American Bumblebees. *Biology Letters* 18: 20210551. https://doi.org/10.1098/rsbl.2021.0551

Kimoto, C., DeBano, S. J., Thorp, R. W., Taylor, R. V., Schmalz, H., DelCurto, T., Johnson, T., Kennedy, P. L., and Rao, S. 2012. Short-term responses of native bees to livestock and implications for managing ecosystem services in grasslands. Ecosphere. Wiley Online Library. https://doi.org/10.1890/ES12-00118.1

Klute, D. S., L. W. Ayers, M. T. Green, W. H. Howe, S. L. Jones, J. A. Shaffer, S. R. Sheffield, and T. S. Zimmerman. 2003. Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. U.S. Department of Interior, Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C. Available: https://digitalcommons.unl.edu/usfwspubs/483/. Accessed November 2022.

Langwig, K. E., W. F. Frick, R. Reynolds, K. L. Parise, K. P. Drees, J. R. Hoyt, T. L. Cheng, T. H. Kunz, J. T. Foster, and A. M. Kilpatrick. 2015 Host and pathogen ecology drive the seasonal dynamics of a fungal disease, white-nose syndrome. Proceedings of the Royal Society Biological Sciences. Vol 282, Issue 1799.

Leidy, R.A. 2007. Ecology, Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California. San Francisco Estuary Institute.

Lu, Q., Z. L. He, and P. J. Stoffella. 2012. Land Application of Biosolids in the USA: A Review. Applied and Environmental Soil Science VO - 2012:50.; Torri, S. I., R. S. Corrêa, and G. Renella. 2017. Biosolid Application to Agricultural Land—a Contribution to Global Phosphorus Recycle: A Review. Pedosphere 27:1–16.

Marin Municipal Water District (MMWD). 2022. Marin Municipal Water District website. Available: http://marinwater.org/. Accessed May 5, 2022.

Mayer K.E., and W.F. Laudenslayer, Jr. 1988 A Guide to Wildlife Habitats of California. State of California, Resources Agency, Department of Fish and Game. Sacramento, CA.

Marta E. Ulaski, Michael C. Quist; Filling Knowledge Gaps for a Threatened Species: Age and Growth of Green Sturgeon of the Southern Distinct Population Segment. Journal of Fish and Wildlife Management 1 June 2021; 12 (1): 234–240. doi: https://doi.org/10.3996/JFWM-20-073

Mesnage, R. and Antoniou, M. N. 2028. Ignoring Adjuvant Toxicity Falsifies the Safety Profile of Commercial Pesticides. Frontiers in Public Health. doi: https://doi.org/10.3389/fpubh.2017.00361.

Metropolitan Transportation Commission (MTC). 2022a. Priority Conservation Areas website. Available: https://mtc.ca.gov/planning/land-use/priority-conservation-areas-pcas. Accessed June 2022.

———. 2022b. San Francisco Bay Trail. Available: https://mtc.ca.gov/operations/regional-trails-parks/san-francisco-bay-trail

———. 2023. Equity Priority Communities website. Available: https://mtc.ca.gov/planning/transportation/access-equity-mobility/equity-priority-communities. Accessed February 2023.

Milliken. 1995. A Time of Little Choice: The Disintegration of Tribal Culture in the San Francisco Bay Area 1769–1810, edited by T. C. Blackburn. Ballena Press Anthropological Papers No. 43. Menlo Park, California.

Moyle, P., Lusardi, R., Samuel, P., Katz, J. 2017. State of the Salmonids: Status of California's Emblematic Fishes 2017. Center for Watershed Sciences, University of California, Davis and California Trout, San Francisco, CA.

Mullin, C. A. 2015. Effects of 'inactive' ingredients on bees. Current Opinion in Insect Science. https://doi.org/10.1016/j.cois.2015.05.006

National Audubon Society v. Superior Court, 33 Cal.3d 419, 189 Cal. Rptr. 346, 658 P.2d 709 (Cal. 1983)

National Marine Fisheries Service (NMFS). 2009. Endangered and Threatened Wildlife and Plants: Final Rulemaking to Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon. Ruling October 9, 2009. 50 CFR Part 226. Vol. 74, No. 195. https://www.govinfo.gov/content/pkg/FR-2009-10-09/pdf/E9-24067.pdf.

———. 2013a. Species Ranges - Salmon and Steelhead (West Coast Region). Available: fisheries.noaa.gov/resource/map/species-ranges-salmon-and-steelhead-west-coast-region.

———. 2013b. Endangered and Threatened Species: Designation of a Nonessential Experimental Population of Central Valley Spring-Run Chinook Salmon Below Friant Dam in the San Joaquin River, CA. Available: https://www.govinfo.gov/content/pkg/FR-2013-12-31/pdf/2013-31296.pdf

———. 2014. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead. California Central Valley Area Office. July 2014.

———. 2016. Final Coastal Multispecies Recovery Plan. National Marine Fisheries Service, West Coast Region, Santa Rosa, California.

———. 2018. Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (*Acipenser medirostris*) National Marine Fisheries Service, West Coast Region, California Central Valley Office, Sacramento, California.

———. 2022. Fisheries West Coast Region Maps and Data Archives. Endangered Species Act Critical Habitat. Available: https://www.fisheries.noaa.gov/national/endangered-species-conservation/critical-habitat#critical-habitat-designations,-maps,-and-gis-data. Accessed April 2022.

———. 2023. ESA Threatened and Endangered Species. Available: https://www.fisheries.noaa.gov/species-directory/threatened-endangered

National Resources Conservation Science (NRCC). 2019. Soil Survey Geographic Database. Accessed January 2024.

Native Land. 2022. Digital website. Available: Native-land.ca. Accessed May 14, 2022.

North Marin Water District (NMWD). 2022. North Marin Water District website. ilAvailable: https://nmwd.com/. Accessed May 5, 2022.

Ogilvie, J.E., Griffin, S.R., Gezon, Z.J., Inouye, B.D., Underwood, N., Inouye, D.W., Irwin, R.E. 2017. Interannual bumble bee abundance is driven by indirect climate effects on floral resource phenology. Ecology Letters. 12: 1507-1515. DOI: https://doi.org/10.1111/ele.12854.

Olofson. 2021. Tobias Rohmer Olofson Environmental, Inc. & Drew Kerr Kerr Ecological Solutions. San Francisco Estuary Invasive Spartina Project 2019-2020 Monitoring and Treatment Report, July 2021. Available: https://spartina.org/documents/20192020ISPMonitoringandTreatmentReportFul.pdf.

O'Neill, B. C., C. Tebaldi, D. P. van Vuuren, V. Eyring, P. Friedlingstein, G. Hurtt, R. Knutti, E. Kriegler, J. Lamarque, J. Lowe, G. S. Meehl, R. Moss, K. Riahi, and B. M. Sanderson. 2016. The Scenario Model Intercomparison Project (SceanrioMIP) for CMIP6. Geoscientific Model Development 9:3461–3482. Available: doi: https://doi.org/10.5194/gmd-9-3461-2016.

Padgett-Flohr, G. E., 2008. Pathogenicity of *Batrachochytrium dendrobatidis* in Two Threatened California Amphibians: *Rana draytonii* and *Ambystoma californiense*. Herpetological Conservation and Biology 3(2): 182-191.

Penrod, K., P. E. Garding, C. Paulman, P. Beier, S. Weiss, N. Schaefer, and R. Branciforte. 2013. Critical Linkages: Bay Area & Beyond. Produced by Science & Collaboration for Connected Wildlands, Fair Oaks, CA www.scwildlands.org in collaboration with the Conservation Lands Network. Available: www.BayAreaLands.org.

Penrod, K., R. Hunter, and M. Merrifield. 2001. Missing Linkages: Restoring Connectivity to the California Landscape, Conference Proceedings. Co-sponsored by California Wilderness Coalition, The Nature Conservancy, U.S. Geological Survey, Center for Reproduction of Endangered Species, and California State Parks. Available: http://www.scwildlands.org/reports/Missing_Linkages.pdf.

Potts, S., Imperatriz-Fonseca, V., Ngo, H. Aizen, M., Biesmeijer, J., Breeze, T., Dicks, L., Garibaldi, L., Hill, R., Settele, J., and Vaebergen, A. 2016. Safeguarding pollinators and their values to human well-being. Nature 540, 220–229. https://doi.org/10.1038/nature20588

Poulin, Ray & Todd, L Danielle & Haug, E.A. & Millsap, B.A. & Martell, Mark. 2011. Burrowing Owl (*Athene cunicularia*). The Birds of North America Online. 10.2173/bow.burowl.01.

Quiñones, R. M., and P. B. Moyle. 2014. Climate Change Vulnerability of Freshwater Fishes in the San Francisco Bay Area. *San Francisco Estuary and Watershed Science* 12(3).

Rosencranz, J. A., K. M. Thorne, K. J. Buffington, C. T. Overton, J. Y. Takekawa, M. L. Casazza, J. McBroom, J. K. Wood, N. Nur, R. L. Zembal, G. M. MacDonald, and R. F. Ambrose. 2019. Rising Tides: Assessing Habitat Vulnerability for an Endangered Salt Marsh-Dependent Species with Sea Level Rise. Wetlands: 39: 1203-1218.

San Francisco Bay Area Water Trail (Water Trail). 2023. The Bay Area Water Trail. Available: https://sfbaywatertrail.org/

San Francisco Bay Joint Venture (SFBJV). 2022. Restoring the Estuary - A Framework for the Restoration of Wetlands and Wildlife in the San Francisco Bay Area. Richmond, CA.

San Francisco Bay National Estuarine Research Reserve (NERR) Management Plan 2018-2023 September 1, 2018.

San Francisco Estuary Institute (SFEI). 1994. Potential environmental impacts of tidal marsh restoration in the North Bay of the San Francisco estuary. San Francisco Estuary Institute, Richmond, Calif. 138 pp.

———. 2017. Bay Area Aquatic Resource Inventory (BAARI), Version 2.1 GIS Data. Last updated Dec. 28, 2017. http://www.sfei.org/data/baari-version-21-gis-data.

———. 2022. Marsh_Polygons_RCIS. 2022 Update of Modern Baylands, Bay Area EcoAtlas V1.50b4 1998: Geographic Information System of wetland habitats past and present. Provided to ESA by Gwen Miller, SFEI, Nov. 2022.

San Francisco Estuary Institute-Aquatic Science Center (SFEI-ARC). 2015. Novato Creek Baylands Vision: Integrating ecological functions and flood protection within a climate-resilient landscape. A SFEI-ASC Resilient Landscape Program report developed in cooperation with the Flood Control 2.0 project Regional Science Advisors and Marin County Department of Public Works, Publication #764, San Francisco Estuary Institute-Aquatic Science Center, Richmond, CA.

Santa Clara Valley Habitat Agency (SCVHA). 2022. Santa Clara Valley Habitat Plan 2021 Burrowing Owl Breeding Season Survey Report. Published May 2022.

Seward, N. W., VerCauteren, K. C., Witmer, G. W., and Engeman, R. M. 2004. Feral Swine Impacts on Agriculture and the Environment. Sheep and Goat Research Journal. 12. Available: https://digitalcommons.unl.edu/icwdmsheepgoat/12.

Shellhammer, H. S. and R.R. Duke. Salt Marsh Harvest Mice and Width of Salt Marshes in the South San Francisco Bay. California Fish and Game 96(2): 165-170.

Shuford, W. D., and T. Gardali, editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Sirois-Delisle, C. and Kerr, J.T. 2018 Climate change-driven range losses among bumblebee species are poised to accelerate. Scientific Reports 8:14464. DOI: https://doi.org/10.1038/s41598-018-32665-y.

Solano County Water Agency (SCWA). 2012. Draft Solano Multispecies Habitat Conservation Plan. Available: https://www.scwa2.com/solano-multispecies-habitat-conservation-plan/

———. 2022. Available: https://www.scwa2.com/. Accessed May 6, 2022.

Sonoma County Agricultural Preservation and Open Space District. 2017. Sonoma County Fine Scale Vegetation and Habitat Map, v. 5/1/2017. https://sonomaopenspace.egnyte.com/dl/qOm3JEb3tD.

Sonoma Land Trust (SLT). 2020. Sonoma Creek Baylands Strategy, Final Report – May 2020. Available: https://www.sfei.org/sites/default/files/biblio_files/Sonoma-Creek-Baylands-Strategy_May-2020_1.pdf

———. 2023. Petaluma River Baylands Strategy – April 2023. Available: https://www.sfei.org/sites/default/files/biblio_files/Petaluma-River-Baylands-Strategy-April-2023.pdf

Sonoma Resource Conservation District (SRCD). 2015. Draft Petaluma Watershed Enhancement Plan. Available: https://sonomarcd.org/wp-content/uploads/2017/06/Petaluma-Watershed-Enhancement-Plan-2015.pdf

Sonoma Water. 2022. Available: https://www.sonomawater.org/. Accessed May 5, 2022.

Spautz H., N. Nur, D. Stralberg, and Y. Chan. 2006. Multiple-scale habitat relationships of tidal marsh breeding birds in the San Francisco Bay estuary. Studies in Avian Biology 32:247-269.

Spencer, W.D., P. Beier, K. Penrod, K. Winters, C. Paulman, H. Rustigian-Romsos, J. Strittholt, M. Parisi, and A. Pettler. 2010. California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected

California. Prepared for California Department of Transportation, California Department of Fish and Game, and Federal Highways Administration. Available: https://apps.wildlife.ca.gov/bios/?bookmark=648. Accessed December 2022.

State Route 37 – Baylands Group (Baylands Group). 2017. San Pablo Baylands: Ensuring a Resilient Shoreline; October 26, 2017.

Straw, E. A. and Brown, M. J. F. 2021. Co-formulant in a commercial fungicide produce causes lethal and sub-lethal effects in bumble bees. Scientific Reports 11:21653.

Straw, E. A., Carpentier, E. N., and Brown, M. J. F. 2021. Roundup causes high levels of mortality following contact exposure in bumblebees. Journal of Applied Ecology. https://doi.org/10.1111/1365-2664.13867

Sustainable Conservation. 2022. Sustainable Conservation Expedited Permitting Summary Table. November 29, 2022. Available: https://suscon.org/wp-content/uploads/2022/11/Sustainable-Conservation-Expedited-Permitting-Summary-Table-11-29-2022.pdf. Accessed December 2022.

Sustaita, D., P.F. Quickert, L. Patterson, L. Barthman-Thompson, S. Estrella. 2011. Salt marsh harvest mouse demography and habitat use in the Suisun Marsh, California. Journal of Wildlife Management. 75(6): 1498-1507.

Team Common Ground. 2020. SR 37 Public Access Scoping Report. June 2020. Available https://indd.adobe.com/view/317e49eb-fa52-47ae-8d29-33912ebfe6dd.

Thorne, J. H., R. M. Boynton, A. J. Holguin, J. A. E. Stewart, and J. Bjorkmand. 2016a. A Climate Change Vulnerability Assessment of California’s Terrestrial Vegetation. California Department of Fish and Wildlife, Sacramento, CA. Available: https://www.researchgate.net/profile/Joseph_Stewart4/publication/296639897_A_climate_change_vulnerability_assessment_of_California's_terrestrial_vegetation/links/56d72def08aee1aa5f75c693/A-climate-change-vulnerability-assessment-of-Californias-terrestrial-vegetation.pdf

Thorne, K. M., MacDonald, G. M., Ambrose, R. F., Buffington, K. J., Freeman, C. M., Janousek, C. N., Brown, L. N., Holmquist, J. R., Guntenspergen, G. R., Powelson, K. W., Barnard, P. L., & Takekawa, J. 2016b. Effects of Climate Change on Tidal Marshes along a Latitudinal Gradient in California (No. 1125; Open-File Report). U.S. Geological Survey. https://doi.org/10.3133/ofr20161125.

Ulaski, M. E. and Quist, M.C. 2021. Filling Knowledge Gaps for a Threatened Species: Age and Growth of Green Sturgeon of the Southern Distinct Population Segment. Journal of Fish and Wildlife Management. 12 (1): 234–240. doi: https://doi.org/10.3996/JFWM-20-073)

United States Army Corps of Engineers (USACE). 1987. Corp of Engineers Wetland Delineation Manual. U.S. Army Engineer Waterways Experiment Station. Available: https://usace.contentdm.oclc.org/digital/collection/p266001coll1/id/4532/

———. 2022. Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS). Available: https://ribits.ops.usace.army.mil/. Accessed May 18, 2022.

United States Department of Agriculture (USDA). 1995. Description of Ecoregions of the United States, Ecosystem Provinces. Available: https://www.fs.fed.us/land/ecosysmgmt/colorimagemap/images/261.html. Accessed May 5, 2022.

———. 2018. Existing Vegetation - CALVEG, Region 5 – North Coast West and Central Coast. USDA-Forest Service, Pacific Southwest Region, McClellan, CA. https://data.fs.usda.gov/geodata/edw/datasets.php?xmlKeyword=Existing+vegetation%3A+Region+5.

United States Fish and Wildlife Service (USFWS). 1998. Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area. Portland, OR.

———. 2002. Recovery Plan for the California Red-Legged Frog (*Rana aurora draytonii*). Portland, OR.

———. 2010. *Salt Marsh Harvest Mouse (Reithrodontomys raviventris) 5-Year Review: Summary and Evaluation.* Sacramento Fish and Wildlife Office, Sacramento, CA. February 2010.

———. 2011a. San Pablo Bay Final Comprehensive Conservation Plan and Environmental Assessment. United States Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California. Available: https://ecos.fws.gov/ServCat/Reference/Profile/8280

———. 2011b. *Hesperolinon congestum* (Marin dwarf-flax) 5 Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service. Sacramento Fish and Wildlife Office. Sacramento, CA.

———. 2013. Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California. Sacramento, California.

———. 2015. Marin Western Flax Range. U.S. Fish and Wildlife Service Environmental Conservation Online System.

———. 2016. San Pablo Bay National Wildlife Refuge Climate Adaptation Plan. Available: https://ecos.fws.gov/ServCat/DownloadFile/108220?Reference=68242

———. 2019a. National Wetlands Inventory. Available: https://www.fws.gov/program/national-wetlands-inventory/wetlands-data.

———. 2019b. Natural Resource Management Plan for the San Francisco Bay National Wildlife Refuge Complex. National Wildlife Refuge System, Pacific Southwest Region, Sacramento, CA.

———. 2023. USFWS Environmental Conservation Online System. Available: http://ecos.fws.gov. Accessed January 2023.

United States Geological Survey (USGS). 2017. Western Ecological Research Center (WERC). Bioregions of the Pacific U.S. Available: https://www.usgs.gov/centers/werc/science/bioregions-pacific-us. Accessed December 22, 2021.

———. 2019. High Resolution Flowlines, National Hydrography Dataset. Available: https://www.usgs.gov/national-hydrography/national-hydrography-dataset.

———. 2020. Artificial Groundwater Recharge. Available: https://www.usgs.gov/mission-areas/water-resources/science/artificial-groundwater-recharge?qt-science_center_objects=0#qt-science_center_objects.

U.S. Geological Survey and Natural Resources Conservation Service (USGS and NRCS). 2013. Watershed Boundary Dataset (GIS layer).

Vallejo Water Department. 2022. Available: https://vallejoca.hosted.civiclive.com/our_city/departments_divisions/water_department. Accessed May 6, 2022.

Wellicome, T.I, L.D. Todd, R.G. Poulin, G.L Holroyd, and R.J. Fisher. 2013. Comparing food limitation among three stages of nesting: supplementation experiments with the burrowing owl. Ecology and Evolution 3(8):2684-2695.

Western Pond Turtle Range-wide Conservation Coalition (WPTRWCC). 2020. Western Pond Turtle Range-wide Management Strategy. Available: https://ecos.fws.gov/docs/recovery_plan/WPT%20RCC%20Strategy%202020.pdf

Wilsey, C., B. Bateman, L. Taylor, J.X. Wu, G., LeBaron, R. Shepard, C. Koseff, S. Friedman, R. Stone, 2019. Survival by Degrees: 389 Bird Species on the Brink. National Audubon Society, New York.

Wright, A. N., R. J. Hijmans, M. W. Schwartz, and H. B. Shaffer. 2013. *California Amphibian and Reptile Species of Future Concern: Conservation and Climate Change*. Final Report to the California Department of Fish and Wildlife Nongame Wildlife Program. Sacramento, CA.

Xerces Society for Invertebrate Conservation (Xerces Society), Defenders of Wildlife, and Center for Food Safety. 2018. A Petition to the State of California Fish and Game Commission to List: Crotch bumble bee (*Bombus crotchii*), Franklin’s bumble bee (*Bombus franklini*), Suckley cuckoo bumble bee (*Bombus suckleyi*), and western bumble bee (*Bombus occidentalis occidentalis*) as Endangered under the California Endangered Species Act.

Yap, T., and J. P. Rose. 2019. A Petition to List the Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lions as Threatened under the California Endangered Species Act (CESA). Center for Biological Diversity and the Mountain Lion Foundation. Oakland and Los Angeles, CA. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=171208&inline.

Zarevúcka, M. 2013. Insecticide Resistance of Bumblebee Species. In R. Chamy, & F. Rosenkranz (Eds.), Biodegradation - Life of Science. IntechOpen. doi: https://doi.org/10.5772/56181

APPENDIX A

State Agency Sponsoring Letter and Notice of Intent

California Department of Transportation

DISTRICT 04
P.O. BOX 23660, MS–1A | Oakland, CA 94623–0660
(510) 715-9059 | FAX (510) 286-6301 TTY 711
www.dot.ca.gov

May 10, 2023

Mr. Charlton H. Bonham
Director
California Department of Fish and Wildlife
1416 Ninth Street
Sacramento, CA 95814

Dear Director Bonham:

In accordance with the California Department of Fish and Wildlife (CDFW) Regional Conservation Investment Strategies Program Guidelines (September 2018), the California Department of Transportation (Caltrans) District 4, a state transportation infrastructure agency, requests that CDFW approve the North Bay Baylands Regional Conservation Investment Strategy (NBB RCIS). The proposed NBB RCIS is located within Caltrans District 4 and has been developed through a regional partnership effort.

Caltrans believes that a successfully implemented NBB RCIS could significantly further the State's public infrastructure goals and regional conservation objectives. By utilizing the best available science to identify areas of high conservation value in the North Bay, the NBB RCIS will help agencies not only avoid and minimize project impacts to high priority areas in the landscape, but also identify priority conservation actions for compensatory mitigation, including as part of advance mitigation programs.

Caltrans anticipates multiple future transportation projects within the NBB RCIS boundary extent. Based on Caltrans long-term environmental impact modeling and anticipated permit conditions for regulated natural resources, compensatory mitigation within the region will be required. However, the available supply of compensatory mitigation credits is limited. The NBB RCIS and associated Mitigation Credit Agreements (MCAs) would yield additional compensatory mitigation credits usable by Caltrans and acceptable to CDFW, which also align with California Streets and Highway Code (CSHC) Section 800.6(a)(3). The NBB RCIS will help prioritize the protection, restoration, and enhancement of high priority conservation areas, as well as facilitate engagement with other environmental agencies.

Caltrans understands that this letter and support for the NBB RCIS does not obligate Caltrans to implement any part of the RCIS, or to enter into a specific MCA. However, Caltrans continues to support the development of a robust RCIS program to implement the conservation goals of the NBB RCIS.

Thank you for your consideration. Should you have any questions, please do not hesitate to contact me at (510) 715-9059, or christopher.caputo@dot.ca.gov.

Sincerely,

CHRISTOPHER CAPUTO
Deputy District Director (Acting)

METROPOLITAN
TRANSPORTATION
COMMISSION

Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105
415.778.6700
www.mtc.ca.gov

NOTICE OF INTENT TO PREPARE NORTH BAY BAYLANDS REGIONAL CONSERVATION INVESTMENT STRATEGY

Description of Proposed Regional Conservation Investment Strategy (RCIS)

In 2016, California State law AB2087 established a conservation planning tool called a Regional Conservation Investment Strategy (RCIS) to promote the conservation of species, habitats, and other natural resources. The RCIS Program is managed by the California Department of Fish and Wildlife (CDFW).

The Metropolitan Transportation Commission (MTC), on behalf of a steering committee including representatives from the San Francisco Estuary Partnership (SFEP), California Department of Transportation (Caltrans) and the Sonoma County Transportation Authority (SCTA), is preparing an RCIS for the North Bay Baylands. The RCIS extends into the jurisdictional boundaries of Marin, Sonoma, Solano, and Napa counties (Figure 1).

The NBB RCIS is being prepared with input from the public and stakeholders, including community-based organizations, tribal members, federal, state, and local agencies, and non-governmental organizations. MTC is developing the North Bay Baylands RCIS to promote regional habitat conservation and advance mitigation planning (see below). Funding for the development of the NBB RCIS was provided by the California Wildlife Conservation Board.

What is the North Bay Baylands RCIS?

The North Bay Baylands RCIS:

- Provides a voluntary, non-binding, non-regulatory conservation assessment.
- Provides a regional conservation strategy for conservation elements through strategic, scientifically grounded actions and investments. Conservation elements include focal species, natural communities, and other elements such as habitat connectivity.
- Establishes conservation and enhancement goals, objectives, and priorities.
- Describes and promotes methods of conservation investment that will contribute to species and habitat conservation, including but not limited to:
  - Land acquisition and protection
  - Habitat and ecological function creation, restoration, and enhancement
  - Habitat corridor and transition zone establishment and enhancement.
- Enables development of Mitigation Credit Agreements (see below).
- Must undergo a public review process and be approved by CDFW.
- Is scheduled for public review in spring 2023.

Mitigation Credit Agreements

Once finalized, the RCIS may facilitate advance mitigation planning where environmental improvement required as mitigation can be implemented in advance of project impacts occurring. This can result in more strategic conservation projects that have greater benefit, while also expediting delivery of infrastructure projects.

METROPOLITAN
TRANSPORTATION
COMMISSION

Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105
415.778.6700
www.mtc.ca.gov

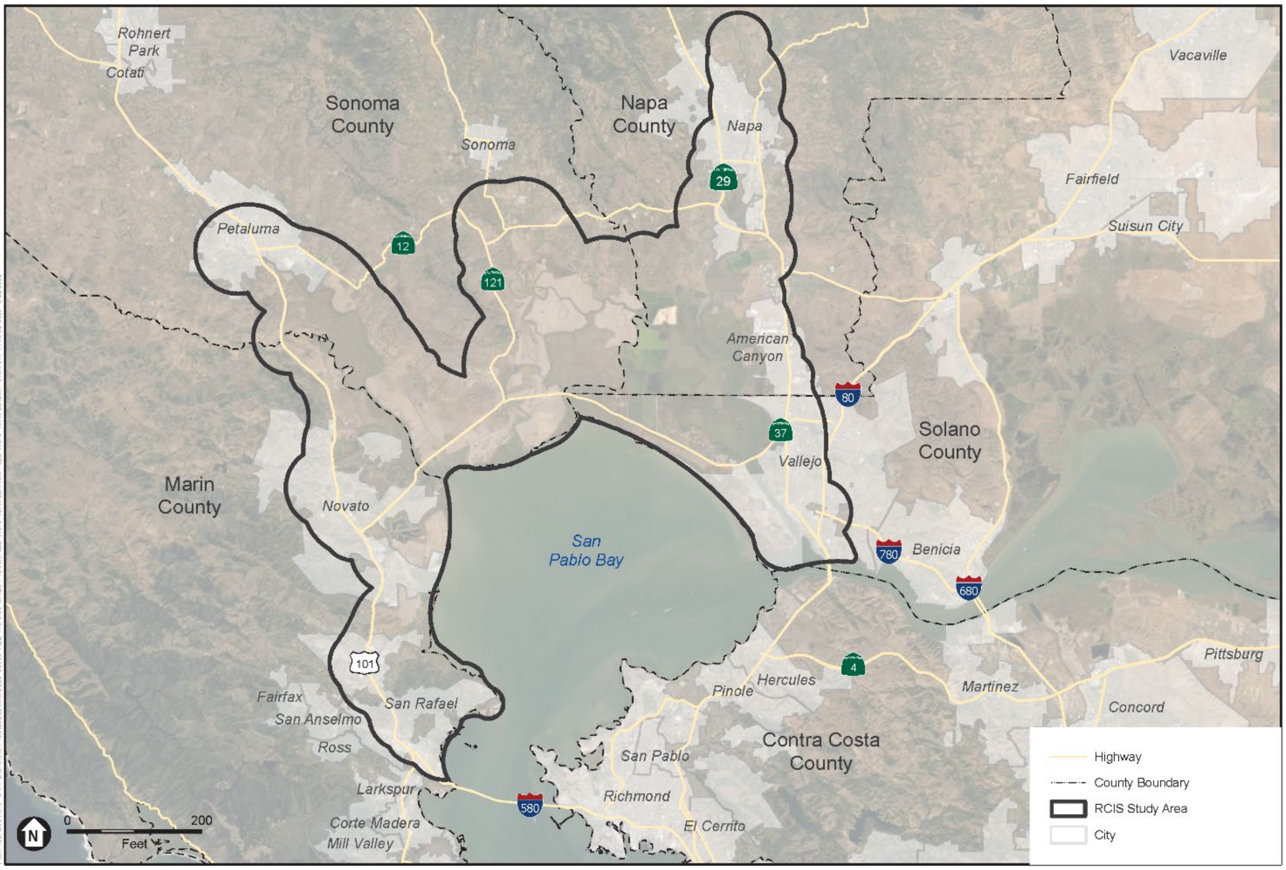
Mitigation Credit Agreements (MCAs) can only be developed under an RCIS that has been approved by CDFW. Anyone can enter an MCA with CDFW. MCAs:

- Create mitigation credits by implementing conservation actions identified in the RCIS
- Must be within the boundary of an approved RCIS
- May be used as compensatory mitigation for impacts under:
    - California Environmental Quality Act (CEQA)
    - California Endangered Species Act
    - Lake and Streambed Alteration Program

Additional information about the North Bay Baylands RCIS can be found at: www.baylandsrcis.org .
More information about CDFW's RCIS Program can be found at:
https://wildlife.ca.gov/Conservation/Planning/Regional-Conservation .

Please contact: rcis@bayareametro.gov for more information about the North Bay Baylands RCIS.

Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105
415.778.6700
www.mtc.ca.gov



SOURCE: ESA, 2021

North Bay Baylands Regional Conservation Investment Strategy

Figure 1
North Bay Baylands Regional Conservation Investment Strategy Area

ESA

APPENDIX B

Public Outreach Process and Public Comment

B. Public Outreach Process and Public Comment

Section 1.4 of the North Bay Baylands Regional Conservation Investment Strategy provides an overview of the public outreach process. This appendix provides additional information on the comments received during the public meeting and public comment period.

B.1 Public Meeting, October 19, 2022

A public meeting was held on October 19, 2022, both in-person and via Zoom. The in-person location was at Caltrans' METS Building on Mare Island (690 Walnut Avenue, Vallejo, CA), within the RCIS area. Participants were made aware that written comments would be recorded and included in this RCIS. Participants were instructed on how to ask questions through the chat interface or use the raise hand function to ask a question. Written comments and questions were read aloud and addressed during the meeting. Table B-1 provides a summary of the questions or comments and their response. Comments and responses provided herein may be paraphrased or otherwise modified slightly to improve clarity.

TABLE B-1: OCTOBER 19, 2022, PUBLIC MEETING WRITTEN AND ORAL COMMENTS AND RESPONSES

Written and Oral Public Comments	Response
Using the salt marsh harvest mouse as an example, how will the RCIS factor in adaptation and habitat at sea level rise?	All species must have a climate change vulnerability assessment in the RCIS. This assessment helps identify threats, such as sea level rise. This information is then incorporated into our goals, objectives, and actions for the species and other conservation elements.
Commenter expressed concern about the potential loss of low-profile wetland habitats (such as salt pannes) and wanted to make sure that habitat restoration considers a diversity of habitat beyond tidal marsh species such as salt marsh harvest mouse and California Ridgway's rail.	A part of having multiple focal species and conservation elements is to capture diversity of habitats. The RCIS is an overall ecosystem plan and not focused on a single species. CDFW requires a representative from every taxon, e.g., fish, insects, mammals, birds. The intent is to represent diverse habitat types.
Will the RCIS be used to guide agency funding or grant funding?	Yes, that is the intent. One of the goals of the RCIS is to be able to have a structure in place to help identify where funding should go. There are a number of grant programs, such as those managed by CDFW or the EPA, that project proponents could approach and describe how their project actions align with RCIS. This helps justify the investment and attract funding.
How will climate change be included in the RCIS? What climate change project will you use and design?	The California Adaptation Planning Guide is still recommending using the climate change projection and modeling from the fifth IPCC report of the 6th edition. After consulting with CDFW, it is recommended to use the best current available information and reference latest information that will be coming out.

B.2 Public Review Period, July 10, 2023 – September 8, 2023

The RCIS was subject to a 60-day public review and comment period, commencing on July 10, 2023, and ending on September 8, 2023. Public comment letters were received from: Ducks Unlimited; the Santa Rosa Plain, Petaluma Valley, Sonoma Valley Groundwater Sustainability Agencies; California Department of Transportation (Caltrans) Headquarters Office of Biological Science and Innovation; Madrone Audubon Society; Marin Audubon Society; Caltrans District 4; and the California State Coastal Conservancy (SCC)[1]. Table B-2 provides the comments received and their response.

TABLE B-2: PUBLIC REVIEW WRITTEN COMMENTS AND RESPONSES

RCIS Section #	Written Public Review Comments	Response
From Ducks Unlimited:		
1.1.1	Commenter asked that Table 1-1 consider whether restoration projects should try to align with conservation element goals and objectives versus the alternative of aligning the RCIS with the regional planning documents that preceded it like Sonoma Creek Baylands Strategy (SCBS, 2020) and Petaluma River Baylands Strategy (PRBS, 2023).	The intent of Table 1.1 is to direct users to sections within the RCIS document. For restoration project proponents, they are directed both to the sections/appendices that summarize other strategy documents as well the conservation strategy (Ch 4), which was developed from the actions in these precedent strategies. No change made.
1.1.1	Commenter asked if it is worth distinguishing between voluntary restoration project designs and mitigation designs (Table 1-1: Row 2)?	The RCIS describes beneficial actions, like restoration, regardless of whether those actions were triggered through a regulatory process (mitigation) or voluntary. No change made.
1.1.1	Commenter asked if impacts on areas with high conservation value should this be avoided or minimized (Table 1-1: Row 3)?	"Minimized" added to the description.
1.1.1	Commenter suggested adding non-profit organizations to Table 1-1: Row 4.	Edited as suggested.
1.1.1	Commenter recommended eliminating row concerning planning documents and asked what areas do we actually need more plans for? There are habitat goals in the SFBJV Restoring the Estuary 2022; there are conservation visions laid out in the Sonoma Creek Baylands Strategy (2020), Petaluma River Baylands Strategy (2023), and the Novato Creek Baylands Strategy (in preparation) (Table 1-1: Row 8).	Table modified to include text updating existing plans. As a non-regulatory document, the RCIS cannot preempt the authority of local agencies; however, they can serve as a resource for when general plans and master plans are updated. The RCIS must consider general plans. No change made.
1.2	Commenter recommends changing "brackish water marsh" to "brackish marsh" in the first sentence.	Edited as suggested.
1.2	Commenter suggested modifying in the first paragraph "these marshes are shown to be among the most robust in the region because of sediment supply from Napa River, Sonoma Creek, and Petaluma River." Because this description differs from subsequent description that includes reference to Scot Dusterhoff's modeling for this region.	Removed reference to low resiliency for these areas.

[1] Comment letters from the State Coastal Conservancy and Caltrans District 4 were received later in September after the public comment period was completed, but were still considered and responded to.

RCIS Section #	Written Public Review Comments	Response
1.3	Commenter indicated the Wildlife Conservation Board provided funding and should be acknowledged.	WCB funding was acknowledged.
1.4	Commenter asked if tribal engagement should be included on the diagram?	Tribal engagement is considered one of the types of focused outreach. Added a footnote to the figure.
2.1.1	The commenter asked if the statement "the 1-mile buffer from SR-37 differs from previous discussions of the RCIS boundary and from maps" is correct in the last 6 lines of text?	Edits made. Areas excluded from the RCIS boundary must be discussed per CDFW's guidelines.
2.2.2	Commenter recommended restoration goals should also reference SFBJV RTE 2022, SCBS 2020, and PRBS 2023.	Restoration plans references included in last sentence.
2.3.1	The commenter suggested making the colors more sufficiently distinct to tell how things are mapped. Skaggs Island is not low intensity agriculture. It has not had agriculture on it at least since the Navy took ownership that I know of. Grazing stopped in the 1990s. It is "faux upland," subsided lands that are pumped to keep them dry. It is dominated by ruderal grasslands interspersed with coyote bush and seasonal wetlands (Figure 2-6).	We have created a color ramp to attempt to group similar habitats together, but display is difficult given the number of habitats displayed on the figure. Data will be available in the future on a website hosted on www.bayareagreenprint.org, which will allow finer detail and resolution of habitat data. The working lands figure uses best available data from the California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program, 2016 (CDOC 2019). The RCIS does not develop new spatial data and existing data sources should be ground-truthed before being incorporated into project planning.
2.4.2.1	The commenter asked if biosolids reference BACWA 2022 could include partner organizations? This was a JV white paper with a number of partners.	Partner organizations included in complete reference.
2.5.4	Commenter suggested replacing Skaggs Island and Haire Ranch and Camp 4 Restoration Projects with "Sonoma Creek Baylands Restoration" to the planned projects list. This will subsume Skaggs, Haire, Camp 4 and add additional. Commenter asked to include Tolay Creek Restoration Project.	The Sonoma Creek area planned projects were edited based on a similar, but conflicting comment provided by SCC. Tolay Creek project added.
2.5.4	Commenter suggested updating figure to include Sonoma Creek Baylands Restoration. This will subsume Skaggs, Haire, Camp 4 and add additional. Commenter also recommended including Tolay Creek Restoration Project (Figure 2-10).	Edits made in text to subsume the indicated projects under Sonoma Creek Baylands Restoration and Tolay Creek Restoration Project added. Map created based on data available from EcoAtlas as of 2022.
2.5.4	The commenter suggested acknowledging that more ambitious goals are laid out in SFBJV 2022, SCBS 2020 and PRBS 2023 or should reference those documents in Figure 2-11 and the text.	Edit made to text to indicate additional goals are described in the indicated documents.

RCIS Section #	Written Public Review Comments	Response
2.5.5	Commenter suggested Public Access and Restoration should include the incorporation of the Guiding Principles from the Sonoma Creek Baylands Strategy (2020).	Reference to SLT 2020 added to Tidal Community Action TIDE 1.1.4 in Chapter 4.
2.7.1	Commenter recommended other relevant plans should be referenced rather than summarized in Appendix G if they would further inform the RCIS.	Relevant plans have been referenced as reviewed and incorporated into the Conservation Strategy in Chapter 4. Plan summaries are not required as part of the RCIS and have been limited to the appendix to aid in the readability of the document.
2.8.1 and 2.1.8.3	The commenter asked if Table 2-9 and the text should include marsh drowning and conversion of marsh type from high to low marsh. The commenter also asked for marsh transgression to be included where possible.	Land conversion due to sea level rise was added to Table 2-9. This is primarily discussed in the climate change section. This section was modified to clarify that high marsh may convert to low marsh.
2.8.2	Commenter asked if there is more known about rising groundwater than Goals Project 1999?	Added additional citations.
3.1	Commenter asked if there is there a way to further explain or reconsider working lands as a conservation element in the RCIS area – the working lands will all become less feasible to sustain with sea level rise, increasing risk of a catastrophic levee breach.	Working lands were reconsidered as part of the revision. Working lands are no longer provided a conservation target acreage and instead are prioritized only when compatible with species recovery benefits and larger regional goals.
4.2.1	Commenter suggested changing the reference of Goals Climate Update to be consistent with other references. Also more typically known as Science Update.	Edits made to citation.
4.2.1	Commenter recommended adding Petaluma River Baylands Strategy (2023) to this list.	Petaluma River Strategy added to list.
4.2.3	The commenter asked if this is implying a target of 50% agriculture protected in perpetuity? If so, that would be contrary to all the regional goal setting and conservation guidance documents (e.g., Baylands Goals, Science Update, SFBJV RTE, SCBS, PRBS). (Table 4-1: Row 1, agriculture)	Protection targets removed for agriculture, barren, eucalyptus, managed ponds, and wastewater ponds.
4.2.3	The commenter asked if percent protected includes State Lands Commission ownership because the percent protected numbers seemed low (Table 4-1: tidal habitats (channel, subtidal embayment, etc.)).	State Lands Commission owned parcels are shown as included in CPAD as of 2022. Data will be available in the future on a website hosted on ww.bayareagreenprint.org, which will allow finer detail and resolution.
4.2.3	The commenter asked if all the salt ponds within the RCIS area are in public ownership already? The commenter also asked what are the 46 acres that are coming up as salt pond and why is it split assuming it is a real thing? (Salt Pond)	Salt ponds were mapped by SFEI in 2022 and overlayed with CPAD data to determine the amount of habitat in public ownership. Data will be available in the future on a website hosted on ww.bayareagreenprint.org, which will allow finer detail and resolution.
4.3.1, RL Objective 1.2	Commenter suggested updating PRBS reference to 2023.	Edited as suggested.

RCIS Section #	Written Public Review Comments	Response
4.3.1	Commenter recommended adding reference to SFBJV's RTE (2022), PRBS (2023), SCBS (2020) (Table 4-3: Row 1).	Edited as suggested.
4.3.1	The commenter recommended including recognition of the need for vegetation management in sensitive habitats to protect native wildlife and plant species populations (Table 4-3: Row RL1.1.4).	Implementation of vegetation management in sensitive communities for the benefit of wildlife is included in actions RL 1.2.2, 1.2.4; HERP 1.1.2, 1.1.3; BEE 1.2.1, 1.3.1, 1.3.2; BUOW 1.2.1, 1.2.3; WL 1.1.2, 1.1.3.
4.3.1	The commenter suggested recognizing the need to add new species and to reprioritize as new species become problematic or are prioritized for control. Early Detection Rapid Response is always the most effective (Table 4-3: RL1.2.2).	Edited action to include emerging priority species.
4.3.5	Commenter recommend adding goals and objectives around tidal marsh persistence that include protection and restoration of adjacent Upland Transition Zone and adjacent uplands habitats (Regional Tidal Communities).	"Upland transition zones" added to TIDE Goal and Objectives. Protection of transition zones already included in RL Objective 1.1.
4.4.5 to 4.16.6	Commenter suggested that it would make sense to add historic range to the maps and strategies because of the extensive conservation that is complete, underway, and planned for this region. (Global Comment for all the species starting on 4-19 and continuing to 4-71)	Historic range maps are not consistently available, and inclusion was beyond the scope of this document. The range maps provided are aligned with the RCIS program guidance.
4.4.5	The commenter asked to ensure this is written in a way that is compatible with regional habitat goals since these areas are prioritized for tidal restoration and upland transgression (Table 4-8: BEE 1.2.5 and 4.4.6).	Suitablity of locations for implementation of actions will need to be ground truthed and coordinated with regional projects.
4.5.5	Commenter asked about recommending near shore reef construction and what type of reefs. Commenter did not believe that the area was identified as suitable for eelgrass or oysters (Table 4-10: GRST 1.3.1).	CDFW comments included references to Huff et al. 2011 speaking to the importance of high sea floor complexity for green sturgeon. The Baylands Ecosystem Habitat Goals Update recommends protecting oyster beds and eelgrass beds near the San Rafael-Richmond Bridge. Caltrans has completed an eelgrass restoration project in this area as well
4.6.5	The commenter asked if the actions in Table 4-12 seemed generally geared towards habitats higher in the watershed and beyond the extent of the RCIS. Commenter asked if it could be reframed to focus on actions that could be accomplished within RCIS boundary.	Included actions are recommended by NMFS for portions of watersheds included within the RCIS area.
4.7.4	Commenter asked to consider whether Chinook Range and habitat should include all restoring habitats within Napa Sonoma marshes as referenced by Moyle et al. 2017 (Figure 4-4).	Modeled habitat uses the NMFS-designated critical habitat. This data is made up of lines as opposed to polygons. Actions included in the chinook salmon strategy focus on tidal marsh enhancement and restoration. This would include the Napa Sonoma marshes.

RCIS Section #	Written Public Review Comments	Response
4.8.6	The commenter noted that the areas in Figure 4-5 are prioritized for tidal restoration and upland transgression and recommended it being written in a way that considers and is compatible with regional habitat conservation and restoration goals.	Suitablity of locations for implementation of actions will need to be ground truthed and coordinated with regional projects.
4.9.5	Commenter asked to change WPT 1.2.2 to, "Where agriculture is present, promote agricultural uses…" (Table 4-20).	Edited as suggested
4.9.6	Commenter recommended in the first bullet to keep in mind that upslope of the historic Baylands margin is the single best opportunity for wetlands to migrate upslope all around the estuary.	Suitablity of locations for implementation of actions will need to be ground truthed and coordinated with regional projects.
4.9.6	Commenter suggested including that Western Pond turtles are present in lower Tolay Creek and other brackish habitats.	Tolay Creek CNDDB occurrences included in figure. Reference to brackish marshes added to Ecological Requirements. This habitat type is not mapped well in RCIS area.
4.10.6	Commenter suggested considering that large portions of what is modeled habitat and based on CNDDB occurrences is part of current or future tidal restoration planning efforts, and that the attributes that support burrowing owls in many of these locations now will not be there in the future (Figure 4-7).	RCIS is a conservation snapshot of current conditions and is not intended to be predictive.
4.12.6	Commenter recommended adding PRBS (2023) and SFBJV (2022) (Section 4.12.6, Bullet 1).	Edited as suggested
4.13.5	Commenter asked about the acreage goals in SFBJV RTE 2022 since they are much higher than that for this region, as are acreages identified in SCBS (2020) and PRBS (2023).	The protection target for this and other focal species is based on present day habitat. It was calculated by using the percentage of present-day habitat protected and using a protection target of 90% of present-day habitat. Enhancement and restoration acreage targets are not included as metrics for those objectives.
4.13.6	Commenter suggested editing this section to include: Tidal marsh is not managed. Tatch-filled bulrush is not present in most of the RCIS area. SMHM also use many other habitat combinations, which vary based on the conditions present. For instance, very high numbers of SMHM were encountered outboard of Sears Point and bulrush is completely absent. Conservation priorities should speak to the opportunities to improve habitat (without active management) within the RCIS. This might include accelerating tidal restoration, adding habitat complexity in restoring tidal marsh (e.g., upland islands), restoring complete tidal marsh ecosystems that grade from tidal marsh to adjacent uplands.	Removed priority to manage tidal marsh habitat.
4.13.6	Commenter suggested that this section should also include the language like what is included in 4.12.6 for rail.	Edited as suggested.

