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EAST BAY
REGIONAL CONSERVATION INVESTMENT STRATEGY

Volume 1

California State Coastal Conservancy
The Nature Conservancy
East Contra Costa County Habitat Conservancy
Metropolitan Transportation Commission
AECOM

ICF

EAST BAY REGIONAL CONSERVATION INVESTMENT STRATEGY

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Foreword

Welcome to the East Bay Regional Conservation Investment Strategy (RCIS). The East Bay RCIS is a voluntary, non-regulatory document that provides a snapshot of existing environmental conditions in the East Bay (Alameda and Contra Costa counties) and identifies actions to protect, enhance, and restore conservation values in the region. The East Bay hosts a rich array of natural resources that provide important services to people and nature. The plants, animals, wetlands, grasslands, forests, creeks and streams in Alameda and Contra Costa Counties help clean our water and air, reduce flood risk and help adapt to sea level rise, provide local food and healthy recreation, sequester carbon to help mitigate climate change, and support a thriving economy. At the same time, the region's habitat and resources are at threat from urbanization, fragmentation, and climate stress. These are some of the values and opportunities the East Bay RCIS is designed to address.

The East Bay RCIS, enabled by AB 2087 (Levine-2016), was developed to help guide conservation investments and land use planning in the region. The East Bay RCIS was also created to enable Regional Advance Mitigation Planning investments to support conservation and infrastructure development goals through Mitigation Credit Agreements (MCAs). An entity can develop an MCA to invest in conservation or enhancement actions listed in an RCIS (Chapter 3 of the East Bay RCIS) and receive mitigation credits for future projects that the entity can then use for their purposes, transfer, or sell to others.

The State Coastal Conservancy (the state agency RCIS proponent), the Nature Conservancy, the Metropolitan Transportation Commission, ICF, and AECOM worked with stakeholders from around the region to develop the document. The stakeholders included representation from resource agencies, transportation agencies, local governments, land use planners, environmental organizations, land trusts, farming and ranching interests, the development community and others (see Appendix C), all of whom can be users of the document.

The East Bay RCIS includes detailed information, compiled from best available scientific data and, including data on key species, habitats, and natural communities in the region. The East Bay RCIS is complimented by the Bay Area Greenprint (www.bayareagreenprint.org), which identifies conservation co-benefits such as clean water, flood risk reduction, carbon sequestration, priorities for tree planting, and habitat connectivity corridors. Taken together, the RCIS and the Greenprint provide guidance for investing in protecting conservation values and avoiding costly impacts to species, habitats, and environmental values.

The document is organized around four chapters:

Chapter 1, Introduction. This chapter provides a general background about the RCIS program with a focus on the East Bay RCIS including the study area, the context and purpose and need, the proponent and stakeholders, CDFW's required elements for an RCIS and organization and information specific to the study area including relevant plans and policies. Read this chapter to get a basic understanding of the document and why it was developed.

Chapter 2, Environmental Setting. This chapter identifies the East Bay RCIS study area's existing environmental conditions and built environment. The environmental conditions sections include information on ecoregions, watersheds, natural communities, focal species and sensitive species, and conservation elements such as habitat connectivity, working landscapes and baylands. It includes foreseeable infrastructure development and a list of existing conservation and mitigation banks. It also includes a section on pressures and stressors that are impacting the environmental health of the region. As required by law, the RCIS's conservation strategy is organized around 'focal species' and natural communities to represent the suite of resources that are important to the ecological health of the region. This chapter identifies the RCIS's focal species (plants and animals) and the rationale for identifying the suite of species. Read this chapter to understand the current environmental conditions in the region that influence the RCIS's conservation strategy.

Chapter 3, Conservation Strategy. This chapter presents the East Bay RCIS's conservation goals, objectives, and priorities and conservation and enhancement actions that can be implemented to achieve the RCIS's goals and objectives. The information in this chapter can help guide conservation funding to resource-rich areas and assist infrastructure agencies and developers to avoid conflicts with species and habitats as they develop plans and projects. Importantly, MCAs must be consistent with the East Bay RCIS by implementing the conservation, restoration, enhancement, and other actions listed in this chapter to receive advance mitigation credit for focal or non-focal species. Read this chapter to find out what conservation strategies are relevant for the RCIS species and habitat.

Chapter 4 Implementation. This chapter provides guidance and suggestions for using the RCIS for various purposes. As a voluntary document, there are no requirements for implementation. That said, the RCIS is meant to be useful to various users, and once approved, MCAs can be developed to implement the conservation actions and habitat enhancement actions recommended in this RCIS to provide efficient project delivery pathways for infrastructure agencies. Thus, the Implementation Chapter provides guidance for conservation investments, advance mitigation activities (including supporting the East Contra Costa Habitat Plan and mitigation banks), the proponent's role in the RCIS and other issues. Read this chapter to get familiar with implementation opportunities. Read this chapter to find out how to use the RCIS to support your work.

Appendices. The appendices include a lot of valuable information, from a glossary of terms, to the outreach activities, to the analysis that identified the list of focal (and non-focal) species. Depending on your use of the RCIS, you may find specific appendices helpful. Read the relevant appendices to find out the supporting data and details about how we crafted this document.

Specific Uses of the Document:

The RCIS can be used by a range of entities, and for a variety of purposes. For example:

- If you are a land use planner in the region: you can use the RCIS to inform general plans, climate action plans, and areas of high conservation value.
- If you work in conservation: you can use the RCIS to locate high-priority areas to invest conservation funding, find out what conservation actions will be most impactful, and to develop MCAs that support your organization's area of focus.
- If you work for an infrastructure agency: you can use the RCIS to site and design projects to avoid impacts to habitats and species, potentially reducing risk for your plans and projects. You can also use the RCIS to develop MCAs to mitigate in advance for your future projects, potentially saving time and money on more efficient and effective mitigation. If the project is within the boundary of the East Contra Costa County Habitat Conservation Plan/Natural Communities Conservation Plan (ECCC HCP/NCCP), it is important to work directly with the ECCC HCP/NCCP Habitat Conservancy on your project and mitigation needs.

- If you invest in or develop mitigation or conservation banks: you can use the RCIS to understand future infrastructure needs and find out where to site a bank in an area that is species rich and has a high number of potential conservation actions.
- If you are interested in wildlife corridors: you can use the RCIS to identify key locations and actions to support habitat connectivity and develop an MCA or seek funding for those actions.
- If you are a land manager: If you own or manage property in an area that is important for habitat or species conservation, including rangeland or farmland, you can use the RCIS to work with public and private partners to bring funding sources to protect or enhance the property.

If you have any questions or if you would like access to the information in the RCIS, please contact California Department of Fish and Wildlife's RCIS Program (https://wildlife.ca.gov/conservation/planning/regional-conservation or RCIS@wildlife.ca.gov).

You can also contact the proponent, the State Coastal Conservancy's Bay Area Program (https://scc.ca.gov/projects/san-francisco-bay/) if you have specific questions about conservation in the San Francisco Bay Area.

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Acronyms and Abbreviations

Acronym	Definition
AB 2087	Assembly Bill No. 2087
ABAG	Association of Bay Area Governments
AC Transit	Alameda-Contra Costa Transit District
Alameda CTC	Alameda County Transportation Commission
Antioch Dunes NWR	Antioch Dunes National Wildlife Refuge
Antioch Dunes Recovery Plan	Revised Recovery Plan for Three Endangered Species Endemic to Antioch Dunes
APLIC	Avian Line Interaction Committee’s
APWRA	Altamont Pass Wind Resource Area
BAARI	Bay Area Aquatic Resource Inventory, version 2.0
BAIFA	Bay Area Infrastructure Financing Authority
BART	Bay Area Rapid Transit
BATA	Bay Area Toll Authority
Bay Area	San Francisco Bay Area
Bay Area IRWMP	Bay Area Integrated Regional Water Management Plan
BISON	Biodiversity Information Serving Our Nation
California Least Tern Recovery Plan	Revised California Least Tern Recovery Plan
California Red-legged Frog Recovery Plan	Recovery Plan for the California Red-legged Frog
California Tiger Salamander Recovery Plan	Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CCED	California Conservation Easement Database
CCTA	Contra Costa Transportation Authority
CDFW	California Department of Fish and Wildlife
CEHCP	California Essential Habitat Connectivity Project
CEQA	California Environmental Quality Act
CFGC	California Fish and Game Code
CFR	Code of Federal Regulations

Acronym	Definition
Chinook and Steelhead Coastal Recovery Plan	Coastal Multispecies Recovery Plan for California Coastal Chinook Salmon, Northern California Steelhead, and Central California Coast Steelhead
CLN	Conservation Lands Network
CNDDB	California Natural Diversity Database
Coastal Conservancy	California State Coastal Conservancy
Corps	U.S. Army Corps of Engineers
CPAD	California Protected Areas Database
CPUs	conservation planning units
Critical Linkages	Critical Linkages: Bay Area and Beyond
CRPR	California Rare Plant Rank
CWD	Climatic water deficit
Delta	Sacramento–San Joaquin Delta
Delta Native Fishes Recovery Plan	Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes
DPS	Distinct Population Segment
DWR	Department of Water Resources
EACCS	East Alameda County Conservation Strategy
EBCE	East Bay Community Energy
EBMUD HCP	East Bay Municipal Utility District Habitat Conservation Plan
EBRPD	East Bay Regional Park District
ECCC HCP/NCCP	East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FRAP	Fire and Resource Assessment Program
Giant Garter Snake Recovery Plan	Recovery Plan for Giant Garter Snake
GIS	geographic information system
Habitat Conservancy	East Contra Costa County Habitat Conservancy
Habitat Plan	Santa Clara Valley Habitat Plan
HCPs	Habitat Conservation Plans
HUC	Hydrologic Unit Code
ITIP	Interregional Transportation Improvement Program
Legislature	California State Legislature

Acronym	Definition
MCA	mitigation credit agreement
MCE	Marin Clean Energy
MTC	Metropolitan Transportation Commission
MW	megawatts
NFWF	National Fish and Wildlife Foundation's
OHV	off-highway vehicle
park	Shadow Cliffs Regional Park
PG&E	Pacific Gas & Electric
Program Guidelines	Regional Conservation Investment Strategies Program Guidelines
project	Shadow Cliffs Regional Park Solar Project
RAMP	Regional Advance Mitigation Planning
RAMP TAC	RAMP Technical Advisory Committee
RCIS	Regional Conservation Investment Strategy
Refuge	Don Edwards San Francisco Bay National Wildlife Refuge
ROWs	right of ways
San Joaquin Valley Recovery Plan	Recovery Plan for Upland Species of the San Joaquin Valley, California
Serpentine Soils Recovery Plan	Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area
SFPUC	San Francisco Public Utilities Commission
SGCN	Species of Greatest Conservation Need
SHOPP	State Highway Operations and Protection Program
SSC	Species of Special Concern
SSURGO	Serpentine map units from the Soil Survey Geographic
SWAP	State Wildlife Action Plan
SWP	State Water Project
Tidewater Goby Recovery Plan	Recovery Plan for Tidewater Goby
TNC	The Nature Conservancy
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USFWS	U.S. Fish and Wildlife Service
Vernal Pool Recovery Plan	Recovery Plan for Vernal Pool Ecosystems in California and Southern Oregon

Acronym	Definition
Western Snowy Plover Recovery Plan	Recovery Plan for Western Snowy Plover Pacific Coast Population
WSIP	Water System Improvement Program

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Chapter 1
Introduction

1.1 Background

In 2016, the California State Legislature (Legislature) worked with the California Department of Fish and Wildlife (CDFW) to find creative ways to guide voluntary conservation actions and habitat enhancement actions for the state's most vulnerable species and their habitats. This collaboration resulted in Assembly Bill No. 2087 (AB 2087), which outlines a program for informing science-based, non-binding, and voluntary conservation actions and habitat enhancement actions that would advance the conservation of focal species,[1] natural communities, and other conservation elements at a regional scale, including actions to address the impacts of climate change and other pressures and stressors that influence the resiliency of those species. Through its passage, AB 2087 amended the California Fish and Game Code (CFGC), Division 2, Chapter 9, to add Sections 1850-1861, which creates a pilot regional conservation investment strategy program.

The program allows for CDFW or any public agency to develop a Regional Conservation Investment Strategy (RCIS) to guide voluntary conservation actions and habitat enhancement actions for a suite of species and natural communities. The RCIS must include specific information about conservation actions and habitat enhancement actions necessary to adequately reduce stressors and negative pressures on those species, including identifying conservation priorities within the region, where appropriate. An RCIS identifies areas of conservation priority for implementation of conservation actions and habitat enhancement actions by public agencies, conservation organizations, or private entities. An approved RCIS may also be used by entities requiring compensatory mitigation to facilitate selection of appropriate mitigation actions and mitigation sites.

To support and guide development of RCISs, CDFW released the *Regional Conservation Investment Strategies Program Guidelines* (Program Guidelines) in April 2017 (California Department of Fish and Wildlife 2017). These Program Guidelines were updated in June 2017 and again in February and September, 2018 (California Department of Fish and Wildlife 2018). This East Bay RCIS was developed consistent with CFGC Section 1850–1861, as well as the September 2018 Program Guidelines. As allowed by the September 2018 Program Guidelines, this East Bay RCIS is exempt from most requirements in the September 2018 Program Guidelines and is subject to the June 2017 Program Guidelines because this RCIS was initiated in March 2016.[2]

A key component of the Program Guidelines is Section 2, *Standard Terminology*, which contains a detailed list of terms, abbreviations, and definitions applicable to RCISs. As required by the Program Guidelines, the East Bay RCIS uses the terms provided in the September 2018 Program Guidelines.

[1] The Program Guidelines define focal species as "(s) Sensitive species that are identified and analyzed in an RCIS and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Focal species may benefit through both conservation investments and MCAs."

[2] The East Bay RCIS held a public meeting on October 24, 2016 as part of the East Bay Regional Park District's Parks Advisory Committee meeting. Written documentation that the East Bay RCIS was initiated prior to January 1, 2017 can be found at the end of Appendix C, *Public Outreach*, *Public Meeting Summary and Comments* in the form of the meeting agenda and an informational handout provided at the meeting.

Appendix A, *Glossary*, integrates these terms and includes additional terms and abbreviations specific to this East Bay RCIS.

By authorizing CDFW to approve RCISs, it is not the intent of the Legislature to regulate the use of land, establish land use designations, or to affect, limit, or restrict the land use authority of any public agency. Nothing in this RCIS is intended to, nor shall it be interpreted to, conflict with controlling federal, state, or local law, including Fish and Game Code sections 1850-1861, or any Guidelines adopted by the Department of Fish and Wildlife pursuant to Section 1858. Therefore, actions carried out as a result of this RCIS will be in compliance with all applicable state and local requirements.

In addition, this East Bay RCIS does not conflict with the following requirements of CFGC Section 1855(b).

> (1) Modify in any way the standards for issuance of incidental take permits or consistency determinations pursuant to Section 2081 or 2080.1, issuance of take authorizations pursuant to Section 2835, the issuance of lake or streambed alteration agreements pursuant to Section 1602, or any other provision of this code or regulations adopted pursuant to this code.
>
> (2) Modify in any way the standards under the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code), or in any way limit a lead agency's or responsible agency's discretion, in connection with any determination of whether a proposed project may or may not result in significant environmental effects or in any way establish a presumption in connection with any determination of whether a proposed project may or may not result in significant environmental effects or whether a proposed project's impacts would be mitigated.
>
> (3) Prohibit or authorize any project or project impacts.
>
> (4) Create a presumption or guarantee that any proposed project will be approved or permitted, or that any proposed impact will be authorized, by any state or local agency.
>
> (5) Create a presumption that any proposed project will be disapproved or prohibited, or that any proposed impact will be prohibited, by any state or local agency.
>
> (6) Alter or affect, or create additional requirements for, the general plan of the city, county, or city and county, in which it is located.
>
> (7) Constitute any of the following, for the purposes of the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code):
>
> > (A) A plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.
> >
> > (B) A local policy or ordinance protecting biological resources.
> >
> > (C) An adopted local, regional, or state habitat conservation plan.

Once an RCIS is approved by CDFW, a sponsor may prepare a mitigation credit agreement (MCA) and request its approval by CDFW. An MCA identifies the type and number of credits a person or entity proposes to create by implementing one or more conservation actions or habitat enhancement actions consistent with the RCIS, as well as the terms and conditions under which those credits may be used. MCAs enable advance mitigation, which is compensatory mitigation for estimated impacts on ecological resources (species and their habitat) and other natural resources that contributes to the fulfillment of regional conservation priorities and that is implemented prior to impacts occurring. A person or entity, including a state or local agency, private entity, or non-governmental organization, can enter into an MCA with CDFW for a single site, a suite of sites, or even a region within an RCIS area.

Credits created through an MCA can be used to "fulfill compensatory mitigation requirements established under any state or federal environmental law, as determined by the applicable local, state, or federal regulatory agency, including compensatory mitigation requirements to compensate for take or other adverse impacts of activities authorized pursuant to the California Endangered Species Act, to reduce adverse impacts to fish or wildlife resources, or both, from activities authorized pursuant to a lake or streambed alteration agreement to less than substantial, or to mitigate significant effects on the environment pursuant to the California Environmental Quality Act." (Assembly Bill No. 2087, Legislative Counsel's Digest, February 17, 2016).

1.2 Purpose and Need for the East Bay Regional Conservation Investment Strategy

CFGC Section 1852(b) states the following.

> The purpose of a regional conservation investment strategy shall be to inform science-based non-binding 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 and other native species depend, and to provide non-binding 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 East Bay RCIS was selected as a pilot RCIS in part because of the substantial available scientific data to support development of a robust RCIS in a relatively short amount of time. It was also selected in part due to the expectation that a number of transportation projects will be designed and proposed for construction in the next 25 years within the RCIS area, and that not all of these projects will have their species mitigation needs met by the East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan (ECCC HCP/NCCP) (Jones & Stokes 2006) approved in 2007 by the U.S. Fish and Wildlife Service (USFWS) and CDFW. Certain projects may not be able to use the ECCC HCP/NCCP for compensatory mitigation either because the activities are not covered by the ECCC HCP/NCCP, or because they are not within the ECCC HCP/NCCP permit area. Furthermore, the initial focus on transportation projects aligns with ongoing efforts by the Metropolitan Transportation Commission (MTC), the State of California Coastal Conservancy (Coastal Conservancy), and The Nature Conservancy (TNC) to establish a Regional Advance

Mitigation Planning (RAMP) program in the San Francisco Bay Area (Bay Area). These efforts are discussed in Section 1.2.1, *Regional Advance Mitigation Planning*. Details regarding how this East Bay RCIS will interact with the ECCC HCP/NCCP and the approvals necessary by the Habitat Conservancy (the implementing entity for the ECCC HCP/NNCP) for the execution of mitigation inside of the ECCC HCP/NCCP permit area are described in Section 4.4.2.6, *Use of Mitigation Credit Agreements in the East Contra Costa County HCP/NCCP Permit Area*.

While identifying potential mitigation for transportation projects was a key influencing factor in selecting this pilot project, this East Bay RCIS can also support the mitigation needs of other types of projects occurring in the RCIS area (Section 1.3.2, *RCIS Area*), including on-going development in the 30 cities and unincorporated areas of the two counties addressed by this East Bay RCIS (outside the ECCC HCP/NCCP permit area), installation or replacement of large-scale utilities, and replacement of aging stormwater management facilities. The pressures and stressors associated with development and infrastructure improvements are discussed in Chapter 2, *Environmental Setting and the Built Environment*.

Additionally, this East Bay RCIS can support regional conservation investments by informing where organizations, such as land trusts, can focus acquisition, restoration, or enhancement where it will have the largest benefit for focal species and other conservation elements.

1.2.1 Regional Advance Mitigation Planning

Transportation and natural resource agencies are collaborating to develop an innovative way to efficiently advance transportation infrastructure in the Bay Area while providing more effective conservation of natural resources and working lands through a RAMP process.

RAMP is a strategic mitigation approach that allows for natural resources (e.g., species, aquatic resources and natural communities) to be protected or restored as compensatory mitigation for estimated impacts before infrastructure projects are constructed, often years in advance. Drawing on regional examples (such as the San Diego Association of Government's TransNet's Environmental Mitigation Program), RAMP was developed by a statewide group of federal and state infrastructure and natural resource agencies interested in integrated infrastructure and conservation planning that seeks to protect biological diversity while accommodating growth. While integrated infrastructure and conservation planning often leads to avoidance and reduced impacts to natural communities and ecosystems, sometimes impacts are unavoidable and must be compensated. The goals of RAMP are improved regional mitigation and conservation planning, improved mitigation and conservation effectiveness, and improved efficiency for infrastructure projects and conservation outcomes.

RAMP enables regional and local representatives from both infrastructure and natural resource agencies to jointly evaluate potential environmental impacts from infrastructure projects proposed for a region, and at the same time ensure that planned mitigation for those impacts contributes to regional conservation priorities. The advance time frame allows strategic mitigation to be implemented and made functional before infrastructure projects' unavoidable impacts occur. Mitigating in advance for a suite of projects allows for more efficient project approvals, adds certainty to cost estimates, and takes advantage of conservation opportunities before important land is lost to conversion.

RAMP is an approach that is consistent with federal and state policies encouraging landscape-scale and watershed-scale mitigation. The Federal Highway Administration's "Eco-Logical Approach" outlines the process and benefits of implementing transportation projects incorporating ecological principles. Federal mitigation guidance and rules emphasize landscape-scale mitigation (U.S. Department of Interior) and watershed-scale mitigation (U.S. Army Corps of Engineers [Corps] and U.S. Environmental Protection Agency [USEPA]).

RAMP is another step in the evolution to support integrated infrastructure and conservation planning and address the limitations of project-by-project mitigation. Other comprehensive, regional, and longer-term mitigation tools include HCPs and NCCPs, which take a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. An HCP/NCCP provides for regional or area wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity through a regulatory process with permit coverage from USFWS and/or CDFW, typically for 30 to 50 years. By contrast, RAMP focuses on integrated conservation and infrastructure planning to provide effective compensatory mitigation but does not result in incidental take permits from USFWS or CDFW.

RAMP is expected to be implemented on the regional scale. In 2014, the MTC and the Coastal Conservancy launched an effort to develop a RAMP initiative in the San Francisco Bay Area. MTC and the Coastal Conservancy are sponsoring Bay Area RAMP, which has been included as a strategy in the region's transportation plan, called Plan Bay Area 2040. Working with state and federal resource agencies and county transportation agencies, MTC and the California Department of Transportation, the initiative is integrating an assessment of predicted compensatory mitigation needs from planned transportation projects with an assessment of Bay Area conservation priorities, relying on existing conservation plans and data sources, and developing a RAMP framework for the region. A draft RAMP planning document was prepared in 2017 (State of California Coastal Conservancy and Metropolitan Transportation Commission 2018).

RAMP is intended to advance project approvals and permits more efficiently and effectively with more certainty by addressing mitigation needs in advance, grounded by regional conservation priorities. The East Bay RCIS intends to facilitate this process by identifying priority areas for conservation at a finer scale (focusing on focal species and natural communities) and providing a framework for crediting conservation actions and habitat enhancement actions, including habitat protection and enhancement, through MCAs.

The East Bay "subregional assessment" for RAMP includes a more detailed assessment of opportunities to link local planned transportation projects with appropriate mitigation projects. It will be designed to identify a portfolio of high-quality conservation projects that can be implemented through one or more MCAs with CDFW; in doing so, it will demonstrate the benefits of the RCIS process.

1.3 East Bay Regional Conservation Investment Strategy Overview

This East Bay RCIS presents conservation goals and objectives for the RCIS area (Chapter 3, *Conservation Strategy*). Incorporated into those goals and objectives are conservation priorities for land acquisition, restoration, and enhancement. These conservation priorities are intended to be used in multiple ways. First, conservation organizations can use these priorities to inform the work they do, ensuring that their efforts align with the goals in the RCIS. This alignment includes the pursuit of funding for land acquisition, restoration, and enhancement. Second, the conservation priorities presented in this RCIS can also inform project permitting and regulatory processes by providing project proponents, regulatory agencies, and those agencies with local land use authority information to identify priority conservation actions that can be used to meet project mitigation needs. Guidance on how the RCIS can be used to support various state and federal permits that typically require mitigation can be found in Appendix B, *Regulatory Process*.