RCIS Section #	Written Public Review Comments	Response
4.18.5	The commenter recommended including action to reconnect tributaries to tidal marshes (Table 4-31).	WATER action 1.1.3 added as applicable action for freshwater wetlands. This action includes reconnecting tributaries to tidal marshes.
4.19.7	The commenter suggested including tributaries to each of these waterways in bullet 1.	Edited as suggested.
4.19.7	Commenter suggested editing Bullet 3 to include: Perennial pepperweed control efforts should be broadened to include control of other prioritized weed species (this could rely on USFWS prioritization, or Cal-IPC, or BAEDN, or other sources) Also the work should expand beyond established treatment areas because we are planning 6,000 acres of restoration in the lower Sonoma Creek corridor. Treatment and control efforts should also be prioritized and informed by planned restoration actions so that newly restored sites do not become large weed sources.	Edited as suggested.
4.19.7	Commenter suggested updating PRBS reference to 2023 in Bullet 4.	Edited as suggested.
4.19.7	Commenter suggested removing Cullinan Ranch from bullet 5. There isn't an adjacent transition zone habitat. Commenter recommended broadening bullet to say," and conserve transition zone land and adjacent uplands that are located near present or future marshes or are located along or near the historic Baylands margin."	Edited as suggested.
4.20.6	Commenter recommended updating PRBS reference to 2023.	Edited as suggested.
4.21.6	The commenter asked to review the priority to increase acreage of upland working lands. Also, if so, this should be framed as an interim priority for locations near the historic Baylands margin as marshes will need accommodation space.	After review of cited source, reworked action to more accurately reflect consideration of low-elevation agricultural areas and removed action as priority.
4.21.6	Commenter suggested reviewing the data. The commenter noted that Skaggs Island, Haire Ranch, Camp 2, and Burdell Unit are not working lands. (Figure 4-18).	Working lands are those shown in California Department of Conservation Farmland Mapping and Monitoring Program with data dated to 2019. This is the most recent data available.
5.2.8	The commenter suggested the BCDC jurisdiction should include salt pond (Table 5-2).	Text added.
From Santa Rosa Plain, Petaluma Valley, Sonoma Valley Groundwater Sustainability Agencies Groundwater Sustainability Agencies:		

RCIS Section #	Written Public Review Comments	Response
4.3.2	Commenter noted the GSPs for both basins identify Coordination of Farm Plans with GSP Implementation as a key management action, which would involve collaboration between the three Sonoma County GSAs and interested members of the agricultural community to evaluate the feasibility of developing a program that coordinates Farm Plans, developed at individual farm sites, with the implementation of the GSPs. This effort will identify areas of mutual interest (for example, improved water use efficiency, increased groundwater recharge, increased monitoring, and data collection, coordinated information sharing, and reporting). Given the common goals and interested parties of this management action and the WATER 1.1.7 action in the RCIS, there appears to be strong potential for collaboration and alignment. (Table 4.4: Water 1.1.7)	Comment is acknowledged. No change made.
4.22.5	Commenter noted the GSAs are supportive of efforts to increase groundwater recharge across the basins and appreciate that the RCIS recommends focusing recharge within the priority groundwater basins (Table 4-35: HYDRO 1.1.6).	Comment is acknowledged. No change made.
4.3.2, 4.22.5	Commenter recommended including monitoring strategies to document and monitor baseline and future groundwater quality conditions, for potential conservation and habitat enhancement actions included in the RCIS which have the potential to alter the distribution of salinity within the groundwater system.	Added WATER action 1.1.9 which includes inventory of baseline groundwater quality conditions and implementation of future monitoring. Added as applicable action to the Hydrological processes other conservation element.
From Caltrans Headquarters Office of Biological Science and Innovation:		
General Comment	The commenter was interested in the prospect of having mitigation credits created through a Mitigation Credit Agreement (MCA). Through the permitting process, Caltrans and CDFW continuously need California Endangered Species Act (CESA) and Lake and Streambed Alteration Agreement compensatory mitigation to apply as offsets for unavoidable transportation project impacts. The RCIS Program and MCA credits have the potential to positively assist with Caltrans and CDFW's ability to find mitigation, and thereby help permitting. Further, when transportation projects could be accelerated, California Streets and Highways Code § 800.6(a)(3) authorizes Caltrans Advance Mitigation Program (AMP) to invest in developing RCISs and MCAs, as well as purchase MCA credits in bulk prior to their use.	Comment is acknowledged. No change made.

RCIS Section #	Written Public Review Comments	Response
General Comment	The commenter noted that as per CDFW's final MCA Guidelines, published, on June 25, 2023, the commenter determined that for the foreseeable future, Caltrans transportation projects and advance mitigation projects will be limited to purchasing MCA credits created by others.	Comment is acknowledged. No change made.
General Comment	The commenter noted that Caltrans cannot perform the role of MCA Sponsor. CDFW's legislation requires that MCA securities take the form of a letter of credit or cash [FGC §1856(g)(17); 1798.5(a)(2)]. Caltrans cannot provide a letter of credit or cash per the prohibition against pledging the credit of the state [Cal. Const., art. XVI, § 6 and GC § 16305.3].	Comment is acknowledged. No change made.
General Comment	The commenter noted that to responsibly spend State funds, the AMP will be prioritizing funding advance mitigation projects that are aligned with multiple natural resource regulatory agencies [See AMP Guidelines and 2021 Statewide Advance Mitigation Initiative MOU]. MCA created credits will be CDFW-only credits. Although allowed under Fish and Game Code for the RCIS program, a framework and process for MCA alignment with other natural resource regulatory agencies was not established through the MCA Guidelines.	A statement regarding prioritization of multi-agency credits was added to the document.
General Comment	According to the commenter, the Advance Mitigation Account is a revolving fund. Consequently, the AMP's long-term funding is contingent on transportation projects paying back the AMP for the credits it purchases or establishes—a process that can only take place after natural resource regulatory agency approval and during a transportation project's environmental permit and conditioning process. To not waste the Advance Mitigation Account and to ensure that all Advance Mitigation Account funds address Caltrans needs, the AMP will need reliable cost and schedule information. Because MCA development schedules and costs are not mandated by law, prescribed in the MCA Guidelines or, as a brand-new program, have a track record, this essential information is not available.	A statement regarding the revolving fund was added to the document.

RCIS Section #	Written Public Review Comments	Response
General Comment	According to the commenter, the NBB RCIS Area (Section 2.2.1) overlaps the Gualala-Salmon, San Pablo Bay, and Tomales-Drake Bays Sub-basins Regional Advance Mitigation Needs Assessment (RAMNA), prepared for Caltrans District 4 in 2022. It can be downloaded from the AMP webpage. The RAMNA, a regional mitigation planning document, can be used by Caltrans District 4 and Caltrans AMP to justify funding advance mitigation projects to purchase or establish credits with Advance Mitigation Account funds for the following resources: • Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) • California red-legged frog (*Rana draytonii*) • California tiger salamander (*Ambystoma californiense*) Central California and Sonoma County Distinct Population Segments ("DPSs") • Swainson's hawk (*Buteo swainsoni*) • Central California Coast evolutionarily significant unit ("ESU") coho salmon (*Oncorhynchus kisutch*) • Northern California Coast DPS steelhead (*O. mykiss*) • Central California Coast DPS steelhead (*O. mykiss*) • longfin smelt (*Spirinchus thaleichthys*) • Southern DPS green sturgeon (*Acipenser medirostris*) • Riparian habitat • Wetland • Non-wetland waters.	The RCIS discusses the Gualala-Salmon, San Pablo Bay, and Tomales-Drake Bays Sub-basins Regional Advance Mitigation Needs Assessment (RAMNA). Only those species listed that are represented in the San Pablo Bay Sub-Basin are included in this RCIS.
General Comment	According to the commenter, Caltrans OBSI recognizes that the NBB RCIS supports all kinds of conservation related investments and is not limited to mitigation and MCAs.	Comment acknowledged. No change made.
General Comment	Commenter requested that the RCIS provide users the opportunity to make habitat connectivity improvements to the following FESA, CESA-listed, or fully protected species identified in the RCIS: salt-march harvest mouse - northern subspecies (*Reithrodontomys raviventris halicoetes*), California red-legged frog (*Rana draytonii*), Green Sturgeon – Southern DPS (*Acipenser medirostris*), Steelhead – Central California Coast DPS (*Oncorhynchus mykiss irideus*), and Chinook Salmon (*Oncorhynchus tshawytscha*) ESUs. See Reference to Crooks in comment below.	These species are included in the RCIS. Habitat connectivity actions are included as applicable for these species.

RCIS Section #	Written Public Review Comments	Response
General Comment	Commenter requested that the RCIS provide users the opportunity to make habitat connectivity improvements to the many protected and unprotected species with the RCIS boundaries that will preserve biodiversity and may help to support healthy populations of avian species identified for conservation actions in the RCIS. These habitat connectivity improvements can benefit native predators such as coyote and bobcat, that control populations of "subsidized" mesopredators, such as racoons, feral cats, skunks, and rats, to maintain ecosystem integrity and limit predation on protected species and listed birds (USFWS personal communication; Crooks & Soulé, 1999) Reference: Crooks, K., Soulé, M. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400, 563–566 (1999). https://doi.org/10.1038/23028	Habitat connectivity actions can be applied throughout the RCIS area. No change made.
4.3.3, 4.3.4	Commenter recommended including focal species of anadromous fishes, but this excludes the full definition of fish under Fish & Game Code § 45, whereas "Fish" means a wild fish, mollusk, crustacean, invertebrate, amphibian, or part, spawn, or ovum of any of those animals. Under that definition, the actions under FISH would also benefit California freshwater shrimp and amphibian species. The FISH Objective 1.2 and the HERP Objective 1.1 are similar, but the HERP objective does not include removal of passage barriers that would improve its efficacy and achieve the infrastructure improvement goals that would result from FISH Objective 1.2 to benefit all HERP species. HERP Objective 1.1 could be strengthened or augmented to go beyond just enhancement of habitat to removal of dispersal barriers to also include removal of passage barriers. (Regional Anadromous Fish (FISH))	This RCIS is not defining "Fish" as stated under Fish & Game Code § 45. Dispersal barriers can apply to infrastructure projects which is discussed further in HERP 2.1.1.
4.3.4	Commenter asked to improve options for "HERP Objective 2.1: Reduce vehicle-related mortality factors" by including a specific mention of roadside exclusion fencing. It is good to include directional fencing, but exclusion fencing alongside roads and linear infrastructure is a similarly effective but slightly different solution that warrants inclusion. (Table 4-6, improve HERP 2.1.1)	Exclusion fencing added to HERP 2.1.1.
4.15.4	The commenter suggested including California freshwater shrimp as an additional species that would benefit from improved Terrestrial and Aquatic Connectivity, in Associated Non-focal Species and Natural Resources.	Added California freshwater shrimp as associated non-focal species to habitat connectivity

RCIS Section #	Written Public Review Comments	Response
4.15.6	Commenter suggested modifying the description of HC Objective 1.1 to eliminate the phrase at the end of the sentence that measures improvements as habitat connected through "otherwise impassable barriers." The term "impassable barriers" could exclude many instances of partially passable barriers that, if remediated, would result in measurable improvements to habitat connectivity. Many roadways, for example, fragment habitat, result in species mortality, and would benefit from habitat connectivity improvements and wildlife crossings, but they are not "otherwise impassable barriers." The commenter suggested changing "impassable barriers" to "habitat connectivity barriers" or just "identified barriers."	Language change to "identified barriers."
4.15.6	The commenter suggested improving HC 1.1.1 by adding "exclusion fence" to the list of wildlife crossing features that would benefit habitat connectivity. This is similar to directional fencing, but slightly different and a very effective tool to eliminate mortality of species due to vehicle collisions.	"Exclusion fencing" added to HC 1.1.1.
5.2.5	Commenter suggested including a sentence or two in the first section that explicitly connects the new Fish & Game Code 1957 created by Senate Bill 790 (2021) that allows CDFW to authorize compensatory mitigation credits through an MCA for wildlife connectivity actions. The definition of wildlife connectivity actions as defined by the legislation is as follows: "'Wildlife connectivity action' means an action that measurably improves aquatic or terrestrial habitat connectivity, or wildlife migration, recolonization, and breeding opportunities inhibited by built infrastructure or habitat fragmentation. A wildlife connectivity action may include, but is not limited to, a road overpass or underpass solely for use by wildlife." Since this RCIS defines many habitat connectivity actions, but does not always phrase them as wildlife connectivity actions, it would help future users of the RCIS to see this connection to MCAs and the new Fish and Game Code explicitly identified.	A phrase regarding CFGC 1957 and wildlife connectivity actions was added to Chapter 5 section on Mitigation Credit Agreements. Definition of wildlife connectivity actions and how relate to conservation strategy actions added to Chapter 4.
From Madrone Audubon Society:		

RCIS Section #	Written Public Review Comments	Response
2.3.2	Petaluma Valley is included as an area of terrestrial biodiversity with a rank or 4 or 5, and noted is that a majority of the RCIS area, excluding areas with higher elevations between the Petaluma River and the Napa-Sonoma Marshes, have an aquatic biodiversity ranking of 5 (CDFW 2018). The commenter noted the species list of consideration may be incomplete related to the Petaluma Valley area. Commenter emphasized that ground-truthing with organizations involved in conservation in the Petaluma Valley (Madrone Audubon, Petaluma Wetlands Alliance, Paula Lane Action Network, Friends of the Petaluma River) be engaged in any proposed activity in this area, to ensure current and complete species identification and protections are assured.	Comment acknowledged. Text and comment are accurate as written. No change made. Suitablity of locations for implementation of actions will need to be ground truthed and coordinated with regional projects.
2.3.3	Commenter recommended a modification of wording in paragraph 2, as highlighted below: *Habitat connectivity in the North Bay Baylands includes landscape-level connection between habitats, sub-watersheds, or watersheds across horizontal gradients. This includes east-west and north-south connections that are enhanced through connecting habitat fragments into larger intact landscape blocks. Aquatic (open water and baylands) to upland transition across elevational gradients includes levees, ecotone levees, horizontal levees, and natural habitat gradients that provide opportunities for movement with daily and annual tidal cycles as well as projected sea level 3 Maps of biodiversity, habitat connectivity, and resiliency can be viewed by accessing the online ACE portal at https://apps.wildlife.ca.gov/ace/. Hydrological connections, riparian corridors and grassland provide linear and spatial connections from upper watersheds to the bay. This includes streams that transport sediment and nutrients from upstream sources to the bay; groundwater sources that can affect surface flows, nutrient and chemical movement, water availability for uptake by plants, and salinity; and tidal circulation that connects riverine to open water habitat and east-west across the North Bay Baylands RCIS area (SLT 2020).*	Edited as suggested.

RCIS Section #	Written Public Review Comments	Response
2.3.3	Commenter recommended modifications to paragraphs 2 and 3, as highlighted below: *Statewide and regionally, scientists and conservationists have been working to identify and map habitat connectivity and understand which habitat linkages are most important to habitat connectivity in California. These efforts include the Missing Linkages project (Penrod et al. 2001), the California Essential Habitat Connectivity Project (Spencer et al. 2010), Critical Linkages: Bay Area and Beyond (Penrod et al. 2013), the California Biodiversity Initiative Roadmap (CNRA 2018), and, most recently, connectivity has been integrated into California's 30x30 initiative (CNRA 2022). Ground truthing, utilizing regional and local conservation input, will verify and refine the macro mapping projects. Habitat connectivity is important for supporting species at different life stages, maintaining ecosystem functions, supporting species migration, maintaining geneflow, and increasing resiliency to climate change. A mosaic of habitats, natural ecosystem processes, and large, intact landscape blocks are essential elements of maintaining these values. Barriers to connectivity, including fish passage barriers, obstructed highway crossings, fragmentation of habitat areas, and other barriers to movement, such as linear transportation and development, affect the ability of species to survive in their habitat and to move across the landscape and negatively affect resiliency.*	Edited as suggested.
2.5.2	Commenter recommended the following modifications to the description and scope of the conceptual and practical description of Open Space: *2.5.2 Open spaces in the RCIS area largely consist of land with a variety of features that is undeveloped. Identifying habitat and species related to open space is critically important for land use planning and as a tool for conservation and support for species survival. Open space identified in watersheds, prioritized for preservation and restoration, can accommodate marsh retreat resulting from sea level rise. Open space includes current extensive agricultural, grazing, and otherwise relatively undeveloped lands.*	Edited as suggested

RCIS Section #	Written Public Review Comments	Response
2.5.4	Commenter recommended modification in the last paragraph of the Restoration Projects section, considering potential future restoration projects to be planned and implemented: *Individually and collectively, these projects are proposing to restore thousands of acres of historic wetlands and transitionary habitat and are an important part of the future of the North Bay Baylands landscape. The North Bay Baylands are a dynamic landscape. New projects may also be identified, planned, and implemented. When implementing actions identified in this RCIS, it is important that project proponents carefully consider these planned restoration projects, in addition to climate change and identifying new projects in an overall process, to understand and anticipate potential future landscape conditions.*	Edited as suggested.
2.5.4	Commenter noticed Tolay Creek is listed as a completed project (1999) and wondered if Tolay Lake Regional Park was a relevant landscape to consider for species, habitat, connectivity and upland relevant to the North Bay Baylands landscape.	Tolay Lake Regional Park added as a planned project.
2.6.1	Commenter recommended renaming "Schollenberger Park (City of Petaluma)" to *Petaluma Wetlands (Shollenberger Park, Alman Marsh, Ellis Creek Wastewater Treatment Facility ponds and habitat, Gray's Marsh) (City of Petaluma)* to reflect the Ramsar Wetland of International Importance 2018 designation that accurately describes publicly owned wetlands relevant to the RCIS.	Edited as suggested.

RCIS Section #	Written Public Review Comments	Response
3.1	A recent stakeholders' meeting discussed the question of selecting certain focal species and then categorizing other species as non-focal, with an expressed need to broaden species and be more inclusive to ensure survival, protection and to support biodiversity. This section indicates: "These conservation elements were selected through a holistic consideration of the RCIS area's ecosystem and current/planned urban/infrastructure development, and collectively aim to represent the biodiversity and ecological functions provided by the North Bay Baylands…" Working Lands are indicated as focal, whereas Grassland, a critically important habitat type, is indicated as non-focal, but should be a priority. Burrowing Owls are indicated as focal, however, the habitat needed by Burrowing Owls is grassland and upland. Being designated as a Species of Special Concern assures only species protection, not habitat conservation and protection. Relying on the CDFW databases and information is also not reflective of ground-truthing and likely available information from conservation nonprofits for species and habitat areas. Commenters agree with other commenters in a recent meeting that the approach to identifying species and conservation strategies needs to be revisited. In the midst of a climate crisis, broadening the priority of species protection and habitat conservation is needed for the North Bay Baylands and environs. Perhaps identifying and dividing the Baylands into several distinct areas that interconnect and noting species and their habitat types would be an optimal approach, compared to the current focal/non-focal one.	Text was added to Section 3.3 to acknowledge that designation of non-focal or focal species does not signify conservation priority. Instead, this designation is used to help structure the document and focus on the conservation strategies. The document has been revised to include additional conservation and habitat enhancement actions per public and agency comments to protect the region's species and habitats.
4.2.1	Commenter noted an updated Petaluma River Watershed Enhancement Plan has been in process and the referenced plan from 2015 is likely outdated and incomplete.	The Petaluma River Baylands Strategy has been reviewed and incorporated by reference into the document.

RCIS Section #	Written Public Review Comments	Response
4.8 and 4.10	Commenter suggests a high priority to understand interconnectedness of species and habitat needs is advised. 4.8 California Red-Legged Frog has a Threatened status. 4.10 Burrowing Owl carries only a Species of Special Concern status, with no required protection of habitat. Both CLRF and BUOW are relevant for upland habitat areas, interconnected to grassland as habitat (not working lands) and a definitive need for protection, including transformation of working lands to grassland open space where at all possible. A relationship of these two species also exists with a CA native mammal, American Badger, present in the Petaluma River Watershed. Abandoned badger burrows are accessed by CLRF, and diminishing habitat for CLRF, AB and BUOW are factors in the Petaluma River Watershed. Burrowing Owls historically could be identified in the Petaluma River Watershed, but habitat loss and human encroachment, along with a CDFW designation that does not protect habitat, do not bode well for this species. American Badger unfortunately also is designated only Species of Special Concern, and habitat for American Badger is not required to be protected.	The conservation strategies were developed with intent to support the recovery of the identified focal species as well as associated non-focal species and other species in the region that are not identified in the document. While badger is not included in the document, it would benefit from the identified regional actions as well as habitat connectivity actions.
From Marin Audubon Society:		
1.1.1	(The) first row should ensure the conservation of all native species that depend on the north bay for residence, overwintering, or refueling stop-over during migration.	No place on Page 1-3 was identified to add in this comment. Instead, 'for native species conservation' was added to the purpose and need description on page 1-5. Waterfowl and Shorebird Habitat was added as a Conservation Element to provide more information on bird residence and migration.
1.1.1	The commenter suggested adding "organizations wishing to restore habitat" to the first box. MAS is neither a land trust nor are we interested in mitigation but has purchased and restored many bayland properties and continues to do so. (Table 1-1: First Objective, second box)	Edited as suggested.
1.1.1	The commenter suggested including entities seeking mitigation - they too should aim to improve the effectiveness of restoration actions. (Table 1-1: Second Objective, second box)	Edited as suggested.
1.1.1	The commenter suggested including other organizations acquiring land for conservation. (Table 1-1: Fourth Objective, second box)	Edited as suggested.
1.1.1	The commentator suggested adding a bullet - "Assess adverse impacts." (Table 1-1: Second Objective, third box)	Edit made to Objective 3 which is about reducing impacts.
2.1.1	Commenter suggested including San Rafael Creek. (Six lines from bottom)	Edited as suggested.

RCIS Section #	Written Public Review Comments	Response
2.5.4	Commenter recommended editing the list of Completed Projects to show MAS projects. This includes adding Petaluma Marsh Expansion Project which restored 100 diked acres to tidal action and was completed in 2007. This site is north of Redwood Landfill and is shown on figure 2-12. Commenter recommended correcting list as well. Bahia Phase 1 was completed in 2008 and Phase 2 in 2013 for a total of 365 formerly diked acres restored to tidal marsh.	Edited as suggested.
2.5.4	The commenter recommended making the following changes to the list of Planned Projects: McInnis Marsh Habitat Restoration, hopefully will be a restoration project in the future but, unfortunately the application for funding was withdrawn by Marin County. Commenter recommended adding MAS's Tiscornia Tidal Marsh and Sea Level Rise Adaptation Project, at the mouth of San Rafael Creek, which will restore tidal marsh, beneficially reuse dredged sediments, and improve flood protection for a disadvantaged community.	Edited as suggested.
2.6.1	Commenter noted that in Figure 2-12 (Protected Lands owned by Non-profits), several MAS owned properties are not shown on this figure: including 60 acres at Bahia, and 20 acres at the mouth of the San Rafael Creek.	The property at the mouth of the San Rafael Creek is shown on the map, through it is quite small. The Bahia property is not included in the CPAD (2022) database.
2.8.1.5	Commenter noted that Livestock, Farming and Ranching are identified as Pressures and Stressors. This discussion lists impacts of farming and ranching that can adversely affect ecosystems. Degradation of water quality, reduced surface and ground water, exposed soils, increased erosion, and direct loss of habitat can be added to the list.	Edit made to Table 2-9. These impacts were already addressed in the text.
3.3	The commenter recommended including migratory waterfowl and shorebirds to the focal species due to their importance in the north bay ecosystems. Contrary to statements at the recent workshop, neither the focal habitats nor habitats that are currently identified as needed to support focal species, provide the habitat requirements of small shorebirds and diving ducks. Diving ducks require open waters of the Bay for resting in rafts and diving for prey. Huge rafts are seen throughout the winter on North Bay waters. Open waters of the bay should be identified as a habitat to be protected (Table 3-1: Focal Species).	Waterfowl and Shorebird Habitat has been added as a new Conservation Element in response to public comments.

RCIS Section #	Written Public Review Comments	Response
3.3	The commenter noted that the habitat needs of shorebirds are not met with the current list of focal species and habitats. Small shorebirds (many Calidris) need tidal flats for foraging, and these are identified. They also need adjacent unvegetated open areas for roosting when the tides cover their foraging tidal flat habitats. Small shorebirds forage and roost together in flocks relying on unvegetated roosting areas that provide open vistas allowing predators to be spotted. Unvegetated uplands or very shallow non-tidal wetlands can serve this function, as can be seen by shorebird use of these habitats at high tides. High tide refugia/roosting habitat is not protected by any of the existing focal habitats or species that we could find (Table 3-1: Focal Species).	Waterfowl and Shorebird Habitat have been added as a new Conservation Element in response to public comments. Additionally, California least tern and Western snowy plover were added as non-focal species.
3.3	Commenter noted that Working Lands are considered a Conservation Element in chapter three. This designation is inconsistent with the more accurate classification as "Pressures and Stressors" and should be removed. While growing crops and grazing can support habitat, the habitat functions will always be limited and uncertain because the primary purpose for which the lands are managed is agriculture. Habitat values are subservient to agricultural purposes. Further, agriculture in baylands contributes to subsidence putting the baylands at greater risk from SLR. Goals for historic baylands should be to restore them to tidal marsh or where not possible, to seasonal wetland habitats. Commenter suggests that Working or agricultural lands designation should only apply to historic uplands, if used at all (Table 3-1: Focal Species).	Per Fish and Game Code Section 1852 subdivision (e)(1), the RCIS program shall consider the conservation benefits of preserving working lands (e.g., farms, orchards, vineyards, and ranches) for agricultural purposes. It is acknowledged that some forms of agriculture are in direct conflict with baylands restoration and species objectives. As noted in Chapter 4, working lands can provide habitat and conservation to some species. The RCIS boundary includes a 1-mile buffer, primarily in upland areas, surrounding the historic baylands where restoration to wetland (seasonal or tidal) would be inappropriate. For these reasons, it is included as a Conservation Element. Upon discussion with CDFW, this conservation element was clarified to apply to upland areas and the quantification targets on working lands were adjusted.
4.2.3	The commenter asked why there is a goal of 50% protected agriculture lands? Commenter suggests that this goal should be limited to agricultural lands that are historic uplands, not diked baylands. In addition, because agricultural lands are in private ownership, any mitigation improvements should be permanently protected by deed restrictions. Mitigation for lost habitats should not be allowed to be destroyed in the future (Table 4.1: Conservation Gaps and Quantitative Targets).	The quantitative conservation target associated with agriculture has been removed.
4.2.3	The commenter asked whether Eucalyptus protection is necessary since Eucalyptus is a highly invasive non-native tree. Commenter does realize some eucalyptus should be tied to these specific species (Table 4-1: -Eucalyptus).	Eucalyptus protection acreage removed.
4.2.3	The commenter asked what habitat types are included under "Other Marsh" (Table 4-1)?	Other Marsh is a category created by SFEI in their 2022 updated baylands habitat dataset. There are no attributes describing additional information included.

RCIS Section #	Written Public Review Comments	Response
4.2.3	The commenter asked what habitat types are included under "Water"? Felt it was too vague (Table 4-1).	Appendix E includes a crosswalk of various regional data sources to the mapped RCIS community. In general, 'water' was used by the regional fine scale maps (VegCAMP) to designate areas where surface water, rather than vegetation, was present. Further description is not provided. Most of the habitat in the RCIS area uses the SFEI Modern Baylands data layer, which provides a more detailed breakdown of water dominated communities, including salt ponds, tidal channels, tidal flats, and shallow subtidal embayment, which are shown on Figure 2-6.
4.2.3	Commenter suggested diked seasonal wetlands should be listed (Table 4-1).	Baylands habitat categories used were those provided by SFEI's 2022 Modern Baylands mapping efforts. Diked seasonal wetlands are not a category included in that data set.
4.2.3	The commenter suggested including Water Habitats on the list (Table 4-1).	Open water habitats area included under other names, consistent with the mapping approach and Appendix E crosswalk. Examples of open water include water, tidal channel, and salt pond.
4.2.3	Commenter asked if CDFW or MTC will be keeping track of progress in reaching target acreage/percentages?	As a voluntary program, the RCIS does not require tracking, unless actions are implemented under a Mitigation Credit Agreement. Implementation and reporting are discussed in Chapter 5.
4.2.4	The commenter did not find it clear whether diked or filled historic baylands are on the priority location list for conservation. These historic tidal marshes should be on the list because they are the primary areas for restoration of tidal marsh habitats and most provide current seasonal wetland habitat (Prioritization Guidelines).	TIDE Objective 1.2 calls for restoration of historical tidal habitats.
4.2.5	Commenter recommended adding shorebirds and diving waterfowl as Focal Conservation Elements. As discussed above, to ensure habitat for the millions of small shorebirds that stop-over to refuel during migration and over-winter in the Bay area, unvegetated adjacent habitats for resting during high tides should be added. Also as addressed above, add open water habitat for diving birds (Table 4-2).	Waterfowl and Shorebird Habitat has been added as a new Conservation Element in response to public comments.
4.3.1	Commenter suggested that restore ecosystem function should include protection of ecotone transition habitat to provide refugia habitat (Table 4-3: RL 1.2.1).	"Ecotone transition habitat" added to RL 1.1.1 in association with RL Protection objective 1.1.
4.3.5	The commenter suggested adding an objective: Protect existing tidal marsh. The goals and objectives speak only to enhancing and restoring. Some tidal marshes are still in private ownership (Table 4-7: Tidal Communities regional Goals and Objectives).	Protection of existing tidal marsh is included in Tidal Wetlands other conservation element objective 1.1.

RCIS Section #	Written Public Review Comments	Response
4.3.5	The commenter suggested that unless there is evidence that impacts from recreational activities adjacent to the Bay Trail and other public access areas on wildlife and habitat has significantly decreased since 1999, commenter notes that it is time to consider a more aggressive approach. The commenter suggests enforcement should be included as a management activity. Adverse impacts of recreation, in addition to those mentioned, include human presence that cause wildlife to flee, vegetation trampling and destruction, unleashed dogs, litter and vector for invasive plants (Table 4.7: TIDE 1.1.4 Manage recreational activities).	Additional language added addressing enforcement as a potential solution to management of recreational activities.
4.3.5	The commenter suggested the variety of depths should include tidal flats. In addition, while focusing on "broad areas of tidal marsh" is important, the value of small marshes should be recognized and prioritized also. Small marshes connect with other marshes and can be restored to expand large areas of habitat, provide connectivity, stop-over habitats along movement corridor routes, and can even support endangered species nesting. MAS is currently expanding a 9-acre tidal marsh that has supported nesting Ridgway's Rails and CA Black Rail as well as providing other services (Table 4-7: TIDE1.2.1).	Edited language to include tidal flats and added focus on connecting suitable habitat through restoration of parcels to create larger blocks of habitat.
4.3.5	Commenter recommended including Gallinas Creek in this list (Table 4-7: TIDE 1.2.5).	Gallinas Creek added to TIDE 1.2.5.
4.3.5	The commenter recommended creating ecotone transition habitats. Add habitat for small shorebirds, as discussed above, to this list (Table 4-7: TIDE 1.2.8).	Habitat for small shorebirds added to action.

RCIS Section #	Written Public Review Comments	Response
5.2, Figure 5-1	The commenter noted the outlined process does not address the loss of habitat. Further, it is impossible to assure that this regional conservation strategy will achieve its stated purpose of conserving focal species, habitat, ecological processes, and habitat connectivity, without also considering the other part of the mitigation equation: habitats lost, and species impacted. The decision process outlined sets up for losing wetlands because it makes it easy to fill them. It is realized that large transportation projects are the impetus for the NBRCIS so perhaps the process should only be available to large scale public benefit projects, for which it would be to difficulty find mitigation. These large projects receive more scrutiny than private for-profit developers and there are fewer places for them to mitigate. But private-interest developers will make use of the RCIS because it will enable them to move even faster through the permitting process. Through our years of advocating for protecting wetlands, we've repeatedly observed developers, who come to local jurisdictions and agencies with mitigation plans for filling wetlands, have their plans easily approved even though the plans do not adequately compensate for the environmental loss. It's easier for the permitting agencies also. Applicants simply pay for credits in a mitigation bank or present a mitigation package that has little to no relationship to the species that they will impact or the kind of wetlands they propose to fill. The mitigations are far away and can even be of a different habitat type (Figure 5-1).	Figure 5-1 has been updated to indicate the importance of avoiding and minimizing impacts prior to seeking mitigation. Figure 5-1 is included in the document to acknowledge that some mitigation pathways are preferred by regulators (due to higher success assurances); project proponents should seek mitigation from HCPs and banks where appropriate before developing permitee-responsible solutions. Specifics about how to quantify impacts and what is suitable mitigation for those impacts is negotiated with regulatory agencies during a project's permitting phase and is not included in the RCIS.
General Comment	According to the commenter, the most ecologically sound compensation for loss of habitat and species impacts, is to mitigate on or near the site of loss by restoring wetlands of the same type. Only when this is not possible should going off-site be acceptable, but there is no requirement for such a review. Without discussion of the habitat loss part of the equation and no discussion of regulatory review, there is very likely to be a loss of tidal marsh and probably other habitat and species as well. Easily approved mitigation is of particular concern for endangered Ridgway's Rail and SMHM, both resident species. A recent example of a mitigation that will result in loss of endangered species habitat is a trail project permitted to fill tidal marsh, that is known habitat for endangered Ridgway's Rail, that is permitted to be mitigated with riparian wetlands in another county, nowhere near the site of loss.	Specific project impacts and mitigation should be addressed with regulators during a project's permitting phase.

RCIS Section #	Written Public Review Comments	Response
General Comment	The commenter suggests the RCIS should discuss mitigation requirements and the review process. This would allow a more accurate and meaningful review of the RCIS potential for success.	Additional text was added to Section 5.2 to acknowledge the importance of avoidance and minimization in project design. There are different mitigation requirements and review processes depending on the mitigation pathway. CDFW's RCIS Guidelines (CDFW 2023a) describe the requirements of Mitigation Credit Agreements; these guidelines are referenced in Section 5.2.5 on MCAs.
General Comment	The commentator suggests further looking at the habitats gained as well as those lost. A recommendation that will assure adequate replacement of mitigation acreage, habitat type and location should also be included. The commenter suggests adding a reference to where there will be a record kept of the acreage of habitat lost in specific locations and the mitigation habitat type and location for both.	Implementation of the RCIS is voluntary. If a project seeks mitigation under the RCIS, it must have an adaptive management and monitoring program as described in Section 5.3 to monitor and report on effectiveness. As the RCIS proponent, MTC must assess progress at least every 10 years if the RCIS is to be extended (see Section 5.4).
From Caltrans D4:		
General Comment	According to the commenter, District 4 Advance Mitigation Projects undergoes an approval process through the Caltrans Headquarters Advance Mitigation Program (AMP). The AMP prioritizes projects which align with multiple regulatory agency mitigation requirements. Therefore, any D4 advance mitigation projects seeking to utilize allowable AMP pathways involving a RCIS or MCA, will likely also seek to gain mitigation credit approval from other agencies. Processes to streamline coordination with and approval from other agencies would be very valuable to Caltrans District 4.	The 2023 CDFW Guidelines for MCAs include additional information for how to gain approval from other agencies for MCAs created from implementation of RCIS actions.
General Comment	According to the commenter, Caltrans District 4 frequently searches for mitigation opportunities for wetlands, non-wetland waters, and riparian habitat resources within the North Bay Baylands Region, as captured in the Gualala-Salmon, San Pablo Bay, and 3 Tomales-Drake Bays Sub-basins Regional Advance Mitigation Needs Assessment (RAMNA). District 4 appreciates the potential opportunity for the creation of mitigation credits for these resources, including development of new MCAs. There are additional opportunities for District 4 to take advantage of conservation strategies outlined in the RCIS for the following focal species: California red-legged frog (*Rana draytonii*), Central California Coast DPS steelhead (*O. mykiss*), Southern DPS green sturgeon (*Acipenser medirostris*) which have been identified by District 4 as "species of mitigation need." There is additional overlap between several non-focal species.	Comment acknowledged. No change made.

RCIS Section #	Written Public Review Comments	Response
General Comment	According to the commenter, District 4 has received recent information indicating that a legal review conducted by Caltrans HQ on the MCA guidelines has revealed that the existing Master Funding Agreement between Caltrans and CDFW pertains solely to project-specific mitigation for transportation projects. Consequently, it has been determined that a new agreement is necessary before CDFW can obtain funding assurance for Caltrans sponsorship of an MCA through the Caltrans Advance Mitigation Program. District 4 is interested in exploring measures to ensure that the possibility of sponsoring an MCA via the AMP is a viable opportunity in the future.	Comment acknowledged. No change made.
1.1	Commenter suggested including a brief definition of MCAs and how they work in the Chapter 5 overview on page 1-2.	Edit made to mention MCAs in the Ch 5 summary. MCAs are briefly defined on page 1-1.
Chapter 1	The commentator asked the benefits of holistic regional planning to be further explained. How does it benefit habitat conservation, infrastructure resilience, and communities?	The value of a holistic, regional plan was added to page 1-1.
2.1.1, 2.2.5	Commenter asked what the ecological impact of including mudflats and tributaries within the RCIS area?	As noted in the document, the tidal mudflats provide habitat for many bird and fish species while the tributaries are important for connecting upstream and downstream areas with the transport of water, sediment, and providing habitat and corridors. Added to 2.2.5 that the streams also serve as habitat.
2.1.1	Commenter suggested adding an explanation of what “ecological uplift” entails.	Text regarding ecological uplift was removed from the document based on another comment. This comment is no longer applicable.
2.2.4	Commenter recommended defining acronyms like BCDC (Bay Conservation and Development Commission) and SFEI (San Francisco Estuary Institute) upon first use.	Acronyms are defined on first use except for those used in citations. These acronyms are defined in the reference section.
2.5.2	Commenter recommended defining what “marsh retreat” is in the context of sea level rise.	Edited as suggested.
2.6.2	Commenter suggested rewriting the first sentence: “Lands protected by fee or easement have permanent limitations on development, preventing their conversion to intensive human uses.” (Lands Protected by Fee)	Edited as suggested.
2.6.2	Commenter suggested adding an explanation of what “fee title ownership” means.	As fee title ownership conveys ownership land rights. An example is provided in the text.
2.6, 2.6.2	Commenter suggested defining conservation easement and how it works.	A phrase was added to clarify what a conservation easement does. Providing details on how to develop a conservation easement is beyond the scope of this document.

RCIS Section #	Written Public Review Comments	Response
2.6.3	The commenter recommended explaining the purpose of mitigation and conservation banks (Mitigation and Conservation Banks).	Edited as suggested.
2.8.1.3	Commenter recommended defining terms like “sediment supply” and “hydrology.” Explain how it affects marsh elevation and the ability of the ecosystem to adapt to sea-level rise (Disrupted Hydrology and Sediment Supply Pathways).	Introductory sentence added. Section already states that reduced sediment supply limits the ecosystem’s ability to adapt to sea level rise as there is less sediment to deposit and build elevation.
3.2	The commenter recommended removing irideus from anadromous federally listed steelhead Oncorhynchus mykiss (Table 3-1: Focal Species and Justification for Selection).	CDFW includes irideus in its accepted scientific name for central California coast steelhead
4.3.4	Commenter recommends ensuring that maintenance of wildlife crossing infrastructure is equally mentioned. Adequate funding and planning for long term maintenance of these structures is important to maintaining viability of existing culverts (Table 4-6: HERP 2.1.1).	Language for including maintenance funding in planning for infrastructure projects added to HERP 2.1.1 and other actions addressing wildlife crossings.
4.8.5	The commenter asked if there was a reason only these specific methods of invasive species control are mentioned? As opposed to depredation or other methods (Table 4-18: CRLF 1.2.3).	These are methods recommended by USFWS in their 2002 recovery plan for the species.
4.15.3	Commenter asked if dikes/levees are considered potential barriers to habitat connectivity to be accounted for in this section?	Dikes/levees added as potentially barriers to connectivity.
4.18.5	The commenter recommended adding a space after 233 (Objective FWMHAB 1.1).	Edited as suggested.
From California State Coastal Conservancy:		
Figure 2-12	Commenter recommends The BMKV property and Hamilton wetlands is owned by SCC. This figure makes it look like those lands are owned by SLC. The SLC owns a very small parcel next to Hamilton.	SLC label removed as suggested.
Figure 2-10	Commenter suggested renaming the figure to “San Francisco Baylands Habitat Restoration Projects” or something similar. Including SFBRA in the title implies that all the projects are funded by SFBRA and they are not.	Figure renamed as suggested.

RCIS Section #	Written Public Review Comments	Response
2.5.4	Commenter suggests changing "Novato Deer Island Tidal Wetlands Restoration" to "Deer Island Basin Tidal Wetlands Restoration Project" and changing "Camp 4 Ranch Acquisition and Restoration Project" to "Camp 4 Ranch Restoration Project" because the acquisition is now complete under planned projects. Commenter suggests adding Lakeville Creek Restoration Project, Camp 5 Ranch Acquisition and Restoration Project, Hudeman Wetlands Tidal Restoration Project, and Tolay Creek Baylands Restoration Project. Note that Ducks Unlimited is leading the Sonoma Creek Baylands Restoration Planning Project, Phase 1, building on the work of the Sonoma Creek Baylands Strategy, which will develop an integrated design for the restoration of Skaggs Island, Haire Ranch, Camp 4, Camp 5, and Hudeman Wetlands.	Edited as suggested.
2.8.1	Commenter suggested adding an example for pressure when defining the term.	Edited as suggested.
2.8.1	The commenter recommended adding predators under land conversion (Table 2-9).	Edit made to seventh bullet.
2.8.1.4	It is not just invasive species that prey on natives. Loss of habitat has resulted in increased predation pressure by natives and non-natives and is affecting conservation of many species in the baylands. Think of great egrets predating black rails during high tides or Peregrine falcons exerting predation pressure on CA least tern and snowy plover nesting colonies; northern harriers hunting over marshes and predating salt marsh harvest mice. These are natural interactions that have become problematic because loss of habitat has reduced populations and areas of suitable habitat to a huge extent. Plus, native predators are difficult to manage because there aren't good non-lethal methods for controlling them.	Edits made. Addition of changing food web dynamics and predation added under Land Conversion and as a footnote under Invasive Species.
2.8.1.5	The commenter saw a presentation about widespread sulfur applications on vineyards in the north bay having a detrimental effect on water quality and noted those are fungicides.	Edit made. Fungicides added to list of potential applications.

RCIS Section #	Written Public Review Comments	Response
4.3.5	In Table 4-7, commenter suggested adding an action to pursue innovative ways of bringing sediment to tidal restoration sites. Beyond improving natural processes, we need to try and purposefully raise many of these areas back to marsh plain elevation so they can be restored to wetlands. Otherwise, they will be subtidal. There is a lot of sediment behind dams that could be used in the Baylands, although that resource is difficult and costly to get. Also, the Army Corps should be encouraged to change its policies around bringing dredged sediment to restoration sites. Currently, it must use the cheapest option for disposing of dredged sediment and sometimes that is a deep-water ocean disposal site instead of a restoration site. Also consider an evaluation of screening criteria for excavated or dredged sediment. In the south bay we are working with regulators to evaluate some contaminant thresholds more carefully to see if screening levels can be adjusted so that more material gets used and less is brought to the dump. We are also thinking about ways to apply material (e.g., mixing sources) so that containment levels can be brought below thresholds and applied to restoration sites.	TW 1.2.1 and 1.2.2 include actions to use dredge sediment for restoration projects that include elevations for a variety of marsh elevations. RCIS Guidelines state that the RCIS is a voluntary program and is not a regulatory document. Policy direction should be addressed through agencies or organization with land use authority.
4.3.4	In several species strategies there is an objective to increase detections of species. The commenter suggested adding a conservation action to monitor species in support of this objective (HERP Objective 1.1).	Species strategies include increase detections of species as a quantitative measurement of habitat enhancement or restoration progress.
4.3.5	Commenter suggested using the term water control structures instead of tide gates. The commenter noted tide gates are associated with muted tidal habitat. Managed ponds have WCS that allow land managers to manipulate pond water levels (Table 4-7: Tide 1.1.5).	Edited as suggested.
4.16.4	The commentator asked if the modeled habitat in Figure 4-13 should be labeled modeled foraging habitat since it is not all suitable for roosting and nesting.	Relabeled as suitable habitat in line with other species maps not making a distinction between foraging and breeding.
4.2	Commenter recommended renaming Shallow Bay to Shallow Subtidal Habitat. Commenter noted it flows better from the last section that was called "Tidal Habitat." Subtidal is more in line with the EcoAtlas naming.	Edited as suggested.

RCIS Section #	Written Public Review Comments	Response
5.2.8	Commenter suggested editing as follows: “A number of conservation grant programs, such as ones administered by the San Francisco Bay Restoration Authority, State Coastal Conservancy, CDFW, NMFS, or the U.S. Environmental Protection Agency, apply in the RCIS area and may be used to fund conservation and habitat enhancement actions identified in this plan." (Section 5.2.8. - Advance Mitigation Funding). In the last sentence, please add the State Coastal Conservancy after San Francisco Bay Restoration.	Edited as suggested.
5.2.7	The commenter asked if stating the RCIS will be in compliance with all applicable laws is necessary? Commenter followed up asking if this has occurred and why it needs to be stated?	Per the RCIS Program Guidelines, the RCIS must include this statement. The RCIS is a voluntary guidance program and does not authorize action.

APPENDIX C

RCIS Pressures and Stressors

C. Pressures and Stressors

Executive Summary

Section 1852(c)(5) of the California Fish and Game Code and the Regional Conservation Investment Strategy (RCIS) Guidelines (CDFW 2023) require that an RCIS include a summary of historic, current, and projected future pressures and stressors in the RCIS area, including a climate change vulnerability assessment, using the best available science. A *stressor* is a degraded condition that is caused by the negative impacts of *pressures*, which are anthropogenic and natural drivers.

This document summarizes historic, current, and projected pressures and stressors on focal and non-focal species and other conservation elements identified as part of this RCIS. These pressures and stressors include climate change, land conversion and development, water pollutants and discharges, disrupted natural hydrology and sediment supply pathways, invasive species and pathogens, and livestock, farming, and ranching. Climate change is the primary stressor described in this document, given the dramatic projected impact of its future stressor on the RCIS area.

This summary is a result of a review of literature from the California Department of Fish and Wildlife's climate website and other supporting documents. A synthesis of pressures and stressors in the RCIS area is provided as summary data in table and text format. No new analyses were conducted as part of this assessment.

Identifying projected non-climate and climate pressures and stressors in the RCIS area helps to guide the prioritization of conservation strategies to be implemented.

C.1 Pressures and Stressors

C.1.1 Regional Pressures and Stressors

The conservation elements in the Regional Conservation Investment Strategy (RCIS) area are influenced by a variety of *pressures*, defined as anthropogenic and natural drivers that could result in degraded ecological conditions known as *stressors* (**Table C.1-1**). Natural communities and species habitat are largely affected by pressures and stressors through one of three mechanisms: loss, fragmentation, and degradation. Species can experience direct mortality, health decline, stress, or lower fecundity (reproductive success) because of changed ecological conditions, such as increased noise or light levels. As species and habitats are lost and degraded, overall resilience and genetic diversity decline.

The State Wildlife Action Plan for the California Department of Fish and Wildlife (CDFW)–designated Bay Delta Conservation Unit, species-specific U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service recovery plans, and a range of RCIS area subregional assessments helped identify the pressures and resulting stressors that are affecting focal and non-focal species and other conservation elements (**Table C.1-1**).