This East Bay RCIS was developed to complement other key planning efforts that overlap the RCIS area. Primarily, it builds on existing efforts to develop a RAMP (discussed above in Section 1.2.1) for the Bay Area with a focus on transportation projects and utilizing the Conservation Lands Network data developed through a Bay Area Open Space Council-led planning effort. This RCIS was also developed to be consistent and coordinated with the ECCC HCP/NCCP, addressing species and geographic locations that are not covered by that plan and including conservation actions that complement the ECCC HCP/NCCP conservation strategy. Additionally, the RCIS considers species recovery plans, city general plans, the East Alameda County Conservation Strategy, and other relevant plans and policies as identified in Section 1.5, *Relevant Plans and Policies* and Chapter 2.

A discussion about the coordination with the ECCC HCP/NCCP and the approvals necessary by the Habitat Conservancy for the execution of mitigation inside of the ECCC HCP/NCCP permit area are described in Section 4.4.2.6.

1.3.1 East Bay Regional Conservation Investment Strategy Development Team

The East Bay RCIS development process began in March, 2016. The process was initiated by the MTC and the Coastal Conservancy, in collaboration with the Contra Costa Transportation Authority (CCTA) and TNC. ICF was the lead technical consultant on the RCIS document, working under the direction of a Core Team described below. Funding for RCIS development, and general support of the RAMP, was provided by the Stephen D. Bechtel, Jr. Foundation and the Coastal Conservancy. Funding for the application fee to CDFW was provided by MTC.

The East Bay RCIS was also developed in close coordination with other local conservation organizations and regulatory agencies, as well representatives from the Santa Clara County RCIS (which is adjacent to the RCIS area) and the Bay Area RAMP Technical Advisory Committee. This coordination is described in more detail below.

1.3.1.1 RCIS Proponent

The Coastal Conservancy is the RCIS proponent and state agency submitting this RCIS to CDFW for approval. The role of the RCIS proponent[3] is described in Chapter 4, *Implementation*. As the RCIS proponent, the Coastal Conservancy is requesting approval of this RCIS through a state agency letter sent to the Director of Fish and Wildlife, as required by CFGC Section 1852(a). The letter summarizes the purpose of this East Bay RCIS from both a conservation perspective and an infrastructure planning perspective. The letter is included in Appendix D, *Letters of Support and Consistency*.

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[3] The Program Guidelines define the RCIS proponent as the "public agency or group of public agencies developing an RCIS for review and approval by CDFW and who is responsible for the technical and administrative updates of an RCIS."

The Coastal Conservancy was established in 1976 to protect and improve natural lands and waterways, to help people get to and enjoy the outdoors, and to sustain local economies along California's coast. The Coastal Conservancy is a non-regulatory agency that supports projects through technical assistance and grant funding to local communities, non-profit organizations, other government agencies, businesses, and private landowners to implement multi-benefit projects that enhance wildlife habitat, create public access to beaches and parklands, conserve farmland, improve water quality, and prepare communities for the impacts of climate change. Since its creation, the Coastal Conservancy has built hundreds of miles of trails and preserved hundreds of thousands of acres of wildlife habitat, coastal farmland, and scenic open space.

1.3.1.2 Core Team

The coordination and development of the East Bay RCIS was guided by the Core Team. The Core Team, led by TNC, was comprised of staff from the Coastal Conservancy, CCTA, the East Contra Costa County Habitat Conservancy, MTC, TNC, and AECOM. The Core Team met approximately quarterly, from March 2016 through early 2019 to provide guidance on the development of the RCIS, including the identification of the RCIS area (Section 1.3.2); focal species (Section 2.2.6, *Focal Species*); the development of conservation goals, objectives, and priorities (Chapter 3); implementation structure (Chapter 4); and to coordinate outreach to stakeholders (Section 1.4, *Public Outreach and Involvement* and Appendix C, *Public Outreach*).

1.3.1.3 Bay Area RAMP Technical Advisory Committee

Because the RCIS was developed, in part, to provide a tool to guide advance mitigation and facilitate MCAs (Chapter 4), the Bay Area RAMP Technical Advisory Committee (RAMP TAC) was involved in the RCIS planning process. The RAMP TAC provided feedback to the Core Team and consultants drafting the RCIS on technical issues and draft elements of the strategy. A list of organizations and agencies that were invited to participate as part of the Bay Area RAMP TAC is provided in Appendix C.

1.3.1.4 Conservation Partners and Infrastructure Agencies

The Core Team conducted outreach to anticipated future users of the RCIS—including local counties and cities, conservation organizations, resource agencies, and public infrastructure agencies—in the process of developing the RCIS. The East Bay RCIS Stakeholder Group was formed with representation from local governments, infrastructure agencies, resource agencies, conservation organizations, watershed organizations, and business organizations. The goals of the outreach were to obtain data and input necessary to ensure the RCIS is comprehensive and effective, and to increase capacity and support for its long-term implementation. Meetings with the Stakeholder Group and other organizations are summarized in Section 1.4 and in Appendix C

1.3.2 East Bay Regional Conservation Investment Strategy Area

A key first step in developing this East Bay RCIS was to define the RCIS area that would be addressed by measures in this RCIS. To develop and define the RCIS area, the Core Team and Stakeholder

Group evaluated alternative RCIS areas and provided feedback to the Core Team. Alternative RCIS areas were developed considering the following types of data in and adjacent to the RCIS area.

- Important topographic or hydrologic boundaries such as watersheds (e.g., the U.S. Geological Survey's standard database of watershed boundaries).
- Areas where conservation may occur that will contribute to species recovery or sustain populations of the expected focal species.
- Existing protected areas.
- Natural community or ecoregional boundaries.
- Jurisdictional boundaries or areas of conservation interest.
- Boundaries of approved or in-process conservation plans or open space strategies, including the ECCC HCP/NCCP.
- Locations of key projects or activities expected to use the RCIS.
- Areas of core habitat or recovery units for one or more focal species.
- Projected development based on current local general plans or capital improvement plans.

The selected RCIS area comprises all of Contra Costa and Alameda Counties (Figure 1-1). This alternative was selected to be all-inclusive at the county-level. The geographic area of this RCIS extends beyond the ECCC HCP/NCCP boundaries (Section 1.5). It encompasses a variety of bayland and inland habitats within 20 different Hydrologic Unit Code (HUC)-10 watersheds.

1.3.3 Focal Species

Focal species are species whose conservation needs are directly addressed through this RCIS. Chapter 2, provides a description of the complete list of focal species for this RCIS, including the selection process. The focal species covered in this RCIS include a number of state and/or federally listed species along with indicator or umbrella species, whose conservation may benefit an array of other species, including non-focal species.[4] Discussions in this RCIS about conservation priorities, including land protection, enhancement, and restoration (Chapter 3) are described within the context of their importance for contributing to the conservation and recovery of focal species and their habitats, as well as for other conservation elements (such as water resources) within an RCIS area.

1.3.4 Other Conservation Elements

CFGC Section 1852(c)(4) states that an RCIS will include, "important resource conservation elements within the strategy area, including, but not limited to, important ecological resources and processes, natural communities, habitat, habitat connectivity, and existing protected areas, and an explanation of the criteria, data, and methods used to identify those important conservation elements."

[4] Non-focal species are species that are not "focal species", as defined in the Program Guidelines, but which are associated with a focal species or other conservation element and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Non-focal species may benefit through both conservation investments and MCAs.

This East Bay RCIS includes habitat connectivity and landscape linkages, working landscapes, baylands, bat habitat, unique land cover types, and important soil types as other conservation elements (Section 2.2.8, *Other Conservation Elements*).

Habitat connectivity is included as a conservation element because movement is essential for wildlife to find mates, seasonal habitat, shelter, and food; to disperse to new habitats; and to track shifting habitats or find new habitat in a changing climate (Section 2.2.8.1, *Habitat Connectivity*). The conservation strategy for habitat connectivity seeks to increase connectivity for native wildlife species across the landscape by protecting and/or improving the condition of natural and semi-natural lands to maintain or restore ecological permeability and to support adaptive adjustments in species distributions in response to climate change (Section 3.9.1, *Habitat Connectivity and Landscape Linkages*).

Working landscapes characterize much the RCIS area outside of urban areas and are an important conservation element for this RCIS (Section 2.2.8.2, *Working Landscapes*). Working lands provide habitat for native birds and other wildlife, including focal species such as tricolored blackbird, Swainson's hawk, and giant garter snake, as well as other native biodiversity. The conservation strategy for working landscapes seeks to conserve working lands for the benefit of focal species, non-focal species and other native species, and agricultural uses in the RCIS area (Section 3.9.2, *Working Landscapes*).

The baylands extend around much of the perimeter of the RCIS along San Francisco Bay, San Pablo Bay, Suisun Bay, and the Delta. Baylands include tidally influenced and managed areas (e.g., salt ponds) that support unique and biodiverse habitats where Bay and Delta waters transition to upland habitats (Section 2.2.8.3, *Baylands*). Historically, much of the baylands along the San Francisco Bay have been lost to, or altered by, urbanization. The remaining bayland habitats in the RCIS area are critically important refuges for populations of rare species, as well as providing a buffer against the effects of sea-level rise. This RCIS includes baylands as a conservation element to maintain and restore functional baylands to protect habitat for native species and provide ecosystem services (Section 3.9.3, *Baylands*).

This RCIS includes bat habitat as a conservation element. Many North American bat species are deemed at-risk (i.e., having vulnerable, imperiled, or critically imperiled NatureServe conservation statuses) and are threatened by factors such as disease, habitat loss, and mortality associated with wind turbine strikes (Hammerson et al. 2017). The RCIS area supports foraging and roosting habitat for a number of insectivorous North American bat species. This RCIS includes bat habitat as a conservation element to protect, restore, and enhance roost sites and other habitat (Section 3.9.4, *Bat Habitat*).

Unique land cover types are locally rare (i.e., within the RCIS area) land cover types that support native vegetation and one or more focal plant or wildlife species (Section 2.2.8.5, *Unique Land Cover Types*).[5] Many of these land cover types have been historically developed and are currently under threat from invasive exotic species, human disturbance, or disease. This RCIS includes unique land cover types as a conservation element to help protect, enhance, and restore the diversity of natural communities and land cover types in the RCIS area (Section 3.9.5, *Unique Land Cover Types*).

[5] See Chapter 2, *Environmental Setting and the Built Environment*, Section 2.2.8.5, for a description of how unique land cover types were identified for this RCIS.

The RCIS area supports a wide diversity of soil types (Section 2.2.8.6, *Soils*), including many identified by this RCIS as important because they have limited distribution and create unique habitats (e.g., serpentine); these include clay lenses, sandy soils, alkali soils, and serpentine soils. This RCIS includes important soil types as a conservation element to protect serpentine soils, alkali soils, sandy soils and clay lenses, and the native species supported by those soils (Section 3.9.6, *Important Soil Types*).

1.3.5 Term of Strategy

After finding that the RCIS meets the requirements of CFGC Section 1852, CDFW may approve an RCIS for an initial period of up to 10 years. CDFW may extend the duration of an approved or amended RCIS for additional periods of up to 10 years after the RCIS proponent updates the RCIS with new scientific information and evaluates the effectiveness of the RCIS (CFGC Section 1856(b)(2), and a new finding that the RCIS continues to meet the requirements of Section 1852. Assuming that this RCIS would be approved in 2019, the RCIS would be valid until the same date of approval in 2029, unless the Coastal Conservancy amends the RCIS prior to that time.

1.3.6 Regional Conservation Investment Strategy Requirements

To approve this East Bay RCIS, CDFW must determine that it meets all of the requirements in the CFGC for an RCIS. To assist CDFW with this determination, Table 1-1 lists the requirements in the order they appear in CFGC and where in this RCIS the required elements are found.