TABLE C.1-1: REGIONAL PRESSURES AND STRESSORS IN THE REGIONAL CONSERVATION INVESTMENT STRATEGY AREA

Pressure	Stressor
Climate change	• Increases in temperature extremes and average annual temperature • Altered hydrology and flow through increases in drought frequency and severity, and more frequent extreme storms • Decrease in soil moisture • Changes in surface water, groundwater table, and sea levels • Changes in the salinity and chemistry of groundwater, surface water, and soils • Increased frequency, intensity, and severity of fire regimes • Changes in spatial distribution, phenology, compositions, and habitats of natural communities and species
Land conversion and development	• Loss of areal extent of natural communities and species habitat • Fragmentation of natural communities and species habitat • Reduction in ecosystem function and complexity • Degradation of species habitat by noise and light pollution • Increases in urban-wildland conflict and recreational impacts • Changes in groundwater table • Increases in invasive species and disease • Increases in barriers to migration/movement • Increases in constrictions that affect water circulation and flow • Increases in incompatible land uses
Water pollutants and discharges	• Changes in water quality from suspended sediment • Increases in chemical pollution, nutrients, and/or algae blooms • Changes in pH and/or dissolved oxygen concentrations • Increases in ecotoxicity for species and migration of pollutants through the food web (e.g., polychlorinated biphenyls)
Disrupted natural hydrology and sediment supply pathways	• Disconnection of tidal flows from marshes • Disconnection of freshwater flows from Bay and marshes • Increases in erosion • Changes to bathymetry • Changes to sediment supply
Invasive species and pathogens	• Changes to natural community composition and food web dynamics • Displacement of native species • Increases in competition for land and resources • Increases in disease susceptibility
Livestock, farming, and ranching	• Pesticide use can negatively impact water quality, habitats, and wildlife and plant species • Increased water consumption impacts aquatic and riparian habitats • Fragmentation of natural communities and species habitats

C.1.2 Species-Specific Pressures and Stressor

This section summarizes the pressures and stressors identified by the State Wildlife Action Plan (CDFW 2015) for the CDFW-designated Bay Delta Conservation Unit, species-specific USFWS recovery plans, and other plans prepared for the North Bay Baylands. The following regional pressures apply to all focal/non-focal species and other conservation elements in the RCIS area:

- Climate change
- Land conversion and development
- Invasive species and pathogens

The remaining regional pressures affect only certain species and other conservation elements in the RCIS area. **Table C.1-2** and **Table C.1-3** identify species-specific pressures and stressors for focal species and other conservation elements and for non-focal species and other conservation elements, respectively.

TABLE C.1-2: PRESSURES AFFECTING FOCAL SPECIES AND OTHER CONSERVATION ELEMENTS

Pressure	Water Pollutants and Discharges	Disrupted Natural Hydrology and Sediment Supply Pathways	Livestock, Farming, and Ranching
Crotch's bumble bee			✓
Green sturgeon	✓	✓	✓
Salmonids	✓	✓	✓
California red-legged frog	✓	✓	✓
Western pond turtle	✓	✓	
Burrowing owl			✓
California black rail	✓	✓	
California Ridgway's rail	✓	✓	
Salt marsh harvest mouse	✓	✓	
Marin western flax			✓
Bat habitat			✓
Riparian corridors	✓	✓	✓
Freshwater wetlands	✓	✓	
Tidal wetlands	✓	✓	
Shallow subtidal habitats	✓	✓	
Working lands	✓	✓	
Hydrological processes	✓	✓	✓
Waterfowl and shorebird habitat	✓	✓	✓

TABLE C.1-3: PRESSURES AFFECTING NON-FOCAL SPECIES AND CO-BENEFITED NATURAL RESOURCES

Pressure	Water Pollutants and Discharges	Disrupted Natural Hydrology and Sediment Supply Pathways	Livestock, Farming, and Ranching
Western ridged mussel	✓	✓	✓
California freshwater shrimp	✓	✓	✓
Callippe silverspot butterfly		✓	
Western bumble bee			✓
Delta smelt	✓	✓	
Longfin smelt	✓	✓	
Sacramento splittail	✓	✓	
Pallid bat			✓
Townsend's big-eared bat			✓
California least tern	✓	✓	
Saltmarsh common yellowthroat	✓	✓	✓
San Pablo song sparrow	✓	✓	✓
Swainson's hawk	✓	✓	✓
Tricolored blackbird	✓	✓	✓
Western snowy plover	✓	✓	
Soft bird's-beak	✓	✓	
Grasslands			✓
Diked wetlands	✓	✓	
Rookeries	✓	✓	

C.2 Climate Change

Climate vulnerability is defined as the amount of evidence that climate change is projected to negatively affect a species, asset, or system (Gardali et al. 2012). Evaluations of climate vulnerability are often measured by exposure, sensitivity, and adaptive capacity:

- **Exposure—**the nature and degree to which a species is exposed to climate change stressors.
- **Sensitivity—**the degree to which the physical condition and functionality of a species is affected by climate change.
- **Adaptive Capacity—**the ability of a species to evolve in response to, or cope with, the impacts of climate change.

Exposure is often the primary variable measured to determine species' susceptibility to climate change stressors. Evaluating sensitivity and adaptive capacity can provide additional information regarding the degree to which a species would be affected by climate change stressors, and the inherent characteristics that allow a species to respond to them. The most vulnerable species are exposed to climate change stressors and have high sensitivity and low adaptive capacity. The following sections describe projected climate change stressors in the RCIS area and the climate vulnerability of focal and non-focal species, other conservation elements, and natural communities in the RCIS area.

C.2.1 Climate Change Projections

A review of the best available science for the RCIS area includes changes in temperature, precipitation, and sea level rise. It includes a discussion of the physical impacts of these climatic changes, including drought, flooding, coastal erosion, and wildfires.

C.2.1.1 Modeling Climate Change

To simulate the response of increasing greenhouse gas concentrations, numerical models (global circulation models) representing physical processes in the atmosphere, ocean, cryosphere, and land surface are currently the most advanced tool available (IPCC 2022). The most recent Intergovernmental Panel on Climate Change (IPCC) report, the Sixth Assessment Report (AR6), updated its scenarios by adding social-socioeconomic pathways (SSPs) to the previously established representative concentration pathways (RCPs) to reflect the impacts of the range of human actions on future climate conditions (IPCC 2022). However, because these scenarios (SSP-RCP) were revised recently—in 2022—most climate adaptation planning guidance and published climate vulnerability assessments still use scenarios (RCPs) from the Fifth Assessment Report (AR5).

Scenarios RCP4.5 and RCP8.5 from AR5 are the most used in climate adaptation planning. RCP8.5 is referred to as a business-as-usual scenario and represents escalating economic growth, with greenhouse gas concentrations exceeding 900 parts per million by the end of the century. A more moderate scenario, RCP4.5 assumes greenhouse gas emissions rising until 2040 and reaching a concentration of 550 parts per million, followed by a stabilization in emissions. The moderate emissions scenario from AR6 is SSP2-RCP4.5, which updates the same RCP model as AR5. SSP2 refers to a central pathway where historical trends continue without substantial deviation (O’Neill et al. 2016). The high-emissions scenario is SSP3-RCP7.0 or SSP5-8.5. SSP3 refers to countries prioritizing regional security and SSP5 assumes energy intensive, fossil fuel–based economies, both of which could lead to societies that are highly vulnerable to climate change (O’Neill et al. 2016).

Incorporating the different RCP or SSP-RCP scenarios into global circulation models created combinations of future conditions that can be used to assess the influence of variables on the projected climate. General-circulation models estimate climate change on a global level because the coarse resolution of available data does not lend itself to detailed regional climate projections. Models are often “downscaled” to allow for more regional and local projections. Using general-circulation models for input, downscaled models are more useful at the local scale for climate adaptation planning than the global-scale projections.

C.2.1.2 State Climate Change Guidance and Resources

A series of guidance documents and studies developed by the State of California has increased the understanding of projected climate change impacts on a regional scale. These documents guide vulnerability assessments and local adaptation strategies. **Table C.2-1** summarizes state guidance documents used for the assessment of climate stressors in the RCIS area. Summaries of projected changes in temperature, precipitation and sea level rise based on low and high emission conditions are shown in **Table C.2-2**.

TABLE C.2-1: STATE OF CALIFORNIA CLIMATE CHANGE GUIDANCE AND RESOURCES

Study (Author/Date)	Summary
California's Fourth Climate Change Assessment–San Francisco Bay Area Summary Report (Ackerly et al. 2018)	• The assessment discusses regional climate change projections of climate stressors, including temperature, sea level rise, precipitation, drought, snowpack, fog, and wildfire. • Potential impacts are also described for a variety of social system and built-environment sectors (e.g., land use and development, transportation infrastructure, economic resilience, and emergency management). • The San Francisco Bay Area Regional Report, which includes the North Bay Baylands, emphasizes potential effects on natural ecosystems, agriculture, and vegetation and habitat distributions, and it lists potential adaptations for each sector.
Ocean Protection Council Sea Level Rise Guidance Update (OPC 2018)	• Compiled, reviewed, and summarized technical findings from the 2017 report as the basis for the 2018 report. • Provides policy direction for state agencies planning for future sea level rise. • Updated every five years (next update in 2023).

TABLE C.2-2: SUMMARY OF CLIMATE STRESSORS

	Historical (1961-1990)	Medium Emissions Mid-century (2035-2064)	Medium Emissions End of Century (2070-2099)	High Emissions Mid-century (2035-2064)	High Emissions End of Century (2070-2099)
Temperature[1] (annual average maximum temperature)	70.7	73.7	74.7	74.4	77.6
Temperature[1] (number of extreme-heat days)	4	9	12	11	22
Precipitation[1] (annual average inches)	24.9	26.1	26.7	26.5	27.7
Sea level rise[2] (feet)	N/A	1.05[3]	3.08[3]	1.97[4]	6.53[4]

Notes:

N/A = not applicable

1. Data generated from 32 downscaled climate projections used to support California's Fourth Climate Change Assessment. Details are described in Pierce et al. (2018).
2. Data generated from the 2022 Sea Level Rise Technical Report from the San Francisco tidal gauge (Collini et al. 2022).
3. Medium Emissions follow the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) trajectory SSP2-RCP4.5.
4. High Emissions follow the IPCC AR6 trajectory SSP3-RCP7.0 or SSP5-8.5.

C.2.1.3 Temperature Projections

RCIS area temperatures are expected to experience significant increased by the end of the century (Ackerly et al. 2018). Based on the RCP8.5 scenario, the projected mean annual temperatures are expected to increase by 3.9 degrees Fahrenheit (°F) by mid-century and 7.1°F by the end -of the -century when compared to historical observations (1961–1990) (Pierce et al. 2018) (Table C.2-2). The number of extreme- heat days is projected to increase to 11 days by mid-century and to 22 days by the end -of the -century (Pierce et al. 2018). Fog and sea breezes will affect warming in the RCIS area, but localized components of the San Francisco Bay Area (Bay Area) climate are not well understood at this time (Ackerly et al. 2018).

C.2.1.4 Precipitation Projections

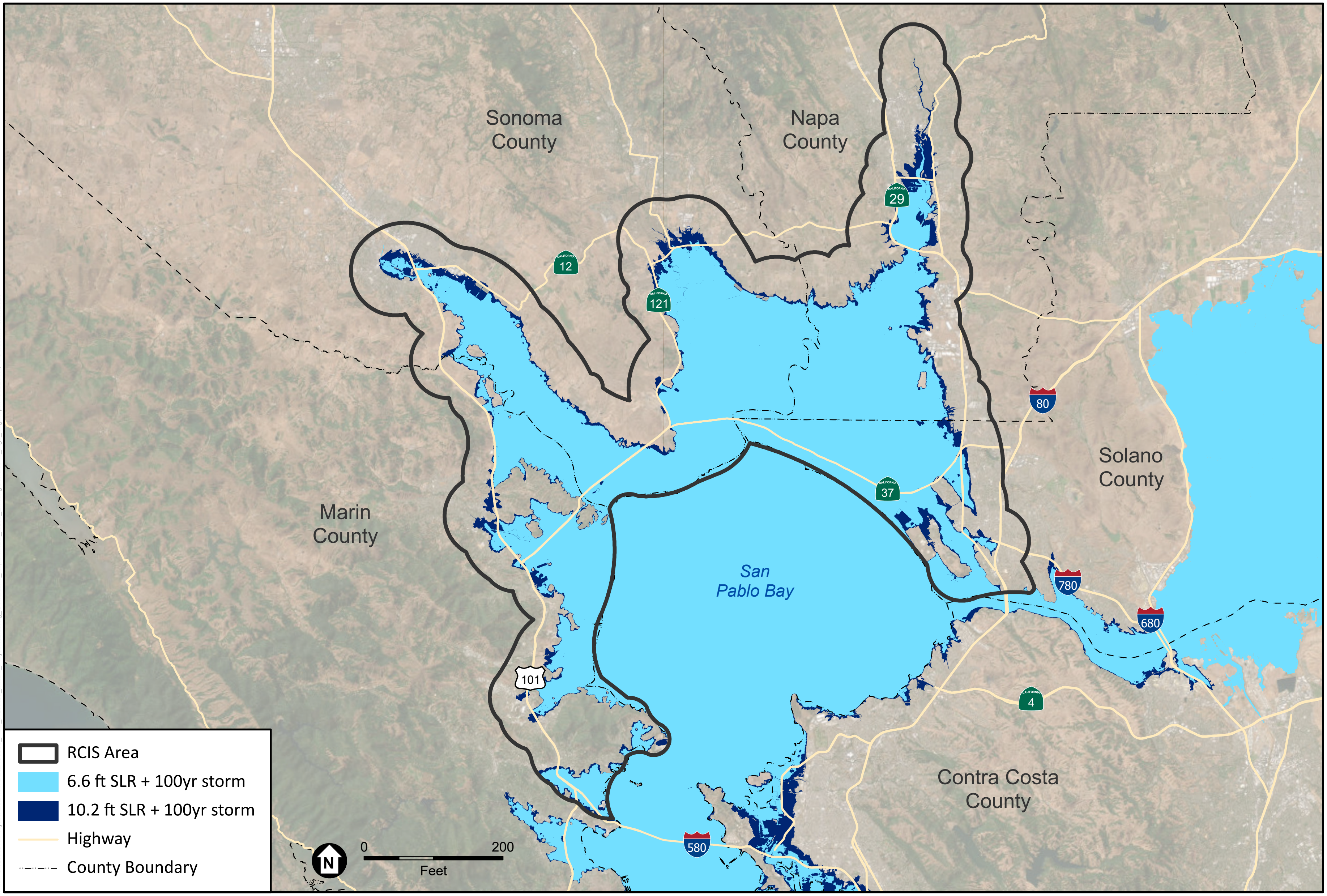
California's precipitation patterns are the most variable in the country and exhibit long periods with no storms; this high variability of mean annual precipitation makes detecting strong signals in future projections challenging (Ackerly et al. 2018). Because the physical processes that affect regional precipitation changes are complex and exhibit high variability by region, projected precipitation models have a high degree of uncertainty (Ackerly et al. 2018). Based on the RCP8.5 scenario, average annual precipitation is projected to increase by 1.6 inches by mid-century and 2.8 inches by the end of the century (Table C.2-2). Even with the uncertainty of precipitation projections, models have suggested that wet years will become wetter and dry years will become drier, with a dry year likely to be followed by more dry years, increasing the risk of drought (Pierce et al. 2018).

Downscaled localized projections show an increase in the magnitude of heavy-precipitation events (Pierce et al. 2018). Historically, northern Sonoma County has experienced the greatest precipitation events in the Bay Area; these events are projected to increase (measured in inches of rain per day) from 6 percent to 21 percent under RCP4.5 and as high as 37 percent under RCP8.5 by the end of the century (Ackerly et al. 2018). Northern Sonoma County is outside the RCIS area, but because it is hydrologically connected, these extreme-precipitation events are likely to have an impact on species and habitats in the RCIS area. Ackerly et al. (2018) estimates that under RCP8.5, what is currently considered a once-in-20-year storm could become a once-in-seven-year or more frequent storm.

C.2.1.5 Sea Level Rise Projections

Sea level in the Bay Area has risen more than 8 inches in the last 100 years (Ackerly et al. 2018). The California Ocean Protection Council (OPC) is currently updating California's sea level rise policy guidance and planning to release in 2023, which will include climate scenarios from IPCC AR6. Based on these new scenarios, sea level in the RCIS area is likely to rise between 1.05 and 1.97 feet by mid-century, and between 3.08 and 6.53 feet by the end of the century (Collini et al. 2022) (Table C.2-2, **Figure C.2-1**). OPC (2018) recommends using the upper limit of the likely range for projects with a high tolerance for flooding (e.g., parks or natural areas). Sea level rise will also move salinity gradients up toward the Sacramento–San Joaquin Delta (Delta) and allow ocean water to intrude farther into the bay (Goals Project 2015).

Regional projections of sea level rise are complicated by highly variable rates of vertical land movement caused by seismic effects, sediment compaction, marsh accretion, and groundwater fluctuations (Ackerly et al. 2018). Because of the uncertainty in regional projections, OPC (2018) also recommends considering sea level rise projections with lower probabilities of occurring. In the RCIS area, a 0.5 percent probability exists that sea level rise will reach or exceed 2.6 feet by mid-century and 6.9 feet by the end of the century (OPC 2018). The H++ scenario, the most extreme sea level rise scenario and was used to determine the boundaries of the RCIS area, projects a potential 3.9 feet of sea level rise by mid-century and 10.2 feet by the end of the century (OPC 2018) (Figure C.2-1). This extreme scenario models rapid ice sheet losses in Antarctica that could increase rates of sea level rise in California above 2 inches per year by the end of the century (OPC 2018).



SOURCE: CoSMoS, 2019; BCDC, 2022; ESA, 2023

North Bay Baylands Regional Conservation Investment Strategy

Figure C.2-1
Sea Level Rise Projections

ESA

C.2.2 Methodology

C.2.2.1 Literature Review

C.2.2.1.1 Regional Climate Change Vulnerability Assessments and Adaptation Plans

A wide range of groups have completed studies evaluating vulnerability and potential adaptation strategies for projected climate change impacts in the RCIS area (see Appendix G). The studies focus on different habitat types and subregional assessments.

C.2.2.1.2 Species-Specific and Natural Community Climate Change Vulnerability Assessments Methodologies

Table C.2-3 summarizes the climate vulnerability assessments reviewed for each focal/non-focal species in the RCIS area. Assessments developed or supported by federal and state agencies were used, along with those developed by nongovernmental agencies. Additional data reviewed included species-specific background information from recovery plans, USFWS five-year reviews, and petitions for federal Endangered Species Act candidacy.

TABLE C.2-3: CLIMATE CHANGE VULNERABILITY ASSESSMENTS FOR FOCAL AND NON-FOCAL SPECIES

Study (Author/Date)	Summary and/or Methodology
"Climate Change–Driven Range Losses among Bumble bee Species are Poised to Accelerate" (Sirois-Delisle and Kerr 2018)	• Uses four RCPs and four general-circulation models to create Maxtent models for 30 North American bumble bee species between baseline (1960–1990) and future projections of year 2050 and 2070. • Models two different dispersal rates (0 km/year and 10 km/year).
Projected Effects of Future Climates on Freshwater Fishes of California (Moyle et al. 2013)	• Presents methodology to allow for systematic evaluation of climate change impacts on freshwater fishes in California and projected future distribution. • Assesses baseline vulnerability using current population trends, species biology, and vulnerability to non-climate stressors. • Assesses climate change vulnerability by assessing exposure, sensitivity, and adaptive capacity variables. • Combines baseline and climate change vulnerability to create combined vulnerability indicating likelihood of species persistence in 2100.
"Climate Change Vulnerability Assessment for Pacific Salmon and Steelhead in the California Current Large Marine Ecosystem" (Crozier et al. 2019)	• Uses four components to assess climate vulnerability: exposure, sensitivity, probability of directional shift, and net direction of climate effects. • Uses exposure and sensitivity attributes of each life history stage to calculate total vulnerability. • Incorporates adaptive capacity into the sensitivity component.
California Amphibian and Reptile Species of Future Concern: Conservation and Climate Change (Wright et al. 2013)	• Creates ecological niche models to project distribution of climatically suitable habitat under four climate scenarios and 11 general-circulation models for 2050. • Measures risk as percentage of currently occupied localities remaining suitable in the future, and the change in suitable habitat within currently occupied localities.

TABLE C.2-3: CLIMATE CHANGE VULNERABILITY ASSESSMENTS FOR FOCAL AND NON-FOCAL SPECIES

Study (Author/Date)	Summary and/or Methodology
"A Climate Change Vulnerability Assessment of California's At-Risk Birds" (Gardali et al. 2012)	• Presents a framework for assessing climate change vulnerability of birds for 2070 and models some species' future distribution. • Uses IPCC 4th Assessment Report RCPs. • Assesses sensitivity and exposure variables.
Survival by Degrees: 389 Bird Species on the Brink (Wilsey et al. 2019)	• Assesses climate change vulnerability using sensitivity and exposure variables. • Creates vulnerability scores for both breeding and wintering range. • Uses IPCC 5th Assessment Report RCPs and 15 general-circulation models for two future time frames (2050s and 2080s).
"Rising Tides: Assessing Habitat Vulnerability for an Endangered Salt Marsh-Dependent Species with Sea Level Rise" (Rosencranz et al. 2019)	• Models changes in suitable habitat for Ridgway's rail under different sea level rise scenarios and incorporates site-specific geomorphology.
Bats: Northern California Climate Change Vulnerability Assessment Summary (Hilberg and Kershner 2019)	• Summarizes studies addressing sensitivity and exposure, which include specific climate stressors and disturbance regimes, non-climate stressors, and adaptive capacity.
Climate Change Vulnerability Assessment of Rare Plants in California (Anacker and Leidholm 2012)	• Uses the NatureServe Climate Change Vulnerability index tool to determine the most at-risk rare California plant species for 2050.
A Climate Change Vulnerability Assessment of California's Terrestrial Vegetation (Thorne et al. 2016)	• Projects the climate change vulnerability of vegetation communities using spatial patterns, sensitivity traits, adaptive capacity traits, and projected climate exposure for 2070–2099. • Uses IPCC 5th Assessment Report RCPs. • Models expected spatial disruption or shifts in area currently occupied by each community. • Uses the Mean Combined Vulnerability Rank to present measures of sensitivity, exposure, and spatial disruption to create an index of vulnerability for comparison between macrogroups.
Terrestrial Climate Change Resilience—Area of Conservation Emphasis dataset (CDFW 2018)	• Uses Thorne et al. (2016) datasets to summarize areas in California that are expected to be buffered from the impacts of climate change.
Climate Change Vulnerability Assessment for the North-Central California Coast and Ocean (Hutto et al. 2015)	• Includes focal marine and coastal species and habitats to be assessed by subject matter experts • Uses IPCC 4th Assessment Report RCPs • Assess exposure, sensitivity, and adaptive capacity variables

NOTES: IPCC = Intergovernmental Panel on Climate Change; km/year = kilometers per year; RCP = Representative Concentration Pathway

Depending on the taxa, different variables to assess exposure and sensitivity to climate stressors, different ranking systems, and different climate models were used. This makes direct comparisons of overall vulnerability between taxa difficult. Additional modeled variables used include:

- *Species distribution models:* Measure of probability of the continued presence of habitat suitability.
- *Adaptive capacity:* The ability of a species, asset, or system to evolve in response to, or cope with the impacts of climate change.
- *Representative concentration pathways (RCPs):* The range of possible future emissions scenarios (studies including these variables use RCPs from AR5).

Where species-specific information is lacking, the vulnerability of many focal/non-focal species was not assessed directly. The vulnerability of the natural communities in which a species occurs can be used to project the current and future vulnerability of that species to climate stressors.

C.2.2.2 Ecological Climate Resilience Assessment

Using the Area of Conservation Emphasis (ACE) dataset, a high-level habitat climate resilience assessment of terrestrial habitats in the RCIS area was conducted (CDFW 2018). A similar aquatic climate resilience dataset has not yet been developed. Using the climate change vulnerability assessment of terrestrial vegetation communities (Thorne et al. 2016), this dataset shows the probability that a given location may function as refugia from climate change impacts. Scores range from 1 (low) to 5 (high). Locations with lower resiliency rankings (1–2) are projected to experience higher climate exposure, with ecological functions reduced or lost. Higher resiliency rankings (4–5) are locations where ecological conditions and functions are more likely to remain suitable for the current suite of plants and wildlife that occur there.

C.2.3 Results

C.2.3.1 Focal/Non-focal Species and Natural Communities Results

C.2.3.1.1 Climate Change Vulnerability Assessments for Focal and Non-focal Invertebrates

Crotch's's Bumble Bee

No specific climate change vulnerability assessment exists for Crotch's's bumble bee. Exposure variables projected to significantly affect bumble bee populations include increased temperature and precipitation, increased drought, increased variability in temperature and precipitation extremes, early snow melt, late frost events, and changes in availability of floral resources (Jackson et al. 2022; Xerces Society et al. 2018). Stressors include increased pathogen exposure, decreased resource availability (both floral and hibernacula), and a decrease in nesting habitat availability due to changes in rodent abundance or distribution (Xerces Society et al. 2018).

Callippe Silverspot Butterfly

USFWS (2020) conducted a species status assessment for the Callippe silverspot butterfly, which included a discussion of climate change vulnerability. One of the most serious potential changes is phenological shifts creating a mismatch between the callippe silverspot butterfly and its host plant. Increased precipitation could lead to shifts in vegetation communities, leading to increases in nonnative annual grasses and encroachment by native shrubs. This may lead to competition between nectar and host plants, reduce larval movement and survival, reduce the availability of oviposition sites, and increase the potential for severe wildfires.

USFWS (2020) also conducted an analysis of future conditions, constructing two future scenarios based on changes in threats and management efforts for the year 2050. Scenario 1 assumes "business as usual" with current management practices, such as grazing and habitat management, and threats maintained at 2020 levels. Because of recent habitat observations of the Sears Point population in the RCIS area, large-scale recent fires, and limited observations in recent years, this population's viability will likely remain low and it has the potential to be extirpated. Scenario 2 assumes that management improves from 2020 levels, and there is the potential to mitigate some of the threats to the species. These improvements in some habitat conditions may increase the viability of the population to moderate in this scenario.

California Freshwater Shrimp

No specific climate change vulnerability assessment exists for California freshwater shrimp. Drought and spring floods are a threat to stable shrimp populations that would be exacerbated by climate change (USFWS 2007). Droughts could reduce streamflows and increase the likelihood that stream segments could dry out during the summer months, potentially leading to local extirpations and decreasing genetic connectivity between populations (USFWS 2007). Sea level rise impacts may result in increased salinity, which could lead to mortality (USFWS 2007).

Western Bumble Bee

Janousek et al. (2023) included used the exposure variables of increased drought and temperature in models of future western bumble bee occupancy declines throughout North America (models also include land cover and pesticide use variables). The model indicated that temperature during the warmest quarter had the largest negative effect on occupancy, though warmer temperatures can occur year-round (Janousek et al. 2023). Higher temperatures reduce the ability of this species ability to forage during hot days (Janousek et al. 2023).

Sirois-Delisle and Kerr (2018) conducted an analysis for all North American bumble bees (including western bumble bee) and investigated dispersal capacity as proxy for their ability to track changes in the distribution of suitable habitat. Assuming a high dispersal rate (10 kilometers [km] per year), western bumble bees are projected to have an approximately 20 percent decrease in total range by 2050, and a 25 percent decrease in total range by 2070 (Sirois-Delisle and Kerr 2018). Assuming that there is no dispersal (0 km/year), the species is projected to have a 20 percent decrease in total range by 2050, and a 30-40 percent decrease (depending on the RCP scenario) by 2070 (Sirois-Delisle and Kerr 2018). Shifts in the phenology of food resources (i.e., earlier and longer flowering seasons) cause disruptions to the life cycle of new bumble bee colonies (Ogilvie et al. 2017). Even in pollinators known to have high dispersal rates, there is still a large lag between the actual colonization of new areas and the rate required to keep pace with climate change (Sirois-Delisle and Kerr 2018).

Western Ridged Mussel

No specific climate change vulnerability assessment exists for western ridged mussel. Dettinger et al. (2015) noted that impacts on water availability in the San Francisco Bay-Delta system are anticipated to result from projected changes to rainfall patterns and snowmelt, which are likely to affect habitat critical for the western ridged mussel (Belvins et al. 2020). Increased severity and variability of storms and droughts and impacts on water quality, including the thermal regime of rivers, are also likely to negatively affect this species (Belvins et al. 2020). Belvins et al. (2020) also note that high water temperatures and low flows have the potential to lead to direct mortality of individuals and population extirpation, affecting the burrowing ability of mussels, and influencing host-fish/mussel interactions and species distribution.

C.2.3.1.2 Climate Change Vulnerability Assessments for Focal and Non-focal Fish Species

Quiñones and Moyle (2014) assessed the climate change vulnerability of freshwater fishes of the Bay Area using methodology developed by Moyle et al. (2013). Baseline Vulnerability metrics included current and long-term population size (last 10 years), current and long-term range trend, current and future vulnerability to stressors other than climate change, life span and reproductive plasticity, vulnerability to stochastic events, and current dependence on human intervention. Climate Change Vulnerability metrics included physiological/behavioral tolerance to temperature increase and precipitation change, vulnerability to change in frequency or degree of extreme weather events, dispersive capability, degree of physical habitat specialization, likely future habitat change because of climate change, ability of species to shift at same rate as habitat, availability of habitat within new range, dependence of exogenous factors, and vulnerability to alien species. **Table C.2-4** shows the results of the assessment for focal and non-focal species.

TABLE C.2-4: CLIMATE CHANGE VULNERABILITY ASSESSMENT FOR FOCAL AND NON-FOCAL FISH SPECIES

Species	Present-Day Vulnerability	Climate Change Vulnerability	Combined Vulnerability Score
Focal Species			
Green sturgeon – southern DPS	Highly Vulnerable	Less Vulnerable	Highly Vulnerable
Steelhead – central California coast DPS	Highly Vulnerable	Highly Vulnerable	Highly Vulnerable
Chinook salmon – Sacramento River winter-run ESU	Critically Vulnerable	Critically Vulnerable	Critically Vulnerable
Chinook salmon – Central Valley spring-run ESU	Critically Vulnerable	Critically Vulnerable	Critically Vulnerable
Chinook Salmon – Central Valley fall/late fall-run ESU	Critically Vulnerable	Critically Vulnerable	Critically Vulnerable
Non-focal Species			
Delta smelt[1]	Critically Vulnerable	Critically Vulnerable	Critically Vulnerable
Sacramento splittail	Less Vulnerable	Highly Vulnerable	Highly Vulnerable
Longfin smelt	Highly Vulnerable	Critically Vulnerable	Highly Vulnerable

Notes:

DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

1. The U.S. Fish and Wildlife Service (USFWS 2022) included climate change as a Factor A threat, which includes "the present or threatened destruction, modification, or curtailment of its habitat or range." Climate change has previously been considered a Factor E threat, "Other natural or manmade factors affecting continuing existence."

SOURCES: Quiñones and Moyle 2014; data compiled by Environmental Science Associates in 2022.

Crozier et al. (2019) conducted a climate change vulnerability assessment of salmonids and included assessments of overall biological sensitivity, climate exposure, adaptive capacity, and vulnerability (**Table C.2-5**). A large number of species attributes were ranked in each category and contributed to the overall vulnerability ranking.

TABLE C.2-5: CLIMATE CHANGE VULNERABILITY ASSESSMENT FOR SALMONIDS

Species	Overall Biological Sensitivity	Overall Climate Exposure	Overall Adaptive Capacity	Overall Vulnerability
Steelhead – central California coast DPS[1]	Moderate	High	Moderate	Moderate
Chinook salmon – Sacramento River winter-run ESU[2]	Very High	High	Low	Very High
Chinook salmon – Central Valley spring-run ESU[3]	Very High	High	Low	Very High
Chinook Salmon – Central Valley fall/late fall-run ESU[4]	Very High	High	Low	Very High

NOTES:

DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

1. No factors had a "very high" vulnerability ranking.
2. Factors with a "very high" ranking include cumulative life-cycle effects, other stressors (e.g., habitat loss), and population viability.
3. Factors with a "very high" ranking include sensitivity in adult freshwater stage, cumulative life-cycle effects, other stressors (e.g., altered systems of the California Central Valley and the Sacramento–San Joaquin Delta), hatchery influence, and population viability.
4. Factors with a "very high" ranking include cumulative life-cycle effects and other stressors (e.g., altered systems of the California Central Valley and the Sacramento–San Joaquin Delta).

SOURCE: Crozier et al. 2019; data compiled by Environmental Science Associates in 2022.

C.2.3.1.3 Climate Change Vulnerability Assessment for Focal Herpetofauna Species

Wright et al. (2013) assessed the climate change vulnerability of all California reptile and amphibian species (**Table C.2-6**). Vulnerability was ranked based on the projection of currently occupied habitat remaining statewide in 2050, and the projected suitable habitat remaining statewide.

The results of the assessment show that California red-legged frog and western pond turtle have statewide population distributions that are projected to remain the same as present-day (2013) distributions. However, the model for California red-legged frog did have an anomaly score, which suggests that although current distribution and habitat suitability is likely to remain constant, projected climate conditions may reduce habitat suitability on average to make this species a high conservation priority.

TABLE C.2-6: CLIMATE CHANGE VULNERABILITY ASSESSMENT FOR FOCAL HERPETOFAUNA SPECIES

Species[1]	Type of Analysis	Low Emissions (RCP4.5)	High Emissions (RCP8.5)	Climate Vulnerability
California red-legged frog	Current Distribution Habitat Suitability	Slightly Reduced Neutral	Slightly Reduced Neutral	Neutral[2]
Western pond turtle	Current Distribution Habitat Suitability	Slightly Reduced Neutral	Slightly Reduced Neutral	Neutral

NOTES:

RCP = representative concentration pathway

1. Projected future range maps were prepared for each species for each RCP.
2. The model's anomaly score suggests that although the current distribution and habitat suitability are likely to persist, projected climate conditions may reduce habitat suitability on average to make this species a high conservation priority.

SOURCES: Wright et al. 2013; data compiled by Environmental Science Associates in 2022.

C.2.3.1.4 Climate Change Vulnerability Assessment for Focal and Non-focal Bird Species

Gardali et al. (2012) assessed the climate change vulnerability of 358 at-risk California bird species and those of focal and non-focal bird species are shown in **Table C.2-7**. The primary sensitivity factor affecting focal and non-focal bird species is habitat specialization; all species had moderate to high vulnerability in this category. Most species also had moderate to high vulnerability to extreme weather and habitat suitability exposure. This is likely because of the species' reliance on marsh habitats that are projected to be affected by climate change.

California Black Rail

Hutto et al. (2015) also assessed the climate vulnerability of exposure and sensitivity factors for California black rail.

Sensitivity to Climate and Climate Change Driven Change (Exposure)

- Sea Level Rise – High
- Precipitation – Moderate
- Wave Action – High
- Storm Intensity – High
- Salinity – High

Sensitivity of Change in Disturbance Regimes (Exposure)

- Flooding – High
- Storms – High

Sensitivity and Current Exposure to Non-Climate Stressors

- Predation – High
- Land Use Change – High
- Coastal Roads/Armoring – High
- Pollution – High
- Invasive Species – High

Adaptive Capacity

- Geographic Extent – Low-Moderate
- Population Status – Low
- Population Connectivity – Low-Moderate
- Dispersal Ability – Low-Moderate
- Diversity of Life History Strategies – Low
- Overall Degree of Diversity/Plasticity – Low
- Value of Species to People – Low-Moderate
- Likelihood of Managing or Alleviating Climate Change Impacts – Moderate-High

Overall Vulnerability

- Sensitivity – Moderate-High
- Exposure – Low-Moderate
- Adaptive Capacity – Low-Moderate
- Vulnerability – Moderate-High

TABLE C.2-7: CLIMATE CHANGE VULNERABILITY ASSESSMENTS FOR FOCAL AND NON-FOCAL AVIAN SPECIES

Species	Habitat Suitability Exposure	Food Availability Exposure	Extreme Weather Exposure	Habitat Specialization Sensitivity	Physiological Tolerances Sensitivity	Migratory Status Sensitivity	Dispersal Ability Sensitivity	Climate Vulnerability Priority List
Focal Species								
Burrowing owl[1]	Low	Low	Low	High	Low	Moderate	Low	N/A
California black rail	High	Low	High	High	Low	Low	Moderate	High
California Ridgway's rail[2]	High	Low	High	High	Low	Low	High	High
Non-focal Species								
California least tern	High	Moderate	Moderate	High	Moderate	High	Low	High
Tricolored blackbird[3,4]	Moderate	Low	Moderate	Moderate	Low	Low	Low	N/A
Swainson's hawk[3,4,5]	High	Low	Moderate	Moderate	Low	High	Low	Moderate
Saltmarsh common yellowthroat	High	Low	Moderate	Moderate	Low	Moderate	Moderate	Moderate
San Pablo song sparrow	High	Low	High	High	Low	Low	High	High
Western snowy plover	Moderate	Low	High	High	Low	Moderate	Low	Moderate

NOTES:

N/A = not applicable

1. The Audubon Climate Report ranked the summer and winter ranges as stable to impacts from 3 degrees Celsius (°C) increases in global temperatures (Wilsey et al. 2019).
2. Rosencranz et al. (2019) projected a loss of 83 percent of breeding season habitat by 2100 as a result of sea level rise without habitat creation, through the transitioning of upland habitat to marsh habitats and habitat restoration.
3. Audubon Climate Priority Species (Wilsey et al. 2019).
4. The Audubon Climate Report ranked the summer range as moderate and the winter range as highly vulnerable to impacts from a 3°C increase in global temperatures (Wilsey et al. 2019).
5. The Audubon Climate Report ranked the summer range as stable to impacts from a 3°C increase in global temperatures (Wilsey et al. 2019).

SOURCES: Gardali et al. 2012; Wilsey et al. 2019; data compiled by Environmental Science Associates in 2022.

C.2.3.1.5 Climate Change Vulnerability Assessment for Focal and Non-Focal Mammals

Salt Marsh Harvest Mouse

No specific climate change vulnerability assessment exists for salt marsh harvest mouse. While the amount of suitable tidal habitat in this species range may increase under a high sea level rise scenario by 2050, by 2100 total habitat suitability is projected to decrease by 83 percent (Rosencranz et al. 2019). The USFWS five-year review (USFWS 2010) included a discussion of climate change threats to the species. Factors identified by USFWS (2010) include (1) habitat loss caused by landward migration of tidal marsh habitat or where sea level rise or erosion exceeds sedimentation; (2) increased salinity gradients; (3) increased heat and desiccation extremes; (4) potential loss and/or decreased fecundity; and (5) high mortality associated with extreme weather events. High mortality associated with extreme storm events is likely to have the greatest negative impact on populations (USFWS 2010). High mortality due to extreme storm events is likely to have the greatest negative impact on populations (USFWS 2010). Climate threats that are likely to impact this species include sea level rise, inundation from storm events, increased frequency of storm events, coastal erosion, and increased wave action (Goals Project 2015).

C.2.3.1.6 Climate Change Vulnerability Assessment for Focal and Non-focal Plant Species

Species-specific climate change vulnerability assessments focusing on plant species and vegetation alliances are rarely conducted; an immense amount of species-specific data is required, which in many cases does not presently exist for a wide range of plants and vegetation alliances. Loarie et al. (2008) projected that in general, focal and non-focal plant species and other conservation elements will experience shifts in distributions to higher elevations and northward, depending on the species' ability to do so. Coastal populations, like those in the RCIS area, are projected to be vulnerable to habitat loss and degradation caused by sea level rise and impacts from extreme-weather events (Loarie et al. 2008).

Marin Western Flax

Anacker and Leidholm (2012) conducted an analysis of a subset of rare California plants, including Marin western flax. Using distributional and natural history information to obtain vulnerability scores, this species was given a score of Not Vulnerable/Presumed Stable. This means that available evidence does not suggest that the abundance and/or range extent of Marin western flax within the geographical area assessed will increase or decrease substantially by 2050, although actual range boundaries may change. Variables that had higher vulnerability scores include indirect-exposure anthropogenic barriers, which was scored as G*reatly Increased*. Sensitivity to changes in temperature of historical thermal niche was scored as *Increased*. The impacts of other sensitivity and exposure variables were scored as either neutral or unknown.

Soft Bird's-Beak

No specific climate change vulnerability assessment exists for soft bird's-beak. USFWS (2013) projected that sea level rise and associated flood control responses may have significant long-term negative impacts on this species. Coastal salt marshes are projected to be highly vulnerable to climate change under both emissions scenarios and global circulation models (see the Appendix), and soft bird's-beak is likely also highly vulnerable.

C.2.3.1.7 Climate Change Vulnerability Assessment for Terrestrial Habitats

Terrestrial habitats where no specific climate change vulnerability assessment has been conducted can use the vulnerability assessment for the natural communities that make up the habitat as a possible indicator of its vulnerability to climate change. Thorne et al. (2016) assessed the climate vulnerability of 31 terrestrial vegetation macrogroups (as defined by the U.S. Natural Vegetation [UCNVC] system) (see the Appendix). Some RCIS natural communities can be categorized into multiple UCNVC macrogroups. No natural community had a Combined Vulnerability Ranking of Low; those with a Mid-High or High ranking in at least one emissions scenario and/or general-circulation model are shown in **Table C.2-8**.

TABLE C.2-8: SUMMARY OF NATURAL COMMUNITIES WITH MID-HIGH OR HIGH COMBINED VULNERABILITY RANKING

North Bay Baylands RCIS Natural Community	Combined Vulnerability Rank
Grassland	
Annual Grassland	Mid-High (RCP4.5, RCP8.5)
Perennial Grassland	Mid-High (RCP4.5, RCP8.5)
Shrub-Dominated	
Coastal Scrub	Mid-High (RCP4.5 Hot and Dry, RCP8.5)
Mixed Chaparral	Mid-High (RCP4.5 Hot and Dry, RCP8.5)
Tree–Deciduous	

North Bay Baylands RCIS Natural Community	Combined Vulnerability Rank
Blue Oak Woodland	Mid-High (RCP8.5 Hot and Dry)
Montane Hardwood	Mid-High (RCP8.5 Hot and Dry)
Valley Oak Woodland	Mid-High (RCP8.5 Hot and Dry)
Tree–Evergreen	
Coastal Oak Woodland	Mid-High (RCP8.5 Hot and Dry)
Montane Hardwood-Conifer	Mid-High (RCP8.5 Hot and Dry)
Wetland	
Freshwater Marsh	High (RCP4.5, RCP8.5)
Tidal Marsh	High (RCP4.5, RCP8.5)
Valley Foothill Riparian	Mid-High (RCP8.5)
Barren	Mid-High (RCP4.5 Hot and Dry, RCP8.5 Hot and Dry)

NOTES: RCIS = Regional Conservation Investment Strategy; RCP = Representative Concentration Pathway

Bat Habitat

Although no specific climate change vulnerability assessments exist for non-focal bat species, studies have projected bat species responses to various climate stressors. Changes in climate exposure variables are likely to have detrimental impacts to the health of bat populations. Increases in the number of severe storms (Fellers and Halstead 2015) and periods of drought (Jones et al. 2009) may have detrimental effects on insect populations, leading to lower prey availability. Increase in overall winter temperatures impact hibernation, by increasing energy needs, depleting fat reserves, and making bats more susceptible to fungal infections (Jones et al. 2009). Increases in temperature (Jones et al. 2009) may cause some the range of some species to be forces and increasing incidences of heat waves may threaten bats with direct and mass mortality (Sherwin et al. 2013).

C.2.3.1.8 Climate Change Vulnerability Assessment for Aquatic Natural Communities

Tidal Wetlands

Due to tidal wetlands’ continuous elevational balancing act, tidal ecosystems are very susceptible to negative impacts from sea level rise. If sea level rise outpaces sediment accretion rates, tidal wetlands will be inundated for longer periods of time (USFWS 2019). This eventually leads to conversion from marsh to tidal flats to open water, as well as the possible expansion of marsh due to increasing inundation with salt water into upland areas (USFWS 2019). Modeling has shown that marshes in the San Pablo baylands will not likely keep pace with sea level rise in the long term in their present form, and much of the current tidal wetlands will transition to lower elevational habitats by 2100 (USFWS 2019). Marshes will transgress inland, particularly where there is elevation capital such as alluvial fans.

Shallow Subtidal Habitats

Sea level rise may increase the rate of shoreline erosion and increase salinity (Hutto et al. 2015). The alteration of tidal flux, including timing and extent of tides, will may have an impact on the species that rely on shallow subtidal habitats. Increased storm activity, including wave action, may also contribute to shoreline erosion and may increase adjacent flooding (Hutto et al. 2015). Relatively acidic water from the Pacific Ocean will flow into the estuary, though it is unclear how the overall pH shift will affect plants and animals that live in shallow subtidal habitats and other adjacent habitats (Hutto et al. 2015, Goals 2015). Recent patterns in ocean upwelling have shown a persistent upward trend (Goals 2015). Upwelling brings cool, nutrient rich, low-oxygen, and low pH water to the surface which promotes phytoplankton blooms. Low oxygen events have the potential to negatively impact the balance of shallow subtidal ecosystems.

Hutto et al. (2015) assessed the climate vulnerability of exposure and sensitivity factors of coastal estuaries, which is likely similar to the shallow subtidal habitats within the RCIS area.

Sensitivity to Climate and Climate Change Driven Change (Exposure)

- Sea Level Rise – High
- Precipitation – High
- Sea Surface Temperature – High
- Air Temperature – High
- Coastal Erosion – Moderate
- Dissolved Oxygen – High
- Dynamic Ocean Conditions (currents/mixing/stratification)– High
- Wave Action – High
- pH – High
- Salinity – High
- Turbidity - Moderate

Sensitivity of Change in Disturbance Regimes (Exposure)

- Flooding – Moderate-High
- Storms – Moderate-High

Sensitivity and Current Exposure to Non-Climate Stressors

- Land Use Change – High
- Coastal Roads/Armoring – High
- Overwater/Underwater Structures – High
- Invasive Species – High

Adaptive Capacity

- Geographic Extent – Transcontinental
- Structural and Functional Integrity – Somewhat degraded
- Continuity of Habitat – Somewhat isolated and/or fragmented
- Habitat Resistance to Stressors/Maladaptive Human Responses – Low
- Ability of Habitat to Recover from Stressor/Maladaptive Human Response Impacts – Moderate-High
- Physical and Topographical Diversity – High
- Diversity of Component Species – High
- Diversity of Functional Groups – Moderate-High
- Value of Habitat to People – Moderate-High
- Likelihood of Managing or Alleviating Climate Change Impacts – Moderate

Overall Vulnerability

- Sensitivity – Moderate-High
- Exposure – High
- Adaptive Capacity – Moderate-High
- Vulnerability – Moderate-High

Waterfowl and Shorebird Habitat

Precipitation pattern changes, sea level rise, declining snowpack, and increased severity and frequency of severe weather could change when wetlands are wet, which could lead to northward expansion of invasive species and greater water management challenges (Ducks Unlimited 2023). Increased existing stresses on wetlands (e.g., nutrient loading, filling, drainage, soil erosion) and uplands (e.g., overgrazing, intensive agricultural practices) would be exacerbated by increased climatic impacts (Ducks Unlimited 2023). Projected sea level rise in coastal shorebird habitats will have increased negative impacts in areas with high tidal amplitudes in shallow lagoons and broad estuaries (Galbraith et al. 2014). A major loss of coastal wintering habitat for shorebirds and waterfowl is anticipated. Many species that breed and/or winter in the RCIS area are projected to lose 10–50 percent or more of their suitable habitat (Galbraith et al. 2014).

C.2.3.2 Ecological Climate Resilience

Most of the RCIS area has an ACE Climate Resilience Score of 3, indicating a 40–60 percent chance of acting as climate refugia under all scenarios and models assessed by Thorne et al. (2016) (CDFW 2018). These areas include most of the upland, high-elevation portions of the RCIS area, which are not projected to be affected by sea level rise. It is important to note that this assessment used spatial data from 2016. Since that time, habitat restoration projects in the freshwater and saltwater marsh portions of the RCIS area have been completed, are in construction, or are in the planning stages, which aim to increase resiliency to sea level rise and other climate stressors.