Table 1-1. Checklist of Required Elements in an RCIS

Fish and Game Code	Required Element	Relevant RCIS Section(s)
1852(c)(2)	An explanation of the conservation purpose of and need for the strategy.	Section 1.2
1852(c)(2)	The geographic area of the strategy and rationale for the selection of the area, together with a description of the surrounding ecoregions and any adjacent protected habitat areas or linkages that provide relevant context for the development of the strategy.	Section 1.3.2
1852(c)(3)	The focal species included in, and their current known or estimated status within, the strategy.	Section 2.2.6, Appendix F
1852(c)(4)	Important resource conservation elements within the RCIS area, including, but not limited to: (1) Important ecological resources and processes (2) Natural communities (3) Habitat (4) Habitat connectivity (5) Existing protected areas, and (6) An explanation of the criteria, and methods used to identify those important conservation elements.	(1) Integrated into Sections 2.2 and 2.3, and Appendices F and H (2) Section 2.2.5 (3) Section 2.2.5, and Appendices F and H (4) Section 2.2.8.1 (5) Section 2.2.1 (6) Integrated into above sections

Fish and Game Code	Required Element	Relevant RCIS Section(s)
1852(c)(5)	A summary of historic, current, and projected future stressors and pressures in the RCIS area, including climate change vulnerability, on the focal species, habitat, and other natural resources, as identified in the best available scientific information, including, but not limited to, the State Wildlife Action Plan.	Section 2.3
1852(c)(6)	Consideration of major water, transportation and transmission infrastructure facilities, urban development areas, and city, county, and city and county general plan designations that accounts for reasonably foreseeable development of major infrastructure facilities, including, but not limited to, renewable energy and housing in the RCIS area.	Section 1.2.1 Section 2.1
1852(c)(7)	Provisions ensuring that the strategy will be in compliance with all applicable state and local requirements and does not preempt the authority of local agencies to implement infrastructure and urban development in local general plans.	Section 1.1
1852(c)(8)	Conservation goals and measurable objectives for the focal species and important conservation elements identified in the strategy that address or respond to the identified stressors and pressures on focal species.	Section 3.7 Section 3.8
1852(c)(9)	Conservation actions, including a description of the general amounts and types of habitat that, if preserved or restored and permanently protected, could achieve the conservation goals and objectives, and a description of how the conservation actions and habitat enhancement actions were prioritized and selected in relation to the conservation goals and objectives.	Section 3.3 Section 3.7 Section 3.8
1852(c)(10)	Provisions ensuring that the strategy is consistent with and complements any administrative draft natural community conservation plan, approved natural community conservation plan, or federal habitat conservation plan that overlaps with the RCIS area.	Section 1.5 Section 3.10 Section 4.4.2.1 Section 4.4.2.6
1852(c)(11)	An explanation of whether and to what extent the strategy is consistent with any previously approved strategy or amended strategy, state or federal recovery plan, or other state or federal approved conservation strategy that overlaps with the RCIS area.	Section 3.10.2
1852(c)(12)	A summary of mitigation banks and conservation banks approved by the department or the U.S. Fish and Wildlife Service that are located within the RCIS area or whose service area overlaps with the RCIS area	Section 2.2.2
1852(c)(13)	A description of how the strategy's conservation goals and objectives provide for adaptation opportunities against the effects of climate change for the strategy's focal species.	Section 3.5 Section 3.8

Fish and Game Code	Required Element	Relevant RCIS Section(s)
1852(c)(14)	Incorporation and reliance on, and citation of, the best available scientific information regarding the strategy area and the surrounding ecoregion, including a brief description of gaps in relevant scientific information, and use of standard or prevalent vegetation classifications and standard ecoregional classifications for terrestrial and aquatic data to enable and promote consistency among regional conservation investment strategies throughout California.	Section 2.2 Section 2.2.3 Section 2.4 Section 2.2.5 Section 4.2.1 Appendix F
1852(d)	A regional conservation investment strategy shall compile input and summary priority data in a consistent format that could be uploaded for interactive use in an Internet Web portal and that would allow stakeholders to generate queries of regional conservation values within the RCIS area.	Data submitted to CDFW with Final RCIS
1852(e)	In addition to considering the potential to advance the conservation of focal species, regional conservation investment strategies shall consider all of the following: (1) The conservation benefits of preserving working lands for agricultural uses. (2) Reasonably foreseeable development of infrastructure facilities. (3) Reasonably foreseeable projects in the RCIS area, including, but not limited to, housing. (4) Reasonably foreseeable development for the production of renewable energy. (5) Draft natural community conservation plans within the area of the applicable regional conservation investment strategy.	(1) Sections 2.2.8.2 and 3.9.3 (2) Section 2.1.2 (3) Section 2.1 (4) Section 2.1.2.4 (5) Sections 1.5, 3.6, 3.10.1, 4.4.2.1, and 4.4.2.6
1854(a)	The department may prepare or approve a regional conservation investment strategy, or approve an amended strategy, for an initial period of up to 10 years after finding that the strategy meets the requirements of Section 1852.	Section 1.3.5
1854(c)(1)	A public agency shall publish notice of its intent to create a regional conservation investment strategy. This notice shall be filed with the Governor's Office of Planning and Research and the county clerk of each county in which the regional conservation investment strategy is found in part or in whole. If preparation of a regional conservation investment strategy was initiated before January 1, 2017, this notice shall not be required.	Not applicable, as this RCIS was initiated before January 1, 2017
1854(c)(3)(*A*)	A public agency proposing a strategy or amended strategy shall hold a public meeting to allow interested persons and entities to receive information about the draft regional conservation investment strategy or amended strategy early in the process of preparing it and to have an adequate opportunity to provide written and oral comments.	Section 1.4 Appendix C

Fish and Game Code	Required Element	Relevant RCIS Section(s)
1854(c)(3)(*B*)	In a draft regional conservation investment strategy or amended strategy submitted to the department for approval, the public agency shall include responses to written public comments submitted during the public comment period.	Section 1.4 Appendix C
1854(c)(3)(*C*)	If preparation of a regional conservation investment strategy was initiated before January 1, 2017, and a public meeting regarding the strategy or amended strategy that is consistent with the requirements of this section was held before January 1, 2017, an additional public meeting shall not be required.	Section 1.4 Appendix C
1854(c)(4)	At least 30 days before holding a public meeting to distribute information about the development of a draft regional conservation investment strategy or amended strategy, a public agency proposing a strategy shall provide notice of a regional conservation investment strategy or amended strategy public meeting as follows: (A) On the public agency's Internet Web site and any relevant LISTSERV. (B) To each city, county, and city and county within or adjacent to the regional conservation investment RCIS area. (C) To the implementing entity for each natural community conservation plan or federal regional habitat conservation plan that overlaps with the RCIS area. (D) To each public agency, organization, or individual who has filed a written request for the notice, including any agency, organization, or individual who has filed a written request to the department for notices of all regional conservation investment strategy public meetings.	Section 1.4 Appendix C
1854(c)(5)	At least 60 days before submitting a final regional conservation investment strategy or amended strategy to the department for approval, the public agency proposing the investment strategy or amended strategy shall notify the board of supervisors and the city councils in each county within the geographical scope of the strategy and provide the board of supervisors and the city councils with an opportunity to submit written comments for a period of at least 30 days.	Section 1.4 Appendix C
1854(e)	The department shall require the use of consistent metrics that incorporate both the area and quality of habitat and other natural resources in relation to a regional conservation investment strategy's conservation objectives to measure the net change resulting from the implementation of conservation actions and habitat enhancement actions.	Section 3.8 Section 3.9 Section 4.2.2

Fish and Game Code	Required Element	Relevant RCIS Section(s)
1856(b)	For a conservation action or habitat enhancement action identified in a regional conservation investment strategy to be used to create mitigation credits pursuant to this section, the regional conservation investment strategy shall include, in addition to the requirements of Section 1852, all of the following: (1) An adaptive management and monitoring strategy for conserved habitat and other conserved natural resources. (2) A process for updating the scientific information used in the strategy, and for tracking the progress of, and evaluating the effectiveness of, conservation actions and habitat enhancement actions identified in the strategy, in offsetting identified threats to focal species and in achieving the strategy's biological goals and objectives, at least once every 10 years, until all mitigation credits are used. (3) Identification of a public or private entity that will be responsible for the updates and evaluation required pursuant to paragraph (2).	(1) Section 3.11 (2) Sections 4.2.1 and 4.2.2 (3) Section 4.2.2

1.4 Public Outreach and Involvement

CFGC Sections 1852 and 1854 outline the requirements for public outreach prior to the approval of a RCIS. CFGC Section 1852(a), requires that an RCIS be developed in consultation with local agencies with land use authority (i.e., a city, a county, or a city and county) within the geographic area of the RCIS. CFGC Section 1854, subdivision (c)(3)(A), requires that the RCIS proponent hold at least one public meeting within one of the counties in which the RCIS is located in whole or in part. After the public meeting, the RCIS proponent shall respond to all written comments submitted during the public meeting and during the public comment period, which begins after CDFW deems the draft RCIS complete and pursuant to public notice (CFCG Section 1854 (c)(3)(B)). Additionally, CDFW recommends that RCIS proponents include a broad array of stakeholders in the development of RCISs to foster collaborative engagement with individuals and entities with relevant experience and expertise (California Department of Fish and Wildlife 2018). The Program Guidelines also recommend that RCISs be developed in consultation with HCP and NCCP Implementing Entities within the geographic area of the RCIS.

The Core Team conducted a variety of public outreach activities to comply with these requirements and recommendations. This includes holding a public meeting on October 24, 2016 in which all local agencies with land use authority within the RCIS area were invited to attend. Written comments and responses from the Core Team with an explanation for how the comments were addressed in the RCIS are in Appendix C. The Core Team also conducted small-group meetings with some stakeholders to discuss their written public comments. Additionally, the Core Team conducted briefings for, and informational outreach to, conservation partners, regulatory agencies, infrastructure agencies, key environmental groups, agricultural and business organizations, and local government including counties and cities within the RCIS area. Outreach was conducted through ad hoc meetings with interested stakeholders and more formal, organized meetings with an East Bay RCIS Stakeholder Group. The Stakeholder Group consists of representatives from county and local governments, transportation and water agencies, natural resource and agricultural conservation organizations, local watershed groups, business organizations, the East Bay Regional Park District, and resource conservation districts. Counties and cities were invited to participate in the Stakeholder Group during a presentation on the East Bay RCIS at the Contra Costa County Planning Directors Meeting and at the Alameda County Technical Advisory Committee. A full list of the invited stakeholders can be found in Appendix C. The Stakeholder Group met five times over the course of the development of the RCIS, including a workshop on conservation priorities, and provided feedback and guidance on the development of the RCIS. The Core Team also updated the Bay Area RAMP TAC during regularly scheduled meetings. These meetings are summarized in Table 1-2.

Table 1-2. Public Outreach and Involvement Meeting Summary

Date	Public Outreach and Involvement*
May 20, 2016	Core Team Meeting
May 25, 2016	Bay Area RAMP TAC Meeting
May 26, 2016	Stakeholder Group Meeting #1
June 8, 2016	Core Team Meeting
June 16, 2016	Bay Area RAMP TAC Meeting
July 12, 2016	Regulatory outreach meeting for Bay Area RCISs
July 13, 2016	Core Team Meeting
July 21, 2016	Stakeholder Group Meeting #2
August 17, 2016	Bay Area RAMP TAC Meeting
August 25, 2016	NMFS meeting
September 28, 2016	Core Team Meeting
October 6, 2016	Inter-agency Meeting for East Bay RCIS
October 13, 2016	Core Team Meeting
October 18, 2016	Bay Area RAMP TAC Meeting
October 24, 2016	Public Meeting at East Bay Regional Park District Headquarter Office
December 1, 2016	Bay Area RAMP TAC Meeting
December 14, 2016	Core Team Meeting
January 17, 2107	Core Team Meeting
January 24, 2017	San Francisco Bay Regional Water Quality Control Board meeting
January 25, 2017	Stakeholder Group Meeting #3
February 16, 2017	Bay Area RAMP TAC Meeting
February 27, 2017	Stakeholder Group Meeting #4 – Workshop on conservation priorities
April 13, 2017	Bay Area RAMP TAC Meeting
April 14, 2017	Contra Costa Planning Directors Meeting
July 20, 2017	Bay Area RAMP TAC Meeting
September 20, 2017	Bay Area RAMP TAC Meeting
October 5, 2017	Alameda County Technical Advisory Committee
March 15, 2018	Core Team Meeting
April 16, 2018	Caltrans meeting
May 11, 2018	Bay Area RAMP TAC Meeting

Date	Public Outreach and Involvement*
May 22, 2018	East Contra Costa Habitat Conservancy Focus Meeting
June 13, 2018	Stakeholder Group Meeting #5 – RCIS Update
September 24, 2018	East Contra Costa Habitat Conservancy Focus Meeting
September 26, 2018	ACTC and Caltrans Meeting
October 4, 2018	Bay Area RAMP TAC Meeting
April 23, 2019	Alameda County Community Development Agency Agricultural Committee
February 4, 2019	Draft RCIS submitted to CDFW
March 6, 2019	Stakeholder Meeting #6 – Discuss Draft RCIS
March 25, 2019	CDFW deemed the RCIS complete and posted it to the CDFW website, initiating a 60-day public review period, which was subsequently extended by 14 days
June 6, 2019	Public review period closed
August 22, 2019	Bay Area RAMP TAC Meeting
December 12, 2019	Bay Area RAMP TAC Meeting
April 27, 2020	Stakeholder Meeting #7 – RCIS Revisions

*This meeting summary does not include ad hoc meetings with individual stakeholders that were conducted upon request. This also does not include biweekly meetings with the Santa Clara County RCIS development team to cross-share information or meetings with the sub-core team (TNC, SCC, ICF, and AECOM) to discuss development of the RCIS.