Other ACE datasets (Species Biodiversity, Significant Terrestrial and Aquatic Habitats, and Terrestrial Connectivity) were reviewed for the RCIS area. Interestingly, areas with lower climate resilience scores—the Napa-Sonoma Wildlife Area/San Pablo National Wildlife Refuge and the Petaluma Valley—had high terrestrial connectivity scores. Most of the RCIS area is categorized as a Highly Significant aquatic habitat, and Burdell Mountain and the upper Napa Valley score high for significant terrestrial habitats.

C.2.4 Discussion

C.2.4.1 Pressures and Stressors

C.2.4.1.1 Land Conversion and Development

Land conversion and development is one of the primary drivers of habitat loss and degradation in the RCIS area. Increasing human populations are putting increasing demands on already limited supplies of land, water, and other natural resources (CDFW 2015). Focal and non-focal species that already have a restricted range in the RCIS area–California black rail, California Ridgway’s rail, salt marsh harvest mouse, callippe silverspot butterfly, Marin western flax, and soft bird’s-beak–will be severely affected by land conversion and development. The natural communities in which these species occur are also among the most vulnerable to climate change stressors. Beyond direct land use conversion, fragmentation of natural communities and species habitat, reduction in ecosystem function and complexity, and additional stressors that degrade habitat quality and function may occur as a result of this pressure.

C.4.1.2 Disrupted Natural Hydrology and Sediment Supply Pathways

Much of the RCIS area is made up of both freshwater and tidal habitats and provides important habitat for many imperiled focal and non-focal species. These aquatic habitats have experienced changes in hydrologic connectivity and, importantly for the stability and resilience of marsh habitat, changes to sediment supply sources. By disconnecting freshwater flows from the bay and marshes, an important sediment source has been reduced or cut off from tidal marshes, leading to increased erosion and changes to San Pablo Bay bathymetry. Sediment-starved marsh systems are projected to become further stressed by increased exposure to climate change, making further erosion and habitat conversion likely to occur.

Sedimentation is the primary process for tidal marshes in the RCIS area to accrete vertically with rising sea levels (Goals Project 2015). Inorganic sedimentation increases as the marsh elevation falls lower in relation to the tides and the depth of water over the marshes increases, in contrast to accumulation of organic matter (Goals Project 2015). The inorganic sediment supply depends on local conditions and on the supply of sediment from the Delta and other local streams, the resuspension of sediment from adjacent mudflats, and the suspended-sediment concentration in tidal waters (Goals Project 2015). Presently, tidal marshes have enough sediment supply to keep up with sea level rise; however, adequate sediment supply is not likely to keep pace with projected future rates of sea level rise (Goals Project 2015).

C.2.4.2 Climate Change Vulnerability

The following focal and non-focal species are ranked as Moderate and above in species-specific assessments of climate change vulnerability and/or occupy natural communities that have a High Combined Vulnerability rank (**Table C.2-9**). These species are the most vulnerable to climate change in the RCIS area.

TABLE C.2-9: SUMMARY OF MOST CLIMATICALLY VULNERABLE FOCAL/NON-FOCAL SPECIES

Focal/Non-focal Species	Climate Change Vulnerability Rank
California red-legged frog	High
California black rail	High
California Ridgway's rail	High
California least tern	High
Swainson's hawk	Moderate
Saltmarsh common yellowthroat	Moderate
San Pablo song sparrow	High
Western snowy plover	Moderate
Steelhead – central California coast DPS	Moderate
Chinook salmon – Sacramento River winter-run ESU	Very High
Chinook salmon – Central Valley spring-run ESU	Very High
Chinook Salmon – Central Valley fall/late fall-run ESU	Very High
Salt marsh harvest mouse	High
Soft bird's-beak	High

NOTES: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

C.3 References

Ackerly, D., A. Jones, M. Stacey, and B. Riordan. 2018. *California's Fourth Climate Change Assessment: San Francisco Bay Area Region Report*. Publication Number: CCCA4-SUM-2018-005. Coordinating agencies: Governor's Office of Planning and Research, California Energy Commission, and California Natural Resources Agency.

Anacker, B., and K. Leidholm. 2012. *Climate Change Vulnerability Assessment of Rare Plants in California*. Sacramento: California Department of Fish and Wildlife.

Belvins, E., S. Jepsen, and S. Selvaggio. 2020. *Petition to list the Western Ridged Mussel (*Gonidea angulata *[Lea, 1838]) as an Endangered Species under the U.S. Endangered Species Act*. Submitted to The Honorable David Bernhardt, Secretary, U.S. Department of the Interior, Washington, DC. Portland, OR: The Xerces Society for Invertebrate Conservation. August 18, 2020. Available: https://xerces.org/sites/default/files/publications/20-023.pdf. Accessed October 20, 2022.

CDFW (California Department of Fish and Wildlife). 2015. California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. Edited by A. G. Gonzales and J. Hoshi. Prepared with assistance from Ascent Environmental, Inc., Sacramento, CA. Available: https://www.wildlife.ca.gov/SWAP/Final.

———. 2018. Area of Conservation Emphasis (ACE). Terrestrial Biodiversity Dataset. Available: https://apps.wildlife.ca.gov/ace/.

———. 2023. Regional Conservation Investment Strategies (RCIS) Program Guidelines. June 2023 Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=213325&inline

Collini, R. C., J. Carter, L. Auermuller, L. Engeman, K. Hintzen, J. Gambill, R. E. Johnson, I. Miller, C. Schafer, and H. Stiller. 2022. *Application Guide for the 2022 Sea Level Rise Technical Report*. National Oceanic and Atmospheric Administration Office for Coastal Management, Mississippi–Alabama Sea Grant Consortium (MASGP-22-028), and Florida Sea Grant (SGEB 88). Available: https://aambpublicoceanservice.blob.core.windows.net/oceanserviceprod/hazards/sealevelrise/noaa-nos-techrpt02-global-regional-SLR-scenarios-US-application-guide.pdf.

Crozier, L. G., M. M. McClure, T. Beechie, S. J. Bograd, D. A. Boughton, M. Carr, T. D. Cooney, J. B. Dunham, C. M. Greene, M. A. Haltuch, E. L. Hazen, D. M. Holzer, D. D. Huff, R. C. Johnson, C. E. Jordan, I. C. Kaplan, S. T. Lindley, N. J. Mantua, P. B. Moyle, J. M. Myers, M. W. Nelson, B. C. Spence, L. A. Weitkamp, T. H. Williams, and E. Willis-Norton. 2019. Climate Vulnerability Assessment for Pacific Salmon and Steelhead in the California Current Large Marine System. *PloS ONE* 14(7): e021771. Available: https://doi.org/10.1371/journal.pone.0217711.

Dettinger, M., B. Udall, and A. Georgakakos. 2015. Western Water and Climate Change. *Ecological Applications* 25:2069–2093.

Ducks Unlimited. 2023. Ducks in a Changing Climate. Available: https://www.ducks.org/conservation/public-policy/climate-change-and-waterfowl/ducks-in-a-changing-climate. Accessed January 2023.

Galbraith, H., D. W. DesRochers, S. Brown, and J. M. Reed. 2014. Predicting Vulnerabilities of North American Shorebirds to Climate Change. *PLoS ONE* 9(9): e108899. Available: https://doi.org/10.1371/journal.pone.0108899.

Gardali, T., N. E. Seavy, R. T. DiGaudio, and L. A. Comrack. 2012. A Climate Change Vulnerability Assessment of California's At-Risk Birds. *PLoS ONE* 7(3): e29507. Available: doi: https://doi.org/10.1371/journal.pone.0029507

Goals Project. 2015. The Baylands and Climate Change: What We Can Do. Baylands Ecosystem Habitat Goals Science Update 2015 prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. California State Coastal Conservancy, Oakland, CA.

Hilberg, L. E., and J. M. Kershner. 2019. *Bats: Northern California Climate Change Vulnerability Assessment Summary*. Version 1.0. Bainbridge Island, WA: EcoAdapt. Available: https://www.cakex.org/sites/default/files/documents/Nor%20Cal%20VA%20Summary_Bats_20Mar2020.pdf.

Hutto, S.V., K.D. Higgason, J. M. Kershner, W.A. Reynier, and D.S. Gregg. Climate Change Vulnerability Assessment for the North-Central California Coast and Ocean. Marine Sanctuaries Conservation Series ONMS-15-02. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD.

IPCC (Intergovernmental Panel on Climate Change). 2022. *Climate Change 2022: Mitigation of Climate Change*. Contribution of Working Group III to the Sixth Assessment Report of the IPCC. Cambridge, UK, and New York: Cambridge University Press. Available: doi: https://doi.org/10.1017/9781009157926

Jackson, H. M., Johnson, S. A., Morandin, L. A., Richardson, L. L., Guzman, L. M., and M'Gonigle, L. K. 2022. Climate Change Winners and Losers among North American Bumblebees. *Biology Letters* 18: 20210551. https://doi.org/10.1098/rsbl.2021.0551

Janousek, W. M., Douglas, M. R., Cannings, S., and Graves, T. A. 2023. Recent and future declines of a historically widespread pollinator linked to climate, land cover, and pesticides. Ecology. 120 (5) e2211223120. https://doi.org/10.1073/pnas.221122312

Loarie, S. R., B. E. Carter, K. Haydoe, S. McMahon, R. Mose, C. A. Knight, and D. D. Ackerly. 2008. Climate Change and the Future of California's Endemic Flora. *PLoS ONE* 3(6): e2505. Available: doi: https://doi.org/10.1371/journal.pone.0002502

Moyle, P. B., J. D. Kiernan, P. K. Crain, and R. M. Quiñones. 2013. *Projected Effects of Future Climates on Freshwater Fishes of California*. California Energy Commission. Publication Number: CEC-500-2012-028.

Ogilvie, J. E., S. R. Griffin, Z. J. Gezon, B. D. Inouye, N. Underwood, D. W. Inouye, and R. E. Irwin. 2017. Interannual Bumble Bee Abundance is Driven by Indirect Climate Effects on Floral Resource Phenology. *Ecology Letters* 12:1507–1515. Available: doi: https://doi.org/10.1111/ele.12854

O'Neill, B. C., C. Tebaldi, D. P. van Vuuren, V. Eyring, P. Friedlingstein, G. Hurtt, R. Knutti, E. Kriegler, J. Lamarque, J. Lowe, G. S. Meehl, R. Moss, K. Riahi, and B. M. Sanderson. 2016. The Scenario Model Intercomparison Project (SceanrioMIP) for CMIP6. *Geoscientific Model Development* 9:3461–3482. Available: doi: https://doi.org/10.5194/gmd-9-3461-2016

California Ocean Protection Council (OPC). 2018 (March 14). State of California Sea-Level Rise Guidance, 2018 Update. Available: https://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf.

Pierce, D. W., J. F. Kalansky, and D. R. Cayan. 2018. *Climate, Drought, and Sea Level Rise Scenarios for the Fourth California Climate Assessment.* California's Fourth Climate Change Assessment, California Energy Commission. Publication Number: CNRA-CEC-2018-006.

Quiñones, R. M., and P. B. Moyle. 2014. Climate Change Vulnerability of Freshwater Fishes in the San Francisco Bay Area. *San Francisco Estuary and Watershed Science* 12(3).

Rosencranz, J. A., K. N. Thorne, K. J. Buffington, C. T. Overton, J. Y. Takekawa, M. L. Casazza, J. McBroom, J. K. Wood, N. Nur, R. L. Zembal, G. M. MacDonald, and R. F. Ambrose. 2019. Rising Tide: Assessing Habitat Vulnerability for an Endangered Salt Marsh-Dependent Species with Sea-Level Rise. *Wetlands and Climate Change* 39:1203–1218.

Sirois-Delisle, C., and J. T. Kerr. 2018. Climate Change-Driven Range Losses among Bumble bee Species Are Poised to Accelerate. *Scientific Reports* 8:14464. Available: doi: https://doi.org/10.1038/s41598-018-32665-y

Thorne, J. H., R. M. Boynton, A. J. Holguin, J. A. E. Stewart, and J. Bjorkmand. 2016. A Climate Change Vulnerability Assessment of California's Terrestrial Vegetation. California Department of Fish and Wildlife, Sacramento, CA. Available: https://www.researchgate.net/profile/Joseph_Stewart4/publication/296639897_A_climate_change_vulnerability_assessment_of_California's_terrestrial_vegetation/links/56d72def08aee1aa5f75c693/A-climate-change-vulnerability-assessment-of-Californias-terrestrial-vegetation.pdf.

USFWS (U.S. Fish and Wildlife Service). 2007. *California Freshwater Shrimp (Syncaris pacifica) 5-Year Review: Summary and Evaluation.* Sacramento Fish and Wildlife Office, Sacramento, CA. December 2007. Available: https://ecos.fws.gov/docs/tess/species_nonpublish/1199.pdf. Accessed October 20, 2022.

———. 2010. *Salt Marsh Harvest Mouse (Reithrodontomys raviventris) 5-Year Review: Summary and Evaluation.* Sacramento Fish and Wildlife Office, Sacramento, CA. February 2010.

———. 2013. *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California.* Sacramento, CA. Pacific Southwest Region, Region 8, Sacramento, CA. August 27, 2013.

———. 2019. Natural Resource Management Plan for the San Francisco Bay National Wildlife Refuge Complex. National Wildlife Refuge System, Pacific Southwest Region, Sacramento, CA.

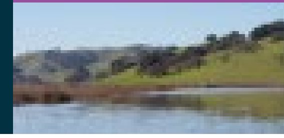
———. 2020. *Species Status Assessment for the Callippe Silverspot Butterfly (Speyeria callippe callippe) Version 1.0.* Region 10, Sacramento, CA. July 2020.

———. 2022. *Hypomesus transpacificus 2022 Species Assessment and Listing Priority Form*. Region XIII, Sacramento, CA.

Wilsey, C., B. Bateman, L. Taylor, J. X. Wu, G. LeBaron, R. Shepard, C. Koseff, S. Friedman, and R. Stone. 2019. *Survival by Degrees: 389 Bird Species on the Brink*. New York: National Audubon Society.

Wright, A. N., R. J. Hijmans, M. W. Schwartz, and H. B. Shaffer. 2013. *California Amphibian and Reptile Species of Future Concern: Conservation and Climate Change*. Final Report to the California Department of Fish and Wildlife Nongame Wildlife Program. Sacramento, CA.

Xerces Society for Invertebrate Conservation, Defenders of Wildlife, Center for Food Safety (Xerces Society). 2018. A Petition to the State of California Fish and Game Commission to List: Crotch's bumble bee (*Bombus Crotch'sii*), Franklin's bumble bee (*Bombus franklini*), Suckley cuckoo bumble bee (*Bombus suckleyi*), and western bumble bee (*Bombus occidentalis occidentalis*) as Endangered under the California Endangered Species Act.



Appendix: Natural Communities Climate Change Vulnerability Assessment

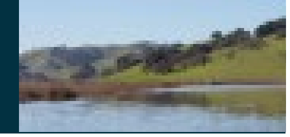


TABLE 1: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A LOW-EMISSION (RCP4.5) SCENARIO

North Bay Bayland RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Co-benefited Natural Resources	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Grassland							
Annual Grassland	• Burrowing owl • California red-legged frog • Marin western flax • Crotch's bumble bee • Bat habitat	• Callippe silverspot butterfly • Western bumble bee • Pallid bat • Townsend's big-eared bat • Tricolored blackbird • Swainson's hawk • Grasslands	California Grassland and Flower Fields	Mid-High	Moderate	Low	Moderate to Mid-High
Perennial Grassland	• Burrowing owl • Crotch's bumble bee • Marin western flax • Bat habitat	• Callippe silverspot butterfly • Western bumble bee • Pallid bat • Townsend's big-eared bat • Tricolored blackbird • Swainson's hawk • Grasslands	California Grassland and Flower Fields	Mid-High	Moderate	Low	Moderate to Mid-High
			North Coast Deciduous Scrub and Terrace Prairie	Moderate	Low	Low	Moderate

TABLE 1: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A LOW-EMISSION (RCP4.5) SCENARIO

North Bay Bayland RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Co-benefited Natural Resources	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Shrub-Dominated							
Coastal Scrub	• Crotch's bumble bee • Burrowing owl • Bat habitat	• Western bumble bee • Pallid bat • Townsend's big-eared bat	Coastal Sage Scrub	Mid-High	Low	Moderate	Mid-High
			North Coast Deciduous Scrub and Terrace Prairie	Moderate	Low	Low	Moderate
Mixed Chaparral	• Crotch's bumble bee • Marin western flax • Bat habitat	• Pallid bat • Townsend's big-eared bat	Chaparral	Moderate	Low	Low	Moderate
Tree–Deciduous							
Blue Oak Woodland	• Bat habitat	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Moderate	Moderate
Montane Hardwood	• Bat habitat	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Moderate	Moderate
Valley Oak Woodland	• Burrowing owl • California red-legged frog • Bat habitat • Working lands	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Moderate	Moderate
Tree–Evergreen							
Coastal Oak Woodland	• California red-legged frog • Bat habitat • Working lands	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Moderate	Moderate

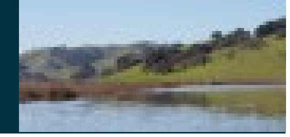


TABLE 1: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A LOW-EMISSION (RCP4.5) SCENARIO

North Bay Bayland RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Co-benefited Natural Resources	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Montane Hardwood-Conifer	• Bat habitat	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Moderate	Moderate
Eucalyptus	• Bat habitat	• Pallid bat • Townsend's big-eared bat	Non-native Forests and Woodlands	Low	Moderate	Low	Low to Moderate
Wetland							
Tidal Marsh	• California black rail • Ridgway's rail • Salt marsh harvest mouse • Tidal habitats • Waterbird and shorebird habitat	• California least tern • Saltmarsh common yellowthroat • San Pablo song sparrow • Western snowy plover • Soft bird's-beak • Diked wetlands	Salt Marsh Meadows	Moderate	High	High	High
Freshwater Marsh	• California red-legged frog • California black rail • Western pond turtle • Freshwater wetland • Waterbird and shorebird habitat	• Tricolored blackbird • Saltmarsh common yellowthroat • Rookeries	Freshwater Marsh	Moderate	High	High	High

TABLE 1: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A LOW-EMISSION (RCP4.5) SCENARIO

North Bay Bayland RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Co-benefited Natural Resources	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Montane Riparian	• California red-legged frog • Western pond turtle • Bat habitat • Riparian corridors	• California freshwater shrimp • Western ridged mussel • Pallid bat • Townsend's big-eared bat • Swainson's hawk • Rookeries	North Coastal Riparian and Montane Riparian Forest and Woodland	Moderate	Low	Low	Moderate
Valley Foothill Riparian	• California red-legged frog • Western pond turtle • Green sturgeon • Steelhead • Chinook salmon ESUs • Bat habitat • Riparian corridors	• California freshwater shrimp • Western ridged mussel • Pallid bat • Townsend's big-eared bat • Saltmarsh common yellowthroat • Swainson's hawk • Rookeries	American Southwestern Riparian Forest and Woodland	Moderate	Moderate	Moderate	Moderate to Mid-High

TABLE 1: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A LOW-EMISSION (RCP4.5) SCENARIO

North Bay Bayland RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Co-benefited Natural Resources	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Other							
Barren	• Marin western flax	None	California Foothill and Coastal Rock Outcrop Vegetation	Mid-High	Low	Moderate	Moderate to Mid-High

NOTES: ESU = Evolutionarily Significant Unit; RCIS = Regional Conservation Investment Strategy; RCP = Representative Concentration Pathway

Source: Thorne et al. 2016

TABLE 2: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A HIGH-EMISSION (RCP8.5) SCENARIO

North Bay Baylands RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Other Conservation Elements	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Grassland							
Annual Grassland	• Burrowing owl • California red-legged frog • Marin western flax • Crotch's bumble bee • Bat habitat	• Callippe silverspot butterfly • Western bumble bee • Tricolored blackbird • Swainson's hawk • Pallid bat • Townsend's big-eared bat • Grasslands	California Grassland and Flower Fields	Mid-High	Moderate	Mid-High	Mid-High
Perennial Grassland	• Burrowing owl • Crotch's bumble bee • Marin western flax • Bat habitat	• Callippe silverspot butterfly • Western bumble bee • Pallid bat • Townsend's big-eared bat • Swainson's hawk • Tricolored blackbird • Grasslands	California Grassland and Flower Fields	Mid-High	Moderate	Mid-High	Mid-High
			North Coast Deciduous Scrub and Terrace Prairie	Moderate	Moderate	Moderate	Moderate
Shrub-Dominated							
Coastal Scrub	• Crotch's bumble bee • Burrowing owl • Bat habitat	• Western bumble bee • Pallid bat • Townsend's big-eared bat	Coastal Sage Scrub	Mid-High	Moderate	Moderate	Moderate to Mid-High
			North Coast Deciduous Scrub and Terrace Prairie	Moderate	Moderate	Mid-High	Moderate to Mid-High

TABLE 2: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A HIGH-EMISSION (RCP8.5) SCENARIO

North Bay Baylands RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Other Conservation Elements	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Mixed Chaparral	• Crotch's bumble bee • Marin western flax • Bat habitat	• Pallid bat • Townsend's big-eared bat	Chaparral	Moderate	Low	Moderate	Moderate
Tree–Deciduous							
Blue Oak Woodland	• Bat habitat	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Mid-High	Moderate to Mid-High
Montane Hardwood	• Bat habitat	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Mid-High	Moderate to Mid-High
Valley Oak Woodland	• Burrowing owl • California red-legged frog • Bat habitat • Working lands	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Mid-High	Moderate to Mid-High
Tree–Evergreen							
Coastal Oak Woodland	• California red-legged frog • Bat habitat • Working lands	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Mid-High	Moderate to Mid-High
Montane Hardwood-Conifer	• Bat habitat	• Pallid bat • Townsend's big-eared bat	California Foothill and Valley Forests and Woodlands	Moderate	Moderate	Mid-High	Moderate to Mid-High
Eucalyptus	• Bat habitat	• Pallid bat • Townsend's big-eared bat	Non-native Forests and Woodlands	Low	Mid-High	Moderate	Low to Moderate

TABLE 2: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A HIGH-EMISSION (RCP8.5) SCENARIO

North Bay Baylands RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Other Conservation Elements	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Wetland							
Tidal Marsh	• California black rail • Ridgway's rail • Salt marsh harvest mouse • Tidal habitats • Waterbird and shorebird habitat	• California least tern • Saltmarsh common yellowthroat • San Pablo song sparrow • Western snowy plover • Soft bird's-beak • Diked wetlands	Salt Marsh Meadows	Moderate	High	High	High
Freshwater Marsh	• California red-legged frog • California black rail • Western pond turtle • Freshwater wetland • Waterbird and shorebird habitat	• Tricolored blackbird • Saltmarsh common yellowthroat • Rookeries	Freshwater Marsh	Moderate	High	High	High
Montane Riparian	• California red-legged frog • Western pond turtle • Bat habitat • Riparian corridors	• California freshwater shrimp • Western ridged mussel • Swainson's hawk • Pallid bat • Townsend's big-eared bat • Rookeries	North Coastal Riparian and Montane Riparian Forest and Woodland	Moderate	Moderate	Moderate	Moderate

TABLE 2: NATURAL COMMUNITIES' CLIMATE CHANGE VULNERABILITY ASSESSMENTS UNDER A HIGH-EMISSION (RCP8.5) SCENARIO

North Bay Baylands RCIS Natural Community	Focal Species and Other Conservation Elements	Non-focal Species and Other Conservation Elements	United States National Vegetation Classification (common name)	Sensitivity and Adaptability Rank	Climate Exposure and Spatial Disruption Rank Warm and Wet	Climate Exposure and Spatial Disruption Rank Hot and Dry	Combined Vulnerability Rank
Valley Foothill Riparian	• California red-legged frog • Western pond turtle • Steelhead • Chinook salmon ESUs • Bat habitat • Riparian habitat • Riparian corridors	• California freshwater shrimp • Western ridged mussel • Swainson's hawk • Saltmarsh common yellowthroat • Pallid bat • Townsend's big-eared bat • Rookeries	American Southwestern Riparian Forest and Woodland	Moderate	Mid-High	Mid-High	Moderate to Mid-High
Other							
Barren	• Marin western flax	None	California Foothill and Coastal Rock Outcrop Vegetation	Mid-High	Moderate	Mid-High	Moderate to Mid-High

NOTES: ESU = Evolutionarily Significant Unit; RCIS = Regional Conservation Investment Strategy; RCP = Representative Concentration Pathway

SOURCE: Thorne et al. 2016

APPENDIX D

RCIS Area Reports: Bay Area Greenprint and Bay Area Conservation Lands Network 2.0

BAY AREA GREENPRINT

RCIS Study Area shp

Overview

Key Facts: 163,326 acres

Counties: Multiple (more than 3)

Watersheds: Multiple (more than 3)

Priority Conservation Areas: 12 PCAs (see online report)

Priority Development Areas: 11 PDAs (see online report)

Cities: Multiple (more than 3)

Includes areas inside:	
Urban Growth Boundaries	Yes
City Limits	Yes
Urban Service Areas	Yes
Transportation Priority Areas	Yes

Protection & Threats

California Protected Areas Database

30% owned by recreation/conservation organization
4% protected by conservation easement

Policy Protections

- Biology and Natural Resources (Policy 4-P-1)
- Community Separators
- Conservation Plan (Policy CON-14, CON-28)
- Creek and Drainageway Setbacks (CON-6)
- Ecology of Creeks and Streams (Policy 1)
- Hillside Development (Policy 2)
- Hillside Project Development Standards (Ordinan...
- Natural Hazards (Policy 10-P-1 B)
- Natural Resources Policy: Stream and Riverbank ...
- Natural and Historic/Cultural Resources (Policy...
- Policy for Reduction of Soil Erosion (OSRC-11a,...
- Protection of Ridges (Policy 2.7)
- Residential Communities Design Principles (Poli...
- Residential Communities Design Principles (Poli...
- Resource Implementation Program (RS.I-67)
- Ridge and Upland Greenbelt (Program DES-4.e)
- Scenic Landscape Unit (Policy OSRC-2a)
- Single-Family Residential: Conservation
- Single-Family Residential: Conservation and Pro...
- Sonoma County Ordinance 6089
- Stream Conservation Areas (Policy BIO-4.1)
- View Protection Program: Structures and Related...

RCIS Study Area shp

Hazards

High Seismic Hazard	48,284 acres	30 % of area
High & Very High Liquefaction	11,424 acres	7 % of area
Historic Rainfall Induced Landslides	13,738 acres	8 % of area
Area Burned Historically	11,075 acres	7 % of area
Wildland-Urban Interface	123,376 acres	76 % of area
High & Very High Fire Hazard Severity	3,607 acres	2 % of area
Tsunami Inundation Area	11,289 acres	7 % of area

Community

5 % of your area is a Community of Concern, defined as areas that are low-income and minority households, or that have a burden of social disadvantages.

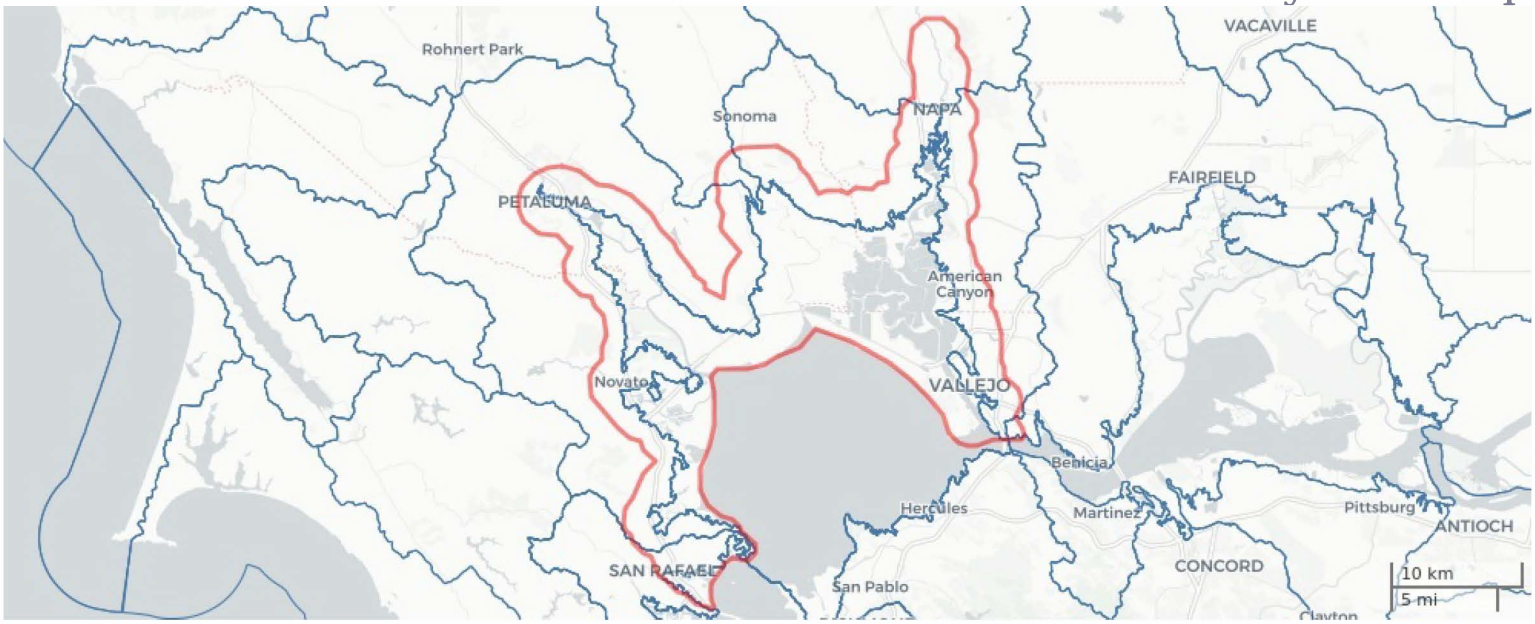
8 % of your area is a Disadvantaged Community, defined as areas burdened by pollution and vulnerable to the adverse effects of pollution.

Did you know?

New urban green spaces provide many benefits to a neighborhood such as better air quality, water quality, improved health, cooling in the summers, reduced flooding, habitat for birds and pollinators such as butterflies and bees and help absorb greenhouse gases. However, urban greening can also increase property values and may spur gentrification and displacement. Collaborating with the community on urban greening projects ensures the investment will serve both new and existing residents, and can be complemented with anti-displacement policies. **7 % of your area includes census tracts that are experiencing or are at risk of gentrification and displacement.**

BAY AREA GREENPRINT

RCIS Study Area shp



Watersheds (HUC10)

- Boundary

RCIS Study Area shp

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total	Amount Protected Bay Area
Prioritized Habitats					
Conservation Lands Network: Priority Lands	19,259	acres	12 %	1 %	1,140,202
Conservation Lands Network: Key Riparian Corridor	105	miles		4 %	735
Baylands	24,054	acres	15 %	23 %	59,729

How will climate change impact prioritized habitats?

Threat: It is assumed that habitats prioritized for conservation action will persist in those locations into the future. If climate change results in projected climate outside of the range of suitable climate for the vegetation types in that area, then the species and habitats in those prioritized lands may be more vulnerable to climate change. **In your area, 2% of prioritized habitats have vegetation types likely to be at the margins of suitable climate.**

Opportunity: Some species and vegetation in prioritized landscapes are likely to persist despite climate change. Climatic changes may not result in climatic stress to all vegetation types because the projected changes are still within the range of suitable climate for those vegetation types. Also, some areas may have a local microclimate options that make those vegetation types more resilient to potential climate stress. **In your area, 15% of prioritized habitats have vegetation types that are likely to have suitable climate in the future. And this area of interest is lower than average resilience for the Bay Area.**

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total	Amount Protected Bay Area
Habitat Connectivity					
Bay Area Critical Linkages: Regional Habitat Linkage	9,194	acres	6 %	1 %	288,613
Bay Area Critical Linkages: Large Landscape Block	579	acres	< 1 %	< 1 %	828,951
Regional Connectivity - Channelized	10,243	acres	6 %	2 %	282,170
Regional Connectivity - Intensified	13,678	acres	8 %	2 %	342,854
Regional Connectivity - Diffuse	39,558	acres	24 %	3 %	338,960

Did you know?

Your area of interest is within a quarter mile of a highway section that presents a barrier to a key habitat linkage.

There are 10 fish passage barriers in your area.

What policies protect habitat?

- Biology and Natural Resources (Policy 4-P-1)
- California Red-Legged Frog
- Conservation Plan (Policy CON-14, CON-28)
- Contra Costa Goldfields
- Creek and Drainageway Setbacks (CON-6)
- Delta Smelt
- Ecology of Creeks and Streams (Policy 1)
- Natural Resources Policy: Stream and Riverbank ...
- Natural and Historic/Cultural Resources (Policy...
- Resource Implementation Program (RS.I-67)
- And 9 more

RCIS Study Area shp

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total	Amount Protected Bay Area
Species and Habitats that might require mitigation (regulation)					
Hotspots of Species Requiring Compensatory Mitigation	Some Species	score			
Important Habitat for T&E Vertebrates	40th	percentile			
Wetlands	36,460	acres	22 %	20 %	77,584
Vernal Pools	1,581	acres	1 %	3 %	12,483

Did you know?

There are observations of rare or protected species in your area of interest.

How will climate change impact species that might require mitigation?

Opportunity: Groundwater Dependent Ecosystems can provide important refuge for rare and endangered species, especially in times of drought, when other habitat options are increasingly stressed by reduced water availability. **Your area has 4,147 acres of Groundwater Dependent Ecosystems.**

BAY AREA GREENPRINT

RCIS Study Area shp

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total	Amount Protected Bay Area
Food Production					
Prime Farmland	4,596	acres	3 %	2 %	13,856
Farmland of Statewide Importance	7,796	acres	5 %	17 %	4,125
Unique Farmland	3,480	acres	2 %	5 %	5,853
Farmland of Local Importance	30,799	acres	19 %	14 %	72,884
Suitable Grazing Land	14,897	acres	9 %	1 %	538,302
Prime Agricultural Land (CA Storie Index Rating 80 - 100)	14,369	acres	9 %	4 %	34,988
Prime Agricultural Land (Irrigated Capability Class 1 or 2)	24,937	acres	15 %	4 %	68,432

Did you know?

Crops in this area are worth as much as $172,603,509. (Note: Because of the differences between county crop types and best available spatial data, countywide Greenprint reports differ from published countywide crop reports.)

How will climate change impact food production?

Threat: A warmer and/or drier climate may require additional irrigation to maintain the same crop in the same location or sustain the same grazing intensity. In your area, **25,003 ac-ft/yr of additional irrigation** will be needed to offset climate change under the "Hotter, Drier" scenario and **6,590 ac-ft/yr of additional irrigation** will be needed under the "Warmer, Wetter" scenario.

Resilience: Agricultural practices such as cover cropping, using soil amendments, and planting hedgerows can sequester CO_2 and mitigate climate change while also providing habitat and improving crop yield, making local food production more resilient to the impacts of climate change. Decentralized stormwater capture on farms can help replenish aquifers. Additionally, planting urban farms can contribute to a resilient food system, improve community access to healthy foods, and reduce the effect of urban heat islands.

What policies protect food production?

- Measure P Agricultural Lands Preservation Initi...
- Measure T Orderly Growth Initiative
- Williamson Act 2006

BAY AREA GREENPRINT

RCIS Study Area shp

Metric	Value	Unit	% Area Contributes to Bay Area Total
Water Supply			
Groundwater Recharge	75,190	ac-ft/yr	3 %
Runoff	37,592	ac-ft/yr	1 %

Did you know?

The 75,190 acre-feet of groundwater recharge in your area is equivalent in volume to the annual water use for 385,556 households.

How will climate change impact water supply?

Threat: Climate change will likely change precipitation and evapotranspiration rates, impacting water supply by altering the quantity of water available for recharging groundwater and runoff to surface water. The Bay Area is likely to experience more extreme water years, including more frequent droughts.

Opportunity: With potential decreases in water supply and increases in water demand as the region becomes hotter and drier, and droughts become more frequent, groundwater basins will be increasingly stressed. Maintaining the infiltration potential of areas with soil and geologic conditions that are most suitable for direct aquifer recharge will become increasingly important in a changing climate. **100,715 acres in your area have have soil or geologic conditions that are more likely to allow recharge at substantially higher rates.**

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total	Amount Protected Bay Area
Water Quality					
Naturalness of Active River Areas	21,693	acres	13 %	4 %	161,102
Wetlands	36,460	acres	22 %	20 %	77,584
Natural Baylands	28,473	acres	17 %	26 %	49,597
Hydrogeologically Vulnerable Areas	100,715	acres	62 %	20 %	78,579

Did you know?

Your area contains 303d listed streams and waterbodies.

Your area has **lower than average** water quality.

Did you know?

A groundwater dependent ecosystem (GDE) contains species and ecological communities that rely on groundwater for some or all of their water requirements. If the connection between these ecosystems and groundwater is lost as a result of drought or unsustainable pumping practices, then streams, wetlands, and springs can be depleted. The Sustainable Groundwater Management Act (SGMA) includes specific requirements to identify and consider impacts to these ecosystems when making groundwater management decisions. **Your area has 4,147 acres of Groundwater Dependent Ecosystems.**

What policies protect water quality?

- BCDC Jurisdiction and Authority

RCIS Study Area shp

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total	Amount Protected Bay Area
Water Hazard Risk Reduction					
100-Year Floodplain	74,109	acres	45 %	14 %	172,655
Natural Baylands	28,473	acres	17 %	26 %	49,597
Flood Water Retention	18,043,446	cubic meters			

Did you know?

The amount of flood water retained in a single storm event in this area would fill **7,217 Olympic-size swimming pools**.

How will climate change impact water hazards?

Threat: Climate change may increase the frequency and extent of potential floods through sea level rise, increased storm surges, and increased flood frequency and intensity. **By 2050, sea level rise may impact 43% of your area. By 2100, as much as 49% could be impacted by sea level rise. 48% of your area is within the 500-year floodplain.**

Opportunity: Natural lands in inundation zones can reduce the velocity and intensity of flood waters and storm surges. Within your area, **65,396 acres within the sea-level rise inundation area have natural or semi-natural land cover. 66,290 acres within the 500-year floodplain have natural land use.**

RCIS Study Area shp

Metric	Value	Unit	% Area Contributes to Bay Area Total
Carbon Stock			
Above-Ground Live Carbon Stock	1,362,513	MT CO2 equiv	1 %
Soil Carbon Storage	14,901,021	MT CO2 equiv	6 %
Urban Forest Carbon Storage	1,960,578	MT CO2 equiv	7 %

Did you know?

Avoiding disturbance in this area would have greenhouse gas emissions reduction benefits equivalent to getting at least **802,014 passenger vehicles** driven for one year off of the road, or benefits equivalent to planting at least **97,066,207 seedlings** and letting them grow for 10 years.

Metric	Value	Unit	% Area Contributes to Bay Area Total
Air Quality			
Sequestration of PM2.5 by Vegetation	20,823,827	grams per year	2 %
Sequestration of NO2 by Vegetation	81,339,685	grams per year	2 %

BAY AREA GREENPRINT

RCIS Study Area shp

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total	Amount Protected Bay Area
Outdoor Recreation					
Potential Regional Trails	124	miles		8 %	456
Existing Regional Trails	78	miles		6 %	907
Pedestrian and Bicycle Paths and Bicycle Routes	109	miles		5 %	253
Publicly-Accessible Protected Area	43,386	acres	27 %	5 %	

Did you know?

There are **20 miles** of pedestrian and bicycle paths (Class I) in your area.

Did you know?

Your area of interest contains locations that are popular for taking photos of scenic outdoor locations.

Did you know?

There are 19 Water Trail sites in your area, and 2 more planned.

RCIS Study Area shp

Metric	Value	Unit	% of Shape	% Area Contributes to Bay Area Total
Urban Greening				
Urban Heat Island - Air Temp	23,579	acres	14 %	5 %
Air Pollution Risk - Cancer-Causing	428	acres	< 1 %	2 %
Air Pollution Risk - Particulate Matter	1,106	acres	1 %	3 %
Park Need - Very High & High	4,486	acres	3 %	4 %
Priority Landscapes for Tree Planting - Very High & High	2,787	acres	2 %	4 %

Did you know?

Green infrastructure has the potential to redirect stormwater runoff in urban areas to help recharge aquifers? Your area of interest has **31,112 acres** of developed land over an aquifer which **has high potential** for green infrastructure to help urban stormwater runoff recharge into groundwater basins. Groundwater recharge, especially in urban systems is complex, and potential pollutants from adjacent land should be evaluated very carefully before developing low impact development recharge projects. Site-scale tools such as GreenPlan-IT can be used for planning and stormwater professionals should be consulted for the design of facilities.

Did you know?

Your area of interest is providing retention (avoided loading) of **128,644 kg/year of nitrogen** in stormwater runoff through infiltration. Strategic placement of green stormwater infrastructure can provide further reduction of nitrogen loading to streams and lakes.

Did you know?

The economic value of stormwater retention by existing infrastructure can be calculated as the cost savings of replacing concrete and steel infrastructure with stormwater green infrastructure. The current value of stormwater retention in your area of interest is approximately **101,797,935** dollars.

BAY AREA GREENPRINT

RCIS Study Area shp

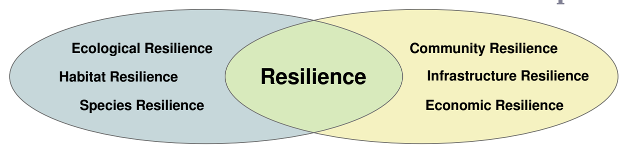
Climate Resilience

Climate change is already threatening the Bay Area's natural and human communities.

- Residents and outdoor workers are experiencing more high heat events.
- Sea level rise, flooding, and catastrophic fire threaten infrastructure and communities.
- Drought threatens the Bay Area's rich agricultural lands and water supply.
- Plants and animals are increasingly stressed by changing conditions.

Systems that are **robust** enough to **persist** and **adapt** over the long run

Resilience for Nature **Resilience for People**



Nature-based solutions can mitigate **climate change** and can make the Bay Area's communities, infrastructure, economy, plants, and animals more **resilient** to impacts from climate change.

For each section below, we present key **risks** and associated nature-based solutions that improve **resilience**.

Climate Change

Carbon Storage

Risk

Heat-trapping gasses, especially carbon dioxide, released into our atmosphere are the leading cause of climate change. In addition to energy use, vehicle miles traveled and other emission sources from the built environment, disturbance of vegetation and soils release carbon into the atmosphere.

Annual average **extreme heat days** (over 85°F) in the Bay Area may increase by **15 to 40 more days per year** by 2050, and potentially 90 more days per year by 2100.

Nature-based Solution

Healthy habitats are one of our only tools to help fight climate change by capturing and storing carbon both in the trunks and stems of vegetation and belowground in the soil.

This area stores **1,362,513 MT CO2 equiv** in vegetation, soils, and street trees. Avoiding disturbance in this area would have greenhouse gas emissions reduction benefits equivalent to getting at least **802,014 passenger vehicles** driven for one year off of the road, or benefits equivalent to planting at least **97,066,207** seedlings and letting them grow for 10 years.

Community Risk and Resilience

Sea-level Rise

Risk from Sea-level Rise

Sea level rise and storm surges may increasingly inundate coastal areas.

43% of your area is within projected **sea-level rise inundation**.

Resilience

Natural lands in inundation zones can reduce the velocity and intensity of storm surges.

Within this area, **65,396 acres within the sea-level rise inundation area** have natural or semi-natural land cover.

Floods

Flood Risk

Climate change may increase the frequency and extent of potential inland floods.

45% of your area is within the **100-year floodplain**.
48% of your area is within the **500-year floodplain**.

Resilience

Natural lands in inundation zones can reduce the velocity and intensity of flood events.

Within this area, **66,290 acres within the 500-year floodplain** have natural land use.

RCIS Study Area shp

Climate Resilience

Community Risk and Resilience, Continued

Fire Risk

Catastrophic Fire Risk

Extreme heat and dry conditions brought by climate change have exacerbated recent fires and complicated efforts to control them.

In your area of interest **3,607 acres are in high or very high fire hazard severity zones** and **11,075 acres have burned in wildfires** since 1950 and **123,376 acres are within the wildland-urban interface**.

Resilience

Greenbelts and resilience parks may provide a buffer for the wildland-urban interface, helping to reduce the destructiveness of fires. Fuels management and controlled burns can help return fire to its historic regime.

Water Supply

Climate Risk

With potential decreases in water supply and increases in water demand as the region becomes hotter and drier, and droughts become more frequent, groundwater basins will be increasingly stressed.

Water sources that extend beyond the Bay Area may also be stressed by climate change. Find out more about where your drinking water comes from in the report Where Does California's Water Come From?

Resilience

Maintaining the infiltration potential of areas with soil and geologic conditions that are most suitable for direct aquifer recharge will become increasingly important in a changing climate.

100,715 acres of your area has soil or geologic conditions that are more likely to allow **recharge at substantially higher rates**.

Proactive action that leverages ecosystem services can enhance the resilience of our water supply, such as: floodplain restoration, soil amendments, groundwater retention ponds, and groundwater injection.

Heat Islands

Climate Risk

Heat islands contribute to higher temperatures in urban areas and can lead to heat-related illness and death.

In this area, **23,579 acres are considered urban heat islands** due to high temperatures, lack of canopy cover, and impervious surfaces.

Resilience

Tree canopy and open space can provide shade and cooling.

2,787 acres in this area are priorities for **street tree planting** and **4,486 acres** are in areas designated as high or very high park need.

Air Quality

Climate Risk

In 2020, fires from within and beyond the Bay Area caused particulate matter in the Bay Area to exceed the national standard for 20 days.

Resilience

Vegetation helps filter pollutants and clean our air, supporting the health of Bay Area communities.

In your area, **20,823,827 grams per year of particulate matter** are sequestered by natural vegetation.

RCIS Study Area shp

Climate Resilience

Food Production Risk and Resilience

Food Production

Climate Risk

A warmer and/or drier climate may require additional irrigation to maintain the same crop in the same location or sustain the same grazing intensity.

In your area, **25,003 ac-ft/yr** of additional irrigation will be needed to offset climate change under the **"Hotter, Drier"** scenario and **6,590 ac-ft/yr** of additional irrigation will be needed under the "Warmer, Wetter" scenario.

Resilience

Agricultural practices such as **cover cropping, using soil amendments, and planting hedgerows** can sequester CO2 and mitigate climate change while also providing habitat and improving crop yield, making local food production more resilient to the impacts of climate change. **Decentralized stormwater capture** on farms can help replenish aquifers. Additionally, **planting urban farms** can contribute to a resilient food system, improve community access to healthy foods, and reduce the effect of urban heat islands.

BAY AREA GREENPRINT

RCIS Study Area shp

Climate Resilience

Ecological Risk and Resilience

Prioritized Habitat

Climate Risk

It is assumed that habitats prioritized for conservation action will persist in those locations into the future. If climate change results in projected climate outside of the range of suitable climate for the vegetation types in that area, then the species and habitats in those prioritized lands may be more vulnerable to climate change.

In your area, **2% of prioritized habitats** have vegetation types likely to be at the **margins of suitable climate**.