1.5 Relevant Plans and Policies

This section identifies state or federal recovery plans, or other state or federal approved conservation strategies that overlap the RCIS area. There are no previously approved RCISs in this RCIS area, although Santa Clara County RCIS is in development concurrently. As required in CFGC Section 1852(c)(10), this RCIS had been developed to be consistent with all existing conservation plans—including, but not limited, to the ECCC HCP/NCCP—and to complement those plans wherever possible (Section 3.10, *Consistency with Approved Conservation Strategies and Recovery Plans*). Furthermore, as required by the Program Guidelines, this RCIS's conservation purpose aligns with the goals and objectives of the State Wildlife Action Plan (California Department of Fish and Wildlife 2015), and any approved regional conservation assessment encompassing the RCIS area. The conservation goals and objectives for this RCIS (Chapter 3) align with many of the Statewide, Bay Delta, and Central Coast Province goals in the State Wildlife Action Plan, and, if implemented, would help to achieve them.

1.5.1 Existing Habitat Conservation Plans and Natural Community Conservation Plans

Table 1-3 provides a list of HCPs and HCP/NCCPs in and surrounding the RCIS area, including the date approved, plan area size, and species covered. The regional HCPs and HCP/NCCPs and conservation strategies are also shown in Figure 1-2.

Table 1-3. HCPs and HCP/NCCPs in the Vicinity of the RCIS Area

HCPs and HCP/NCCPs	Year Approved	Plan Area Size (Acres)	Species Covered
East Contra Costa County HCP/NCCP	2006	175,435	Longhorn fairy shrimp, vernal pool fairy shrimp, tadpole fairy shrimp, midvalley fairy shrimp, California tiger salamander, California red-legged frog, foothill yellow-legged frog, western pond turtle, giant garter snake, silvery legless lizard, Alameda whipsnake, burrowing owl, tricolored blackbird, San Joaquin Kit fox, Mount Diablo manzanita, brittlescale, San Joaquin spearscale, big tarplant, Mount Diablo fairy lantern, recurved larkspur, round-Leaved filaree, Diablo helianthella, Brewer's dwarf flax, showy madia, adobe navarretia
Pacific Gas and Electric's San Francisco Bay Area Operations and Maintenance HCP	2017	402,440	California freshwater shrimp, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, Delta green ground beetle, Bay checkerspot butterfly, callippe silverspot butterfly, Lange's metalmark butterfly, Mission blue butterfly, San Bruno elfin butterfly, California tiger salamander, California red-legged frog, Alameda whipsnake, San Francisco garter snake, Ridgway's rail, salt marsh harvest mouse, San Joaquin kit fox, pallid manzanita, Sonoma sunshine, coyote ceanothus, fountain thistle, Santa Clara Valley dudleya, Contra Costa wallflower, Marin dwarf flax, Burke's goldfields, Contra Costa goldfields, Sebastopol meadowfoam, Antioch Dunes evening primrose, white-rayed pentachaeta, and Metcalf Canyon jewelflower
East Bay Municipal Utility District HCP	2008	28,000	California red-legged frog, pallid bat, pallid manzanita, steelhead (California Central Valley Distinct Population Segment (DPS)), Santa Cruz tarplant, Alameda whipsnake, western pond turtle
Santa Clara Valley HCP/NCCP[a]	2013	508,669	Bay checkerspot butterfly, California tiger salamander, California red-legged frog, foothill yellow-legged frog, western pond turtle, burrowing owl, least Bell's vireo, tricolored blackbird, San Joaquin kit fox, Tiburon Indian paintbrush, coyote ceanothus, Mount Hamilton thistle, Santa Clara Valley dudleya, fragrant fritillary, Loma Prieta hoita, smooth lessingia, Metcalf Canyon jewelflower, most beautiful jewelflower

HCPs and HCP/NCCPs	Year Approved	Plan Area Size (Acres)	Species Covered
San Francisco Public Utilities Commission Alameda Watershed HCP[b]	In development	47,800	California tiger salamander, California red-legged frog, foothill yellow-legged frog, tricolored blackbird, burrowing owl, callippe silverspot butterfly, Pacific Townsend's big-eared bat, western pond turtle, Alameda whipsnake, Pacific lamprey, California Central Coast steelhead, fall and late-fall run Central Valley Chinook salmon, Congdon's tarplant, Hospital Canyon larkspur, most beautiful jewelflower
Warmington Homes Assumption of The Bluffs HCP	1999	32.3	San Joaquin kit fox, California tiger salamander
San Bruno Mountain HCP[b]	1982 (Amended in 2009)	3,600	Mission blue butterfly, callippe silverspot butterfly, San Bruno elfin butterfly, Bay checkerspot butterfly, San Francisco garter snake
San Joaquin County HCP[b]	2000	912,640	Total of 97 species; See http://www.eastalco-conservation.org/documents/sjmscp-factsheet.pdf
Solano Multispecies HCP[b]	In development	585,000	Ferris milk-vetch, alkali milk-vetch, vernal pool smallscale, Suisun thistle, soft bird's-beak, Boggs Lake hedge hyssop, Contra Costa goldfields, legenere, Mason's lilaeopsis, Colusa grass, San Joaquin Valley Orcutt grass, Solano grass, Swainson's hawk, California black rail, California clapper rail, burrowing owl, tricolored blackbird, California tiger salamander, California red-legged frog, giant garter snake, Salt marsh harvest mouse, Conservancy fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, Delta Green Ground Beetle, valley elderberry longhorn beetle, callippe silverspot butterfly, green sturgeon, Chinook salmon-winter run, Chinook salmon-fall/late-fall run, Chinook salmon-spring run, steelhead-Central Coast, Central Valley steelhead, Delta smelt, Sacramento splittail, longfin smelt

[a] A small portion of the Santa Clara Valley HCP/NCCP (the expanded study area and permit area for burrowing owl conservation) overlaps the RCIS area.

[b] Plan is not within the RCIS area.

1.5.2 Approved Recovery and Other Conservation Plans

Several state or federal recovery plans overlap the RCIS area and many state and local conservation plans address the RCIS area (Table 1-4).

Table 1-4. Approved Recovery and Other Conservation Plans

Plan Type	Plan Name	Date Published	Incorporation into RCIS
Multi-Species Recovery Plans	Recovery Plan for the ESU of Sacramento River Winter-Run Chinook Salmon, Central Valley	NMFS 2014	Steelhead and Sacramento River Winter-Run Chinook Salmon are

Plan Type	Plan Name	Date Published	Incorporation into RCIS
	Spring-Run Chinook Salmon, and DPS of California Central Valley Steelhead		focal species; recovery units used in habitat model
	Coastal Multispecies Final Recovery Plan: California Coastal Chinook Salmon ESU, Northern California Steelhead DPS and Central California Coast Steelhead DPS	NMFS 2016	Central California Coast Steelhead is a focal species.
	Recovery Plan for the Sacramento-San Joaquin Native Fishes	USFWS 1996	Reviewed and incorporated, as applicable, in the Salmon and Steelhead conservation strategy.
	Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California	USFWS 2013a	Incorporated into the Summary of Baylands Conservation Strategy (Appendix H, *Summary of Bayland Conservation Strategies*).
	Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon	USFWS 2005a	Vernal pool brachiopods and Contra Costa goldfields are focal species.
	Recovery Plan for Upland Species of the San Joaquin Valley	USFWS 1998a	Palmate-bracted bird's beak and San Joaquin kit fox are focal species; incorporated into species specific conservation strategies.
	Revised Recovery Plan for Three Endangered Species Endemic to the Antioch Dunes, California	USFWS 1984	There is no conservation strategy for the Antioch dunes since the majority is protected and managed as a USFWS Refuge.
	Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area	USFWS 1998b	RCIS developed in close coordination with this program for serpentine soils and focal plant species on serpentine soils.
Single Species Recovery Plans	Recovery Plan for the Central California Distinct Population Segment of California Tiger Salamander	USFWS 2017a	Focal species; critical habitat included in prioritization
	Recovery Plan for the Giant Garter Snake	USFWS 2017b	Focal species; incorporated into conservation strategy
	Recovery Plan for Tidewater Goby	USFWS 2005b	Reviewed and incorporated, as applicable, in the baylands conservation strategy.
	Recovery Plan for Large-Flowered Fiddleneck	USFWS 1988	Reviewed and incorporated, as applicable, in the focal plant species conservation strategy.
	Recovery Plan for Pallid Manzanita	USFWS 2015	Focal species; incorporated into conservation strategy.

Plan Type	Plan Name	Date Published	Incorporation into RCIS
	Recovery Plan for California Least Tern	USFWS 1985a	Reviewed and incorporated, as applicable, in the baylands conservation strategy
	Recovery Plan for Western Snowy Plover Pacific Coast Population	USFWS 2007	Reviewed and incorporated, as applicable, in the baylands conservation strategy
	Recovery Plan for California Red-Legged Frog	USFWS 2002	Focal species; critical habitat included in prioritization
State-Wide or Regional Conservation Planning Documents	Bay Area Regional Advanced Mitigation Planning Program	State Coastal Conservancy & MTC 2018	RCIS developed in close coordination with this program
	Audubon Important Bird Areas	Audubon 2016	Incorporated into baylands and avian conservation strategies, as applicable.
	State Wildlife Action Plan	CFDW 2015	Incorporated into focal species selection process and climate adaption discussion.
	Riparian Bird Conservation Plan	Riparian Habitat Joint Venture 2004	Reviewed and incorporated into conservation strategy, as applicable.
Regional Conservation Strategies	East Alameda County Conservation Strategy	ICF International 2010	Land cover data incorporated
	San Francisco Bay Subtidal Habitat Goals Report	California State Coastal Conservancy and Ocean Protection Council et al. 2010	Goals incorporated into conservation strategy and included in Appendix H.
	Baylands Ecosystem Habitat Goals	Goals Project 1999, Baylands Goals Project 2015	Goals incorporated into conservation strategy and included in Appendix H.
	The Conservation Lands Network 1.0	Bay Area Open Space Council 2011	Land cover data incorporated
Critical Habitat	California Red-Legged Frog	USFWS 2010	Focal species; critical habitat included in prioritization
	Four Vernal Pool Invertebrates and Eleven Vernal Pool Plants	USFWS 2003	Focal species (vernal pool branchiopods and Contra Costa goldfields); critical habitat included in prioritization.
	Antioch Dunes Evening Primrose and Contra Costa Wallflower	USFWS 1978	The RCIS does not include a conservation strategy for these species

Plan Type	Plan Name	Date Published	Incorporation into RCIS
	Tidewater Goby	USFWS 2013b	Reviewed and incorporated into baylands and steelhead and salmon conservation strategies, as applicable.
	Central Valley Steelhead DPS	NMFS 2005	Focal species; critical habitat included in prioritization.
	Central California Coast Steelhead DPS	NMFS 2005	Focal species; critical habitat included in prioritization.
	Sacramento River Winter-Run Chinook Salmon Evolutionarily Significant Unit	NMFS 1992	Focal species; critical habitat included in prioritization.
	Alameda Whipsnake	USFWS 2006	Focal species; critical habitat included in prioritization
	Western Snowy Plover–Pacific Coastal Population	USFWS 2012	Critical habitat reviewed and used in baylands conservation strategy prioritization
	Large-Flowered Fiddleneck	USFWS 1985b	Critical habitat incorporated into focal plant species conservation strategy
	California Tiger Salamander (Central Coast DPS)	USFWS 2005c	Focal species; critical habitat included in prioritization
Wildlife Linkage Analyses	Bay Area and Beyond: Critical Linkages	Penrod et al. 2013	Linkages included in prioritization
	California Essential Habitat Connectivity Project	Spencer et al. 2010	Linkages included in prioritization

1.5.3 General Plans

The RCIS area includes 18 cities in Contra Costa County, including four cities that are permittees to the ECCC HCP/NCCP, and 16 cities in Alameda County. Both counties and all of the cities have general plans which include a description of the extent of each city or county jurisdictional boundaries. Those general plan boundaries, and the implications they have on the conservation landscape are described in Chapter 2.

1.5.4 Watershed Plans

Four local watershed plans overlap the RCIS area. Four watershed plans that overlap the RCIS area are include the following.

- The San Francisco Public Utilities Commission Alameda Watershed Management Plan (EDAW, Inc. 2001).
- City of Berkeley Watershed Management Plan (City of Berkeley 2011).
- Contra Costa County Watersheds Stormwater Resource Plan (Larry Walker Associates et al. 2018).

- Alameda County Water District South Bay Aqueduct Watershed Protection Program Plan (ESA 2008).

These plans informed the development of this RCIS's conservation strategy (Chapter 3).

1.6 Document Organization

This East Bay RCIS and supporting information is presented in the chapters and appendices listed below.

Chapter 1, Introduction. Chapter 1 discusses the background, purpose of and need for the RCIS, the planning process, strategy team, advisors, RCIS area, and relevant plans in the RCIS area.

Chapter 2, Environmental Setting and the Built Environment. Chapter 2 provides a current assessment of the natural resources in the RCIS area, focal species lists, and major infrastructure in the RCIS area. Chapter 2 also discusses the pressures and stressors to focal species and other conservation elements.

Chapter 3, Conservation Strategy. Chapter 3 presents the conservation goals and objectives and the actions and conservation priorities to achieve the conservation goals and objectives.

Chapter 4, Implementation. Chapter 4 discusses how the RCIS will be implemented, including coordination with other resource agencies, and development of MCAs.

Chapter 5, References. Chapter 5 is a bibliography of printed references and personal communications cited in the text.

Chapter 6, List of Preparers and Reviewers. Chapter 6 identifies the people and their affiliated institutions that contributed to the development of this Santa Clara County RCIS.

Appendix A, Glossary.

Appendix B, Regulatory Process.

Appendix C, Public Outreach.

Appendix D, Letters of Support and Consistency.

Appendix E, Evaluation of Species for Inclusion as Focal Species.

Appendix F, Focal Species Profiles.

Appendix G, Non-focal Species Summaries.

Appendix H, Summary of Baylands Conservation Strategies.

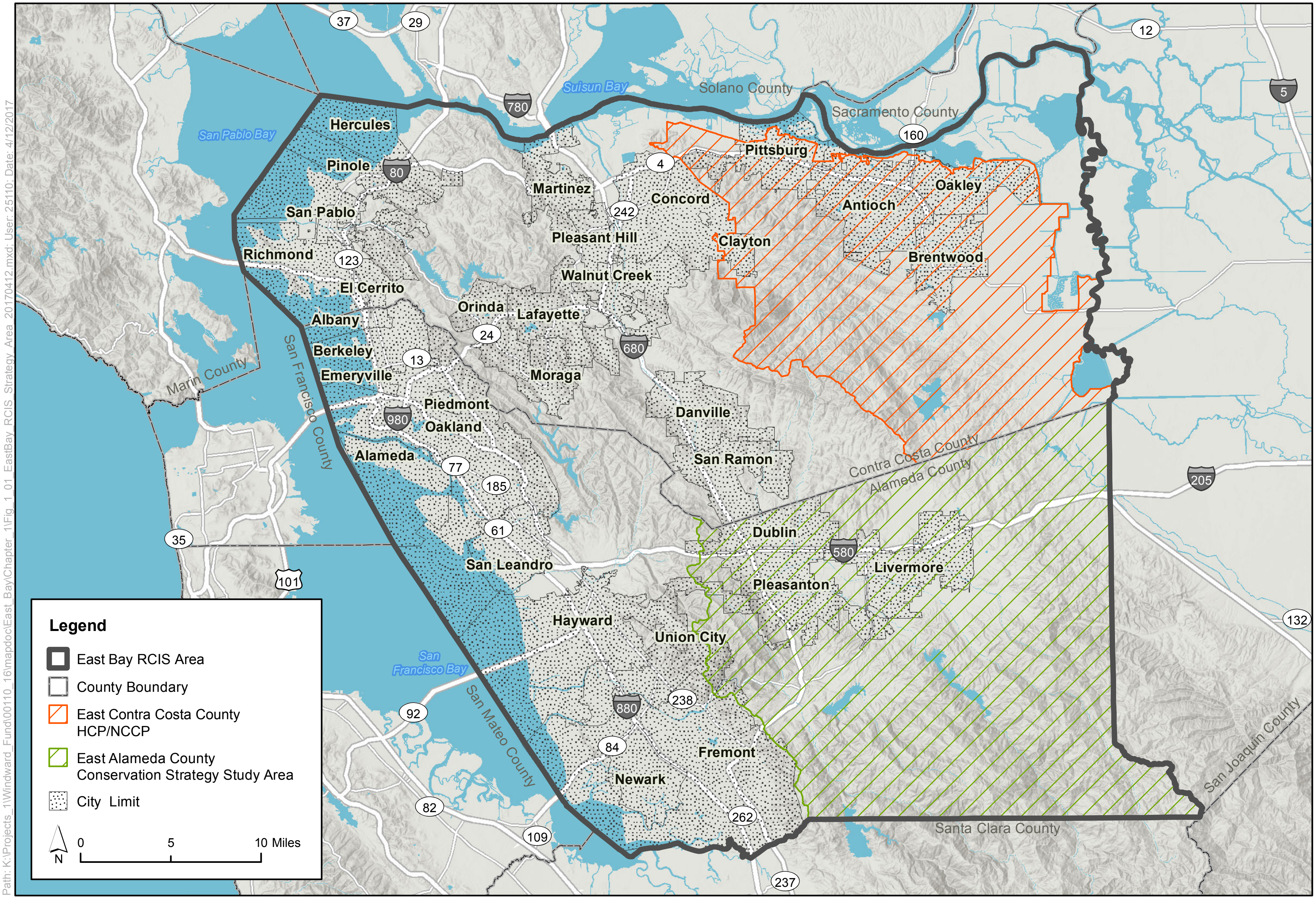

Figure 1-1
East Bay RCIS Area

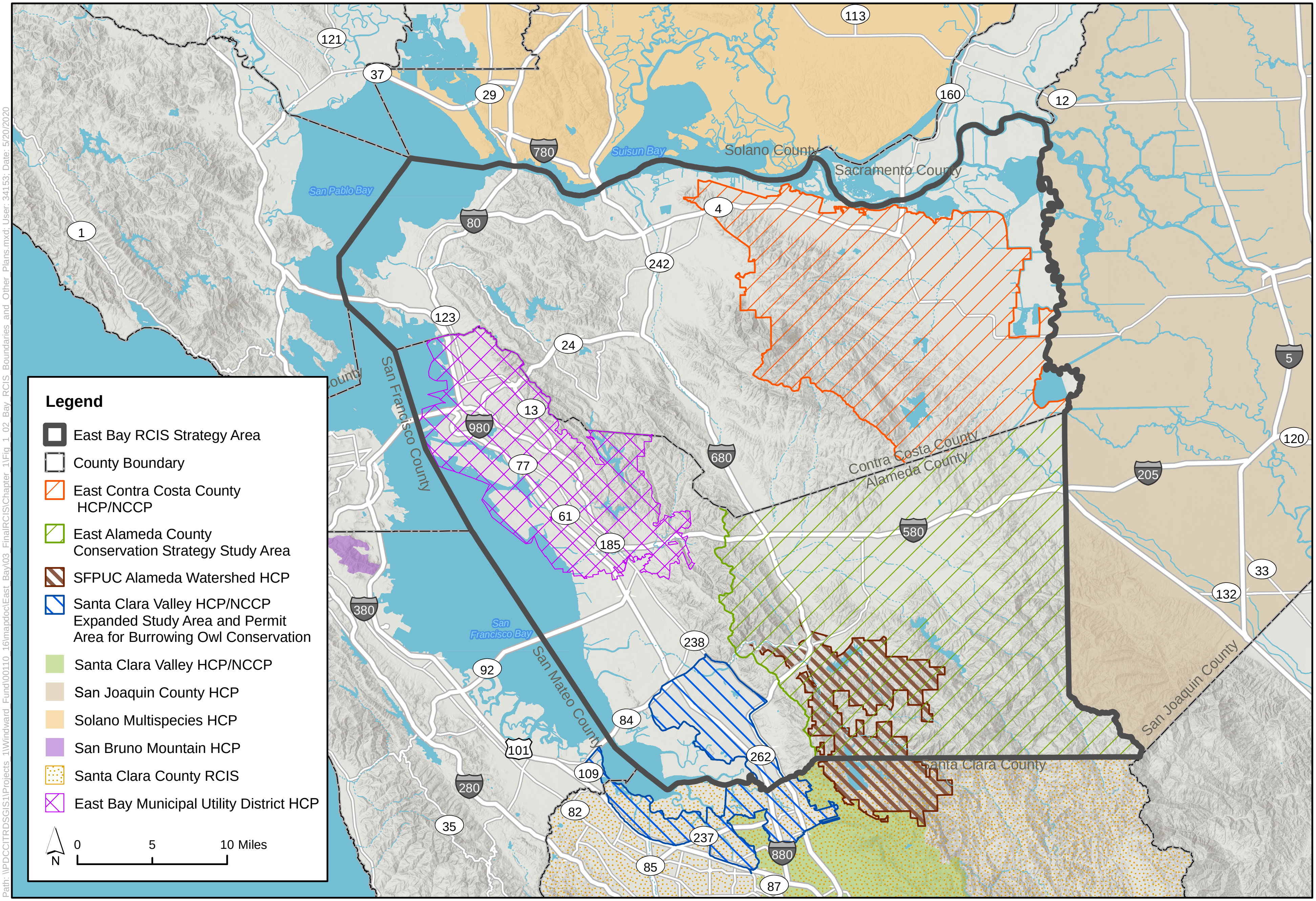

Figure 1-2
Regional Conservation Plans and Strategies within and Adjacent to the RCIS Strategy Area

Chapter 2
Environmental Setting and the Built Environment

This chapter presents an overview of the environmental setting and built environment in the East Bay RCIS area to provide context for the voluntary conservation and enhancement actions (Chapter 3, *Conservation Strategy*). The RCIS area landscape consists of the built environment and natural resources in the RCIS area. This overview consists of the best available information on government planning boundaries, major infrastructure, natural resources, conservation elements, science gaps, and pressures and stressors relevant to the focal species and the conservation goals and objectives of this RCIS.

Section 2.1, *Built Environment*, covers the following subject areas, as required in the California Fish and Game Code (CFGC) Section 1850 and the RCIS Program Guidelines (California Department of Fish and Wildlife 2018a).

- Reasonably foreseeable urban development described within the context of local government planning (Section 2.1.1, *Local Government Planning*).
- Major infrastructure (water infrastructure, transportation infrastructure, transmission infrastructure, and renewable energy projects) (Section 2.1.2, *Major Infrastructure*).

This chapter describes the natural environment in the RCIS area for the following topics.

- Protected areas
- Ecoregions
- Watersheds
- Natural communities and land cover types
- Focal species

This chapter also identifies the following conservation elements that inform the conservation strategy.

- Habitat connectivity
- Working landscapes
- Baylands
- Bat habitat
- Unique land cover types
- Soils

Additionally, this chapter addresses the following pressures and stressors on conservation elements and focal species. These pressures and stressors can result in a loss or modification of habitat or direct take of individuals or populations.

- Housing and urban areas
- Livestock, farming, and ranching

- Climate change and its influence on sea-level rise, drought, and wildfire
- Non-native species and disease
- Loss of habitat connectivity
- Disruption of natural fire disturbance regime
- Dams and water management/use
- Mining, quarrying, and renewable energy
- Air pollutants
- Tourism and recreation

Finally, the chapter discusses the following gaps in scientific information that must be considered when developing the conservation strategy.

- Focal Species Occurrence Data
- Rare Plant Distribution
- Wildlife Movement
- Pond Functionality and Longevity
- California Ground Squirrel Distribution

2.1 Built Environment

This section describes the local government jurisdictions and plans, as well as the infrastructure in the RCIS area.

2.1.1 Local Government Planning

CFGC Section 1852(c)(6) requires ". . . consideration of … city and county general plan designations that accounts for reasonably foreseeable development of… housing in the RCIS area." This section describes urban development areas and city and county general plan designations that describe future urban development that is reasonably foreseeable.