Resilience

Some species and vegetation in prioritized landscapes are likely to persist despite climate change either because projected changes are still within the range of suitable climate for those vegetation types or because local microclimate options that make those vegetation types more resilient to potential climate stress.

In this area, **15%% of prioritized habitats** have vegetation types that are likely to have **suitable climate** in the future.

This area is **lower than average** resilience for the Bay Area.

Catastrophic Fire Risk

Artificially-severe fire can limit an ecosystem's ability to recover and can cause rapid changes to habitat and the wildlife it supports.

In your area, **< 1%** of prioritized habitats are in **high and very high fire severity zones**.

Resilience

Fuels management and controlled burns can help return fire to its historic regime.

RCIS Study Area shp

Climate Resilience

Ecological Risk and Resilience

Species and Habitats That Might Require Mitigation

Climate Risk

Drought may reduce water availability causing changes to habitat and cover and exposing species to stressful conditions.

Resilience

Under drought conditions, Groundwater Dependent Ecosystems can provide important refuge for rare and endangered species, especially in times of drought, when other habitat options are increasingly stressed by reduced water availability. Your area has **4,147 acres of Groundwater Dependent Ecosystems**.

Risk from Sea-Level Rise

Sea level rise may inundate important coastal habitat.

32,174 acres of coastal habitat is vulnerable to sea-level rise, meaning they do not have enough room to migrate inland in response. Restoration and management of these habitats or adapting the built environment can enhance their resilience. These areas may still play an important role in protecting communities from the impacts of sea-level rise.

Resilience

Estuarine wetlands will need room to migrate inland as sea levels rise. Estuarine migration space is undeveloped uplands that are projected to become tidal with sea level rise. Migration space will need to be conserved, restored, and/or managed for tidal marshes and other bay habitats to move inland as sea level rises. These habitat types, and particularly marshes, provide multiple benefits to people, including enhancing shoreline resilience, improving water quality, and sequestering carbon. Up to **20,050 acres in this area could be potential future habitat for coastal marsh migration**.

Connectivity

Climate Risk

Climate change may cause habitats to be unsuitable for plants and animals. Those that cannot adapt to quickly changing conditions may have to move to find new habitat.

Resilience

Maintaining and enhancing habitat connectivity will make plants and animals better track change in suitable climate.

1,037 acres of land are within a climate migration route connecting current climate conditions to similar climates in the future.

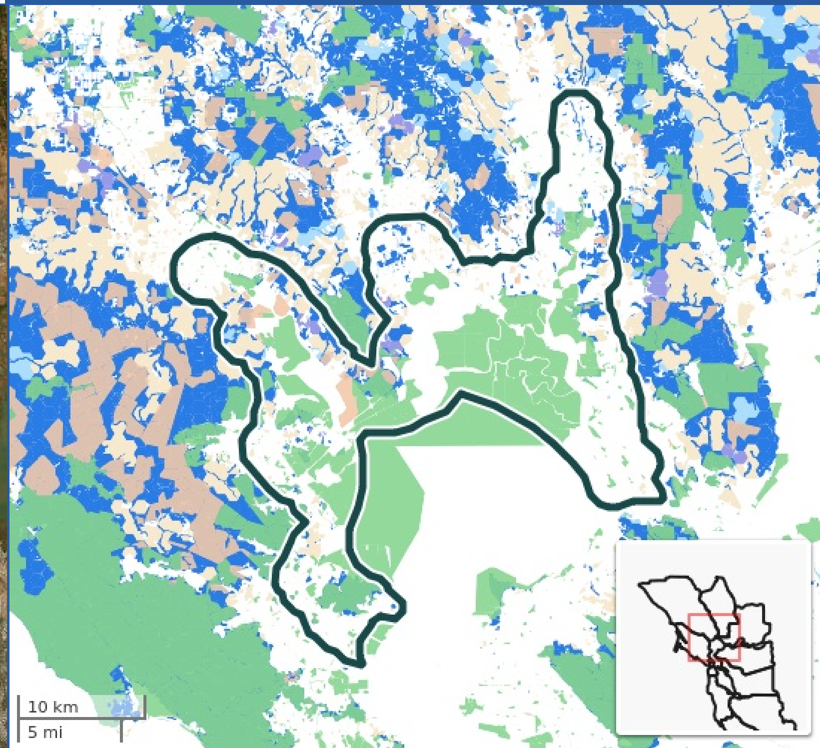
RCIS Study Area shp

About the Greenprint

The Greenprint is designed as a regional, screening-level evaluation tool. Sources for more accurate natural resource data may exist in your area of interest. Please consult with the appropriate agencies and organizations. Furthermore, site visits and biological surveys are essential for parcels of all sizes when considering conservation actions.

When reporting areas under 100 acres, some metrics, policies, and other report items may be omitted due of the resolution of the source data.

Report generated using Greenprint fishnet version 6. When comparing reports generated at different times, check data version numbers. Read more about our data versions at bayareagreenprint.org/download/

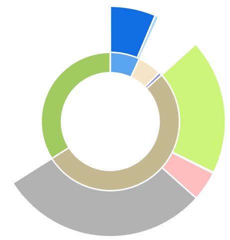


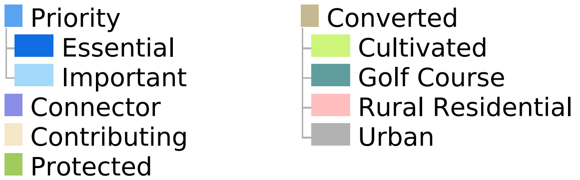
Highlights

About NBB RCIS CLN

This area is 163,326 acres in size, and spans 9 landscape units. This area consists primarily of Agriculture (General) and Urban/Developed (General).

CLN Land Classes





Top Regional Habitat Goals

Terrestrial or Aquatic

Serpentine Grasslands
Sonoma Mountain
17 acres unprotected here

240 acres protection goal — 198 acres protected

Riparian Mixed Hardwood
Napa Valley
124 acres unprotected here

250 acres protection goal — 39 acres protected

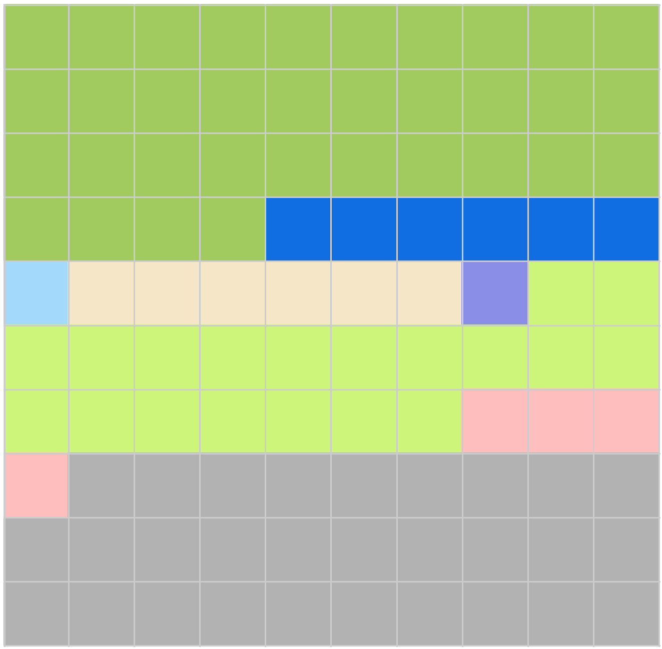
Top Stream Goals For Your Area

Stream	Aquatic Species	Miles
Napa River	river lamprey, Pacific lamprey, California roach, hardhead, Sacramento pikeminnow, Sacramento sucker, threespine stickleback, rainbow trout (anadromous), Chi...	14.3
Sonoma Creek	Pacific lamprey, Sacramento splittail, longfin smelt, threespine stickleback, rainbow trout (anadromous), Chinook salmon, tule perch, longjaw mudsucker, Paci...	7.9

Important note
Users of the Conservation Lands Network Explorer are strongly encouraged to verify the information provided in this report with site visits and biological surveys.

These are highlights of the property. See the following pages for full conservation values.

CLN Land Classes



(33.9%) Protected (52,491 acres)

(6.9%) Priority (10,709 acres)
- (6.4%) Essential (9,862 acres)
- (0.5%) Important (847 acres)

(5.7%) Contributing (8,835 acres)
(0.8%) Connector (1,206 acres)

(52.8%) Converted (81,591 acres)
- (19.0%) Cultivated (29,423 acres)
- (0.1%) Golf Course (156 acres)
- (4.2%) Rural Residential (6,477 acres)
- (29.5%) Urban (45,535 acres)

Conservation Targets

Coarse Filter Vegetation Targets			Selected Area		Regional Protection Goal			
Vegetation Type	Landscape Unit	Rarity Rank	Total Acres	Gap * Acres	Total Acres	Goal Acres	Protected Acres	Gap * Acres
Riparian Mixed Hardwood	Napa Valley	1	136	124	278	250	39	212
Riparian Mixed Hardwood	Sonoma Valley	1	49	49	128	115	3	112
Riparian Mixed Hardwood	Vaca Mountains West	1	19	19	165	148	12	136
Serpentine Grasslands	Sonoma Mountain	1	21	17	266	240	198	41
Riparian Mixed Hardwood	SF Bay and Baylands	1	16	15	22	19	2	18
Serpentine Hardwood	Marin Coast Range	1	13	12	294	264	216	48
Riparian Mixed Hardwood	Southern Mayacamas Mountains	1	10	10	73	66	3	63
Valley Oak	Coastal Grasslands	1	9	9	41	37	9	29
Riparian Mixed Hardwood	Marin Coast Range	1	6	6	277	250	160	90
Serpentine Grasslands	Marin Coast Range	1	17	6	985	887	683	204
Riparian Mixed Hardwood	Coastal Grasslands	1	7	5	120	108	13	96
Riparian Mixed Hardwood	American Canyon	1	3	3	3	3	0	3
Willow (Shrub)	Coastal Grasslands	1	3	3	236	212	93	119
Willow	Napa Valley	1	3	3	3	3	0	3
Valley Oak	American Canyon	1	2	2	53	47	29	18
Coast Live Oak	Marin Coast Range	2	2,438	394	4,675	3,506	3,113	394
Moderate Grasslands	American Canyon	2	703	382	747	560	178	382
Coast Live Oak	Sonoma Mountain	2	327	319	3,870	2,903	869	2,033
Coast Live Oak	Vaca Mountains West	2	270	254	3,928	2,946	796	2,150

* Coarse-filter conservation targets are sizable habitat patches and are defined by combining vegetation types with Landscape Units (e.g. Blue Oak in Vaca Mountains West). The area you selected is part of one or more Landscape Units. Some Landscape Units have reached their protection goals for different coarse-filter conservation targets, but most still require additional protection for each target. The 'Gap' column under 'Selected Area' quantifies the additional acres toward the target goal that would result from the protection of this area. The 'Gap' column under "Regional Protection Goal" quantifies the remaining acres needed to achieve the goal for a given coarse-filter conservation target.

Conservation Targets

Coarse Filter Vegetation Targets

Vegetation Type	Landscape Unit	Rarity Rank	Selected Area Total Acres	Selected Area Gap * Acres	Regional Protection Goal Total Acres	Regional Protection Goal Goal Acres	Regional Protection Goal Protected Acres	Regional Protection Goal Gap * Acres
Warm Grasslands	Napa Valley	2	413	183	449	337	154	183
Coast Live Oak	Coastal Grasslands	2	174	172	1,087	815	65	750
Oregon White Oak	Marin Coast Range	2	242	126	721	541	384	157
Barren	Vaca Mountains West	2	93	93	271	203	59	143
California Bay	Sonoma Mountain	2	53	53	708	531	206	325
Blue Oak	Sonoma Mountain	2	58	44	58	44	0	44
Coast Live Oak	Southern Mayacamas Mountains	2	44	39	3,226	2,420	847	1,572
Blue Oak	American Canyon	2	46	38	97	73	35	38
Interior Mixed Hardwood	Coastal Grasslands	2	36	36	1,238	929	128	801
Coast Live Oak	American Canyon	2	34	33	92	69	18	51
Barren	Sonoma Valley	2	41	33	44	33	0	33
Barren	Sonoma Mountain	2	35	29	102	76	46	30
Blue Oak	Southern Mayacamas Mountains	2	21	21	304	228	4	224
California Bay	Southern Mayacamas Mountains	2	23	21	640	480	10	470
Coastal Mixed Hardwood	Marin Coast Range	2	54	17	185	139	122	17
Moderate Grasslands	Southern Mayacamas Mountains	2	61	15	68	51	36	15
Oregon White Oak	Coastal Grasslands	2	14	14	101	76	19	57
Barren	American Canyon	2	21	12	214	161	11	150
Pickleweed - Cordgrass	American Canyon	2	24	10	59	45	30	14
Tule - Cattail	American Canyon	2	18	10	37	28	18	10
North Coast Mixed Shrub	Marin Coast Range	2	13	10	1,503	1,127	925	202
Coastal Mixed Hardwood	Southern Mayacamas Mountains	2	10	10	51	38	4	34
Coastal Mixed Hardwood	Sonoma Mountain	2	9	9	80	60	31	29
Coyote Brush	Vaca Mountains West	2	9	9	12	9	0	9
Coyote Brush	American Canyon	2	8	8	13	9	1	8
Blue Oak	Marin Coast Range	2	43	7	48	36	29	7
Blue Oak	Napa Valley	2	6	6	12	9	0	9
Coastal Mixed Hardwood	Napa Valley	2	6	5	6	5	0	5
Pickleweed - Cordgrass	Sonoma Mountain	2	4	4	8	6	1	5
Tule - Cattail	Sonoma Valley	2	6	4	6	4	0	4
Tule - Cattail	Sonoma Mountain	2	4	3	4	3	0	3
Coyote Brush	Sonoma Valley	2	2	2	3	2	0	2
Barren	Southern Mayacamas Mountains	2	2	2	109	82	10	72
Pickleweed - Cordgrass	Coastal Grasslands	2	5	1	170	127	63	64
Tule - Cattail	Napa Valley	2	1	1	2	2	0	2
Barren	Marin Coast Range	2	14	0	240	180	199	0
Coyote Brush	Marin Coast Range	2	97	0	10,488	7,866	8,125	0

* Coarse-filter conservation targets are sizable habitat patches and are defined by combining vegetation types with Landscape Units (e.g. Blue Oak in Vaca Mountains West). The area you selected is part of one or more Landscape Units. Some Landscape Units have reached their protection goals for different coarse-filter conservation targets, but most still require additional protection for each target. The 'Gap' column under 'Selected Area' quantifies the additional acres toward the target goal that would result from the protection of this area. The 'Gap' column under "Regional Protection Goal' quantifies the remaining acres needed to achieve the goal for a given coarse-filter conservation target.

Conservation Targets

Coarse Filter Vegetation Targets

Vegetation Type	Landscape Unit	Rarity Rank	Selected Area: Total Acres	Selected Area: Gap * Acres	Regional Protection Goal: Total Acres	Regional Protection Goal: Goal Acres	Regional Protection Goal: Protected Acres	Regional Protection Goal: Gap * Acres
Pickleweed - Cordgrass	Marin Coast Range	2	24	0	148	111	132	0
Redwood - Douglas-Fir	Marin Coast Range	2	2	0	3,786	2,840	3,371	0
Moderate Grasslands	Sonoma Mountain	2	133	0	140	105	122	0
Tule - Cattail	Southern Mayacamas Mountains	2	1	0	2	1	1	1
Warm Grasslands	Sonoma Mountain	3	6,398	4,539	30,626	15,313	8,522	6,791
Warm Grasslands	Coastal Grasslands	3	2,030	1,675	21,155	10,578	3,667	6,911
Warm Grasslands	Southern Mayacamas Mountains	3	671	650	12,100	6,050	2,514	3,536
Warm Grasslands	American Canyon	3	665	589	24,748	12,374	8,618	3,756
Warm Grasslands	Vaca Mountains West	3	402	362	7,353	3,677	1,478	2,199
Warm Grasslands	Sonoma Valley	3	168	152	451	226	74	152
Blue Oak	Vaca Mountains West	3	127	127	10,193	5,096	2,281	2,815
Lower Montane Mixed Chaparral	Vaca Mountains West	3	25	25	20,242	10,121	7,628	2,494
Interior Mixed Hardwood	Vaca Mountains West	3	23	23	50,521	25,261	9,545	15,716
California Bay	Marin Coast Range	3	1,244	0	17,888	8,944	12,244	0
Interior Mixed Hardwood	Marin Coast Range	3	1,119	0	32,712	16,356	19,134	0
Moderate Grasslands	Marin Coast Range	3	385	0	15,246	7,623	8,882	0
Warm Grasslands	Marin Coast Range	3	1,730	0	29,004	14,502	16,597	0

* Coarse-filter conservation targets are sizable habitat patches and are defined by combining vegetation types with Landscape Units (e.g. Blue Oak in Vaca Mountains West). The area you selected is part of one or more Landscape Units. Some Landscape Units have reached their protection goals for different coarse-filter conservation targets, but most still require additional protection for each target. The 'Gap' column under 'Selected Area' quantifies the additional acres toward the target goal that would result from the protection of this area. The 'Gap' column under "Regional Protection Goal' quantifies the remaining acres needed to achieve the goal for a given coarse-filter conservation target.

Conservation Targets

Fine Filter Species and Habitat Targets: Points			Selected Area		Regional Protection Goal			
Species / Target	Landscape Unit	Rarity Rank	Total	Gap *	Total	Goal	Protected	Gap *
Blennosperma bakeri	Sonoma Valley	1	2	2	8	7	5	3
Pond	American Canyon	2	22	18	126	94	33	62
Vernal Pool	Napa Valley	2	2	2	5	4	0	4
Vernal Pool	American Canyon	2	1	1	1	1	0	1
Strix occidentalis caurina	Marin Coast Range	2	6	0	1,420	1,065	1,275	0
Lasthenia conjugens	Vaca Mountains West	2	1	1	2	2	1	1
Astragalus tener var. tener	American Canyon	2	2	1	2	2	1	1
Fritillaria liliacea	Marin Coast Range	2	1	0	11	8	8	1
Pond	SF Bay and Baylands	3	142	81	435	218	94	124
Pond	Southern Mayacamas Mountains	3	78	76	586	292	41	252
Pond	Sonoma Valley	3	40	40	101	50	7	44
Pond	Sonoma Mountains	3	42	35	285	142	46	97
Pond	Napa Valley	3	32	31	223	112	7	105
Pond	Marin Coast Range	3	30	26	418	209	180	29
Pond	Coastal Grasslands	3	17	10	641	320	114	207
Pond	Vaca Mountains West	3	8	7	504	252	65	187
Lathyrus jepsonii var. jepsonii	Napa Valley	3	1	1	1	1	0	1
Juglans hindsii	Napa Valley	3	1	1	1	1	0	1
Hemizonia congesta ssp. congesta	Marin Coast Range	3	2	1	4	3	2	1
Downingia pusilla	American Canyon	3	1	1	1	1	0	1
Lilaeopsis masonii	Napa Valley	3	1	0	1	1	1	0
Polygonum marinense	Marin Coast Range	3	1	0	1	1	1	0

* Fine-filter conservation targets are individual species or small habitats that might not be captured by the vegetation-based coarse-filter conservation targets. The area you selected is part of one or more Landscape Units. Some Landscape Units have reached their protection goals for different fine-filter conservation targets, but most still require additional protection for each target. The 'Gap' column under 'Selected Area' quantifies the additional acres toward the target goal that would result from the protection of this area. The 'Gap' column under "Regional Habitat Goal' quantifies the remaining acres needed to achieve the goal for a given fine-filter conservation target.

Conservation Targets

Fine Filter Species and Habitat Targets: Areas			Selected Area		Regional Protection Goal			
Species / Target	Landscape Unit	Rarity Rank	Total Acres	Gap * Acres	Total Acres	Goal Acres	Protected Acres	Gap * Acres
Vernal Pool	SF Bay and Baylands	2	1,025	108	84	1,490	1,161	329
Vernal Pool	Sonoma Valley	2	94	68	8	70	3	68
Vernal Pool	Napa Valley	2	42	31	3	31	0	31
Vernal Pool	American Canyon	2	33	0	5	25	29	0
Vernal Pool	Southern Mayacamas Mountains	2	50	0	14	44	47	0
Vernal Pool	Coastal Grasslands	2	9	0	26	356	77	279

* Fine-filter conservation targets are individual species or small habitats that might not be captured by the vegetation-based coarse-filter conservation targets. The area you selected is part of one or more Landscape Units. Some Landscape Units have reached their protection goals for different fine-filter conservation targets, but most still require additional protection for each target. The 'Gap' column under 'Selected Area' quantifies the additional acres toward the target goal that would result from the protection of this area. The 'Gap' column under "Regional Habitat Goal' quantifies the remaining acres needed to achieve the goal for a given fine-filter conservation target.

Conservation Targets

Stream Conservation Targets

Totals: 38 miles of Priority 1 stream targets 67 miles of Priority 2 stream targets

Stream Name and Watershed	Priority *	Length miles	Fish Species
Napa River Napa River Watershed	1	14.3	river lamprey, Pacific lamprey, California roach, hardhead, Sacramento pikeminnow, Sacramento sucker, threespine stickleback, rainbow trout (anadromous), Chinook salmon, tule perch, prickly sculpin, riffle sculpin
Sonoma Creek Sonoma Creek Watershed	1	7.9	Pacific lamprey, Sacramento splittail, longfin smelt, threespine stickleback, rainbow trout (anadromous), Chinook salmon, tule perch, longjaw mudsucker, Pacific staghorn sculpin
Sonoma Creek Sonoma Creek Watershed	1	3.9	Pacific lamprey, California roach, Sacramento pikeminnow, Sacramento sucker, threespine stickleback, rainbow trout (anadromous), Chinook salmon, tule perch, prickly sculpin, riffle sculpin
Carneros Creek Napa River Watershed	1	2.6	California roach, Sacramento sucker, rainbow trout (anadromous), prickly sculpin
Huichica Creek Sonoma Creek Watershed	1	2.3	Pacific lamprey, California roach, threespine stickleback, rainbow trout (anadromous)
Fowler Creek Sonoma Creek Watershed	1	2.2	rainbow trout (anadromous)
Milliken Creek Napa River Watershed	1	1.9	California roach, Sacramento pikeminnow, Sacramento sucker, threespine stickleback, rainbow trout (A, R), prickly sculpin, riffle sculpin, river lamprey
Napa Creek Napa River Watershed	1	1.9	California roach, Sacramento splittail, Sacramento sucker, threespine stickleback, rainbow trout (anadromous), prickly sculpin
Soda Creek Napa River Watershed	1	0.8	California roach, Sacramento sucker, threespine stickleback, rainbow trout (anadromous), prickly sculpin
Napa River Napa River Watershed	1	0	No Data Available
Petaluma River Petaluma River Watershed	2	14.8	rainbow trout (anadromous)
Napa River Napa River Watershed	2	9.8	No Data Available
Novato Creek Marin to SF Bay	2	7.9	rainbow trout (anadromous), native fishes
Tulucay Creek Napa River Watershed	2	4	California roach, Sacramento pikeminnow, Sacramento splittail, sacramento sucker, threespine stickleback, rainbow trout (anadromous), tule perch (possible), prickly sculpin
Unnamed Stream Sonoma Creek Watershed	2	3.5	Pacific lamprey, California roach, threespine stickleback, rainbow trout (anadromous)
Schell Creek Sonoma Creek Watershed	2	2.7	threespine stickleback, rainbow trout (anadromous)
Arroyo San Jose Creek Marin to SF Bay	2	2.7	California roach, Sacramento sucker, threespine stickleback, rainbow trout (anadromous), Chinook salmon, prickly sculpin
Tolay Creek Sonoma Creek Watershed	2	2.7	threespine stickleback
Miller Creek Marin to SF Bay	2	2.5	rainbow trout (anadromous), native fishes

* Priority 1 Streams: Coho salmon streams and inland steelhead streams (including adfluvial rainbow trout streams)
Priority 2 Streams: Inland native fish-bearing streams and coastal steelhead streams

Conservation Targets

Stream Conservation Targets

Stream Name and Watershed	Priority *	Length miles	Fish Species
Suscol Creek Napa River Watershed	2	2.1	California roach, Sacramento sucker, threespine stickleback, rainbow trout (anadromous), tule perch (possible), prickly sculpin
Arroyo Seco Sonoma Creek Watershed	2	2.1	rainbow trout (anadromous)
Vineyard Creek Marin to SF Bay	2	2	rainbow trout (anadromous), native fishes
Adobe Creek Petaluma River Watershed	2	1.9	rainbow trout (anadromous)
Salvador Creek Napa River Watershed	2	1.8	California roach, rainbow trout, threespine stickleback, Chinook salmon
San Antonio Creek Petaluma River Watershed	2	1.7	California roach (possible), threespine stickleback
Rodgers Creek Sonoma Creek Watershed	2	1.5	California roach, Sacramento pikeminnow, Sacramento sucker, rainbow trout (anadromous), cottid sp.
Sarco Creek Napa River Watershed	2	1.1	California roach, rainbow trout (anadromous), Sacramento sucker, threespine stickleback, prickly sculpin
Nathanson Creek Sonoma Creek Watershed	2	1	California roach
Lynch Creek Petaluma River Watershed	2	0.8	rainbow trout (anadromous)
Petaluma River Petaluma River Watershed	2	0.5	Pacific lamprey, California roach, Sacramento splittail, Sacramento blackfish, threespine stickleback, rainbow trout (anadromous), Chinook salmon, tule perch, prickly sculpin

* Priority 1 Streams: Coho salmon streams and inland steelhead streams (including adfluvial rainbow trout streams)
Priority 2 Streams: Inland native fish-bearing streams and coastal steelhead streams
More information on priority streams can be found in the CLN 2.0 final report at www.bayarealands.org

Beyond Biodiversity

A piece of land can hold value to us for many reasons, from its native biodiversity to its value for recreation, food production, or public safety.

Recreation

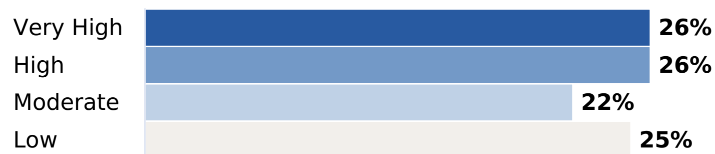
Publicly accessible open spaces within 1 mile of this area: California State Lands Commission, San Pablo Bay National Wildlife Refuge, Napa-Sonoma Marshes Wildlife Area, San Pablo Bay Wildlife Area, Petaluma Marsh Wildlife Area and 305 more.

Regional trails: Bay Area Ridge Trail, Juan Bautista de Anza National Historic Trail, Napa Valley Vine Trail, PriorityConservationArea 2016 Trails, SF Bay Trail

Visiblity

The Bay Area's iconic scenery is a key value, driving not only a sense of well-being for local residents, but also a massive tourist economy.

Visibility from major roads and populated places



Food Production

The Farmland Mapping and Monitoring Program and the Storie Soil Index together provide a broad picture of a land's value for food production.

Farmland

4,543 acres	(3%)	Prime Farmland
7,725 acres	(5%)	Farmland of Statewide Importance
30,715 acres	(19%)	Farmland of Local Importance
3,384 acres	(2%)	Unique Farmland
14,797 acres	(9%)	Grazing Land

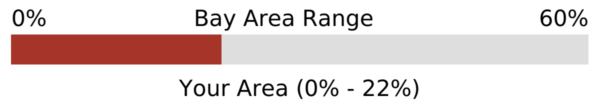
Storie Soil Index

14,274 acres	(9%)	Grade 1 - Excellent
15,373 acres	(9%)	Grade 2 - Good
19,407 acres	(12%)	Grade 3 - Fair
32,432 acres	(20%)	Grade 4 - Poor
39,536 acres	(24%)	Grade 5 - Very Poor
10,569 acres	(6%)	Grade 6 - Nonagricultural

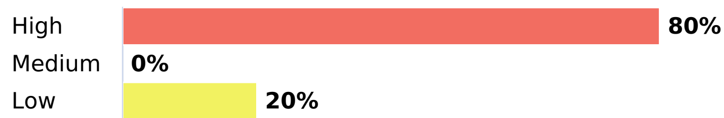
Fire Hazard Reduction

Careful land management can reduce the risk of catastrophic fires. These indices show how likely a wildfire is to happen in this area and how intense a fire might be.

Fire Probability 2001-2025



Fire Intensity



Wildland Urban Interface

The zone of transition between unoccupied land and human development, and likely including communities that are within 0.5 miles of the zone. These wildland urban interface (WUI) lands and communities adjacent to and surrounded by wildlands are at risk of wildfires.

Wildland Urban Interface: 60,152 acres (37%)

Flood Hazard Reduction

When rain is falling, some areas are more likely than others to be in harm's way. At the same time, flooding can provide rich and varied wildlife habitat. Preserving flood zones helps provide natural buffers for people and the built environment.

100-Year Flood Zone: 75,389 acres (46%)

500-Year Flood Zone: 3,799 acres (2%)

Carbon Storage

Healthy habitats store carbon and climate change makes this service is ever more critical. High-storage areas could be candidates for climate mitigation.

1,365,851 metric tons of greenhouse gas equivalent is stored in this area in the above-ground vegetation.

This property stores more carbon per acre than **15%** of natural areas in the region.

Water Supply for People

Many people rely on local watersheds for drinking water, whether from streams and reservoirs or from wells that draw on groundwater.

Municipal Drinking Water Supply Watersheds: 0 acres (0%)

Sustainable Groundwater Mgmt. Act (SGMA) Basins:

Where Is It?

Size 163,326 acres

Coordinates 38.163, -122.422

Conservation Lands Network Landscape Unit(s) SF Bay and Baylands, Marin Coast Range, American Canyon, Sonoma Mountain, Coastal Grasslands, Southern Mayacamas Mountains, Napa Valley and 2 more.

Conservation Status

Areas Essential to CLN Goals:	18,248 acres
Areas Important to CLN Goals:	847 acres
Areas Contributing to CLN Goals:	8,835 acres
Conservation Suitability:	Moderately Suitable (410)

Protection vs Conversion

Protected Lands:	52,491 acres
Converted Lands:	81,591 acres

Elevation

High points anchor viewsheds and watersheds.
Low points shelter wetlands and receive runoff.

Minimum Elevation:	-219 ft
Maximum Elevation:	1,080 ft

Slope

Steep slopes can be unbuildable, while flat lands are often under pressure from development and agriculture.

Very Steep (30%+):	7%	Steep (20-30%):	5%
Moderate (10-20%):	9%	Flat (0-10%):	79%

Nitrogen Deposition

Emission of nitrogen from vehicles and agriculture stimulates annual grass growth that crowds out native wildflowers, builds up thatch, and increases fire fuels. Grassland management (primarily grazing) is essential where deposition is high.

8 kg/ha/yr (High)

Critical Linkages

The **Bay Area Critical Linkages** project considers habitat and movement needs of more than 60 species in the San Francisco Bay Area and San Benito, Monterey, Mendocino, and Lake Counties. **Linkages** are broader regions of connectivity important to facilitate the movement of multiple species and maintain ecological processes. These linkages seek to connect **Large Landscape Blocks** areas of high ecological integrity that build upon the existing conservation network in the region.

Largest Linkage None

Large Landscape Blocks 571 acres, 0 % of area

Suitable Habitat for Species

Birds

Acorn Woodpecker, Burrowing Owl, California Quail, Hutton's Vireo, Loggerhead Shrike, Northern Harrier, Northern Spotted Owl, Pileated Woodpecker, Saltmarsh Common Yellowthroat, Warbling Vireo, White-Tailed Kite, Wrentit, Yellow Warbler

Mammals

American Badger, Black Bear, Black-Tailed Deer, Bobcat, Brush Rabbit, California Kangaroo Rat, Dusky-footed Woodrat, Long-eared Myotis, Mountain Lion (Puma), Pallid Bat, Red Tree Vole, Ringtail, Sonoma Chipmunk, Tule Elk, Western Gray Squirrel

Plants

Blue Oak, Brittle Leaf Manzanita, Buckbrush, California Foothill Pine, California Sagebrush, Coastal Redwood, Dutchman's pipe, Long-tailed Wild Ginger, Napa False Indigo, Pitcher Sage, Purple Needlegrass, Redwood Sorrel, Valley Oak, Wild Hyacinth

Reptiles & Amphibians

California Giant Salamander, California Kingsnake, California Red-Legged Frog, California Tiger Salamander, San Joaquin Coachwhip, Western Pond Turtle, Western Toad, Yellow-Legged Frog

Invertebrates

Bay Checkerspot, Myrtle's Silverspot

How Resilient Is This Area?

Climate change adds new kinds of uncertainty to conservartion planning, so it's important to look at multiple measures of resilience.

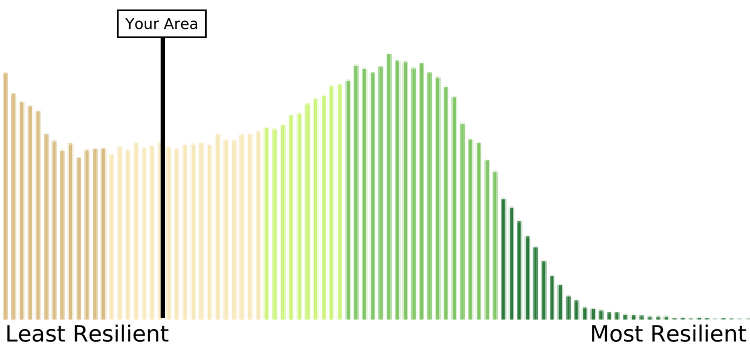
Vegetation Risk

Some vegetation types in this area are more at risk from climate change than others. This chart indicates which of the top 10 plant communities in this area are close to the edges of their comfort zone and will require additional stewardship.

We developed an estimate of how close to the edge of the climatic “comfort zone” - drought tolerance - a given stand of vegetation is at present. This information can be used to identify vegetation stands that may require extra consideration and/or effort - for example, monitoring for mortality, managing soils for maximum moisture retention and below-ground flow, or restoring hydrologic connectivity lost to road building or other diversions. Local topography can also guide interpretation - stands on drier microsites, such as upper slopes and hilltops with thin soils, or south-facing slopes, may be more vulnerable.

Landscape Resilience

The resilience of the entire landscape depends on the availability of water and the ease with which plants and animals can move and adapt.



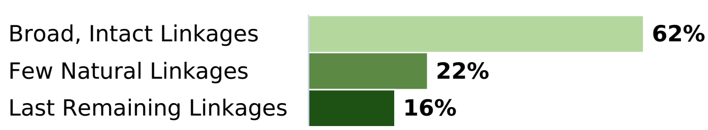
We compared your area of interest to the whole Bay Area, as shown at left. Protecting areas that are more resilient can measurably improve regional resiliency. Areas that are less resilient need careful attention if they are home to native plant communities or other important conservation values.

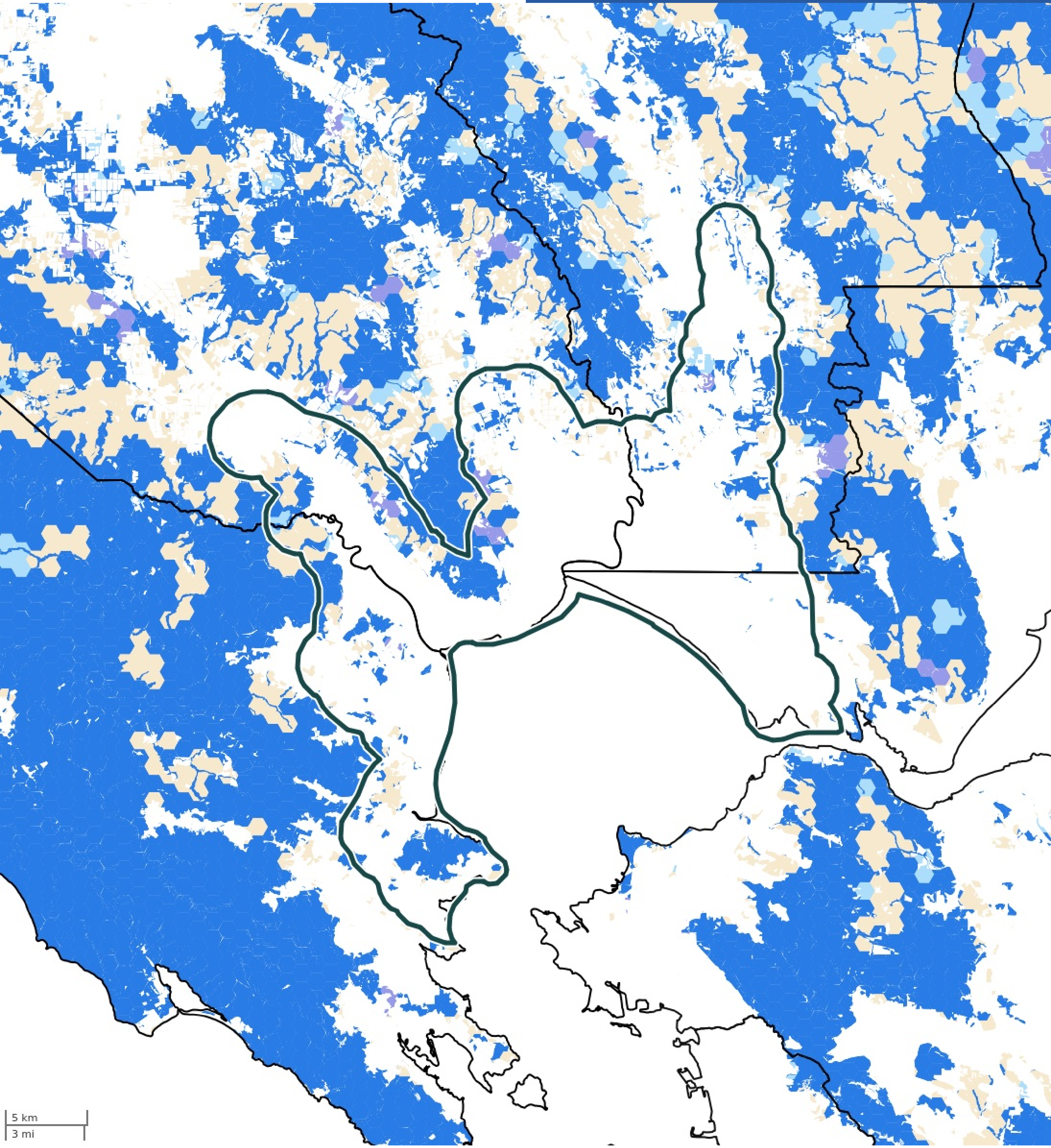
Landscape Connectivity

Landscape connectivity is a measure of the ability of plants and animals in a region to move among patches of habitat.

Acres in your area measured with OmniScape, a wall-to-wall picture of landscape connectivity for plant and animal species whose movement is inhibited by developed or agricultural land uses (data created by The Nature Conservancy).

See previous page for information about Critical Linkages in this area.





See Next Page for Legend

Map Legend

Conservation Lands Network (2018)

- Areas Essential to Conservation Goals
- Areas Important to Conservation Goals
- Areas That Ensure a Connected Network
- Contributes to Conservation Goals

County Boundaries

- County Boundary

Climate and Water

This section of the report shows current and predicts future climate and water reports for the selected area.

Recent Climate and Water Averages

Summer (Jun, Jul, Aug) Maximum	26.9 °C
Winter (Dec, Jan, Feb) Minimum	4.1 °C
Precipitation	646 mm/year
Runoff	134 mm/year
Recharge	102 mm/year
Evapotranspiration	406 mm/year
Climatic Water Deficit	793 mm/year
Cloud Cover	26% of days Jul to Sep
Fog and Low Cloud Cover	4.7 hrs/day summertime average

Scenario	Time	AET mm/yr		CWD mm/yr		Winter Minimum °C		Summer Maximum °C		Precipitation mm/yr		Recharge mm/yr		Runoff mm/yr	
Baseline	1951-1980	406	-	793	-	4.1	-	26.9	-	646	-	102	-	134	-
Recent	1989-2018	418	+12	794	+1	4.6	+0.5	26.9	+0.1	663	+17	96	-6	163	+29

All data values show change from the baseline of 1951-1980.

How do these numbers relate to on-the-ground considerations?

Actual Evapotranspiration (AET): The amount of water transferred from the soil to the atmosphere through vegetation and direct surface evaporation. Decreased AET means less vegetation productivity. Increased AET means more vegetation productivity.

Climatic Water Deficit (CWD): An integrated measure of seasonal water stress and aridity. It is the additional amount of water that could have evaporated had it been freely available. It is calculated as a cumulative sum over the dry season. Increased CWD means higher water stress for vegetation, and greater risk of fire. Greatly increased CWD (50-100+ mm/year over 30 years) can lead to death of existing vegetation through drought stress. Decreased CWD means less water stress and potentially lower fire risk.

Fog and Low Cloud Cover: Coastal fog (Fog and Low Cloud Cover or FLCC) is the signature summer weather of the SF Bay Area, and profoundly affects ecosystems from redwoods, maritime chaparral, to lichen encrusted rocks and trees. FLCC shades the land and water, reducing temperatures and increasing humidity, and in select locations with well-placed trees produces fog drip that can exceed 40 inches of water during the dry season that maintains soil moisture and streamflow (Torregrosa et al 2019).

Winter Temperature Minimum (Tmin): Average winter (December through February) daily minimum temperature. The average minimum temperature over the coldest months (December-February) is a prime determinant of frost and freeze frequency, and chilling hours for winter dormant plants.

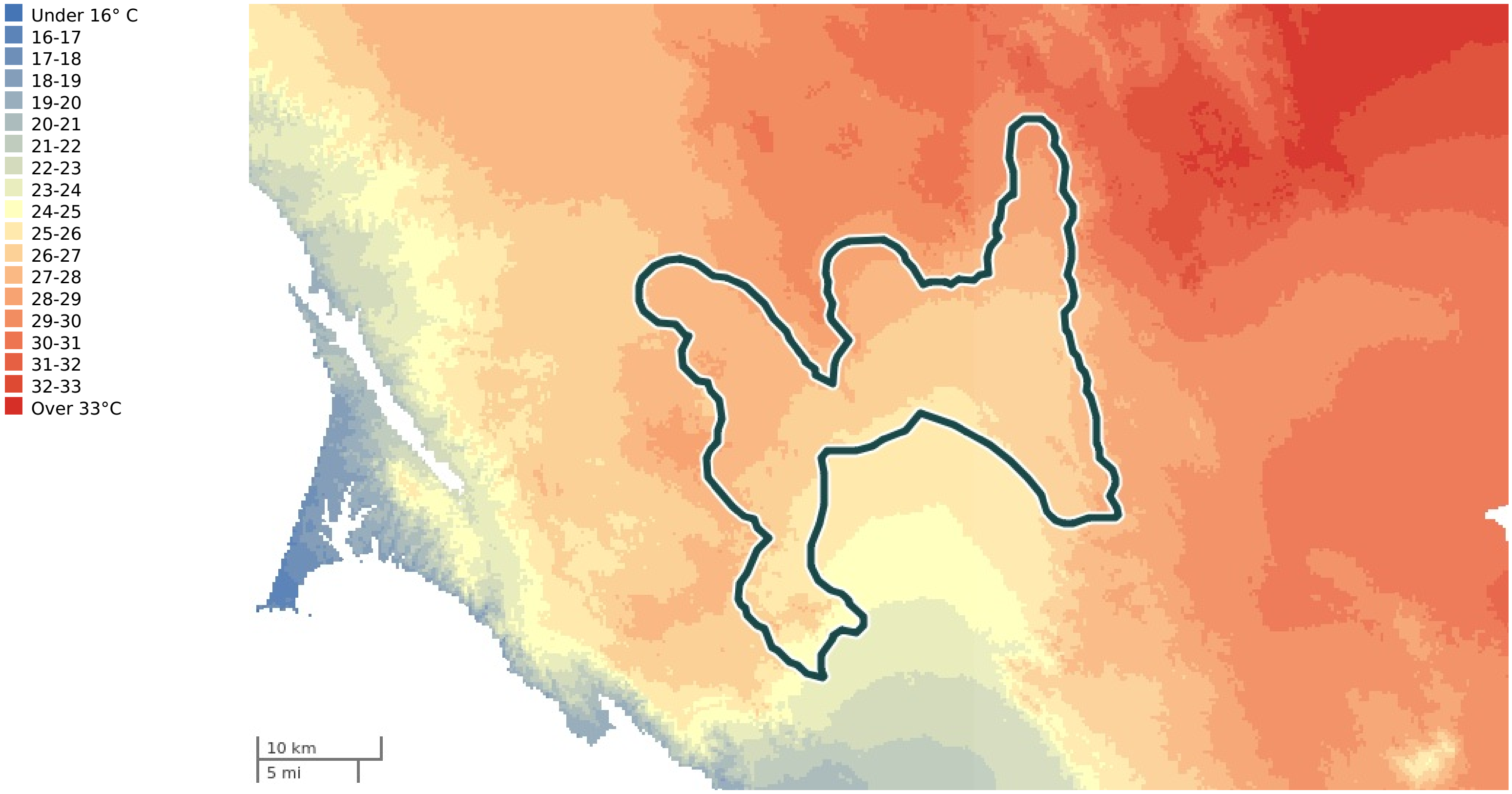
Summer Temperature Maximum (Tmax): Average summer (June-August) daily maximum temperature. The average summer maximum temperature in the three warmest months (June-August) is a prime determinant of heat wave extremes, and is an important contributor to AET and aridity.

Precipitation (PPT): The total annual precipitation in mm. Increased PPT directly increases runoff, may increase recharge if distributed through the rainy season, and can ameliorate aridity if it falls in March-May (higher AET and lower CWD). Decreased PPT directly decreases runoff and recharge, and increases aridity (lower AET and higher CWD).

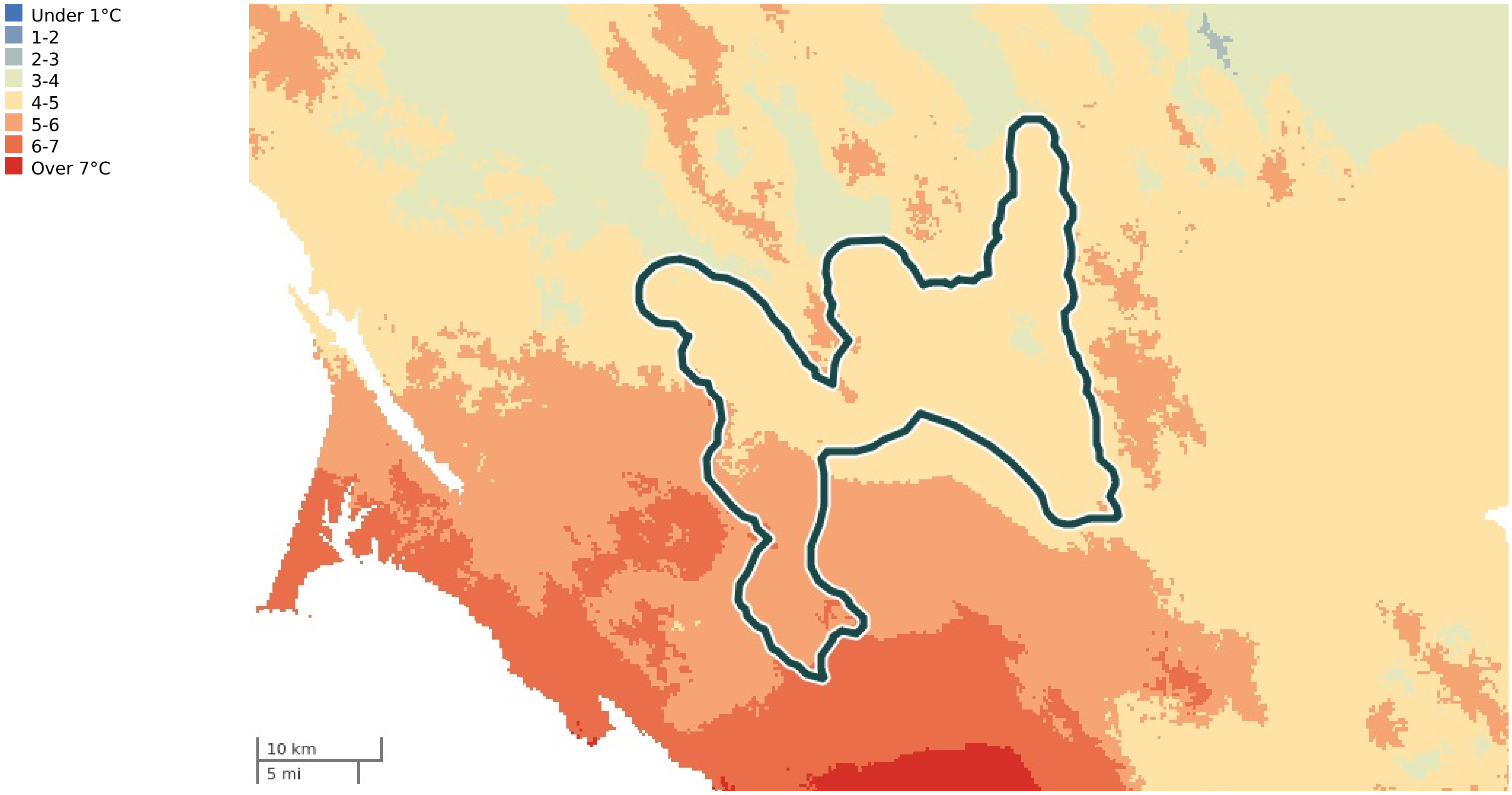
Recharge: The amount of water that drains below the rooting zone and becomes groundwater for more than a month. Recharge is affected greatly by bedrock permeability and soil depth. Because recharge provides natural subsurface storage that provides the sole source of stream baseflow in the dry season, and many Bay Area communities depend on well water, it is a precious resource. Conservation of high recharge areas is a critical climate change adaptation. Increases in recharge result in greater groundwater aquifer storage and maintenance of baseflow (stream flows during periods absent precipitation) during multi-year droughts. Decreases in recharge results in less groundwater storage and loss of baseflow, especially during multi-year droughts.

Runoff: The amount of water that feeds surface water stream flow, and generally occurs during storms when the soil is fully charged with water. Runoff occurs on shallower soils more rapidly than on deeper soils.

Maximum Temperature (deg C), Recent 1989-2018

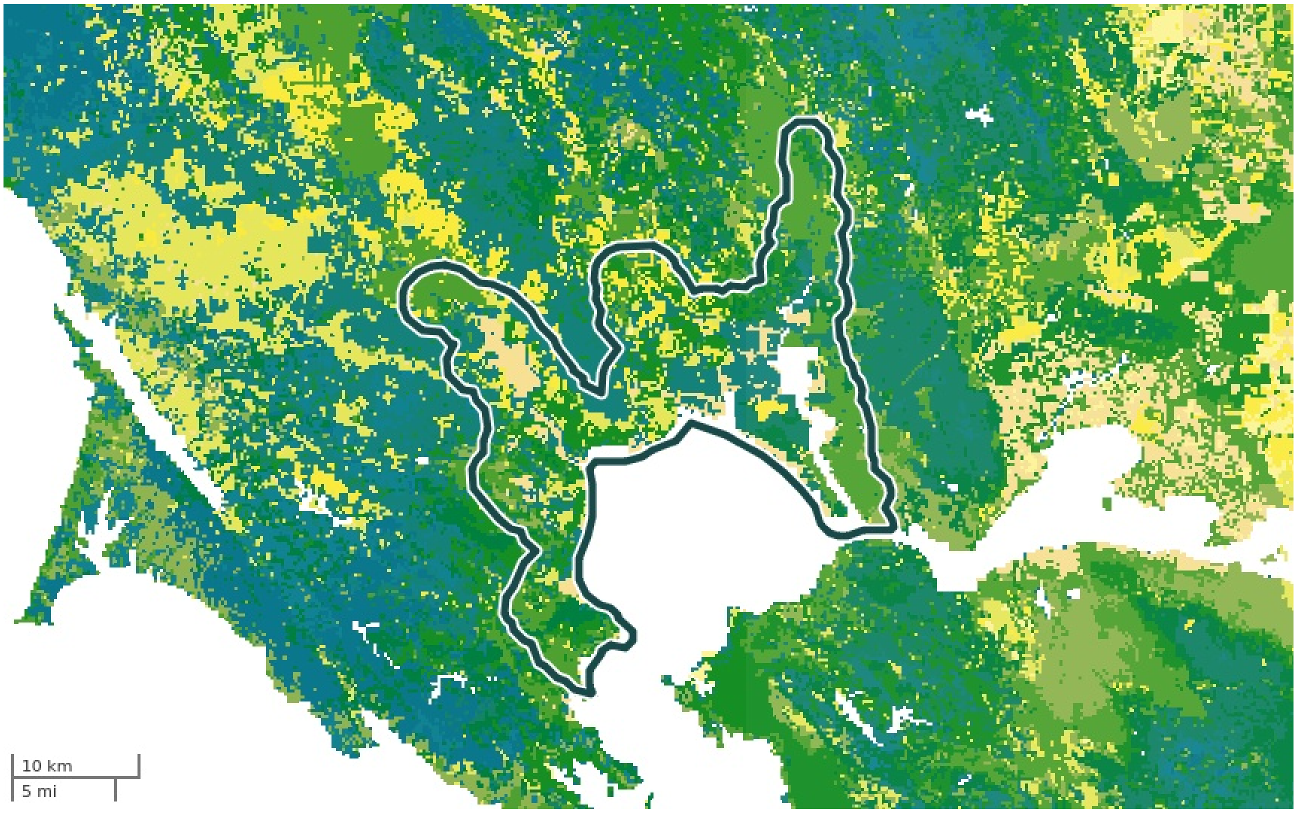


Minimum Temperature (deg C), Recent 1989-2018



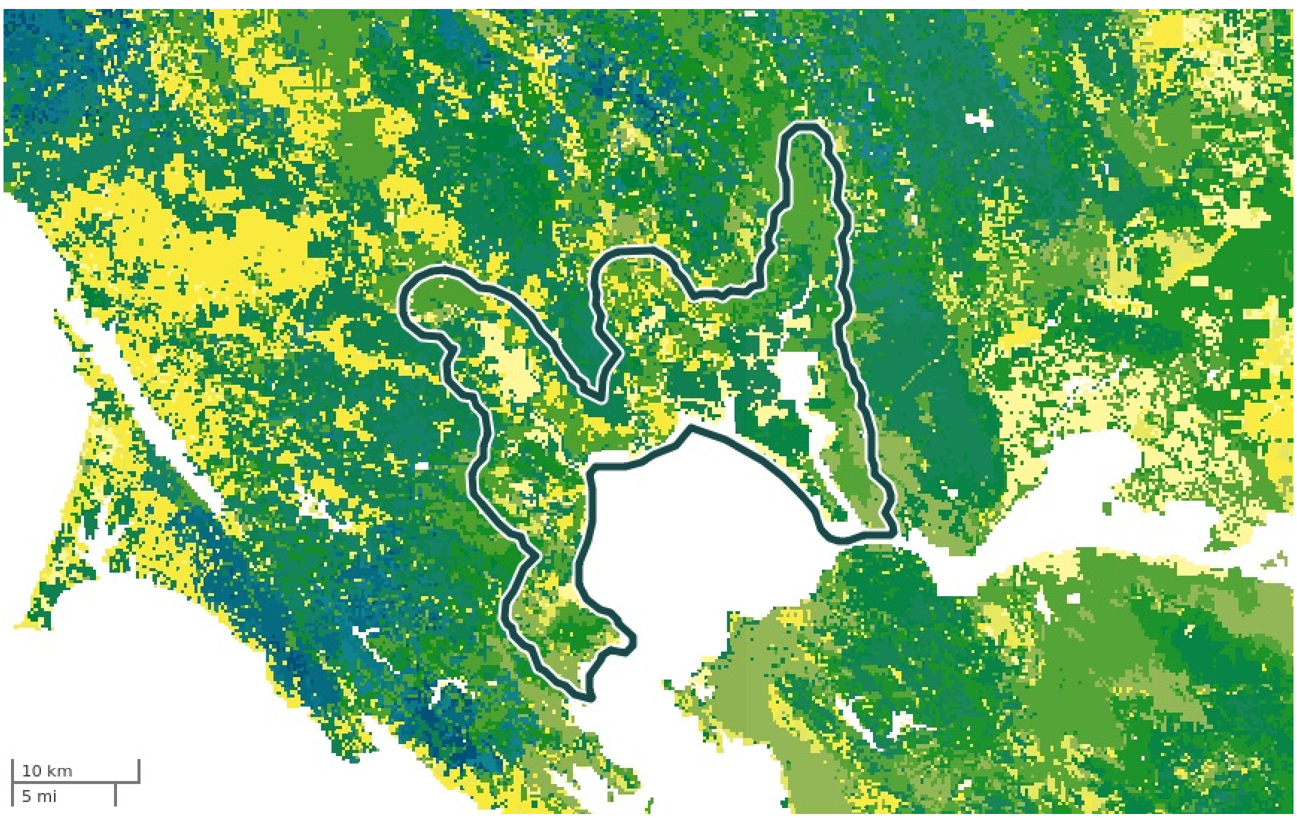
Climate Water Deficit (mm/yr), Recent 1989-2018

- Under 550 mm/year
- 550-600
- 600-650
- 650-700
- 700-750
- 750-800
- 800-850
- 850-900
- 900-950
- 950-1000
- 1000-1050
- Over 1050 mm/year



Evapotranspiration (mm/yr), Recent 1989-2018

- Under 250 mm/year
- 250-300
- 300-350
- 350-400
- 400-450
- 450-500
- 500-550
- 550-600
- 600-650
- 650-700
- 700-750
- 750-800
- 800-850
- Over 850 mm/year



Data Sources

Beyond Biodiversity

Recreation data sources
Publicly accessible open spaces: Bay Area Protected Areas Database
Regional trails: Bay Area Ridge Trail Council, MTC/ABAG (San Francisco Bay Trail), California Coastal Commission/Conservancy (California Coastal Trail)
Compiled by Bay Area Open Space Council and Greenbelt Alliance

Visibility data sources
Areas visible from major roads and populated places in order to help communities maintain their visual character: USGS 10-meter Digital Elevation Model (2018), TIGER Major Roads (2018)
Analysis by Bay Area Open Space Council

Food Production data sources
Farmland: Farmland Mapping and Monitoring Program, 2016 Edition
Storie Soil Index (based on soil characteristics that govern the land's potential utilization and productive capacity; lands with an index score of 80-100 are statutorily defined as prime agricultural land): Methods | Data: USDA - Soil Survey Geographic Database

Fire Hazard Reduction data sources
Fire Probability 2001-2025: Probability estimate of fire occurring within a 25-year period (a function of mean fire return interval) for 2001-2025. The estimate is based on natural and human factors and effects of climate change (an average of GFDL and PCM climate models and the A2 emissions scenario) as analyzed in Mann et al. 2015
Fire Intensity: CAL FIRE Fire and Resource Assessment Program (FRAP). Fire Regime and Condition Class (FRCC) GIS layer (GRID format, v03_2) of historical fire regime and condition class. Fire intensity is a function of deviation from the historical regime and condition.

Wildland Urban Interface data sources
The University of Wisconsin: Map layers that support inquiries into the effects of housing growth on the environment, such as where housing and vegetation intermingle or where housing is in the vicinity of contiguous wildland vegetation.

Flood Hazard Reduction data source: 100- and 500-year flood zones: FEMA, 3/18/2019. The "100-year flood" zone has a 1% chance of flooding each year. The "500-year flood" zone is beyond the 100-year zone and has a 0.2% chance of flooding each year.

Carbon Storage data source: Aboveground Carbon Storage: The amount of carbon stored in live vegetation such as trees, shrubs, and grasses as calculated by Gonzalez et al. 2015. Converted lands (urban, cultivated) were removed.

Water Supply for People data source: Municipal drinking water supply watersheds. Watersheds that supply water to a water utility. Source: The Nature Conservancy

Where is it?

Coordinates: Latitude and longitude in World Geodetic System (WGS84) decimal degrees.

Conservation Status: Conservation Lands Network 2.0 Land Classes

Protection vs. Conversion: Bay Area Protected Areas Database, 2017 Edition; CLN 2.0 Converted Lands Layer

Planning Watersheds: CalWater 2.2.1 (State Water Resources Control Board, California Department of Water Resources, California Department of Forestry and Fire Protection, California Teale GIS Solutions Group, California Department of Fish and Game)

Elevation: USGS ⅓ arc-second (~10-meter) Digital Elevation Model - The National Elevation Dataset
Slope: USGS ⅓ arc-second (~10-meter) Digital Elevation Model - The National Elevation Dataset. Analysis: Bay Area Open Space Council

Nitrogen Deposition: National Atmospheric Deposition Program

Critical Linkages

Linkages, Large Landscape Blocks, Suitable Habitat for Species: Critical Linkages: Bay Area and Beyond project

Data Sources

How Resilient Is This Area?

Vegetation Risk data source: Vegetation: Eveg (USFS); 1981-2010 average Climatic Water Deficit (USGS California Basin Characterization Model, 2014). An estimate of proximity to the edge of their "comfort zone" for a given stand of vegetation using the climate variable Climatic Water Deficit (CWD). The 95th percentile CWD value was determined via Cumulative Distribution Function for each natural vegetation type in the 10-county Bay Area. The 95th percentile was used as a proxy for a given stand's upper tolerance limit for CWD. In other words, stands with CWD values beyond the 95th percentile are assumed to be at very high risk of drought. Stands with CWD values approaching the 95th percentile are assumed to be at high risk.

Landscape Resilience data source: Resilient Sites, a custom TNC product. An index that indicates the presence and accessibility of microhabitat options by quantifying both the permeability of the landscape and the diversity in potential "wetness" and "heat" based on topography. Learn more about this dataset: Resilient Land page on Conservation Gateway

Connectivity data source: Omnidirectional Circuitscape "OmniScape", a custom TNC product. Regional habitat connectivity for plant and animal species whose movement may be inhibited by developed or agricultural land uses. Data were produced by the The Nature Conservancy, California using modeling methods developed by McRae et al. (2016). Learn more about this dataset: OmniScape Explorer

Climate and Water

All climate variables except fog: California Basin Characterization Model, 2019. Methods are the same as California Basin Characterization Model version 8 (2017) except with unique time horizons (Mid-century 2036-2064, End of century 2070-2099) to match the California Fourth Climate Assessment.

Fog data source: Torregrosa, A., et al. 2016. More at Climate Commons
Grids showing the hours per day of summertime fog and low cloud cover (FLCC) over a decade for North and Central Coastal California on either a monthly or annual basis.

APPENDIX E

Vegetation Crosswalk

E. Vegetation Crosswalk

The RCIS uses a detailed GIS-based map of land cover types within the RCIS area to spatially characterize the distribution of existing natural communities and habitat. The data used in the RCIS is a compilation of multiple, current vegetation layers. This consisted of fine-scale vegetation (VegCAMP) data, using the National Vegetation Classification System (NVCS), for Marin (GGNPC 2021), Sonoma (Sonoma County Agricultural Preservation and Open Space District 2017) and Napa (CDFW 2020b) counties, and CALVEG Existing Vegetation (Eveg) for Solano County (USDA 2018), plus the updated Modern Baylands data from SFEI (SFEI 2022). The VegCAMP data provide finer scale resolution while the Modern Baylands data are not as high resolution, but are more current and more reflective of recent restoration actions in the region. VegCAMP and Eveg data sources included crosswalks to CWHR types. ESA cross-walked the Modern Baylands data to CWHR to allow for a consistent classification system across the entire RCIS area. To develop the RCIS Natural Communities classification system, ESA examined and cross-walked CWHR and NCVS classifications across all of the source datasets. This section provides a crosswalk of VegCAMP data for each county to the California Wildlife Habitat Relationships (CWHR) and RCIS communities (Table E.1-1). The State Ranking and Sensitivity status is indicated for sensitive natural communities in parentheses after alliance and association names.

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Agriculture	Cropland	N/A	Agriculture	Perennial Cropland	N/A	N/A
Agriculture	Deciduous orchard	Orchard or Grove	Agriculture	Orchard or Grove	N/A	N/A
Agriculture	Irrigated Hayfield	Intensively Managed Hayfield	Agriculture	Intensively Managed Hayfield	Agriculture (General)	N/A
Agriculture	Irrigated Hayfield	Irrigated Pasture	Agriculture	Irrigated Pasture	N/A	N/A
Agriculture	Irrigated Row and Field Crops	Annual Cropland	Agriculture	N/A	N/A	N/A
Agriculture	Irrigated Row and Field Crops	Perennial Agriculture	Agriculture	N/A	N/A	N/A
Agriculture	N/A	N/A	N/A	N/A	N/A	Low Intensity Agriculture
Agriculture	Orchard - Vineyard	Vineyard	Agriculture	Orchard - Vineyard	N/A	N/A
Agriculture	Orchard - Vineyard	Vineyard Replant	Agriculture	Orchard - Vineyard	N/A	N/A

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Grassland	Annual Grassland	California Annual and Perennial Grassland Macrogroup	California Annual Herb/Grass Group	Californian Annual & Perennial Grassland Mapping Unit	Annual Grassland	N/A
Grassland	N/A	California Annual and Perennial Grassland Macrogroup	N/A	Californian Annual & Perennial Grassland Mapping Unit	Moderate Grasslands	N/A
Grassland	Annual Grassland	California Annual and Perennial Grassland Macrogroup	California Annual Herb/Grass Group	N/A	Warm Grasslands	N/A
Grassland	Perennial Grassland	N/A	N/A	*Conium maculatum - Foeniculum vulgare* Semi-natural Alliance	N/A	N/A
Grassland	Perennial Grassland	N/A	N/A	*Calamagrostis nutkaensis* Alliance (S2)[1]	N/A	
Barren	Barren	Barren & Sparsely Vegetated	N/A	Barren and Sparsely Vegetated	Barren	N/A
Barren	Barren	Dry Stock Pond	N/A	Mudflat/Dry Pond Bottom Mapping Unit	N/A	N/A
Blue Oak Woodland	Blue Oak Woodland	*Quercus douglasii* Alliance	*Quercus douglasii* Alliance	*Quercus douglasii* Alliance	Blue Oak	N/A
Blue Oak-Foothill Pine	Blue Oak-Foothill Pine	N/A	*Quercus douglasii - Quercus agrifolia* Association	N/A	N/A	N/A
Chamise-Redshank Chaparral	Chamise-Redshank Chaparral	*Adenostoma fasciculatum* Alliance	*Adenostoma fasciculatum* Alliance	*Adenostoma fasciculatum* Alliance	N/A	N/A
Closed-Cone Pine-cypress	Closed-Cone Pine-cypress	*Pinus radiata* Alliance	N/A	N/A	N/A	N/A

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Coastal Oak Woodland	Coastal Oak Woodland	*Quercus agrifolia* Alliance	*Quercus agrifolia* Alliance	*Quercus agrifolia* Alliance	Coast Live Oak	N/A
Coastal Oak Woodland	Coastal Oak Woodland	*Umbellularia californica* Alliance (S3)	N/A	*Umbellularia californica* Alliance (S3)	N/A	N/A
Coastal Oak Woodland	Coastal Oak Woodland	*Quercus* (*agrifolia, douglasii, garryana, kelloggii, lobata, wislizenii*) Alliance	*Quercus* (*agrifolia, douglasii, garryana, kelloggii, lobata, wislizenii*) Alliance	*Quercus* (*agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni*) Alliance	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	*Acacia* spp. - *Grevillea* spp. - *Leptospermum laevigatum* Semi-natural Alliance	N/A	N/A
Coastal Scrub	Coastal Scrub	Non-native Shrub	N/A	Non-native Shrub	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	Shrub (Urban Window)	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	Shrub Fragment	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	*Genista monspessulana* Semi-natural Association	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	*Cytisus scoparius* Provisional Semi-natural Association	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	*Cortaderia* (*jubata, selloana*) Semi-natural Alliance	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	*Gaultheria shallon* - *Rubus* (*ursinus*) Alliance	N/A	N/A
Coastal Scrub	Coastal Scrub	*Baccharis pilularis* Alliance	N/A	*Baccharis pilularis* Alliance	N/A	N/A

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Coastal Scrub	Coastal Scrub	N/A	N/A	*Toxicodendron diversilobum* (*Baccharis pilularis*) Association[1]	N/A	N/A
Coastal Scrub	Coastal Scrub	N/A	N/A	*Artemisia californica* - (*Salvia leucophylla*) Alliance	N/A	N/A
Douglas Fir	Douglas Fir	N/A	N/A	*Pseudotsuga menziesii* - (*Notholithocarpus densiflorus - Arbutus menziesii*) Alliance	N/A	N/A
Redwood	Redwood	N/A	N/A	*Sequoia sempervirens* Alliance (S3)	N/A	N/A
Developed/ Urban	Urban	Developed	N/A	Developed	N/A	N/A
Developed/ Urban	Urban	Urban Window	Urban or Built-up	Deciduous Hardwood (Urban Window)	N/A	N/A
Developed/ Urban	Urban	N/A	N/A	N/A	N/A	N/A
Developed/ Urban	Urban	Major Roads	N/A	N/A	N/A	N/A
Developed/ Urban	Urban	N/A	N/A	N/A	N/A	N/A
Developed/ Urban	Urban	N/A	Vacant	N/A	N/A	N/A
Eucalyptus	Eucalyptus	*Eucalyptus* (*globulus, camaldulensis*) Semi-natural Alliance	Eucalyptus	N/A	N/A	N/A

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Freshwater Marsh	Fresh Emergent Wetland	Western North American Freshwater Marsh Macrogroup	California Warm Temperate Marsh/Seep Group	N/A	N/A	N/A
Freshwater Marsh	Fresh Emergent Wetland	Western North American Freshwater Marsh Macrogroup	Temperate Pacific Tidal Salt and Brackish Meadow Group	N/A	N/A	N/A
Freshwater Marsh	Fresh Emergent Wetland	Western North American Freshwater Aquatic Vegetation Macrogroup	N/A	N/A	N/A	Seasonal Wetlands
Lacustrine	Lacustrine	N/A	Water	N/A	N/A	N/A
Lacustrine	Lacustrine	N/A	Riverine, Lacustrine, and Tidal Mudflats	N/A	Lacustrine	N/A
Managed Pond	N/A	N/A	N/A	N/A	N/A	Managed Pond
Mixed Chaparral	Mixed Chaparral	N/A	Californian Xeric Chaparral Group	*Arctostaphylos* (*canescens, manzanita, stanfordiana*) Alliance (S3)	N/A	N/A
Mixed Chaparral	Mixed Chaparral	N/A	N/A	*Arctostaphylos glandulosa* Alliance (S3)	N/A	N/A
Montane Hardwood	Montane Hardwood	N/A	N/A	*Quercus kelloggii* Alliance	N/A	N/A
Montane Hardwood	Montane Hardwood	N/A	N/A	*Aesculus californica* Alliance (S3)	N/A	N/A
Montane Hardwood	Montane Hardwood	N/A	California Broadleaf Forest and Woodland Group	*Arbutus menziesii* Alliance	N/A	N/A
Montane Hardwood	Montane Hardwood	*Quercus garryana* Alliance (S3)	N/A	*Quercus garryana* Alliance (S3)	N/A	N/A

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Montane Riparian	Montane Riparian	Vancouverian Riparian Deciduous Forest Group	N/A	N/A	N/A	N/A
Montane Riparian	Montane Riparian	N/A	N/A	*Acer macrophyllum* Alliance (S3)	N/A	N/A
Montane Riparian	Montane Riparian	N/A	N/A	*Acer macrophyllum - Alnus rubra* Alliance	N/A	N/A
Other Marsh	N/A	N/A	N/A	N/A	N/A	Other Marsh
Riverine	N/A	N/A	N/A	Channel	N/A	N/A
Tidal Marsh	Saline Emergent Wetland	North American Pacific Coastal Salt Marsh Macrogroup	Temperate Pacific Tidal Salt and Brackish Meadow Group	*Sarcocornia pacifica* (*Salicornia depressa*) Alliance (S3)	N/A	Tidal Marsh
Tidal Marsh	Saline Emergent Wetland	North American Pacific Coastal Salt Marsh Macrogroup	N/A	*Grindelia stricta* Provisional Association (S2S3/Y)	N/A	Tidal Marsh
Tidal Marsh	Saline Emergent Wetland	North American Pacific Coastal Salt Marsh Macrogroup	N/A	*Distichlis spicata* Alliance	N/A	Tidal Marsh
Tidal Marsh	Saline Emergent Wetland	North American Pacific Coastal Salt Marsh Macrogroup	N/A	*Bolboschoenus maritimus* Alliance (S3)	N/A	Tidal Marsh
Tidal Marsh	Saline Emergent Wetland	North American Pacific Coastal Salt Marsh Macrogroup	N/A	N/A	Saline Emergent Wetland	Tidal Marsh
Tidal Marsh	Saline Emergent Wetland	North American Pacific Coastal Salt Marsh Macrogroup	N/A	N/A	N/A	Tidal Marsh
Tidal Marsh	Saline Emergent Wetland	North American Pacific Coastal Salt Marsh Macrogroup	N/A	*Spartina foliosa* Association (S3/Y)	N/A	Tidal Marsh

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Tidal Marsh	Saline Emergent Wetland	Tidal Panne	N/A	N/A	N/A	Tidal Marsh
Salt Pond	N/A	N/A	N/A	N/A	N/A	Salt Pond
Shallow Subtidal Embayment	N/A	N/A	N/A	N/A	N/A	Shallow Subtidal Embayment Without Submerged Aquatic Vegetation
Tidal Channel	N/A	N/A	N/A	N/A	N/A	Tidal Channel
Tidal Flat	N/A	N/A	N/A	N/A	N/A	Tidal Flat
Not Determined	N/A	N/A	Unknown	N/A	N/A	N/A
Not Determined	N/A	Forest Sliver	N/A	Forest Fragment	N/A	N/A
Not Determined	N/A	N/A	N/A	Non-native Forest	N/A	N/A
Not Determined	N/A	N/A	N/A	Non-native Herbaceous	N/A	N/A
Valley Foothill Riparian	Valley Foothill Riparian	*Populus fremontii* Association (Y)	N/A	N/A	N/A	N/A
Valley Foothill Riparian	Valley Foothill Riparian	N/A	Southwestern North American Riparian Evergreen and Deciduous Woodland Group	*Salix gooddingii - Salix laevigata* Alliance (S3)	N/A	N/A
Valley Foothill Riparian	Valley Foothill Riparian	N/A	Southwestern North American Riparian/ Wash Group	*Salix lasiolepis* Alliance	N/A	N/A
Valley Foothill Riparian	Valley Foothill Riparian	*Rubus armeniacus* Alliance	N/A	*Rubus armeniacus* Semi-natural Association	N/A	N/A
Valley Oak Woodland	Valley Oak Woodland	*Quercus lobata* Alliance (S3)	*Quercus lobata* Alliance (S3)	*Quercus lobata* Alliance (S3)	Valley Oak	N/A
Valley Oak Woodland	Valley Oak Woodland	N/A	*Quercus lobata* Riparian Alliance (S3)	N/A	N/A	N/A

RCIS Natural Community	CWHR	Sonoma County	Napa County	Marin County	Solano County	SFEI Modern Baylands
Wastewater Pond	N/A	N/A	N/A	N/A	N/A	Wastewater Pond
Water	N/A	Water	Water	Water	Water (General)	
Wet Meadow	Wet Meadow	N/A	Vancouverian Coastal/Tidal Marsh and Meadow Group	N/A	N/A	N/A

Notes:
1. The polygons for this community type were replaced by the SFEI Modern Baylands layer.

APPENDIX F

Water Districts in the RCIS Area

F. Water Districts in the RCIS Area

F.1 Marin Municipal Water District

Marin Municipal Water District (MMWD) manages 22,000 acres of watershed land on Mount Tamalpais and in west Marin and provides water to 191,000 people (MMWD 2022). MMWD procures water from seven local reservoirs - Lagunitas, Phoenix, Alpine, Bon Tempe, Kent, Nicasio and Soulajule – as well as purchases Russian River water from Sonoma County Water Agency. The reservoirs and the Russian River are outside of the RCIS area.

F.2 North Marin Water District

North Marin Water District (NMWD) supplies water to approximately 64,000 people in Novato and West Marin (NMWD 2022). Twenty percent of the water NMWD supplies to Novato comes from Stafford Lake reservoir, and 80% is purchased from Sonoma County Water Agency, the source of which is a groundwater aquifer adjacent to the Russian River. Water for West Marin is supplied from groundwater adjacent to Lagunitas Creek. Stafford Lake, Lagunitas Creek and the Russian River are outside of the RCIS area.

F.3 Sonoma Water

Sonoma Water supplies water to nine cities and special districts that in turn deliver drinking water to more than 600,000 residents in portions of Sonoma and Marin counties (Sonoma Water 2022). SCWA manages and maintains a water transmission system that provides water from Lake Mendocino and Lake Sonoma (which are outside of the RCIS area) via the Russian River. These water supply sources are outside of the RCIS area.

F.4 City of Napa Water Division

The City of Napa Water Division serves approximately 87,000 people in the City of Napa and adjacent areas. Lake Hennessey is the primary local water source for the City of Napa water system (City of Napa Water Division 2022). Milliken Reservoir is a seasonal source of water used during the high-demand summer and early fall period. Raw water from Milliken Reservoir is released into Milliken Creek where a portion of which is diverted into an aboveground water line that runs to the Milliken Water Treatment Plant. Treated water is delivered to the distribution system via the Milliken Transmission Line. Neither Lake Hennessey nor Milliken Reservoir is within the RCIS area. The third water source for City of Napa is contracted imported surface water from the State Water Project. The North Bay Aqueduct transports water from the Sacramento-San Joaquin Delta to Cordelia Forebay, from which the Cordelia pumping plant sends the water through underground pipelines to Napa County.

F.5 Solano County Water Agency

Solano County Water Agency (SCWA) is a wholesale water supply agency providing untreated water to cities and agricultural districts in Solano County from the Federal Solano Project and the North Bay Aqueduct of the State Water Project (SCWA 2022). Within the RCIS area, SCWA includes the entire County of Solano. For flood control, SCWA is responsible for operations and maintenance of the Ulatis Flood Control Project and the Green Valley

Flood Control Project, which are outside of the RCIS area. However, SCWA has authority to deal with all flood control matters within the boundaries of SCWA. www.scwa2.com

F.6 City of Vallejo Water Department

The Vallejo Water Department provides water service to 121, 000 people through more than 38,000 service connections, serving customers within city limits and unincorporated areas adjacent to the City, as well as some customers in American Canyon (Vallejo Water Department 2022). The City of Vallejo provides source water from Lake Berryessa transported to the City's water facilities via the Putah South Canal; from the State Water Project, which travels from Lake Oroville, through the Sacramento River to the State's North Bay Aqueduct pumping facilities; and two interconnected lakes, Lakes Frey and Madigan, owned by the City. These water supply sources and canals are outside of the RCIS area.

APPENDIX G

Existing Plans and Studies

G. Existing Plans and Studies

G.1 Consistency with NCCPs, HCPs, Recovery Plans, and RCAs

This section is provided for compliance with Section 4.3.4.5 of the RCIS Program Guidelines (CDFW 2023a). There is no CDFW-approved Regional Conservation Assessment (RCA) that covers the North Bay.

G.1.1 Consistency with NCCPs and HCPs

As noted in Chapter 2, Regional Conditions, there are two overlapping Habitat Conservation Plans – the Draft Solano County Multi-Species Habitat Conservation Plan (HCP) and the Pacific Gas and Electric Company Bay Area Operations & Maintenance HCP Plan. Neither document is a Natural Community Conservation Plan (NCCP). A general summary of consistencies and inconsistencies is provided in Chapter 2. **Tables G.1-1 and G.1-2** provide specific objectives from the draft Solano County HCP and how they are consistent or inconsistent with the North Bay Baylands RCIS (SCWA 2012). The draft Solano County HCP only overlaps with a small portion of the North Bay Baylands RCIS area, which is in Solano County, generally west of Interstate-80.

The PG&E HCP covers the 9-county Bay Area. It is organized differently than the draft Solano County Multispecies HCP with high level goals and objectives for all covered species and habitats and mitigation targets by species. Overall goals and objectives are:

- *Goal 1: Maintain habitat quality for covered species in the Plan Area by restoring disturbed areas.*
    - *Objective 1.1. Re-contour and reseed areas of temporary habitat disturbance that are greater than 0.1 acre with a commercial native grassland seed mix, or a mix otherwise appropriate for the site being restored within 1 year and prior to the onset of the next rainy season.*
- *Goal 2: Contribute to the network of permanently protected and managed lands in the study area that support populations of covered species.*
    - *Objective 2.1. Increase the amount of lands protected or managed for covered species adjacent to existing protected areas (e.g., preserves, mitigation banks, and protected watersheds) or within areas identified as having high priority for conservation through mitigation purchases over the permit term…*
- *Goal 3: Pursue conservation actions that result in clear and direct species benefits (e.g., restoration and recovery projects).*
    - *Objective 3.1. Contribute to tidal marsh restoration via in-kind services or monetary contributions to organizations whose missions are to conduct conservation work.*
    - *Objective 3.2. Contribute to habitat enhancement and restoration for covered species via in-kind services or monetary contributions.*

These goals and objectives are consistent with the North Bay Baylands RCIS. Both documents organize actions around protecting, enhancing, and restoring habitat. The PG&E HCP provides specific mitigation targets for individual species anticipated to be impacted by operations and maintenance projects throughout the 9-county covered area. Consistent with the goals and objectives, these mitigation targets aim to preserve, restore, and enhance habitats.

TABLE G.1-1: DRAFT SOLANO COUNTY MULTISPECIES HABITAT CONSERVATION PLAN CONSISTENCY REVIEW FOR FOCAL SPECIES

Species	Relevant HCP Strategies	RCIS Consistency Review
Burrowing owl (specific strategy in draft HCP)	• BO 1.1, BO 1.2, BO 1.3: Preserve/manage agricultural lands, annual grasslands, foraging habitat, and nesting opportunities • BO 2.1: Preserve/manage one active burrowing owl nest for each known burrowing owl nest affected by Covered Activities • BO 2.2: Install, monitor, and maintain at least 70 burrow complexes within the 140 ac of unplanted grassland • BO 2.3, 2.4, 2.5: Provide more suitable burrows • BO 2.3: Expand ground squirrel populations in grassland reserve	The RCIS burrowing owl conservation strategy includes protection of known occurrences and habitat as well as enhancing and restoring habitat. Actions are provided to expand ground squirrel populations and install and improve burrows. The RCIS additionally includes actions for vegetation management and reduction of insecticides. These strategies are consistent with the draft HCP.
California red-legged frog (Specific strategy in draft HCP)	• RLF 1.1 Preserve/manage upland, riparian, and aquatic habitats • RLF 1.2 Preserve existing and create new breeding habitat • RLF 1.3 Promote native grasses and grazing regimes that support a mix of vegetation heights • RLF 1.4 Maintain habitat connectivity between conservation landscape blocks • RLF 1.5 Prohibit activities that increase habitat for predators	The RCIS California red-legged frog conservation strategy includes protecting suitable and potential suitable aquatic and upland habitats; enhancing and restoring occupied, suitable, critical, habitat; creating new habitat; and reducing disease-related mortality. These strategies are consistent with the draft HCP. Additional RCIS actions include relocation of California red-legged frog egg masses when appropriate, promotion of California red-legged frog habitat and population through implementation of fire management guidelines, and removal of non-native species. These actions are compatible with the draft HCP.
Green Sturgeon (Riparian, stream, and freshwater marsh strategy in the draft HCP)	• RSM 1.1 Preserve/restore/enhance riparian habitat • RSM 1.4 Maintain peak flows from storm water discharge and natural hydrological processes • RSM 1.5 Maintain and increase water quality for Covered Species inhabiting receiving waters within and downstream of Plan Area • CM 2.4 Contribute to increasing food production and habitat quality for longfin smelt and green sturgeon through restoration of tidal marsh habitat and improvements to water quality discharge • CM 1.1 Increase the quality of coastal marsh habitat to remove invasive species and improve water quality.	The RCIS Green Sturgeon conservation strategy incorporates protecting existing habitat, enhancing, and restoring suitable Green Sturgeon estuarine, tidal channel, riverine, marine, and riparian habitat. RCIS regional landscape, water quality, anadromous fish, tidal communities, and hydrologic processes also support Green Sturgeon. These strategies include actions to improve water quality and tidal marsh habitats and remove passage barriers. These strategies are consistent with the draft HCP. The RCIS additionally includes specific actions to construct nearshore reefs to provide habitat heterogeneity, reduce water current speeds, trap sediment and increase diversity of marine invertebrates and prey sources. These actions are compatible with the draft HCP.

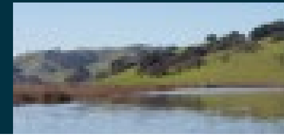


TABLE G.1-1: DRAFT SOLANO COUNTY MULTISPECIES HABITAT CONSERVATION PLAN CONSISTENCY REVIEW FOR FOCAL SPECIES

Species	Relevant HCP Strategies	RCIS Consistency Review
Chinook Salmon (fall run, winter run and spring run) Steelhead (Central Coast ESU) (Riparian, stream, and freshwater marsh strategy in the draft HCP)	• RSM 1.1 Preserve/restore/enhance riparian habitat • RSM 1.2, RSM 1.3 Develop and adopt invasive species control programs • RSM 1.4 Maintain peak flows from storm water discharge and natural hydrological processes • RSM 1.5 Maintain and increase water quality for Covered Species inhabiting receiving waters within and downstream of Plan Area • CM 1.1 Increase the quality of coastal marsh habitat to remove invasive species and improve water quality.	The RCIS steelhead conservation strategy promotes persistence of sustainable and resilient steelhead populations and aims to protect, enhance, and restore known occupied reaches and suitable steelhead spawning and rearing habitat. Similarly, the Chinook Salmon conservation strategy promotes and protects, expands, and improves the quality of sustainable Chinook Salmon juvenile rearing habitat. RCIS regional landscape, water quality, anadromous fish, tidal communities, and hydrologic processes also support Chinook Salmon and steelhead. These strategies include actions to improve water quality and tidal marsh habitats and remove passage barriers. These strategies are consistent with the draft HCP. Additional actions for the steelhead in the RCIS include improvements of riparian canopy cover, composition, and structure. This includes developing riparian buffers and installing wood/boulder structures to degraded reaches of streams to increase pool frequency and volume and increase stream channel heterogeneity. These actions are compatible with the draft HCP.
California Ridgway's rail California black rail Salt marsh harvest mouse Soft bird's beak (Coastal marsh strategy in the draft HCP)	• CM 1.1 Increase the quality of coastal marsh habitat by controlling invasive exotic plants and animals and improve water quality • CM 2.1 Preserve/manage coastal brackish marsh habitats • CM 2.2 Restore/manage shallow water aquatic habitat	The draft HCP provides a strategy for coastal marsh habitat that serves as an umbrella for California Ridgeway's rail, California black rail, salt marsh harvest mouse, and soft bird's beak. The RCIS provides a separate strategy for each wildlife species and soft bird's beak is an associated non-focal species. The RCIS includes regional landscape and tidal community strategies in addition to a tidal habitat other conservation element, which additionally identifies actions that support these species. The RCIS conservation strategies for California black rail, California Ridgeway's rail and salt marsh harvest mouse promote persist and resilient populations through the protection, enhancement, and restoration of occupied and suitable breeding and foraging habitat along with creating new habitat. Actions include focus on acquiring and protecting high marsh and ecotonal habitat, along with lands that could be restored to high marsh and ecotonal habitat. These strategies and actions are consistent and compatible with the draft HCP.

TABLE G.1-2: SOLANO COUNTY MULTISPECIES HABITAT CONSERVATION PLAN CONSISTENCY REVIEW FOR NON-FOCAL SPECIES

Species	Relevant HCP Strategies	RCIS Consistency Review
Callippe silverspot butterfly (specific strategy in the draft HCP)	• CSB 1.1 Preserve and manage suitable callippe silverspot butterfly breeding habitat. • CSB 1.2: Increase the quantity and quality of breeding habitat and adult nectar sources for callippe silverspot butterfly within the Callippe Silverspot Butterfly Conservation Area. • CSB 1.3: Reserve Management Plans shall include vegetation management strategies that promote establishment of native grasses and low residual cover of introduced annual grasses • CSB 1.4 Maintain connectivity between core breeding sites and existing subpopulations within the Callippe Silverspot Butterfly Conservation Area by preserving corridors with a minimum width of 300 ft oriented along hilltops and ridgelines.	The callippe silverspot butterfly is a non-focal species in the RCIS area associated with the conservation strategies developed for Crotch bumble bee, burrowing owl, and working lands. Actions to support callippe silverspot butterfly include acquiring and protecting lands, reducing insecticide and pesticides, implementing compatible grazing practices, reducing and removing fire loads and non-native plants, and restoring annual and perennial grasslands with native species. Callippe silverspot butterfly would benefit from the regional landscape strategy to protect and restore lands. The RCIS lacks specific measures to protect core breeding sites, nectar sources, and corridors for callippe silverspot butterfly, but the actions proposed are not in conflict with the draft HCP.
Tricolored blackbird (Riparian, stream, and freshwater marsh strategy in the draft HCP)	• RSM 2.4 Establish new nesting habitats for tricolored blackbirds in agricultural reserves • RSM 2.5 Preserve one known tricolored breeding site with a similar sized breeding population for each known breeding colony affected by development	The tricolored blackbird is a non-focal species in the RCIS area associated with the conservation strategies developed for Crotch bumble bee, burrowing owl, western pond turtle, habitat connectivity, freshwater wetlands, and working lands. Actions to support tricolored blackbird include restoring annual and perennial grasslands with native plant species, enhance and manage suitable vegetation structure, implement compatible grazing practices during highly active periods (late spring and summer), and reducing insecticide and pesticides. Tricolored blackbird would benefit from the regional landscape strategy to protect and restore lands. The RCIS lacks specific measures such as establishing new nesting habitats for tricolored blackbirds in agricultural reserves and preserving one known tricolored breeding site with a similar sized breeding population for each known breeding colony affected by development.

TABLE G.1-2: SOLANO COUNTY MULTISPECIES HABITAT CONSERVATION PLAN CONSISTENCY REVIEW FOR NON-FOCAL SPECIES

Species	Relevant HCP Strategies	RCIS Consistency Review
Swainson's hawk (specific strategy in the draft HCP)	• SH 1.1 Preserve and manage in perpetuity a minimum of 5,970 ac of agricultural foraging habitat in the Swainson's Hawk Irrigated Agriculture Potential Reserve Area • SH 1.2 Manage reserves established for Swainson's hawk mitigation within the Irrigated Agriculture Potential Reserve Area: At least 50 percent of cultivated lands in the reserve system & Five (5) percent of the Irrigated Agriculture Reserve system, measured on a system-wide basis, shall be set aside and established in permanent, naturalized herbaceous and woody/shrub cover. • SH 1.3 Preserve and manage 13,000 to 15,000 ac of Valley Floor Grassland habitat to promote Swainson's hawk foraging and nesting opportunities within Swainson's Hawk Valley Floor Grassland Potential Reserve Areas. • SH1.4: Preserve and manage 3,300 ac of grassland and oak savanna to promote Swainson's hawk foraging and nesting opportunities within the Inner Coast Range Potential Reserve Areas. • SH 2.1 Provide a minimum average density of suitable nest tree or grove of trees • SH 2.2 Preserve and manage one active Swainson's hawk nest for each known Swainson's hawk nest affected by Covered Activities	The Swainson's hawk is a non-focal species in the RCIS area associated with the conservation strategies developed for Crotch bumble bee, burrowing owl, habitat connectivity, riparian corridors, and working lands. Actions to support Swainson's hawk include acquiring and protecting lands, reducing insecticide and pesticides, implementing compatible grazing practices, reducing, and removing fire loads and non-native plants, restoring annual and perennial grasslands with native species, enhance and manage suitable vegetation structure. Swainson's hawk would benefit from the regional landscape strategy to protect and restore lands. The RCIS lacks specific measures such as preserve and manage agricultural foraging habitat, Valley Floor Grassland for nesting opportunities, a minimum average density of suitable nest tree or grove of trees, and one active Swainson's hawk nest for each known Swainson's hawk nest affected by Covered Activities, but the actions proposed are not in conflict with the draft HCP.

TABLE G.1-2: SOLANO COUNTY MULTISPECIES HABITAT CONSERVATION PLAN CONSISTENCY REVIEW FOR NON-FOCAL SPECIES

Species	Relevant HCP Strategies	RCIS Consistency Review
Delta Smelt (Riparian, stream, and freshwater marsh strategy in the draft HCP)	• CM 1.1 Increase the quality of coastal marsh habitat to remove invasive species and improve water quality. • CM 2.1 Preserve, manage, and restore 80 ac of coastal brackish marsh habitats. Restored marsh habitats shall include a matrix of mid- to high-elevation tidal marsh interspersed with tidal channels targeted to provide habitat for California black rail, California clapper rail, salt marsh harvest mouse, Delta smelt, and Mason's lilaeopsis. • CM 2.2 Plan Participants shall restore and manage 175 ac of shallow water aquatic habitat suitable for Delta smelt and Sacramento splittail in the lower Delta area of Solano County.	The Delta Smelt is a non-focal species in the RCIS area associated with the conservation strategies developed for Green Sturgeon, steelhead, Chinook Salmon, habitat connectivity, tidal wetlands, and hydrological processes. Actions to support Delta Smelt include construct nearshore reefs to provide habitat heterogeneity; reduce water current speeds; trap sediment and increase diversity of marine invertebrates and prey sources; improve riparian canopy cover, composition, structure, and large woody debris recruitment; and include riparian buffers in county and city general plans and ordinances. The RCIS includes improvement and protection of coastal marsh habitat as part of the regional strategy and tidal marsh other conservation element. The actions proposed are consistent with the draft HCP.
Longfin Smelt (Riparian, stream, and freshwater marsh strategy in the draft HCP)	• CM 2.4 Contribute to increasing food production and habitat quality for longfin smelt and green sturgeon through restoration of tidal marsh habitat (Objectives CM 2.1 and 2.2) and improvements to water quality discharge from urban and agricultural sources (Objective CM 1.1). • CM 1.1 Increase the quality of coastal marsh habitat to remove invasive species and improve water quality.	The Longfin Smelt is a non-focal species in the RCIS area associated with the conservation strategies developed for Green Sturgeon, steelhead, Chinook Salmon, habitat connectivity, tidal wetlands, shallow bay, and hydrological processes. Actions to support for Longfin Smelt include: construct nearshore reefs to provide habitat heterogeneity; reduce water current speeds; trap sediment and increase diversity of marine invertebrates and prey sources; improve riparian canopy cover, composition, structure, and large woody debris recruitment; include riparian buffers in county and city general plans and ordinances; restore and protect local stream hydrology to provide the flow regimes necessary to move fine sediments to the bay while protecting stream health; manage ground water pumping to reduce subsidence of ground surface; and acquire and/or restore key migration corridors. The RCIS includes improvement and protection of coastal marsh habitat as part of the regional strategy and tidal marsh other conservation element. The RCIS lacks specific measures such as contributing to increasing food production. The actions proposed are consistent with the draft HCP.