2.1.1.1 East Bay RCIS Area Jurisdictions

The RCIS area includes all of Alameda County and Contra Costa County. Alameda County is 821 square miles (525,440 acres) and includes 14 incorporated cities. Approximately 1.7 million people live in Alameda County (Alameda County Public Health Department 2020), with approximately 91% of the population living in the incorporated cities. As of 2009, when the last census was conducted, the four most populated cities in Alameda County were (in descending order) Oakland, Fremont, Hayward, and Berkeley (Alameda County Community Development Agency 2009).

Contra Costa County is 804 square miles (514,560 acres) and includes 19 incorporated cities and towns. As of July 2019, approximately 1.2 million people live in Contra Costa County, with approximately 85% of the population living in the incorporated cities and towns. The four most populated cities in Contra Costa County are (in descending order) Concord, Richmond, Antioch, and San Ramon (Contra Costa County 2020).

By 2040, the Bay Area is projected to add 2.1 million people, increasing total regional population from 7.2 million to 9.3 million, an increase of 30% or roughly 1% per year (Metropolitan Transportation Commission 2013). This population growth will influence both major infrastructure development in the region and also the response of focal species and natural communities to these changes.

2.1.1.2 Land Use Designations

Each city and county in the RCIS area is required to develop and periodically update general plans that include land use designations. These designations typically include uses for urban development at various densities, rural development, commercial development, institutional development, and open space. Table 2-1 and Figure 2-1 show the land use designations of the two counties and 35 cities in the RCIS area.

Table 2-1. Land Use Designations in the RCIS Area

City or Unincorporated County	Land Use Designations
Alameda County (Unincorporated)	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use, Mixed Use: Commercial & Industrial, Mixed Use: Residential & Parks/Open Space or Agriculture, Other Unknown, Parks/Open Space, Residential, Water
Alameda	Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential
Albany	Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Commercial & Industrial, Mixed Use: Other, Mixed Use: Residential & Commercial, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential
Berkeley	Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Other, Mixed Use: Residential & Commercial, Parks/Open Space, Residential
Dublin	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Commercial & Industrial, Mixed Use: Other, Mixed Use: Residential & Commercial, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential
Emeryville	Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Residential & Commercial, Parks/Open Space, Residential
Fremont	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Residential & Commercial, Parks/Open Space, Residential, Water
Hayward	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Commercial & Industrial, Mixed Use: Other, Mixed Use: Residential & Commercial, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential
Livermore	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use: Other, Mixed Use
Newark	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential
Oakland	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use: Residential & Commercial, Mixed Use, Water

City or Unincorporated County	Land Use Designations
Piedmont	Commercial, Education/Public/Semi-Public, Parks/Open Space, Residential
Pleasanton	Agriculture/, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use, Mixed Use: Commercial & Industrial, Water
San Leandro	Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Mixed Use: Residential & Commercial, Residential
Union City	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use: Other
Contra Costa County (Unincorporated)	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use, Mixed Use: Agriculture & Parks/Open Space, Mixed Use: Commercial & Industrial, Mixed Use: Other, Mixed Use: Residential & Commercial, Other/Unknown, Parks/Open Space, Residential, Water
Antioch	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use, Water
Brentwood	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use: Residential & Commercial, Mixed Use
Clayton	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential
Concord	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Commercial & Industrial, Mixed Use: Other, Mixed Use: Residential & Commercial, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential
Danville	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use
El Cerrito	Commercial, Parks/Open Space, Residential
Hercules	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Commercial & Industrial, Mixed Use: Residential & Commercial, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential
Lafayette	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use: Residential & Commercial
Martinez	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use, Water
Moraga	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential
Oakley	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Water
Orinda	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use, Parks/Open Space, Residential
Pinole	Commercial, Education/Public/Semi-Public, Industrial, Mixed Use, Parks/Open Space, Residential, Mixed Use: Commercial & Industrial, Mixed Use: Residential & Commercial
Pittsburgh	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use, Parks/Open Space, Residential, Water
Pleasant Hill	Commercial, Education/Public/Semi-Public, Industrial, Mixed Use, Parks/Open Space, Residential

City or Unincorporated County	Land Use Designations
Richmond	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Commercial & Industrial, Mixed Use: Residential & Commercial, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential
San Ramon	Agriculture, Commercial, Education/Public/Semi-Public, Industrial, Parks/Open Space, Residential, Mixed Use
San Pablo	Commercial, Education/Public/Semi-Public, Industrial, Mixed Use: Commercial & Industrial, Mixed Use: Residential & Commercial, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential
Walnut Creek	Agriculture, Commercial, Education/Public/Semi-Public, Mixed Use: Other, Mixed Use: Residential & Parks/Open Space or Agriculture, Parks/Open Space, Residential

In 2006, the Association of Bay Area Governments (ABAG) undertook efforts to collect land use data from all the cities and counties under its jurisdiction (Association of Bay Area Governments 2006). It aggregated the data and grouped the many different land use designations into 14 simplified categories (Figure 2-1). The ABAG dataset is the most comprehensive and readily available land use dataset for the San Francisco Bay Area (Bay Area).

The land use categories used in this East Bay RCIS are listed below, along with a brief description of the type of development or other feature included under each category. These nine land use categories were aggregated from the 14 land use categories used by ABAG.

- **Agriculture.** This land use category includes agriculture of all types and scales, from smaller row-crop farming operations to larger facilities such as nurseries. For a few municipalities, it also includes managed open space and areas designated as ranchlands or rural agriculture. This category also includes land used for grazing that is not otherwise assigned a Parks/Open Space land use designation. Although grazing land is also included in the Parks/Open Space category, it is the predominant type of agricultural land use in the RCIS area.

- **Commercial.** This land use category includes different facilities that serve high- and low-density commercial or retail businesses. Examples include restaurants, automotive services, business centers, neighborhood commercial centers, research and development facilities, office spaces, roadside services, transit centers, hotels, and community and regional shopping centers. This land use category also includes water-related commerce and commercial recreation.

- **Education/Public/Semi-Public.** This land use designation applies to public and private education facilities, including school district lands, schools, and college campuses. It also applies to public service facilities such as wastewater treatment plants, parking lots, community facilities/civic uses, maintenance yards, utility infrastructure, medical and dental facilities, and correctional facilities.

- **Industrial.** This land use category includes light and heavy industrial uses that typically support industrial production (manufacturing), storage (warehousing), distribution, and repair.

- **Mixed Use.** This land use category is associated with one or more of the mixed-use categories assigned by ABAG, including Mixed Use, Mixed Use: Commercial & Industrial, Mixed Use: Other, Mixed Use: Residential & Commercial, Mixed Use: Residential & Industrial, and Mixed Use: Residential & Parks/Open Space or Agriculture.

While the terminology varies by jurisdiction, the general term applies to areas that mix multiple other land uses, often including a residential component. In the RCIS area, these uses include historic preservation neighborhoods, combined industrial/commercial uses, institutional lands that also provide some amount of open space or commercial use, transit-oriented development (residential mixed with commercial near a public transit station), and medium- to high-density housing complexes.

- **Other/Unknown.** This land use category includes areas of planned development and special planning areas, including urban reserves (areas of open land reserve for agriculture, floricultural, and horticultural uses), mines and quarries, and utilities, which do not fit into the other land use categories or areas where land use data was not available. This land use category also includes transportation rights-of-way.
- **Parks/Open Space.** This land use category includes undeveloped land across broad landscapes and within residential areas. Examples include land managed for the protection of watersheds, state and county parks, city parks, fallow fields, delta recreation areas, and grassy hillsides surrounding residential development. This land use category excludes grazing land where it is included within the agriculture designation by ABAG, except when grazing land (or rangeland) occurs where designated as parks/open space by ABAG. Much of the parks and open space lands, including designated watersheds, in the RCIS area are dominated by rangelands, however, and are grazed (L. Ford, pers. comm).
- **Residential.** This land use category includes residential areas of all sizes, including rural residential areas, mixed residential areas, and low- and high-density residential areas, as well as mobile home parks.
- **Water.** This land use category includes the San Francisco Bay and other areas identified as open water.

2.1.1.3 Plan Bay Area

Plan Bay Area 2040 (Metropolitan Transportation Commission 2017) is a state-mandated, integrated long-range transportation and land use plan. As required by Senate Bill 375, all metropolitan regions in California must complete a Sustainable Communities Strategy as part of a Regional Transportation Plan. In the Bay Area, the Metropolitan Transportation Commission and the Association of Bay Area Governments are jointly responsible for developing and adapting a Sustainable Communities Strategy that integrates transportation, land use, and housing to meet greenhouse gas reduction targets set by the California Air Resource Board. The region adopted its previous plan—Plan Bay Area—in July 2013 (Metropolitan Transportation Commission 2013). Plan Bay Area 2040 is a limited and focused update that builds upon the original Plan Bay Area, but with updated planning assumptions that incorporate key economic, demographic and financial trends from the previous four years (Metropolitan Transportation Commission 2017).

Plan Bay Area 2040 provides a roadmap for accommodating projected household and employment growth in the nine-county Bay Area by 2040, as well as a transportation investment strategy for the region. Plan Bay Area 2040 is relevant to this East Bay RCIS because it provides insight into geographic areas where reasonably foreseeable urban development may occur. Furthermore, Plan Bay Area links regional transportation planning and funding with regional and local population growth and future land use, and as such, also provides some insight into major infrastructure development as related to transportation (this issue is considered further in Section 2.1.2.2, *Transportation*). Plan Bay Area 2040 was based on local planning efforts; Alameda and Contra Costa counties and other San Francisco Bay Area cities and counties participated in its development. Plan Bay Area 2040 projects population growth, housing, and employment for the year 2040 under three scenarios, plus a "no project" alternative.[1] As projected for the three scenarios and no project alternative, by 2040 Alameda County will make up a 15-21% share of total San Francisco Bay Area population growth, employment in Alameda will make up a 21-22% share of total San Francisco Bay Area employment growth, and there will be a housing increase of approximately 94,000- 162,000 units. Under the same three scenarios, by 2040, Contra Costa County will make up a 6-15% share of total San Francisco Bay Area population growth, employment in Contra Costa will make up a 12-13% share of total San Francisco Bay Area employment growth, and there will be a housing increase of approximately 32,000- 109,000 units.

Plan Bay Area 2040 can be used to inform decision-making related to the challenges of future population growth in the East Bay RCIS area; however, it is not intended to interfere with local land use authority and does not replace local general plans or community-specific plans. Plan Bay Area 2040 provides no regional authority over cities and counties to decide how and where land is developed or preserved. Local governments are encouraged to utilize Plan Bay Area 2040 as a tool to inform land use and development decisions in the San Francisco Bay Area.

Plan Bay Area's Action Plan 2040 includes recommendations to expand existing resilience efforts to address threats to the Bay Area's communities, ecosystems, and economy. As described in Plan Bay Area 2040, "[r]esilience efforts help the region protect assets and people from natural disasters like earthquakes, floods, landslides and fires as well as prepare for climate change hazards like sea level rise, extreme storms and droughts. Resilience underpins the achievement of many other goals in the plan, such as housing, infrastructure and economic development that may be significantly compromised by the impacts of disasters or climate change."

Plan Bay Area 2040 recommended resilience actions include the following measures (Metropolitan Transportation Commission 2017), as presented in the Plan Bay Area 2040 Action Plan.

- **Develop a regional governance strategy for climate adaptation projects:** Develop an institutional strategy for managing, coordinating, and implementing regional and local projects related to climate change adaptation.
- **Establish and provide a resilience technical services team:** Broadly share data, best practices and grant opportunities for climate adaptation and natural hazard mitigation. Continue to assess built environment and social vulnerabilities and identify workable solutions through public and private avenues. Investigate how to incorporate resilience into Priority Development Area planning and Complete Streets requirements.
- **Expand the region's network of natural infrastructure:** Coordinate regional programs to preserve and expand natural features that reduce flood risk, strengthen biodiversity, enhance air quality, improve access to urban and rural public space, mitigate urban heat island effects, and enhance health. Leverage existing initiatives — including Priority Conservation Areas, the

[1] See Plan Bay Area 2040 for details about the three scenarios and the "no project" alternative, and projections for population growth, employment, and housing in Santa Clara County at: http://www.planbayarea.org/counties/focus-santa-clara-county

Resilient by Design Challenge, the Bay Trail and other regional trails, San Francisco Estuary Partnership, and Bay Restoration Authority — and partner with special districts and cities.

- **Establish the Regional Advance Mitigation Program (RAMP):** Advance mitigation for infrastructure projects to strengthen regional biological conservation priorities. Work to secure off-site compensatory mitigation lands for multiple infrastructure projects in advance of environmental reviews to improve both project delivery and conservation outcomes.