TABLE G.1-2: SOLANO COUNTY MULTISPECIES HABITAT CONSERVATION PLAN CONSISTENCY REVIEW FOR NON-FOCAL SPECIES

Species	Relevant HCP Strategies	RCIS Consistency Review
Sacramento Splittail (Riparian, stream, and freshwater marsh strategy in the HCP)	• RSM 1.1 Preserve/restore/enhance riparian habitat • RSM 1.2, RSM 1.3 Develop and adopt invasive species control programs • RSM 1.4 Maintain peak flows from storm water discharge and natural hydrological processes • RSM 1.5 Maintain and increase water quality for Covered Species inhabiting receiving waters within and downstream of Plan Area • CM 1.1 Increase the quality of coastal marsh habitat to remove invasive species and improve water quality.	The Sacramento Splittail is a non-focal species in the RCIS area associated with the conservation strategies developed for Green Sturgeon, steelhead, Chinook Salmon, habitat connectivity, tidal wetlands, shallow bay, and hydrological processes. Actions to support Sacramento Splittail include construct nearshore reefs to provide habitat heterogeneity; reduce water current speeds; trap sediment and increase diversity of marine invertebrates and prey sources; improve riparian canopy cover, composition, structure, and large woody debris recruitment; and include riparian buffers in county and city general plans and ordinances. The RCIS includes the riparian other conservation element and regional strategies to preserve/restore/enhance riparian habitat, improve water quality and habitat quality, and implement invasive species control programs. There are no actions specific to Sacramento Splittail, but the actions proposed are not in conflict with the draft HCP.

G.1.2 Consistency with Recovery Plans

A recovery plan is a document published by United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), or California Department of Fish and Wildlife (CDFW) that lists the status of a listed species and the actions necessary to remove the species from the endangered species list (CDFW 2023a). **Table G.1-3** provides a consistency review of Recovery Plans that overlap with the geography and species covered in the RCIS.

G.2 Other Existing Plans and Studies Summaries

Numerous plans and studies were considered in developing the goals and objectives for the RCIS. **Table G.2-1** provides a summary of the key plans and studies that were consulted in development of the RCIS, which specifically focus on the species and habitats relevant to the RCIS. These documents should be consulted for more detailed recommendations, strategies, and policies when implementing actions in the RCIS as applicable.

TABLE G.1-3: CONSISTENCY WITH RECOVERY PLANS

Document	Year	Author	Goals/Objectives	How Considered in the RCIS
Recovery Plan for the California Red-legged Frog	2002	USFWS	• Protect existing populations by reducing threats. • Restore and create habitat that will be protected and managed in perpetuity. • Survey and monitor populations and conduct research on the biology of and threats to the subspecies. • Reestablish populations of the subspecies within its historic range.	Consistent with the Recovery Plan, the RCIS aims to protect suitable and potentially suitable aquatic and upland habitats and allow expansion of suitable habitat. The RCIS also includes actions to enhance and restore occupied, suitable, and USFWS-designated critical habitat. The RCIS specifically describes reducing disease-related mortality, which, while not directly discussed in the recovery plan, is a threat to the species. The RCIS is consistent with this recovery plan.
Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California.	2013	USFWS	• Secure self-sustaining wild populations of each covered species throughout their full ecological, geographical, and genetic range. • Ameliorate or eliminate, to the extent possible, the threats that caused the species to be listed or of concern and any future threats. • Restore and conserve a healthy ecosystem function supportive of tidal marsh species.	The RCIS aims to protect, restore, and enhance tidal marsh habitat and natural transition zones, address habitat fragmentation, manage cattle grazing, and reconnect major tributaries. Examples of actions to reduce threats to tidal communities include managing flood control infrastructures, modifying/ removing dikes and/or levees, controlling predator access, managing invasive species, and managing salinity levels. Not all these actions are described in the recovery plan, but they are consistent with the plan's objectives to reduce threats and restore ecosystem function. The RCIS includes species strategies for focal species aimed at securing sustainable and resilient populations. The RCIS is consistent with this recovery plan.
Recovery Plan for The Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the DPS of California Central Valley Steelhead	2014	NMFS	• Secure existing populations by addressing stressors. • Reintroduce populations into historically occupied or other suitable areas. • Reduce the present or threatened destruction, modification, or curtailment of habitat or range. • Ameliorate utilization for commercial, recreational, scientific, or educational purposes. • Abate disease and predation. • Establish the adequacy of existing regulatory mechanisms for protecting the ESUs and DPSs now and into the future (i.e., post-delisting).	The RCIS aims to provide habitat and support sustainable and resilient populations by addressing stressors. Specific actions include developing fish-friendly water operations, improving water quality, removing fish passage barriers, and protecting and enhancing rearing habitats. The RCIS does not specifically call for ameliorating use for commercial, scientific, or educational purposes or regulatory mechanisms. The RCIS is consistent with this recovery plan.

TABLE G.1-3: CONSISTENCY WITH RECOVERY PLANS

Document	Year	Author	Goals/Objectives	How Considered in the RCIS
Final Coastal Multispecies Recovery Plan for California Coastal Chinook Salmon, Northern California Steelhead and Central California Coast Steelhead (Volume 4)	2016	NMFS	• Above goals 1-6 apply to CCC steelhead. • Ensure the status of CCC steelhead status is at a minimal risk of extinction (i.e., viable) based on abundance, growth rate, spatial structure, and diversity.	Analysis is the same as above. These actions from the RCIS help to support the viability of Chinook Salmon and steelhead in the RCIS area. The RCIS is consistent with this recovery plan.
Final Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (*Acipenser medirostris*)	2018	NMFS	• Increase sDPS Green Sturgeon abundance, distribution, productivity, and diversity by reducing threats associated with habitat degradation and access, contaminants, and take.	The RCIS strategies for Green Sturgeon and their habitat include protecting existing green sturgeon habitat; promoting expansion of suitable habitat; and enhancing and restoring suitable Green Sturgeon estuarine, tidal channel, riverine, and marine habitat. The RCIS is consistent with this recovery plan.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
State-wide Planning Documents			
Sea Level Rise Guidance Update	2018	California Coastal Commission	This document focuses specifically on how to apply the Coastal Act to the challenges presented by sea level rise through Local Coastal Program (LCP) certifications and updates and Coastal Development Permit decisions. It organizes current science, technical, and other information, and practices into a single resource to facilitate implementation of the Coastal Act by coastal managers at the state and local level. This document is part of a larger statewide strategy to respond to climate change that includes both emissions reductions and adaptation planning to address the impacts of a changing climate.
California Department of Gish and Wildlife (CDFW) State Wildlife Action Plan (SWAP)	2015	CDFW	CDFW developed the SWAP to conserve California's diverse wildlife and the vital habitat they inhabit. It works towards its conservation goals with the consideration of the growing human population. Vol 1, Ch 5.3 of this plan provides the specific conservation strategies of the Bay Delta that include the North Baylands. This subchapter includes an overview of the geography in the Bay Delta and important wildlife species that reside in the area, such as California red-legged frog, western pond turtle, gray fox, etc. It also lists common invasive plant species and those that are native (willow, alder, bay, etc.). There are detailed tables for the conservation units and targets for the Bay Delta, key ecological attributes, focal species, key pressures on the conservation targets, stressors, and conservation strategies. These tables are accompanied by in-depth subsections. Chapter 6 of SWAP is dedicated to anadromous fish and their conservation. Chapters that follow Chapter 6 cover plan implementation, monitoring, and preparation.
Planning for Sea-Level Rise Database Bill (AB 2516, Gordon)	Bill passed in 2014, Database last updated 2017	Ocean Protection Council	This bill required that the Natural Resources Agency and the Ocean Protection Council collaborate to create a public online Sea Level Rise Database by January 1st, 2016. This database was to include a survey of efforts in the state taken to prepare and adapt to sea level rise. Resurveys were to be taken biannually until the repeal of the bill on January 1st, 2018. The database now includes projects with their contact, purpose, county, cities involved, funding information, potential land changes, as well as LCP statuses.
Sustainable Groundwater Management Act (SGMA) Portal	2014	California Department of Water Resources (DWR)	SGMA is a three-bill legislative package passed in 2014 that provides a framework to help conserve California's groundwater systems. Of the three bills, AB 1739 (Dickenson) authorizes local agencies to adopt their own groundwater management plan. In conjunction with SB 1168 (Pavley), the bills gave a timeline for local agencies to elect to be, or form, a groundwater sustainability agency (GSA) by 2017. By 2020, all medium and high priority basins must be covered by one of these local agencies. Annually, these agencies must report groundwater data to DWR, and recertify themselves every 5 years. By 2040, each basin should achieve its sustainability goals. Within the RCIS area, there are several groundwater basins: Novato Valley (2-030), Petaluma Valley (2-001), Sonoma Valley (2-002.02), and the Napa-Sonoma Lowlands (2-002.03). There are two exclusives GSA's, Petaluma Valley GSA and Sonoma Valley GSA, that may have local groundwater plans for the RCIS area.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
San Francisco Bay Planning Documents			
San Francisco Bay Trail Plan	1989	State Coastal Conservancy (SCC)	The plan for the Bay Trail proposed development of a regional hiking and bicycling trail around the perimeter of San Francisco and San Pablo bays. The plan was prepared by the Association of Bay Area Governments pursuant to Senate Bill 100 which mandated that the Bay Trail provide connections to existing park and recreation facilities, create links to existing and proposed transportation facilities, and be planned in such a way as to avoid adverse effects on environmentally sensitive areas.
Baylands Ecosystem Habitat Goals. A report of habitat recommendations*	1999	SCC	The Baylands Ecosystem Habitat Goals Report is a guiding document for restoration of baylands habitats in the San Francisco Bay. In addition to describing the species and habitats that call the baylands home, the report outlines a vision for restoration by region. See the North Bay Baylands RCIS Chapter 2 for additional summaries. North Bay: Sets acreage targets in different habitat goal categories for protection, restoration, and enhancement; identified opportunities to restore marsh/upland transitions and expand and reintroduce populations of rare plant and animal species through implementing tidal restoration projects, expanding tidal prism, enhancing flood protection, developing freshwater managed wetlands for waterfowl, and enhancing stream and riparian habitat. Novato Creek Sub-region: Recommends restoring a wide continuous brand of tidal marsh along the bayfront from Black Point to Gallinas Creek, and along Gallinas and Novato Creeks. Additional recommended ensuring natural transition zones from wetlands to uplands; enhancing managed marshes and seasonal ponds in areas not restored to tidal marsh; ensuring a natural transition to uplands throughout and providing an upland buffer outside the Baylands boundary; and protecting oak woodlands and mixed evergreen forest along the entire ridge and hillslopes form Black Point to Rush Creek and the oak woodlands at Deer Island and Hanna Ranch. North Marin Sub-region: Identifies opportunities to restore marsh/upland transitions; expand and reintroduce populations of rare plant and animal species expansion; use treated wastewater to develop freshwater managed wetlands for waterfowl; enhance stream and riparian habitat; and expand suitable habitat for many tidal marsh species like California Ridgway's rail.
Baylands Ecosystem Species and Community Profiles: Life histories and environmental requirements of key plants, fish, and wildlife*	2000	SCC	This document served as the biological foundation for the Baylands Ecosystem Habitat Goals Project and was a scientific document intended to lead to the improvement of habitat conditions and water quality throughout the Bay and along its tributaries.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
San Francisco Bay Plan	2011	Bay Conservation and Development Commission (BCDC)	Adopted in 1968, the San Francisco Bay Plan outlines the future development of the Bay for both the human and wildlife populations. Its major proposals include developing marine ports, deepening shipping channels, expanding airport facilities, and maintaining wildlife refuges. The plan recognizes the importance of the Bay's natural resources and needs for conservation and considers those needs in the approval of permit applications for further development within its jurisdiction (urban development, freeway enhancement/extension, bay fill placement, etc.). It considers the Bay as a single body of water, and efforts to be conducted at the regional level.
San Francisco Bay Area Water Trail Plan	2011	SCC	This plan provides a guide to implementing the San Francisco Bay Area Water Trail. It includes maps with valuable information on existing access and trail-related issues. The vision for the trail is a network of launching and landing sites that allows people in human-powered boats and beachable sail craft to enjoy the natural, historic, cultural, and scenic richness of San Francisco Bay through continuous, multiple-day and single-day trips on the bay.
The Baylands and Climate Change: What We Can Do	2015	SCC San Francisco Estuary Institute (SFEI)	This document is an update to the 1999 Baylands Ecosystem Habitat Goals report. It urges swift action to restore historic Baylands to increase their likelihood of staying apace with sea level rise. See the North Bay Baylands RCIS Chapter 2 for additional summary.
Fill for Habitat Amendment	2019	BCDC	BCDC had initially sought to minimize the amount of future bay fill placement. With sea level rise predictions, the San Francisco Bay Plan was amended to increase the amount of bay fill placed (where appropriate) for potential habitat needs as more frequent and longer lasting flooding occurs. This provides the opportunity to build larger and wider levees and allow current marshes to move landward as well as create new marshes and other vital habitat such as eelgrass beds and oyster reefs. As expected, there is potential for harmful consequence with allowing more bay fill to be placed, and its use for habitat expansion will be heavily considered for each project prior to implementation. This amendment also helps to expedite the permitting of general bay restoration efforts. Using bay fill for habitat expansion has already been implemented near the RCIS area for projects such as the Sonoma Creek Enhancement project, which created 3 acres of tidal marsh to upland transition habitat.
Regional Water Resources Planning for the San Francisco Bay Area	2019	Bay Area Integrated Regional Water Management Program (IRWMP)	IRWMP is both a plan and program taken on by the nine Bay Area counties. It is guided by five major goals that together promote the enhancement of water quality and supply, flood protection, public health, habitat and watershed resource protection, and the overall health of the Bay. IRWMP serves as a means of collaboration between counties and agencies, accelerated responsiveness to the needs of the goals listed, and helps secure state and federal funding.
SF Bay Shoreline Adaptation Atlas	2019	SFEI	This atlas splits the entire San Francisco Bay shoreline into Operational Landscape Units (OLUs) (report consists of a total of 30 OLUs). For each OLU, information is provided about areas that are potentially vulnerable to future sea level rise and recommends geographically specific and science-based adaptation strategies.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
Natural Resource Management Plan for San Francisco Bay National Wildlife Refuge Complex	2019	USFWS	The San Francisco Bay National Wildlife Refuge Complex conducted surveys and reviewed previous surveys of biological resources to identify the most crucial monitoring needs in the next 15 years (2018-2033). The Plan includes an inventory and monitoring plan (IMP) that describes how to determine the most important surveys for refuge staff to implement under a tight budget. Survey information is stored in the Planning and Reporting Inventory and Monitoring at Refuges database.
Restoring the Estuary	2022	San Francisco Bay Joint Venture (SFBJV)	SFBJV was set up to preserve and restore the habitats that support diverse wildlife populations, especially waterfowl populations. The habitats include all types of wetlands, riparian habitat, and adjoining uplands throughout the San Francisco Bay. The objectives included:1) Fund restoration and incentivize projects and approaches to preserve, restore and enhance the wetlands, riparian habitat, and associated uplands; 2) Secure funding for the preservation and restoration efforts and provide support for on-going monitoring, evaluation, and research; 3) create an Implementation Strategy for the SFBJV.
North Bay Regional Planning Documents			
Phase 2 Information | North Bay Water Reuse Program	2002	North Bay Water Reuse Program	This program is composed of 11 member agencies that aim to address water supply concerns in the North Bay by investing in projects that offset the potable demand (using recycled water). It also seeks to help enhance ecosystems, maintain public health and safety, promote sustainability, and implement recycled water facilities. The North Bay already has limited surface and ground water resources, and climate change will further limit this supply. Using recycled water will extend water supply, increase reliability during drought, lower costs, and have a lower carbon footprint. The program is currently in phase 2, which builds on the infrastructure of phase 1 efforts through increasing treatment and distribution of recycled water, groundwater management, and taking on projects beneficial to both the environment and community. Once both phases are complete, there is a potential for over 30,000 acre-fee per year of recycled water to be provided to the region to build long-term resiliency.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
San Pablo Bay National Wildlife Refuge Final Comprehensive Conservation Plan	2011	USFWS	This Comprehensive Conservation Plan (CCP) guides management of the San Pablo Bay National Wildlife Refuge for 15 years, beginning in 2011. Under the chosen alternative in this plan, the service would be tasked with: • Developing an inventory and monitoring program • Prioritizing and expanding tidal restoration activities • Assessing and preparing for climate change influences • Improving visitor access and develop a visitor services plan for public opportunities • Considerably increasing its educational and interpretation programs. • Developing wildlife population goals • Adding habitat management activities that would improve hydrological connectivity of tidal marsh habitat • Prioritizing new activities for the conservation and restoration of sub-tidal habitat. The CCP also provides an impact analysis based on these proposed tasks, the refuge's agency system, planning process, biological resources, implementation, etc. It includes many tables for habitat goals, species occurrences, economic demographics, and more.
Adapting to Sea Level Rise Along the Northbay Shoreline*	2013	North Bay Watershed Association	The purpose of this report is to demonstrate how the Future San Francisco Bay Tidal Marshes Climate Smart Planning Tool (www.prbo.org/sfbayslr) could be used by agencies responsible for coastal areas in North San Francisco Bay to develop adaptive management plans. In the Novato Creek watershed, there are opportunities for tidal marsh restoration to increase resiliency to sea level rise, including increasing initial elevations of restoration projects to allow the marshes a better chance of keeping pace with sea level rise.
San Pablo Bay National Wildlife Refuge Climate Adaptation Plan	2016	USFWS	The purpose of this climate adaptation project is to use the best available information to identify a suite of actions with the highest likelihood of achieving refuge goals that are feasible and contribute to larger landscape conservation. The report stated that transition zone habitat and restoration often occur on the slopes of flood control levees.
San Pablo Baylands: Ensuring a Resilient Shoreline*	2017	State Routes 37 Baylands Group	This white paper was prepared in response to the SR 37 redesign effort led by the Metropolitan Transportation Commission and the transportation authorities of Marin, Sonoma, Napa, and Solano counties. It emphasizes the importance of protecting, enhancing, and restoring the tidal wetlands, natural resources, ecosystem services, and habitats of the San Pablo Baylands.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
Reoaking the North Bay	2020	SFEI	This document acknowledges the astounding loss of the oak savanna in the Napa and Sonoma valleys due to the clearing for urban development, orchards, and vineyards. The report identifies opportunities and provides guidance to agencies, landowners, and other interested parties for restoring oak habitat. It outlines the strategy and need to reestablish the valley oak and other oak associated species to the area, enhance high quality habitat for wildlife, facilitate wildlife movement, provide genetic connectivity between oaks, and provide ecosystem services, all while remaining climate change responsible and remaining in fire-ready guidelines.
North Bay Sub-Regional Planning Documents			
An Introduction to the Historical Ecology of the Sonoma Creek Watershed: A Tool for Developing an Action Plan for the Critical Coastal Area Program.	2008	SFEI	This is a short, brochure-style document that introduces how historical ecology can help guide environmental recovery in the Sonoma Creek Watershed. It highlights areas of interests for potential restoration including historical freshwater wetlands and stream channels in the Sonoma Creek Watershed.
Napa County Voluntary Oak Woodland Management Plan	2010	Napa County Conservation Division	This management plan provides the conservation framework needed to preserve and restore the oak woodland resources in Napa County. The document includes the location and health of the oak woodlands; identifies threats; outlines conservation strategies; supports landowner/agency/non-profit grant eligibility; and improves collaboration for the effort in aiding the longevity of the Napa Oak Woodlands. The plan will protect existing oak woodlands by developing a program for conservation and enhancement, direct funding and mitigation towards areas of highest resource value, encourage long-term stewardship and vitality of existing oak woodlands, restore oak species that were previous cleared, encourage land use and development that aligns with the plan, and maximize the oak woodland and other canopy levels to achieve nature ecosystem processes (erosion, flood, air quality, etc.).
Napa-Sonoma Marshes Wildlife Area Land Management Plan	2011	CDFW	The purpose of this management plan is to protect wetlands and restore and enhance areas that were historically wetlands in the Napa-Sonoma Marshes Wildlife Area at the northern edge of San Pablo Bay. It uses an ecosystem approach to habitat management to provide a framework for managing the vital habitat types of the area: tidal and seasonal wetlands, sloughs, managed ponds, former salt ponds, riparian corridors, and upland grasslands. This approach is intended to aid both common and sensitive species of the area. The continued management and restoration of this wildlife area would provide high quality habitat for migrating waterfowl, fish, and other aquatic species, and residing terrestrial plants and wildlife. The plan includes detailed sections and tables for planning, management strategy, geography, climate, benefitting species, community influences, etc.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
Lower Sonoma Creek Flood Management and Ecosystem Enhancement	2012	SCC Sonoma Water	This study is to identify and evaluate opportunities to address flooding issues and ecosystem enhancement in the Schelville area (southern portion of the Sonoma Creek watershed within the reaches of Sonoma Creek and Schell Creek from immediate upstream of Highway 121 to San Pablo Bay). Includes a watershed scale approach combining: 1) stormwater detention in the upper watershed, 2) acquisition of easements on affected lands for seasonal floodwater conveyance, and 3) acquisition of lands at risk for current or future flooding that may be restored to tidal wetlands.
Novato Creek Baylands Vision	2015	SFEI	This report explores the potential for incorporating ecological functions into managing the flood risk on lower Novato Creek. It describes the historical landscape and identifies the driving forces for habitat change through time. It demonstrates the role of ecological elements in flood protection and provides a framework for future flood control projects.
Marin Shoreline Adaptation and Vulnerability Study *	2017	Marin County Public Works	This report includes a vulnerability assessment to identify the risks and exposure from sea level rise. It includes identification of two key transportation facilities that are vulnerable to sea level rise: SR 37 between Atherton Avenue and U.S. Highway (HWY) 101 and HWY 101at the HWY 101/SR 37 Interchange in Novato.
SR37 Sea Level Rise and Transportation *	2018	Metropolitan Transportation Commission (MTC)	The SR 37 Corridor Plan is a high-level assessment of key current and anticipated issues on SR 37 and lays out near, mid, and long-term improvements to help to address such issues. It sets a goal of no net loss of wetlands habitat to mitigate for project widening by integrating restoration elements into the project design.
Southern Sonoma County Stormwater Resources Plan	2019	Sonoma Water	The purpose of the Stormwater Resources Plan is to identify and prioritize storm water capture and dry weather runoff projects as key components to manage a safe, clean, and resilient water supply. Objectives of plan: 1) to guide future watershed-based, addressing major challenges and opportunities for managing storm water and dry weather runoff and 2) to prioritize multi-benefit projects for implementation and attract funding.
Passenger Rail Service Novato to Suisun City	2019	Sonoma-Marin Area Rail Transit (SMART)	The purpose of this report is to examine the technical feasibility of implementing passenger rail service between Novato and Suisun City, document the existing physical conditions of the corridor, propose limited infrastructure options and their corresponding operating characteristics, identify potential infrastructure and environmental challenges, prepare order of magnitude schedule and cost estimates, and recommend next steps. SR-37 is the primary roadway corridor that runs roughly parallel with the rail line owned by SMART.
SR 37 - Adaptation Summary of Studies	2020	Transportation Authority of Marin	The SR 37 Corridor Adaptation Study follows eight years of ongoing state and regional transportation agencies' planning efforts focused on the entire 21-mile SR 37 corridor between HWY 101 in Marin County and Interstate 80 in Solano County. This document contains a summary of previous studies related to transportation, trail plans, the environment, the Novato Area, Marin County Flood Control, and other plans and studies.

TABLE G.2-1: OTHER EXISTING PLANS AND STUDIES SUMMARIES

Document	Year	Author	Summary
Climate Ready Sonoma County: Climate Hazards and Vulnerabilities. Prepared as part of Climate Action 2020	2020	Sonoma County Regional Climate Protection Authority	The purpose of this climate vulnerability assessment is to provide an initial screening of the county's community resources that are vulnerable to climate change hazards. It is not a comprehensive vulnerability analysis and does not provide site-specific prescriptions for action. It addresses climate hazards in Sonoma County (i.e., hotter and drier weather with long summers) and vulnerabilities (i.e., people and social systems, built systems, and natural and working lands), and discusses how to respond to climate change vulnerabilities.
Sonoma Creek Baylands Strategy	2020	Sonoma Land Trust	The purpose of this document is to provide Sonoma Land Trust and its partners with a clear and comprehensive plan that coordinates the protection, acquisition, restoration, and enhancement of diverse Baylands habitat (e.g., subtidal, mudflat, tidal marsh, brackish marsh, freshwater marsh, upland-wetland transition). It integrates natural processes to increase climate resilience of the Sonoma Creek Baylands, identifies appropriate public access, and provides recommendations for the re-design of SR 37 and the SMART rail to improved connectivity through the Sonoma Creek Baylands.
SR37 Public Access Scoping Report	2020	MTC Bay Area Regional Collaborative	This project primarily focuses on pedestrian, bike, and water trails. The discussion focuses on connecting trail segments, taking advantage of existing or temporary levees for trails while restoration is in process or utilizing highway improvements to add lanes for pedestrians and bikes.
Petaluma River Baylands Strategy	2023	Sonoma Land Trust	With funding from the California Wildlife Conservation Board, Sonoma Land Trust and partners are developing a climate adaptation and resilience strategy for the Petaluma River Baylands sub-region. This forward-looking document will set the conservation agenda for the next decade in the Petaluma River Baylands.

APPENDIX H

Policies Greenprint

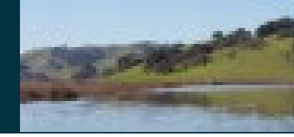


TABLE H-1: POLICIES GREENPRINT

Policy	Summary	County	Jurisdiction	Source[1]
Ecology of Creeks and Streams (Policy 1)	Section 19.35 of the Novato Zoning Ordinance establishes buffer areas along watercourses to protect water quality, minimize flood hazards and maintain or expand storage capacity for flood waters. Section 19.35 establishes a “stream protection zone” that includes the stream bed, the stream banks, all riparian vegetation, and a buffer zone at least 50 feet wide, measured from the top of the channel bank. The stream protection zone may be expanded or reduced based on specific site conditions. Any proposed development, grading, fill, planting, or vegetation removal requires a use permit. To obtain a use permit, an applicant must submit a Stream Management Plan and incorporate annual maintenance requirements into the project.	Marin	City of Novato	City of Novato Code of Ordinances
Hillside Project Development Standards (Ordinance 19.26.050)	No development potential shall be allowed for areas with average slopes of greater than 25 percent.	Marin	City of Novato	City of Novato Code of Ordinances
Creek and Drainageway Setbacks (CON-6)	Adequate setback for a structure from a drainageway shall be determined at the time of project review. Setbacks should include a twenty-five foot (25’) or greater setback between any structure and the high top of the creek bank.	Marin	City of San Rafael	City of San Rafael Ordinances
Ridge and Upland Greenbelt (Program DES-4.e)	Protect views of the Ridge and Upland Greenbelt Areas by amending policies and maps to identify a border on parcels that abut the area. For example, Ridge and Upland Greenbelt lands would be rezoned to the Planned District category and adjacent buffer areas to a transitional district, thereby subjecting them to County Design Review Requirements that include visually sensitive designs and rural densities.	Marin	Marin County	Marin Countywide Plan, 2014 Update
Stream Conservation Areas (Policy BIO-4.1)	A Stream Conservation Area (SCA) is established to protect the active channel, water quality and flood control functions, and associated fish and wildlife habitat values along streams. Sets a 20-foot buffer minimum in city corridor; 100-foot minimum in coastal, baylands corridors; 20 feet minimum in streams. Inside the City-Centered Corridor, a setback from streams is 100 feet for parcels above 2 acres, 50 feet between 0.50 and 2 acres and 20 feet for 1/2 acres.	Marin	Marin County	Marin Countywide Plan, 2014 Update

TABLE H-1: POLICIES GREENPRINT

Policy	Summary	County	Jurisdiction	Source[1]
Biology and Natural Resources (Policy 4-P-1)	Create setbacks for all tributaries to the Petaluma River extending a minimum of 50 feet outward from the top of each bank, with extended buffers where significant habitat areas, vernal pools, or wetlands exist. Development shall not occur within this setback, except as part of greenway enhancement (for example, trails and bikeways).	Sonoma	City of Petaluma	City of Petaluma General Plan
Natural Hazards (Policy 10-P-1 B)	On sites with slopes greater than 30 percent, require all development to be clustered outside of the 30 percent slope areas (and preferably on land less than 15 percent in slope) where possible.	Sonoma	City of Petaluma	City of Petaluma General Plan
Policy for Reduction of Soil Erosion (OSRC-11a, 11b)	Design discretionary projects so that structures and roads are not located on slopes of 30 percent or greater. Include erosion control measures for any discretionary project involving construction or grading on lands with slopes over 10 percent.	Sonoma	Sonoma County	Open Space and Resource Conservation (permitsonoma.org)
Scenic Landscape Unit (Policy OSRC-2a)	To retain the largely open, scenic character of important Scenic Landscape Units, this policy directs the County to avoid amendments to increase residential density in Scenic Landscape Units in excess of one unit per ten acres. The land use plan may designate a lower density or larger minimum lot size.	Sonoma	Sonoma County	Open Space and Resource Conservation (permitsonoma.org)
Sonoma County Ordinance 6089	Ordinance Number 6089 established Streamside Conservation Areas (SCAs) to protect and enhance riparian corridors along streams to balance multiple uses. SCAs include 200 feet from Russian River, 100 feet from Flatland and 50 feet from other riparian corridors.	Sonoma	Sonoma County	Sonoma County Zoning Regulations
Natural and Historic/Cultural Resources (Policy P8.3.2)	Where riparian corridors are retained, they shall be protected by an adequate buffer with a minimum 100-foot protection zone from the edge of the tree, shrub, or herb canopy. Prohibits developments that alter the biological integrity of Riparian Corridors unless no feasible alternative exists or the damaged habitat is replaced with a habitat of equivalent value.	Napa	City of American Canyon	City of American Canyon General Plan

TABLE H-1: POLICIES GREENPRINT

Policy	Summary	County	Jurisdiction	Source[1]
Residential Communities Design Principles (Policy 1.11.7b)	Require developments to preserve the topographic character of hillsides and canyons by concentrating projects on lesser slopes; no mass grading on slopes exceeding 25 percent.	Napa	City of American Canyon	City of American Canyon General Plan
Residential Communities Design Principles (Policy 1.11.7b)	Prohibition of development on slopes exceeding 50 percent and maintenance of natural grades in higher elevation areas.	Napa	City of American Canyon	City of American Canyon General Plan
Natural Resources Policy: Stream and Riverbank Protection (NR-1.1)	The City shall protect riparian habitat along the Napa River and its tributaries from incompatible urban uses and activities. Policy NR-1.4 establishes that the City will review all future waterway improvement projects (e.g., flood control, dredging, private development), as well as all projects that are within 100 feet of the waterway, to ensure that they protect and minimize effects on the riparian and aquatic habitats. Native plantings are encouraged along waterways to stabilize banks and reduce stormwater runoff.	Napa	City of Napa	City of Napa General Plan
Conservation Plan (Policy CON-14, CON-28)	CON-14: To offset possible losses of fishery and riparian habitat due to discretionary development projects, developers shall be responsible for mitigation when avoidance of impacts is determined to be infeasible. Such mitigation measures may include providing and permanently maintaining similar quality and quantity habitat within Napa County, enhancing existing riparian habitat, or paying in-kind funds to an approved fishery and riparian habitat improvement and acquisition fund. Replacement habitat may occur either on-site or at approved off-site locations, but preference shall be given to on-site replacement; and CON-28: To offset possible additional losses of riparian woodland due to discretionary development projects and conversions, developers shall provide and maintain similar quality and quantity of replacement habitat or in-kind funds to an approved riparian woodland habitat improvement and acquisition fund in Napa County. While on-site replacement is preferred where feasible, replacement habitat may be either on-site or off-site as approved by the County.	Napa	Napa County	Conservation_Element_06.23.09 (countyofnapa.org)

TABLE H-1: POLICIES GREENPRINT

Policy	Summary	County	Jurisdiction	Source[1]
View Protection Program: Structures and Related Improvements	Protects the scenic quality of the County both for visitors as well as residents. No building or other administrative permit shall be issued for any new structure or improvement to an existing structure if the structure is located on a slope of 15 percent or more, or if the structure is located on any minor or major ridgeline.	Napa	Napa County	Viewshed Protection Program
Hillside Development (Policy 2)	Hillside projects in Planned Development areas in which buildings are proposed on average natural slopes in excess of 10% shall be carefully evaluated to insure the enhancement and preservation of the natural topography and character of the hillsides.	Solano	City of Vallejo	City of Vallejo General Plan
Resource Implementation Program (RS.I-67)	This policy in the General Plan called for an ordinance to be developed that protects riparian water quality through proper buffer zones that keep riparian areas an appropriate width apart from one another depending upon the size of the developed land. This ordinance was not developed; however, the County considers imposing buffers as needed based on the potential environmental impacts identified in a CEQA report.	Solano	Solano County	Personal communication, Solano County Planning Department

NOTE:

1 BayAreaGreenprint 2022

APPENDIX I

Evaluation Matrix

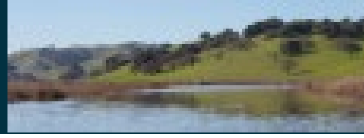


TABLE I-1: EVALUATION MATRIX

Scientific Name	Common Name	Occurrence in Study Area		Protections						Habitat	Other Considerations					
		CNDDB Occ Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		Umbrella or keystone species	Endemic or unique to study area	SGCN (SWAP)	Climate change vulnerability list	Critical habitat connectivity needed	Habitat limited or already protected
Fish																
Acipenser medirostris	green sturgeon	0	maybe	Threatened	None	SSC	G3			open bay, slough	no	no	yes	no	yes	no
Entosphenus tridentate	Pacific lamprey	0	maybe	None	None		G4			open bay, slough	no	no	yes	yes	no	no
Eucyclogobius newberryi	tidewater goby	1	no	Endangered	None	0	G3	S3		open bay, slough	no	no	no	no	no	Yes
Hypomesus transpacificus	Delta smelt	5	yes	Threatened	Endangered	0	G1	S1		open bay, slough	yes	no	yes	yes	yes	Yes
Oncorhynchus mykiss irideus pop. 8	steelhead - central California coast DPS	5	yes	Threatened	None	0	G5T2T3Q	S2S3		open bay, slough, riparian	yes	no	yes	yes	yes	no
Oncorhynchus tshawytscha	Chinook salmon - fall/late fall ESU	0	maybe	None	None	SSC	G5T2T3Q	S2S3		open bay, slough, riparian	yes	no	no	yes	yes	no
Oncorhynchus tshawytscha	Chinook salmon- spring-run ESU	0	maybe	Threatened	Threatened		G5T2T3Q	S2S3		open bay, slough, riparian	yes	no	no	yes	yes	no
Oncorhynchus tshawytscha	Chinook salmon - Sacramento River winter-run ESU	0	maybe	Endangered	Endangered		G5T2T3Q	S2S3		open bay, slough, riparian	yes	no	no	yes	yes	no
Pogonichthys macrolepidotus	Sacramento splittail	7	yes	None	None	SSC	GNR	S3		open bay, slough	no	no	yes	yes	no	no
Spirinchus thaleichthys	longfin smelt	4	no	Candidate	Threatened	0	G5	S1		open bay, slough	no	no	no	yes	no	no
Thaleichthys pacificus	eulachon	1	no	Threatened	None	0	G5	S2		open bay, slough	no	no	no	no	no	no
Mollusks																
Gonidea angulata	western ridged mussel	1	no	None	None	0	G3	S1S2		n/a	no	no	no	no	no	no
Tryonia imitator	mimic tryonia (=California brackishwater snail)	2	no	None	None	0	G2	S2		n/a	no	no	no	no	no	no
Vespericola marinensis	Marin hesperian	1	no	None	None	0	G2	S2		n/a	no	no	no	no	no	no
Crustaceans																
Branchinecta lynchi	vernal pool fairy shrimp	1	no	Threatened	None	0	G3	S3		vernal pool	yes	no	Yes	no	no	yes
Calasellus californicus	An isopod	1	no	None	None	0	G2	S2		n/a	no	no	no	no	no	no
Syncaris pacifica	California freshwater shrimp	3	no	Endangered	Endangered	0	G2	S2		riparian	no	no	no	no	no	no
Arachnids																
Calicina diminua	Marin blind harvestman	1	no	None	None	0	G1	S1		n/a	no	no	no	no	no	no
Talanites ubicki	Ubick's gnaphosid spider	1	no	None	None	0	G1	S1		n/a	no	no	no	no	no	no
Insects																
Adela oplerella	Opler's longhorn moth	3	no	None	None	0	G2	S2		n/a	no	no	no	no	no	no
Andrena blennospermatis	Blennosperma vernal pool andrenid bee	1	no	None	None	0	G2	S2		n/a	no	no	no	no	no	no

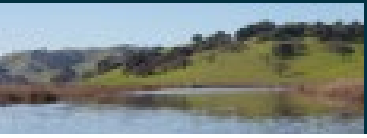


Table I-1: Evaluation Matrix

Scientific Name	Common Name	Occurrence in Study Area		Protections						Habitat	Other Considerations					
		CNDDB Occ Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		Umbrella or keystone species	Endemic or unique to study area	SGCN (SWAP)	Climate change vulnerability list	Critical habitat connectivity needed	Habitat limited or already protected
Bombus caliginosus	obscure bumble bee	1	no	None	None	0	G4?	S1S2		grasslands	yes	no	Yes	no	no	no
Bombus crotchii	Crotch bumble bee	1	no	None	None	0	G3G4	S1S2		grasslands	yes	no	Yes	no	no	no
Bombus occidentalis	western bumble bee	12	yes	None	None	0	G2G3	S1		grasslands	yes	no	Yes	no	no	no
Danaus plexippus pop. 1	monarch - California overwintering population	5	yes	Candidate	None	0	G4T2T3	S2S3		forest	no	no	Yes	no	no	no
Speyeria callippe callippe	callippe silverspot butterfly	3	no	Endangered	None	0	G5T1	S1		n/a	no	no	Yes	no	no	no
Nycticorax nycticorax	Sonoma zerene fritillary	1	no	None	None	0	G5T1	S1		n/a				no	no	
Amphibians																
Ambystoma californiense pop. 3	California tiger salamander - Sonoma County DPS	2	maybe	Endangered	Threatened	WL	G2G3	S2		grasslands	yes	no	yes	yes	yes	no
Dicamptodon ensatus	California giant salamander	5	yes	None	None	SSC	G3	S2S3		forest	no	no	yes	no	no	no
Rana boylii	foothill yellow-legged frog	13	yes	None	Endangered	SSC	G3	S3		grasslands	no	no	yes	no	no	no
Rana draytonii	California red-legged frog	37	yes	Threatened	None	SSC	G2G3	S2S3		grasslands	yes	no	yes	no	yes	no
Taricha rivularis	red-bellied newt	1	no	None	None	SSC	G2	S2		forest, riparian	no	no	yes	no	no	yes
Reptiles																
Emys marmorata	western pond turtle	30	yes	Threatened	None	SSC	G3G4	S3		riparian, pond	yes	no	yes	no	no	no
Masticophis lateralis euryxanthus	Alameda whipsnake	0	no	Threatened	Threatened		G4T2			chaparral	yes	no	yes	no	yes	yes
Thamnophis gigas	Giant garter snake	0	no	Threatened	Threatened		G2			riparian, agricultural lands	no	no	yes	no	yes	yes
Birds																
Agelaius tricolor	tricolored blackbird	8	yes	None	Threatened	SSC	G1G2	S1S2		freshwater marsh, agricultural lands	no	no	yes	no	yes	no
Aquila chrysaetos	golden eagle	4	no	None	None	FP; WL	G5	S3		grasslands	yes	no	yes	yes	no	no
Ardea alba	great egret	1	maybe	None	None	0	G5	S4		marshes, grasslands, forest	yes	no	yes	no	no	no
Ardea herodias	great blue heron	4	maybe	None	None	0	G5	S4		marshes, grasslands, forest	yes	no	yes	no	no	no
Athene cunicularia	burrowing owl	15	yes	None	None	SSC	G4	S3		grasslands	yes	no	yes	no	no	no
Brachyramphus marmoratus	marbled murrelet			Threatened							no	no	no	yes	yes	no
Buteo regalis	ferruginous hawk	1	no	None	None	WL	G4	S3S4		grasslands	yes	no	no	no	no	no
Buteo swainsoni	Swainson's hawk	9	yes	None	Threatened	0	G5	S3		riparian, grasslands	yes	no	yes	yes	no	no

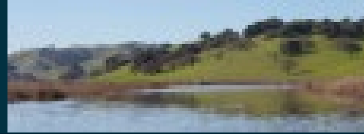


TABLE I-1: EVALUATION MATRIX

Scientific Name	Common Name	Occurrence in Study Area		Protections						Habitat	Other Considerations					
		CNDDB Occ Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		Umbrella or keystone species	Endemic or unique to study area	SGCN (SWAP)	Climate change vulnerability list	Critical habitat connectivity needed	Habitat limited or already protected
Charadrius nivosus nivosus	western snowy plover	3	no	Threatened	None	SSC	G3T3	S2		beach	no	no	no	no	yes	no
Circus hudsonius	northern harrier	3	no	None	None	SSC	G5	S3		marshes, grasslands, agricultural lands	yes	no	no	no	no	no
Coccyzus americanus	Yellow-billed cuckoo			Threatened							no	no	no	yes	yes	no
Coturnicops noveboracensis	yellow rail	1	no	None	None	SSC	G4	S1S2		marshes	no	no	no	yes	no	no
Egretta thula	snowy egret	1	maybe	None	None	0	G5	S4		marshes, grasslands, forest	yes	no	no	no	no	no
Elanus leucurus	white-tailed kite	3	no	None	None	FP	G5	S3S4		marshes, grasslands, forest	yes	no	yes	yes	no	no
Falco peregrinus anatum	American peregrine falcon	2	no	Delisted	Delisted	FP	G4T4	S3S4		marshes, beach, urban, cliffs	yes	no	yes	yes	yes	no
Geothlypis trichas sinuosa	saltmarsh common yellowthroat	41	yes	None	None	SSC	G5T3	S3		marshes, riparian	no	no	yes	yes	no	no
Hydroprogne caspia	Caspian tern	1	no	None	None	0	G5	S4		open bay, sloughs, islands	no	no	no	no	no	no
Laterallus jamaicensis coturniculus	California black rail	24	yes	None	Threatened	FP	G3G4T1	S1		marshes	no	no	yes	yes	yes	no
Melospiza melodia maxillaris	Suisun song sparrow	1	no	None	None	SSC	G5T3	S3		marshes	no	no	yes	yes	no	no
Melospiza melodia samuelis	San Pablo song sparrow	32	yes	None	None	SSC	G5T2	S2		marshes	yes	yes	yes	yes	no	yes
Nycticorax nycticorax	black-crowned night heron	1	maybe	None	None	0	G5	S4		marshes, grasslands, forest	no	no	no	no	no	no
Pandion haliaetus	osprey	8	maybe	None	None	WL	G5	S4		open bay, slough	yes	no	no	yes	no	no
Rallus obsoletus obsoletus	California Ridgway's rail	28	yes	Endangered	Endangered	FP	G3T1	S1		salt marshes	Yes	no	yes	yes	yes	no
Riparia riparia	bank swallow	1	no	None	Threatened	0	G5	S2		open space, cliffs	yes	no	yes	yes	no	no
Sterna antillarum browni	California least tern	0	no	Endangered	Endangered	FP	G4T2T3Q			open bay, slough, beach	No	No	Yes	Yes	yes	no
Strix occidentalis caurina	Northern spotted owl	0	no	Threatened							yes	No		yes	yes	no
Mammals																
Antrozous pallidus	pallid bat	20	yes	None	None	SSC	G4	S3		rocky deserts, grasslands, coniferous forests	yes	no	yes	no	no	no
Corynorhinus townsendii	Townsend's big-eared bat	3	no	None	None	SSC	G4	S2		western desert, pine forests	yes	no	no	no	no	no
Reithrodontomys raviventris	salt-marsh harvest mouse	22	yes	Endangered	Endangered	FP	G1G2	S1S2		marshes	yes	yes	yes	no	yes	no
Sorex ornatus sinuosus	Suisun shrew	9	yes	None	None	SSC	G5T1T2Q	S1S2		marshes	no	yes	yes	no	no	yes
Taxidea taxus	American badger	7	yes	None	None	SSC	G5	S3		grasslands	yes	no	yes	no	no	no

TABLE I-1: EVALUATION MATRIX

Scientific Name	Common Name	Occurrence in Study Area		Protections						Habitat	Other Considerations					
		CNDDB Occ Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		Umbrella or keystone species	Endemic or unique to study area	SGCN (SWAP)	Climate change vulnerability list	Critical habitat connectivity needed	Habitat limited or already protected
Dicots																
Amorpha californica var. *napensis*	Napa false indigo	9	yes	None	None	0	G4T2	S2	1B.2	Broadleafed upland forest, Chaparral, Cismontane woodland	no	yes	no	yes	no	-
Amsinckia lunaris	bent-flowered fiddleneck	2	no	None	None	0	G3	S3	1B.2	Cismontane woodland, Coastal bluff scrub, Valley and foothill grassland	no	no	no	no	no	-
Arctostaphylos montana ssp. *montana*	Mt. Tamalpais manzanita	1	no	None	None	0	G3T3	S3	1B.3	Chaparral, Valley and foothill grassland	no	yes	no	no	no	-
Astragalus tener var. *tener*	alkali milk-vetch	3	no	None	None	0	G2T1	S1	1B.2	vernal pool	no	yes	no	no	no	-
Balsamorhiza macrolepis	big-scale balsamroot	3	no	None	None	0	G2	S2	1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland	no	no	no	yes	no	-
Blennosperma bakeri	Sonoma sunshine	4	no	Endangered	Endangered	0	G1	S1	1B.1	vernal pool	no	yes	no	yes	yes	-
Blepharizonia plumosa	big tarplant	1	no	None	None	0	G1G2	S1S2	1B.1	Valley and foothill grassland	no	no	no	no	no	-
Castilleja affinis var. *neglecta*	Tiburon paintbrush	1	no	Endangered	Threatened	0	G4G5T1T2	S1S2	1B.2	Valley and foothill grassland	no	yes	no	no	yes	-
Ceanothus confusus	Rincon Ridge ceanothus	1	no	None	None	0	G1	S1	1B.1	Chaparral, Cismontane woodland, Closed-cone coniferous forest	no	yes	no	no	no	-
Ceanothus purpureus	holly-leaved ceanothus	13	yes	None	None	0	G2	S2	1B.2	Chaparral, Cismontane woodland	no	yes	no	yes	no	-
Ceanothus sonomensis	Sonoma ceanothus	2	no	None	None	0	G2	S2	1B.2	Chaparral	no	yes	no	no	no	-
Centromadia parryi ssp. *congdonii*	Congdon's tarplant	1	no	None	None	0	G3T1T2	S1S2	1B.1	Valley and foothill grassland	no	no	no	yes	no	-
Centromadia parryi ssp. *parryi*	pappose tarplant	2	no	None	None	0	G3T2	S2	1B.2	Chaparral, Coastal prairie, Marshes and swamps, Meadows and seeps, Valley and foothill grassland	no	yes	no	no	no	-
Chloropyron maritimum ssp. *palustre*	Point Reyes salty bird's-beak	3	no	None	None	0	G4?T2	S2	1B.2	Marshes and swamps	no	yes	no	no	no	-
Chloropyron molle ssp. *molle*	soft salty bird's-beak	8	yes	Endangered	Rare	0	G2T1	S1	1B.2	Marshes and swamps	no	no	yes	no	yes	-
Chorizanthe valida	Sonoma spineflower	1	no	Endangered	Endangered	0	G1	S1	1B.1	Coastal prairie	no	yes	no	no	yes	-
Cicuta maculata var. *bolanderi*	Bolander's water-hemlock	1	no	None	None	0	G5T4T5	S2?	2B.1	Marshes and swamps	no	yes	no	no	no	-
Delphinium luteum	golden larkspur	1	no	Endangered	Rare	0	G1	S1	1B.1	Chaparral, Coastal prairie, Coastal scrub	no	yes	no	no	yes	-

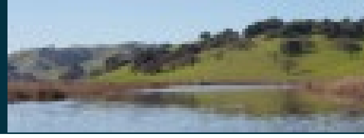


TABLE I-1: EVALUATION MATRIX

Scientific Name	Common Name	Occurrence in Study Area		Protections						Habitat	Other Considerations					
		CNDDB Occ Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		Umbrella or keystone species	Endemic or unique to study area	SGCN (SWAP)	Climate change vulnerability list	Critical habitat connectivity needed	Habitat limited or already protected
Downingia pusilla	dwarf downingia	5	yes	None	None	0	GU	S2	2B.2	Valley and foothill grassland, Vernal pools	no	no	no	no	no	-
Erigeron greenei	Greene's narrow-leaved daisy	6	yes	None	None	0	G3	S3	1B.2	Chaparral	no	yes	no	no	no	-
Eriogonum luteolum var. *caninum*	Tiburon buckwheat	6	yes	None	None	0	G5T2	S2	1B.2	Chaparral, Cismontane woodland, Coastal prairie, Valley and foothill grassland	no	yes	no	no	no	-
Eryngium jepsonii	Jepson's coyote-thistle	1	no	None	None	0	G2	S2	1B.2	Valley and foothill grassland, Vernal pools	no	yes	no	no	no	-
Extriplex joaquinana	San Joaquin spearscale	3	no	None	None	0	G2	S2	1B.2	Chenopod scrub, Meadows and seeps, Playas, Valley and foothill grassland	no	yes	no	no	no	-
Hemizonia congesta ssp. *congesta*	congested-headed hayfield tarplant	11	yes	None	None	0	G5T2	S2	1B.2	Valley and foothill grassland	no	no	no	no	no	-
Hesperolinon congestum	Marin western flax	7	yes	Threatened	Threatened	0	G1	S1	1B.1	Chaparral, Valley and foothill grassland	no	yes	yes	yes	yes	-
Horkelia tenuiloba	thin-lobed horkelia	1	no	None	None	0	G2	S2	1B.2	Broadleafed upland forest, Chaparral, Valley and foothill grassland	no	yes	no	no	no	-
Isocoma arguta	Carquinez goldenbush	1	no	None	None	0	G1	S1	1B.1	Valley and foothill grassland	no	yes	no	yes	no	-
Lasthenia conjugens	Contra Costa goldfields	4	no	Endangered	None	0	G1	S1	1B.1	vernal pool	no	no	no	no	yes	-
Lathyrus jepsonii var. *jepsonii*	Delta tule pea	13	yes	None	None	0	G5T2	S2	1B.2	Marshes and swamps	no	no	no	no	no	-
Legenere limosa	legenere	1	no	None	None	0	G2	S2	1B.1	Vernal pools	no	no	no	no	no	-
Leptosiphon jepsonii	Jepson's leptosiphon	1	no	None	None	0	G2G3	S2S3	1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland	no	yes	no	no	no	-
Lessingia micradenia var. *micradenia*	Tamalpais lessingia	1	no	None	None	0	G2T2	S2	1B.2	Chaparral, Valley and foothill grassland	no	no	no	no	no	-
Lilaeopsis masonii	Mason's lilaeopsis	6	yes	None	Rare	0	G2	S2	1B.1	Marshes and swamps, Riparian scrub	no	no	yes	no	no	-
Lupinus sericatus	Cobb Mountain lupine	1	no	None	None	0	G2?	S2?	1B.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest	no	yes	no	no	no	-
Microseris paludosa	marsh microseris	1	no	None	None	0	G2	S2	1B.2	Cismontane woodland, Closed-cone coniferous forest, Coastal scrub, Valley and foothill grassland	no	no	no	yes	no	-

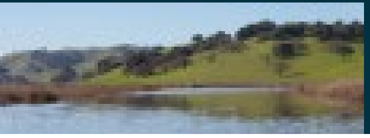


TABLE I-1: EVALUATION MATRIX

Scientific Name	Common Name	Occurrence in Study Area		Protections						Habitat	Other Considerations					
		CNDDB Occ Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		Umbrella or keystone species	Endemic or unique to study area	SGCN (SWAP)	Climate change vulnerability list	Critical habitat connectivity needed	Habitat limited or already protected
Navarretia leucocephala ssp. *bakeri*	Baker's navarretia	1	no	None	None	0	G4T2	S2	1B.1	vernal pool	no	no	no	no	no	-
Plagiobothrys mollis var. *vestitus*	Petaluma popcornflower	1	no	None	None	0	G4?TX	SX	1A	saltmarsh, coastal	no	yes	no	no	no	-
Polygonum marinense	Marin knotweed	6	yes	None	None	0	G2Q	S2	3.1	Marshes and swamps	no	yes	no	no	no	-
Senecio aphanactis	chaparral ragwort	1	no	None	None	0	G3	S2	2B.2	Chaparral, Cismontane woodland, Coastal scrub	no	no	no	no	no	-
Sidalcea calycosa ssp. *rhizomata*	Point Reyes checkerbloom	2	no	None	None	0	G5T2	S2	1B.2	Marshes and swamps	no	yes	no	yes	no	-
Streptanthus anomalus	Mount Burdell jewelflower	2	no	None	None	0	G1	S1	1B.1	Cismontane woodland	no	yes	no	no	no	-
Streptanthus glandulosus ssp. *pulchellus*	Mt. Tamalpais bristly jewelflower	3	no	None	None	0	G4T2	S2	1B.2	Chaparral, Valley and foothill grassland	no	yes	no	no	no	-
Symphyotrichum lentum	Suisun Marsh aster	4	no	None	None	0	G2	S2	1B.2	Marshes and swamps	no	no	no	yes	no	-
Trichostema ruygtii	Napa bluecurls	5	yes	None	None	0	G1G2	S1S2	1B.2	Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley and foothill grassland, Vernal pools	no	yes	no	no	no	-
Trifolium amoenum	two-fork clover	4	no	Endangered	None	0	G1	S1	1B.1	Coastal bluff scrub, Valley and foothill grassland	no	yes	no	no	yes	-
Trifolium hydrophilum	saline clover	6	yes	None	None	0	G2	S2	1B.2	Coastal bluff scrub, Valley and foothill grassland	no	yes	no	no	no	-
Trifolium polyodon	Pacific Grove clover	1	no	None	Rare	0	G1	S1	1B.1	Coastal bluff scrub, Valley and foothill grassland	no	no	no	yes	no	-
Viburnum ellipticum	oval-leaved viburnum	2	no	None	None	0	G4G5	S3?	2B.3	Coastal bluff scrub, Valley and foothill grassland	no	no	no	no	no	-
Monocots																
Agrostis hendersonii	Henderson's bent grass	1	no	None	None	0	G2Q	S2	3.2	Valley and foothill grassland, Vernal pools	no	no	no	no	no	-
Allium peninsulare var. *franciscanum*	Franciscan onion	3	no	None	None	0	G5T2	S2	1B.2	Cismontane woodland, Valley and foothill grassland	no	yes	no	no	no	-
Brodiaea leptandra	narrow-anthered brodiaea	8	yes	None	None	0	G3?	S3?	1B.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley and foothill grassland	no	yes	no	no	no	-
Carex lyngbyei	Lyngbye's sedge	1	no	None	None	0	G5	S3	2B.2	Marshes and swamps	no	no	no	no	no	-
Fritillaria lanceolata var. *tristulis*	Marin checker lily			None	None		G5T2	S2	1B.1	Coastal bluff scrub, Coastal prairie, Coastal scrub	no	yes	no	yes	no	-

TABLE I-1: EVALUATION MATRIX

Scientific Name	Common Name	Occurrence in Study Area		Protections						Habitat	Other Considerations					
		CNDDB Occ Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		Umbrella or keystone species	Endemic or unique to study area	SGCN (SWAP)	Climate change vulnerability list	Critical habitat connectivity needed	Habitat limited or already protected
Fritillaria liliacea	fragrant fritillary	5	yes	None	None	0	G2	S2	1B.2	Cismontane woodland, Coastal prairie, Coastal scrub, Valley and foothill grassland	no	yes	no	yes	no	-
Lilium pardalinum ssp. *pitkinense*	Pitkin Marsh lily	1	no	Endangered	Endangered	0	G5T1	S1	1B.1	Cismontane woodland, Marshes and swamps, Meadows and seeps	no	yes	no	no	yes	-
Pleuropogon hooverianus	North Coast semaphore grass	1	no	None	Threatened	0	G2	S2	1B.1	Broadleafed upland forest, Meadows and seeps, North Coast coniferous forest	no	yes	no	no	no	-
Rhynchospora californica	California beaked-rush	1	no	None	None	0	G1	S1	1B.1	Bogs and fens, Lower montane coniferous forest, Marshes and swamps, Meadows and seeps	no	yes	no	no	no	-
Habitats																
Coastal Brackish Marsh	Coastal Brackish Marsh	3	no	None	None	0	G2	S2.1	0	Coastal Brackish Marsh	yes	no	no	yes	no	-
Northern Coastal Salt Marsh	Northern Coastal Salt Marsh	8	yes	None	None	0	G3	S3.2	0	Northern Coastal Salt Marsh	yes	no	no	yes	no	-
Northern Vernal Pool	Northern Vernal Pool	2	maybe	None	None	0	G2	S2.1	0	Northern Vernal Pool	yes	no	no	no	no	-
Serpentine Bunchgrass	Serpentine Bunchgrass	1	no	None	None	0	G2	S2.2	0	Serpentine Bunchgrass	yes	no	no	yes	no	-

APPENDIX J

Non-focal Species and Co-benefited Natural Resources Ecological Requirements and Associated Focal Species Actions

J. Non-focal Species and Co-benefited Natural Resources Ecological Requirements and Associated Focal Species Actions

A non-focal species is a species that is associated with a focal species or other conservation element and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. The RCIS Program Guidelines (CDFW 2023) requires than an RCIS include a brief, science-based justification indicating how the non-focal species' ecological requirements align with those of a focal species or another conservation element and how actions benefit the non-focal species. Co-benefited natural resources are habitats that benefit from the RCIS conservation strategy for focal species and other conservation elements and unlike non-focal species are not eligible for MCAs. Information for these non-focal conservation elements and associated co-benefited resources is provided below in **Table J-1** and **Table J-2**. **Table J-3** and **Table J-4** provide matrices linking the non-focal conservation elements and associated co-benefited resources with focal conservation elements.

Callippe Silverspot Butterfly (*Speyeria callippe callippe*)

Callippe silverspot butterfly shares ecological functions and/or similar habitats as its associated focal conservation elements: Crotch's bumble bee, burrowing owl, and working lands. This species uses similar floral food resources as the Crotch's bumble bee in grassland habitats which are also used by burrowing owls. These grasslands are also often on working lands. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable annual and perennial grasslands communities may benefit for callippe silverspot butterfly. For example, implementation of BEE 1.2.3 would reduce the use of insecticides and pesticides in floral communities that function as foraging and breeding habitat for callippe silverspot butterfly.

Western Bumble Bee (*Bombus occidentalis*)

Western bumble bee shares ecological functions and/or similar habitats as its associated focal conservation elements: Crotch's bumble bee, burrowing owl, and working lands. This species uses similar floral food resources as the Crotch's bumble bee in grassland and coastal scrub habitats which are also used by burrowing owls. These grassland habitats are also often on working lands. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable annual and perennial grasslands and coastal scrub communities that may benefit western bumble bee. For example, implementation of BEE 1.2.1 would manage for native plant communities with wide range of blooming periods to provide for foraging habitat throughout the year.

Western Ridged Mussel (*Gonidea angulate*)

Western ridged mussel shares ecological functions and/or similar habitats as its associated focal conservation elements: steelhead, habitat connectivity, riparian corridors, and hydrological processes. This species can be found in waterways, with stable substrates similar to steelhead habitat requirements, in healthy riparian corridors with functional hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable riverine, montane riparian, and valley foothill riparian may benefit western ridged mussel. For example, implementation of HYDRO 1.1.1 would restore and protect stream hydrology to promote natural water flow regimes and healthy streams required by western ridged mussel.

California Freshwater Shrimp (*Syncaris pacifica*)

California freshwater shrimp shares ecological functions and/or similar habitats as its associated focal conservation elements: steelhead, habitat connectivity, riparian corridors, and hydrological processes. This species is commonly found in waterways with overhanging stream bank vegetation, such as those preferred by steelhead, in healthy riparian corridors with functional hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable riverine, montane riparian, and valley foothill riparian may benefit California freshwater shrimp. For example, implementation of STEEL 1.2.1 would improve riparian canopy cover and create overhanging stream bank vegetation required by California freshwater shrimp.

Delta Smelt (*Hypomesus transpacificus*)

Delta smelt shares ecological functions and/or similar habitats as its associated focal conservation elements: green sturgeon, steelhead, Chinook salmon, habitat connectivity, tidal wetlands, shallow subtidal habitat, and hydrological processes. In the RCIS area, delta smelt are found in similar tidal and estuarine habitats used by migrating, rearing, and juvenile green sturgeon, steelhead, and Chinook salmon. These habitats would be enhanced with greater habitat connectivity and functional hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable estuarine, tidal channel, and shallow subtidal embayment may benefit delta smelt. For example, implementation of HYDRO 1.1.4 would enhance the quality of tidal channels in the fringing marsh bordering northern San Pablo Bay for delta smelt.

Longfin Smelt (*Spirinchus thaleichthys*)

Longfin smelt shares ecological functions and/or similar habitats as its associated focal conservation elements: green sturgeon, steelhead, Chinook salmon, habitat connectivity, tidal wetlands, shallow subtidal habitats, and hydrological processes. In the RCIS area, longfin smelt are found in similar tidal and estuarine habitats used by migrating, rearing, and juvenile green sturgeon, steelhead, and Chinook salmon. These habitats would be enhanced with greater habitat connectivity and functional hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable riverine, estuarine, marine, and shallow subtidal embayment may benefit longfin smelt. For example, implementation of STEEL 1.2.3 would enhance the quality of habitat at the mouth of the tributary waterways to promote migration of longfin smelt to suitable freshwater breeding habitat outside of the RCIS area.

Sacramento Splittail (*Pogonichthys macrolepidotus*)

Sacramento splittail shares ecological functions and/or similar habitats as its associated focal conservation elements: green sturgeon, steelhead, Chinook salmon, habitat connectivity, tidal wetlands, shallow subtidal habitats, and hydrological processes. In the RCIS area, Sacramento splittail are found in similar tidal and estuarine habitats used by migrating, rearing, and juvenile green sturgeon, steelhead, and Chinook salmon. These habitats would be enhanced with greater habitat connectivity and functional hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable estuarine, marine, tidal channel, and shallow subtidal embayment may benefit Sacramento splittail. For example, implementation of STEEL 1.2.3 would enhance the quality of habitat at the mouth of the tributary waterways to promote migration of Sacramento Splittail.

Pallid Bat (*Antrozous pallidus*)

Pallid bat shares ecological functions and/or similar habitats as its associated focal conservation elements: Crotch's bumble bee, burrowing owl, habitat connectivity, bat habitat, riparian corridors, and working lands. This species forages in habitats used by Crotch's bumble bee and burrowing owl, as well as habitats found in working lands. Increasing habitat connectivity could create roosting habitat. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore all terrestrial natural communities may benefit pallid bat. Implementation of BAT 1.2.1 designs infrastructure projects, including culverts, to encourage roosting, and ensure that they are compatible with bats.

Townsend’s Big-eared Bat (*Corynorhinus townsendii*)

Townsend’s big-eared bat shares ecological functions and/or similar habitats as its associated focal conservation elements: Crotch's bumble bee, habitat connectivity, riparian corridors, bat habitat, and working lands. This species forages in habitats used by Crotch's bumble bees and burrowing owl, as well as along the edges of riparian corridors and habitats found in working lands. Increasing habitat connectivity could create roosting habitat. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore all terrestrial natural communities may benefit Townsend’s big-eared bat. Implementation of BAT 1.2.1 designs infrastructure projects, including culverts, to encourage roosting, and ensure that they are compatible with bats.

California Least Tern (*Sterna antillarum browni*)

California least tern shares similar habitats as its associated focal conservation elements: tidal wetlands, shallow subtidal habitats, hydrological processes, and waterfowl and shorebird habitat. This species breeds and forages in tidal wetlands, shallow subtidal habitats, and waterfowl and shorebird habitats, which relies on functional hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable tidal marsh, tidal channels, estuarine, marine, and shallow subtidal embayment may benefit California least tern. For example, implementation of TIDE 1.2.3 would promote installation of gravel beaches, offshore reefs, and other nature-based solutions to manage marsh erosion to support both nesting and foraging habitat for California least tern.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbird shares similar habitats as its associated focal conservation elements: Crotch's bumble bee, western pond turtle, burrowing owl, habitat connectivity, bat habitat, freshwater wetlands, and working lands. Tricolored blackbird forages in habitats used by Crotch's bumble bee and burrowing owl, which includes bat habitat. Tricolored blackbird breeds in similar habitat as western pond turtle, which includes freshwater wetlands. Foraging and breeding habitat is often found in working lands. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable agriculture, annual grasslands, perennial grasslands, and freshwater marsh communities that may benefit tricolored blackbird. For example, implementation of BEE 1.2.5 would implement compatible grazing practices during active periods such as summer and spring to promote a successful foraging and breeding habitat for the tricolored blackbird.

Swainson's Hawk (*Buteo swainsoni*)

Swainson's hawk shares similar habitats as its associated focal conservation elements: Crotch's bumble bee, burrowing owl, habitat connectivity, riparian corridors, and working lands. This species forages in habitats used by Crotch's bumble bee and burrowing owl, which are often found in working lands. Swainson's hawks often breed along riparian corridors. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable agriculture, annual grassland, perennial grasslands, montane riparian, and valley foothill riparian habitats may benefit Swainson's hawk. For example, implementation of BUOW 1.2.2 would promote the reduction/elimination of the control effort of small mammals to provide suitable prey species populations for Swainson's hawk.

Western Snowy Plover (*Charadrius nivosus nivosus*)

Western snowy plover shares similar habitats as its associated focal conservation elements: tidal wetlands, hydrological processes, and waterfowl and shorebird habitats. This species breeds in tidal areas used by other shorebirds, which relies on functional hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable tidal marsh, tidal flats, managed ponds, other marsh and salt pond communities may benefit western snowy plover. For example, implementation of TIDE 1.2.1 would incorporate tidal flat and tidal marsh restoration and enhancement that includes required elevations for tidal flats, low marsh, mid marsh, and high marsh components to improve breeding habitat for the western snowy plover.

Soft Bird's-Beak (*Chloropyron molle ssp. molle*)

Soft bird's beak shares similar habitats as its associated focal conservation elements: California black rail, California Ridgway's rail, salt marsh harvest mouse, tidal wetlands, and habitat connectivity. This species occurs in tidal wetlands used by California black rail, California Ridgway's rail, and salt marsh harvest mouse. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable tidal marsh may benefit soft bird's-beak. For example, implementation of TIDE 1.2.1 would manage elevations for tidal flats, low marsh, mid marsh, and high marsh components to promote restoration and enhancement of tidal wetlands suitable for the soft bird's beak.

Saltmarsh Common Yellowthroat (*Geothlypis trichas sinuosa*)

Saltmarsh common yellowthroat shares similar habitats as its associated focal conservation elements: California Ridgway's rail, California black rail, habitat connectivity, freshwater wetlands, tidal wetlands, hydrological processes, and waterfowl and shorebird habitat. This species is found in brackish marshes like the California black rail, tidal wetlands like the California Ridgway's rail, and is also known to use freshwater wetlands and riparian habitats. These wetland habitats are used by waterfowl and shorebirds and rely on function hydrological processes. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable freshwater marsh, tidal marsh, tidal channel, other marsh, and valley foothill riparian habitats may benefit saltmarsh common yellowthroat. For example, implementation of TIDE 1.2.1 would manage elevations for tidal flats, low marsh, mid marsh, and high marsh components to promote restoration and enhancement of tidal wetland habitat suitable for saltmarsh common yellowthroat.

San Pablo Song Sparrow (*Melospiza melodia*)

San Pablo song sparrow shares similar habitats as its associated focal conservation elements: California Ridgway's rail, California black rail, habitat connectivity, tidal wetlands, hydrological processes, and waterfowl and shorebird habitat. This species thrives in high marsh and tidal channels used by California Ridgway's rail, California black rail, and waterfowl and shorebird species. These tidal habitats rely on functional hydrological connectivity. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable tidal marsh, tidal channel, wastewater pond and other marsh natural communities may benefit San Pablo song sparrow. For example, implementation of TIDE 1.2.1 would focus on restoration and connecting of large blocks of suitable habitat along the shore of San Pablo Bay for the San Pablo song sparrow.

Grasslands

Grasslands may be co-benefited by actions implemented for its associated focal conservation elements: Crotch's bumble bee, California red-legged frog, western pond turtle, burrowing owl, Marin western flax, and working lands. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore may co-benefit grassland habitats. For example, implementation of WL 1.1.2 would focus on promoting and implementing more wildlife and native-plant friendly practices, such as planting cover crops, conducting controlled burns, creating secondary channels to improve flow, and removing overcrowded vegetation habitat, which would benefit grasslands.

Diked Wetlands

Diked wetlands may be co-benefited by actions implemented for its associated focal conservation elements: habitat connectivity, hydrological processes, and waterfowl and shorebird habitat. Diked wetlands are an important habitat component for migrating waterfowl and shorebirds. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable may co-benefit other marsh and managed ponds that make up diked wetlands habitats. For example, implementation of TIDE 1.1.2 would enhance diked wetlands through realignment of levees and drainage ditches.

Rookeries

Rookeries may be co-benefited by actions implemented for its associated focal conservation elements: habitat connectivity, riparian corridors, freshwater wetlands, hydrological processes, and waterfowl and shorebird habitat. Rookeries are used as nesting habitat for birds, and are found in wetlands, rocky areas, and riparian corridors. Actions for the associated focal conservation elements and regional strategies in Table J-1 that protect, enhance, or restore suitable valley foothill riparian and fresh emergent wetland communities that may benefit rookeries. For example, implementation of RIP 1.2.1 would maintain and enhance plant and wildlife species diversity and richness in relation to the rookeries.

TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Callippe silverspot butterfly *Speyeria callippe callippe* • Status: Federally endangered	• Special status • SWAP species • Population in Sonoma County is one of four total	• Annual Grassland • Perennial Grassland	• Found in native grassland and associated habitats (USFWS 1997) • Lays eggs on dry remains of larvae foodplant, *Viola pedunculata*, or the surrounding debris (USFWS 1997)	• Crotch's bumble bee • Burrowing owl • Working lands	• All RL actions • BEE 1.2.1, 1.2.3, 1.2.5, 1.3.1, 1.3.2 • BUOW 1.2.1, 1.2.2, 1.2.4 • All WL actions
Western bumble bee *Bombus occidentalis* • Status: State Candidate Endangered	• Special status • SWAP species	• Annual Grassland • Perennial Grassland • Coastal Scrub	• Found in open grassland and scrub habitats (Xerces Society et al. 2018) • Primarily nests underground (Xerces Society et al. 2018) • Generalist foragers visiting a variety of flowering plants (Xerces Society et al. 2018)	• Crotch's bumble bee • Burrowing owl • Working lands	• All RL actions • BEE 1.1.1, 1.2.1, 1.2.3, 1.2.4, 1.2.5, 1.2.6, 1.3.1, 1.3.2 • BUOW 1.2.1, 1.2.2, 1.2.3, 1.2.4 • All WL actions
Western ridged mussel *Gonidea angulate* • Status: None	• Taxonomic representative • Napa River is one of 17 California waterbodies with known occurrences • State rank critically imperiled/imperiled	• Montane Riparian • Riverine • Valley Foothill Riparian	• Prefer constant water flow that is well-oxygenated with stable substrates in areas of low gradient (Xerces Society 2020) • Rarely in streams that are continuously turbid (Xerces Society 2020)	• Steelhead • Habitat connectivity • Riparian corridors • Hydrological processes	• All RL actions • All WATER actions • STEEL 1.2.1, 1.2.2, 1.3.2, 1.3.4 • HC 1.1.2, 1.1.3, 1.1.4 • All RIP actions • HYDRO 1.1.1, 1.1.2, 1.1.5, 1.1.6, 1.1.7, 1.1.8

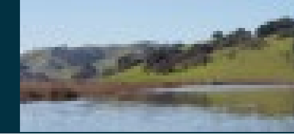


TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
California freshwater shrimp *Syncaris pacifica* • Status: Federally endangered, State endangered	• Special status • Sonoma Creek, Napa River, and Huichica Creek are among few known waterways statewide with occurrences	• Montane Riparian • Riverine • Valley Foothill Riparian	• Found in perennial lowland freshwater streams in Marin, Napa, and Sonoma Counties (Martin et al. 2009) • Typically occupies areas with overhanging stream bank vegetation, sandy substrate, slower water velocities, and an abundance of underwater structures (Martin et al. 2009)	• Steelhead • Habitat connectivity • Riparian corridor • Hydrological processes	• All RL actions • All WATER actions • STEEL 1.2.1, 1.2.2, 1.3.1, 1.3.2, 1.3.4 • HC 1.1.2, 1.1.3, 1.1.4 • All RIP actions • HYDRO 1.1.1, 1.1.2, 1.1.5, 1.1.6, 1.1.7, 1.1.8
Delta smelt *Hypomesus transpacificus* • Status: Federally threatened; State endangered	• Special status • SWAP species • Umbrella or keystone species • Climate change vulnerability list • Critical habitat connectivity needed • Habitat limited or already protected	• Estuarine • Tidal Channel • Shallow Subtidal Embayment	• Endemic to San Francisco Estuary (IEP MAST 2015) • Spawns in freshwater, rears in fresh to brackish water (IEP MAST 2015) • Larger tidal sloughs and tributaries adjacent to San Pablo Bay, including the lower Napa River (IEP MAST 2015)	• Green sturgeon • Steelhead • Chinook salmon • Habitat connectivity • Tidal wetlands • Shallow subtidal habitat • Hydrological processes	• All RL actions • All WATER actions • All FISH actions • TIDE 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.6, 1.2.1, 1.2.2, 1.2.5 • GRST 1.3.1 • STEEL 1.2.3 • CHIN 1.2.1 • HC 1.1.2, 1.1.3 • TW 1.2.1, 1.2.3, 1.2.6 • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.7, 1.1.8

TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Longfin smelt – San Francisco Bay-Delta DPS *Spirinchus thaleichthys* • Status: State threatened; Federally proposed endangered	• Special status • Climate change vulnerability list	• Riverine • Estuarine • Marine • Shallow Subtidal Embayment	• Facultatively anadromous and spawns in brackish to freshwater in Delta (USFWS 2022) • Juveniles and migrating adults forage in San Pablo Bay (USFWS 2022) • During wet years, have been detected in the lower Napa and lower Petaluma rivers (USFWS 2022)	• Green sturgeon • Steelhead • Chinook salmon • Habitat connectivity • Tidal wetlands • Shallow subtidal habitat • Hydrological processes	• All RL actions • All WATER actions • All FISH actions • TIDE 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.6, 1.2.1, 1.2.2, 1.2.5 • GRST 1.3.1 • STEEL 1.2.3 • CHIN 1.2.1 • HC 1.1.2, 1.1.3 • TW 1.2.1, 1.2.3, 1.2.6 • All SUBTIDAL actions • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.7, 1.1.8
Sacramento splittail *Pogonichthys macrolepidotus* • Status: Species of special concern	• Special status • SWAP species • Climate change vulnerability list	• Riverine • Estuarine • Marine • Shallow Subtidal Embayment	• Self-sustaining population in lower Petaluma Rivers. During wet years, have been detected in the lower Napa and Napa Marsh (Moyle et al. 2004) • Spawn on seasonally inundated floodplains, juveniles rear in brackish water (Moyle et al. 2004) • Prefer freshwater, though are tolerant of moderate salinities (USFWS 1996)	• Green sturgeon • Steelhead • Chinook salmon • Habitat connectivity • Tidal wetlands • Shallow subtidal habitat • Hydrological processes	• All RL actions • All WATER actions • All FISH actions • TIDE 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.6, 1.2.1, 1.2.2, 1.2.5 • GRST 1.3.1 • STEEL 1.2.3 • CHIN 1.2.1 • HC 1.1.2, 1.1.3 • TW 1.2.1, 1.2.3, 1.2.6 • All SUBTIDAL actions • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.1.7, 1.1.8

TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Pallid bat *Antrozous pallidus* • Status: Species of special concern	• Special status • SWAP species • Western Bat Working Group High Priority species	• All terrestrial communities	• Roosts in trees and structures such as bridges, buildings, and barns (WBWG 2017) • Forages in open areas (WBWG 2017)	• Crotch's bumble bee • Burrowing owl • Habitat connectivity • Bat habitat • Riparian corridors • Working lands	• All RL actions • WATER 1.1.1, 1.1.4, 1.1.5 • All WL actions • All BAT actions • BEE 1.2.3, 1.3.1; 1.3.2 • BUOW 1.2.4 • HC 1.1.4 • RIP 1.2.1, 1.2.3
Townsend's big-eared bat *Corynorhinus townsedii* • Status: Species of special concern	• Special status • Western Bat Working Group High Priority species	• All terrestrial communities	• Roosts in trees, caves, tunnels, and structures such as bridges, buildings, and barns (WBWG 2017) • Prefers to forage along habitat edges (WBWG 2017)	• Crotch's bumble bee • Burrowing owl • Habitat connectivity • Riparian corridors • Bat habitat • Working lands	• All RL actions • WATER 1.1.1, 1.1.4, 1.1.5 • All WL actions • All BAT actions • BEE 1.2.3, 1.3.1; 1.3.2 • BUOW 1.2.4 • HC 1.1.4 • RIP 1.2.1, 1.2.3

TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
California least tern *Sternula antillarum browni* • Status: Federally endangered; State endangered; State Fully protected	• Special status • SWAP species • Climate change vulnerability list	• Tidal Channel • Tidal Marsh • Estuarine • Marine • Shallow Subtidal Embayment	• Breeding habitat: light-colored sand, dirt, or dried mud close to a lagoon or estuary. (USFWS 2020) • Feeds on mostly fish (USFWS 2020)	• Tidal Wetlands • Shallow Subtidal Habitat • Hydrological processes • Waterfowl and shorebird habitat	• All RL actions • WATER 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5 • TIDE 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.6, 1.1.8, 1.2.1, 1.2.2, 1.2.3, 1.2.4, 1.2.6, 1.2.7, 1.2.8 • TW 1.2.1, 1.2.3, 1.2.4 • All SUBTIDAL actions • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.7, 1.1.8 • BIRD 1.2.1, 1.2.2, 1.2.3, 1.2.5
• Swainson's hawk *Buteo swainsoni* • Status: State threatened	• Special status • SWAP species • Climate change vulnerability list	• Agriculture • Annual Grasslands • Perennial Grasslands • Montane Riparian • Valley Foothill Riparian	• Typical habitat: open desert, grassland, or cropland containing scattered, large trees or small groves (CDFW 2006) • Feeds on small mammals, amphibians, reptiles, birds, large arthropods, rarely fish (CDFW 2006) • Usually nest near water, but also arid regions (CDFW 2006)	• Crotch's bumble bee • Burrowing owl • Habitat connectivity • Riparian corridors • Working lands	• All RL actions • WATER 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.7 • All WL actions • BEE 1.2.3, 1.3.1, 1.3.2 • BUOW 1.2.2, 1.2.4, 1.3.1 • HC 1.1.2, 1.1.4 • ALL RIP actions

TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Tricolored blackbird *Agelaius tricolor* • Status: State threatened; Species of special concern	• Special status • SWAP species	• Agriculture • Annual Grasslands • Perennial Grasslands • Freshwater Marsh	• Nest over or near freshwater, especially emergent wetlands in dense cattails or tule (CDFW 2008) • Roost in flocks in emergent wetlands or trees (CDFW 2008) • Feeds on mostly insects, spiders, seeds, and cultivated grains (CDFW 2008)	• Crotch's bumble bee • Burrowing owl • Western pond turtle • Habitat connectivity • Bat habitat • Freshwater wetlands • Working lands	• All RL actions • WATER 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.7 • All WL actions • BEE 1.2.3, 1.2.5, 1.3.1, 1.3.2 • WPT 1.2.2, 1.2.3 • BUOW 1.2.4 • HC 1.1.4 • All FW actions
Western snowy plover *Charadrius nivosus nivosus* • Status: Federally threatened; Species of special concern	• Special status • SWAP species • Climate change vulnerability list	• Tidal Marsh • Tidal Flat • Managed Pond • Other Marsh • Salt Pond	• Breeding habitat: Flat, open areas with sandy or saline substrates and sparse vegetation (USFWS 2007) • Forage on invertebrates in intertidal zone, sandy areas above high tide, salt pans, and along edges of salt marshes, salt ponds, and lagoons (USFWS 2007)	• Tidal wetlands • Hydrological processes • Waterfowl and shorebird habitat	• All RL actions • WATER 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5 • TIDE 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.6, 1.1.8, 1.2.1, 1.2.2, 1.2.3, 1.2.4, 1.2.6, 1.2.7, 1.2.8 • TW 1.2.1, 1.2.2, 1.2.3, 1.2.4 • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.7, 1.1.8 • BIRD 1.2.1, 1.2.2, 1.2.3, 1.2.5

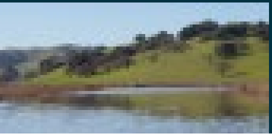


TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa* • Status: Species of special concern	• Special status • SWAP species • Climate change vulnerability list	• Freshwater Marsh • Tidal Marsh • Tidal Channel • Other Marsh • Valley Foothill Riparian	• Breeding habitat: riparian woodland, brackish marsh, freshwater marsh, and salt marsh. Also found in ecotones between aquatic and upland habitats (Shuford and Gardali 2008) • Feed on insects and spiders (Shuford and Gardali 2008) • Dense vegetation required for nesting, song perches, and cover from predators (Shuford and Gardali 2008)	• California Ridgway's rail • California black rail • Salt marsh harvest mouse • Habitat connectivity • Riparian corridors • Freshwater wetlands • Tidal wetlands • Hydrological processes • Waterfowl and shorebird habitat	• All RL actions • WATER 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5 • All TIDE actions • SMHM 1.2.3 • HC 1.1.2, 1.1.3 • All FW actions • All TW actions • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.7, 1.1.8 • BIRD 1.2.3, 1.2.5
San Pablo song sparrow *Melospiza melodia samuelis* • Status: Species of special concern	• Nearly endemic to the RCIS area • Umbrella or keystone species • SWAP species • Climate change vulnerability list	• Tidal Marsh • Tidal Channel • Wastewater Pond • Other Marsh	• Habitat: high marsh with pickleweed and tidal channels lined with gumplant (Shuford and Gardali 2008) • Dense vegetation required for nesting, song perches, and cover from predators (Shuford and Gardali 2008)	• California Ridgway's rail • California black rail • Salt marsh harvest mouse • Habitat connectivity • Tidal wetlands • Hydrological processes • Waterfowl and shorebird habitat	• All RL actions • WATER 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5 • All TIDE actions • SMHM 1.2.3 • HC 1.1.2, 1.1.3 • All TW actions • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.7, 1.1.8 • BIRD 1.2.3, 1.2.5

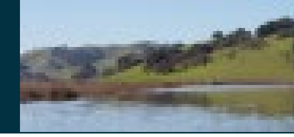


TABLE J-1: NON-FOCAL SPECIES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Soft bird's beak *Chloropyron molle* ssp. *molle* Status: Federally endangered, State listed- rare	• Special status • SWAP species • Critical habitat connectivity needed	• Tidal Marsh	• Found in tidal and brackish marshes in a range of soil types (e.g., peaty clay silt tidal marsh soils, mineral alluvial sediments along the margins of shallow salt pans at the upper marsh edge, and marsh soils that formed on top of artificial fill (USFWS 2013, 2023)	• California black rail • California Ridgway's rail • Salt marsh harvest mouse • Habitat connectivity • Tidal wetlands • Hydrological processes	• All RL actions • WATER 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5 • All TIDE actions • HC 1.1.2, 1.1.3 • All TW actions • HYDRO 1.1.1, 1.1.2, 1.1.4, 1.1.7, 1.1.8

TABLE J-3: CO-BENEFITED NATURAL RESOURCES, ECOLOGICAL REQUIREMENTS, ASSOCIATIONS, AND BENEFICIAL ACTIONS

Co-Benefited Natural Resource	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Grasslands	• Important habitat for wetland to upland transition zones. • Perennial grasslands are an uncommon plant community that support many native plant species. • Supports numerous special-status species.	• Annual Grassland • Perennial Grassland	• Annual grasslands dominated by annual grasses like wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue (CDFW 2005a) • Annual grasslands occur on flat planes to gently rolling foothills, commonly found on Entisols and Alfisols dominated soils (CDFW 2005a) • Perennial grasslands dominated by perennial grasses like California oatgrass, Pacific hairgrass, and sweet vernal grass (CDFW 2005b) • Perennial grasslands occur on ridges and south-facing slopes, within maritime climatic influence, commonly found on Mollisols soils (CDFW 2005b)	• Crotch's bumble bee • Burrowing owl • California red-legged frog • Western pond turtle • Marin western flax • Working lands	• All RL actions • BEE 1.1.1, 1.2.1, 1.2.3, 1.2.5, 1.3.1, 1.3.2 • BUOW 1.2.1, 1.2.2, 1.2.3, 1.2.4, 1.3.1 • CRLF 1.2.2, 1.2.3, 1.2.4, 1.3.1 • WPT 1.2.2 • MWF 1.2.1, 1.3.3 • WL 1.1.1, 1.1.2, 1.1.3
Diked wetlands	• Diked wetlands are managed to support waterfowl and migratory birds	• Other Marsh • Managed Pond	• Historical tidal marshes that have been isolated from tidal influence by dikes or levees, but which maintain primarily wetland features (Goals Project 1999) • Plant communities vary greatly and can resemble those of local tidal salt marsh, tidal brackish marsh, non-tidal perennial freshwater marsh, or seasonally wet grasslands (Goals Project 1999)	• Habitat Connectivity • Hydrological processes • Waterfowl and Shorebird habitats	• All RL actions • All WATER actions • TIDE 1.1.2, 1.1.3, 1.1.4, 1.1.6, 1.1.8 • HC 1.1.2, 1.1.4 • HYDRO 1.1.3, 1.1.6, 1.1.7 • BIRD 1.2.2, 1.2.4, 1.2.5
Rookeries	• Critical for some bird species that rely on the baylands, including keystone species such as herons and egrets. • Requested by stakeholders.	• Valley Foothill Riparian • Freshwater Marsh	• Suitable habitat for birds to nest, wetlands, rocky areas, dense vegetation • High concentration of nesting Great Egrets in Suisun Bay coincided with the most biologically productive waters in the San Francisco Bay estuary (Kelly et al. 1993)	• Habitat connectivity • Riparian corridors • Freshwater wetlands • Hydrological processes • Waterfowl and Shorebird habitats	• All RL actions • All WATER actions • HC 1.1.1, 1.1.2, 1.1.4 • RIP 1.2.1, 1.2.2 • HYDRO 1.1.1, 1.1.6, 1.1.7 • All FW actions • BIRD 1.2.1, 1.2.2, 1.2.5

TABLE J-4: MATRIX OF NON-FOCAL SPECIES AND CO-BENEFITED NATURAL RESOURCES TO ASSOCIATED REGIONAL STRATEGIES

Non-focal Species and Co-benefited Natural Resources	Regional Landscape	Water Quality	Anadromous Fish	Tidal Communities
Callippe silverspot	X			
Western bumble bee	X			
Western ridged mussel	X	X		
California freshwater shrimp	X	X		
Delta smelt	X	X	X	X
Longfin smelt	X	X	X	X
Sacramento splittail	X	X	X	X
Pallid bat	X			
Townsend's big-eared bat	X			
California least tern	X	X		X
Tricolored blackbird	X	X		
Swainson's hawk	X	X		
Soft bird's-beak	X	X		X
Saltmarsh common yellowthroat	X	X		X
San Pablo song sparrow	X	X		X
Western snowy plover	X	X		X
Grasslands	X			
Diked wetlands	X	X		X
Rookeries	X	X		

TABLE J-3: MATRIX OF NON-FOCAL SPECIES AND CO-BENEFITED NATURAL RESOURCES TO ASSOCIATED FOCAL CONSERVATION ELEMENT STRATEGIES

Non-focal Species and Co-benefited Natural Resources	Crotch's Bumble Bee	Green Sturgeon	Steelhead	Chinook Salmon	California Red-legged Frog	Western Pond Turtle	Burrowing Owl	California Black Rail	California Ridgway's Rail	Salt Marsh Harvest Mouse	Marin Western Flax	Habitat Connectivity	Bat Habitat	Riparian Corridors	Fresh Wetlands	Tidal Wetlands	Shallow Subtidal Habitat	Working Lands	Hydrological Processes	Waterfowl and Shorebird Habitat
Callippe silverspot	X						X											X		
Western bumble bee	X						X											X		
Western ridged mussel			X									X		X					X	
California freshwater shrimp			X									X		X					X	
Delta smelt		X	X	X								X				X	X		X	
Longfin smelt		X	X	X								X				X	X		X	
Sacramento splittail		X	X	X								X				X	X		X	
Pallid bat	X						X					X		X				X		
Townsend's big-eared bat	X						X					X		X				X		
California least tern																X	X		X	X
Tricolored blackbird	X					X	X					X	X		X			X		
Swainson's hawk	X						X					X	X					X		
Soft bird's-beak								X	X	X		X				X				
Saltmarsh common yellowthroat								X	X	X		X		X	X	X			X	X
San Pablo song sparrow								X	X	X		X				X			X	X
Western snowy plover																X			X	X
Grasslands	X				X	X	X				X							X		
Diked wetlands												X							X	X
Rookeries												X		X	X				X	X

References

California Department of Fish and Wildlife (CDFW). 2005a. *California Wildlife Habitat Relationships System: Annual Grassland*. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=67384&inline. Accessed February 1, 2023.

———. 2005b. *California Wildlife Habitat Relationships System: Perennial Grassland*. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=67386&inline. Accessed February 1, 2023.

———. 2006. *California Wildlife Habitat Relationships System: Swainson's Hawk*. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=1673&inline=1. Accessed January 26, 2023.

———. 2008. *California Wildlife Habitat Relationships System: Tricolored-Blackbird*. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=2181&inline=1. Accessed January 26, 2023.

———. 2023. Regional Conservation Investment Strategies Program Guidelines. June 2023. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=213325&inline

IEP MAST (Interagency Ecological Program, Management, Analysis and Synthesis Team). 2015. *An updated conceptual model of Delta smelt biology: our evolving understanding of estuarine fish*. Technical Report 90, January 2015, prepared for the San Francisco Bay/Delta Estuary.

Goals Project. 1999. Baylands Ecosystem Habitat Goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency, San Francisco, Calif./S.F. Bay Regional Water Quality Control Board, Oakland, Calif.

Kelly, J. P., Pratt, H. M., & Greene, P. L. (1993). The Distribution, Reproductive Success, and Habitat Characteristics of Heron and Egret Breeding Colonies in the San Francisco Bay Area. Colonial Waterbirds, 16(1), 18–27. https://doi.org/10.2307/1521552.

Martin, B., Saiki M., Fong D. 2009. *Habitat Requirements of the Endangered California Freshwater Shrimp (Syncaris Pacifica) in Lagunitas and Olema Creeks, Marin County, California, USA. Journal of Crustacean Biology*, Volume 29, Issue 4. Pages 595–604, https://doi.org/10.1651/08-3134.1, Accessed on January 26, 2023.

Moyle, P.B., R.D. Baster, T. Sommer, T.C. Foin, and S.A. Matern. 2004. Biology and Population Dynamics of Sacramento splittail (*Pogonichthys macrolepidotus*) in the San Francisco Estuary: A Review. San Francisco Estuary and Watershed Science [online serial]. Vol. 2, Issue 2 (May 2004), Article 3. Available online at: https://pdfs.semanticscholar.org/5e1d/a18c0649f747088efe 36e6a254feaccf5778.pdf.

Shuford, W. D., and Gardali, T., editors. 2008. *California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California*. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

United States Fish and Wildlife Service (USFWS). 1996. Sacramento-San Joaquin Delta Native Fishes Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR. Available online at: https://ecos.fws.gov/docs/recovery_plan/961126.pdf.

———. 1997. *Endangered and Threatened Wildlife and Plants; Determination of Endangered Status of the Callippe Silverspot Butterfly and the Behren's Silverspot Butterfly and Threatened Status of the Alameda Whipsnake*. Available: http://go.microsoft.com/fwlink/p/?LinkId=255141. Accessed on January 26, 2023.

———. 2007. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandriunus nivosus*). In 2 volumes. Sacramento, CA. Available: https://ecos.fws.gov/docs/recovery_plan/070924.pdf

———. 2013. Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California. Sacramento, California.

———. 2020. California least tern (*Sternula antillarum browni*) 5-year Review: 2020 Summary and Evaluation. Carlsbad Fish and Wildlife Office, Carlsbad, CA.

———. 2022. Species Status Assessment for the San Francisco Bay-Delta Distinct Population Segment of the Longfin Smelt. U.S. Fish and Wildlife Service. San Francisco Bay-Delta Fish and Wildlife Office, Sacramento, CA.

———. 2023. Soft Bird's-Beak (*Chloropyron molle* ssp. *molle*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, San Francisco Bay-Delta Fish and Wildlife Office. Available: https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/8889.pdf

Western Bat Working Group (WBWG). 2017. *Western Bat Species*. Available: https://wbwg.org/western-bat-species/

Xerces Society for Invertebrate Conservation (Xerces Society), Defenders of Wildlife, and Center for Food Safety. 2018. *A Petition to the State of California Fish and Game Commission to List: Crotch's bumble bee (Bombus crotchii), Franklin's bumble bee (Bombus franklini), Suckley cuckoo bumble bee (Bombus suckleyi), and western bumble bee (Bombus occidentalis occidentalis) as Endangered under the California Endangered Species Act.* Available: https://www.xerces.org/publications/policy-statements/california-esa-bumble-bee-petition-2018

Xerces Society for Invertebrate Conservation (Xerces Society). 2020. *A Petition to list The Western Ridged Mussel Gonidea angulata (lea, 1838) As An Endangered Species under the U.S. Endangered Species Act*. Available: https://xerces.org/sites/default/files/publications/20-023.pdf