2.1.2 Major Infrastructure

This section describes existing and reasonably foreseeable development of major infrastructure facilities in the RCIS area, including water, transportation, transmission facilities, and renewable energy projects, as required by CFGC Section 1852(c)(6).

2.1.2.1 Water

Major water infrastructure in the RCIS area includes canals, engineered channels, reservoirs, artificial marshes, artificial water features, and flood control channels (Figure 2-2). The four major water districts in the RCIS area, and the major infrastructure managed by those districts, are described in the following sections.

Contra Costa Water District

The Contra Costa Water District[2] delivers water to approximately 500,000 people in central and eastern Contra Costa County. Formed in 1936 to provide water for irrigation and industry, the district is one of the largest urban water districts in California. The Contra Costa Water District regularly maintains and improves its water system. Major capital improvements and/or annual operations and maintenance activities include the following projects (Contra Costa Water District 2017).

- Annual Canal Loop Cleaning.
- Main Canal Modernization Studies.

The Contra Costa Water District also owns and operates the Los Vaqueros Reservoir, a 160,000 acre-foot reservoir within a 20,000-acre watershed. Contra Costa Water District uses the Los Vaqueros Reservoir to store fresh water pumped from the Sacramento–San Joaquin Delta (Delta) during the winter and spring. Water from the reservoir is then used in the summer and fall to supplement water pumped from the Delta to improve water quality. The reservoir serves as an emergency storage facility and provides recreation, flood control benefits, and terrestrial habitat in the watershed (Contra Costa Water District 2017). In 2012, the reservoir was expanded from 100,000 acre-feet to 160,000 acre-feet capacity. Another expansion project is currently being planned that would improve pump stations and pipelines and could increase the reservoir's capacity up to 275,000 acre-feet.[3]

[2] https://www.ccwater.com/
[3] https://www.ccwater.com/lvstudies

Alameda County Water District

The Alameda County Water District[4] supplies water to the residents and businesses of southern Alameda County. The district supplies drinking water to the more than 350,000 people in the cities of Fremont, Newark, and Union City. The District manages approximately 900 miles of pipeline as well as several treatment facilities. The Alameda Creek Fish Passage Project and Main Renewal and Seismic Upgrade Program are two ongoing advances run by the Alameda County Water District described below. Two additional projects are the advanced meter infrastructure project and the Kaiser Pond diversion pipeline improvement project.

As part of the Alameda Creek Fish Passage Project, the Alameda County Water District and a number of Bay Area agencies have worked for more than a decade to make the creek a more accessible for fish, and steelhead in particular. To improve fish passage through the Alameda Creek Flood Control Channel, the district has removed one rubber dam, constructed fish ladders at two rubber dams, and installed fish screens at off-stream diversions. Upcoming fish passage projects include the following.[5]

- Rubber Dam No.3 Fish Ladder (in progress in 2018).
- Shinn Pond Fish Screen (scheduled to start in 2019).
- Rubber Dam No. 1 and Flood Control Drop Structure Fish Ladder (scheduled to start in 2019).
- Alvarado-Niles Pipeline Seismic Improvement Project (scheduled to start fall 2018).[6]

The Alameda County Water District's Main Renewal and Seismic Upgrade Program[7] (also referred to as the Main Replacement and Seismic Upgrade Program) upgrades and seismically retrofits water delivery pipelines and facilities. Intensive infrastructure upgrades improve water supply reliability for customers in the event of a major earthquake and reduce service interruptions due to aging pipelines.

Alameda County Flood Control and Water Conservation District

The Alameda County Flood Control and Water Conservation District,[8] also known as Zone 7, covers 272,000 acres in the Livermore-Amador Valley in eastern Alameda County. Specifically, the Zone 7 Water Agency serves 222,000 people in the cities of Pleasanton, Livermore, Dublin, and in the Dougherty Valley area. Zone 7 was created in 1947 through California legislation and was formed by a vote of local residents in 1957. Of the 10 active zones in Alameda County, only Zone 7 has its own elected member board of directors (Alameda County 2016).

Zone 7 supplies irrigation water to the south Livermore Valley vineyards. Zone 7 owns 37 miles of flood protection channels and has an active flood management program under a stream management master plan. Zone 7 also conducts restoration projects such as the Arroyo Mocho Floodplain and Riparian Forest Restoration Project and the Upper Altamont Creek Planting Project (Alameda County 2016).

[4] https://www.acwd.org/
[5] https://www.acwd.org/index.aspx?NID=456
[6] https://www.acwd.org/index.aspx?NID=594
[7] https://www.acwd.org/faq.aspx?TID=37
[8] https://www.acfloodcontrol.org/

East Bay Municipal Utility District

The East Bay Municipal Utility District[9] is a special district that provides drinking water to 1.4 million customers in the East Bay in parts of Alameda and Contra Costa Counties. The district serves 685,000 wastewater customers across 212,480 acres, from Crockett in the North to San Lorenzo in the south and eastward from San Francisco Bay through the Oakland-Berkeley hills to Walnut Creek and south through the San Ramon Valley. The East Bay Municipal Utility District began treating wastewater in 1951 to protect the San Francisco Bay. The wastewater treatment service area extends along the east shore of the Bay, from Richmond to Oakland (East Bay Municipal Utility District 2020). Major capital improvements expected to occur include the following projects.

- Alameda North Bay Farm Island Pipeline Crossing (Crossing #1 scheduled to begin in 2018).
- Recycled Water Projects. No scheduled start date but include the following.
  - RARE Phase 2
  - RARE Future Expansion
  - North Richmond Expansion
  - Phillips 66 Phase 1
  - Phillips 66 Phase 2
  - SRVRWP Phase 5
  - SRVRWP Phase 6
  - East Bayshore Phase 1B
  - East Bayshore Phase 2
  - San Leandro Phase 3
  - Satellite Recycled Water Projects
  - Reliez Valley Recycled Water Project
- West of Hills Northern Pipeline (Berkeley project work to install the 48" transmission pipe along Ellsworth Street will begin in fall 2018).
- Almond Reservoir Replacement (Construction to begin in 2020).
- Leland Reservoir Replacement (Construction to begin in 2020).
- Central Reservoir Replacement (Construction to begin in 2024).
- Dos Osos Reservoir Replacement (Construction to begin in 2023).

San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC)[10] is the third largest municipal utility in California, and supplies drinking water to approximately 2.7 million customers in the Bay Area (San

[9] https://www.ebmud.com/
[10] http://www.sfwater.org/

Francisco Public Utilities Commission 2020). SFPUC manages the complex Hetch Hetchy Regional Water System that supplies the City of San Francisco as well as providing wholesale water to 24 cities and water districts, and two private utilities in Alameda, Santa Clara, and San Mateo Counties who are represented by the Bay Area Water Supply and Conservation Agency.[11] The regional water system consists of over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, 18 dams, five pump stations and two water treatment plants. Approximately eighty-five percent of the water comes from Sierra Nevada snowmelt stored in the Hetch Hetchy Reservoir on the Tuolumne River in Yosemite National Park, with the remainder being supplied by the Alameda and Peninsula watersheds. The Alameda watershed contributes surface water supplies that are captured and stored in the Calaveras and San Antonio Reservoirs, both of which include associated dam facilities (Calaveras Dam and James H. Turner Dam, respectively).

In 2002, SFPUC adopted a multi-year, $4.8 billion dollar capital Water System Improvement Program (WSIP) to rebuild and retrofit the regional water system to improve reliability and ensure seismic safety. The program consists of 87 projects; 35 within San Francisco, and 52 regional projects spread over seven counties from the Sierra foothills to San Francisco. As of December 31, 2019, 42 regional projects were completed, one was in closeout, six were in construction, and one regional project was in design (Alameda Creek Recapture Project). The forecast final completion date for the WSIP is May 2023.[12] Active projects in the RCIS area include the following.

- Alameda Creek Recapture (in re-design and environmental review)
- Fish Passage Facilities within the Alameda Creek Watershed
- Calaveras Dam Replacement
- Alameda Creek Diversion Dam
- WSIP Closeout – Sunol Valley, consisting of sub-projects.
    - Alameda Siphon 4 Carrier Water System Modifications
    - Erosion Repair at Quarry Pond F3 East
    - Sunol Valley Water Treatment Plant Polymer Feed Facility
    - Miscellaneous work at Alameda West Portal, Irvington Portal and San Antonio Backup Pipeline
    - New Irvington Tunnel Water Quality Equipment Relocation
    - San Antonio Backup Pipeline Carrier Water System Modifications

California Department of Water Resources

The California Department of Water Resources[13] (DWR) was established in 1956 by the State Legislature to protect, conserve, develop, and manage much of California's water supply, including the State Water Project (SWP), the nation's largest state-built water conveyance program. The SWP supplies drinking water to approximately 27 million people, irrigation water to approximately 750,000 acres of farmland, maintenance of flood control facilities, hydroelectric power generation, recreational areas, and fish and wildlife habitat. The entire project encompasses over 700 miles of

[11] http://bawsca.org/
[12] http://sfwater.org/Modules/ShowDocument.aspx?documentid=14921
[13] http://water.ca.gov/

canals, tunnels, and pipelines with 36 storage facilities, 21 pumping plants, five hydroelectric power plants, and four pumping-generating plants. Within the RCIS area, DWR facilities include Bethany Reservoir with associated Banks and South Bay Pumping Plants, the South Bay Aqueduct, Dyer Reservoir, Patterson Dam and Reservoir, Del Valle Dam, Lake Del Valle, and Del Valle Pumping Plant, and the Clifton Court Forebay (California Department of Water Resources 2020).

DWR plans to begin the Bethany Dams Improvement Project[14] in spring 2021. The project includes improvement repairs to the Bethany Forebay Dam and four saddle dams to repair rodent holes and erosion areas, and placement of downstream embankment rock slope protection underlain with wire mesh as a preventative measure to prevent future rodent burrowing.

2.1.2.2 Transportation

Numerous transportation networks serve the RCIS area. Figure 2-3 shows major transportation infrastructure in the RCIS area, including airports, transit hubs, transit priority areas, Statewide Transportation Improvement Program capital improvement projects, passenger railways, and rail stations. Plan Bay Area 2040 is a regional strategy for how the Bay Area, including the East Bay RCIS area, can grow and includes identification of, and planning for, new and upgraded transportation infrastructure (Metropolitan Transportation Commission 2017). The plan identifies over 100 transportation projects planned for Alameda and Contra Costa Counties.

Transportation Planning

Transportation planning agencies develop comprehensive strategies for transportation at the state, regional, or local level, in coordination with diverse groups of stakeholders. Major transportation planning agencies in the RCIS area include California Department of Transportation (Caltrans), the Alameda County Transportation Commission, and Contra Costa Transportation Authority. These three major agencies are described in the following sections.

Caltrans

Caltrans[15] manages more than 50,000 miles of California's highways and freeways, provides intercity rail services, permits more than 400 public-use airports and special-use hospital heliports, and works with local agencies. Caltrans District 4[16] includes Sonoma, Napa, Solano, Marin, San Francisco, Contra Costa, Alameda, San Mateo, and Santa Clara Counties. In Alameda County, Caltrans manages the San Francisco-Oakland Bay Bridge demolition and tolls, express lanes, bridge repair project, Dumbarton Bridge, and more. In Contra Costa County, Caltrans is involved with a number of construction projects, including State Route 4, 580 Richmond-San Rafael Bridge Access Improvements, Interstate 80 SMART Corridor project, and more (California Department of Transportation 2017).

Plan Bay Area 2040 identifies over sixty roadway improvement projects supported by Caltrans or in partnership with Alameda County Transportation Commission or Contra Costa Transportation Commission (described below). Caltrans' Office of State Highway Operations and Protection Program[17] (SHOPP) Management has primary responsibility for planning, developing, managing,

[14] http://water.ca.gov/Programs/State-Water-Project/SWP-Facilities/Bethany-Dams-Improvement-Project
[15] http://www.caltrans.ca.gov/
[16] http://www.dot.ca.gov/d4/
[17] https://dot.ca.gov/programs/transportation-programming/state-highway-operation-protection-program-shopp-minor-program-shopp

and reporting the four-year SHOPP portfolio of projects, among other tasks. Caltrans identifies future projects in the regularly updated State Highway System Management Plan.[18] Caltrans also identifies projects on highway and passenger rail corridors of strategic importance in their Interregional Transportation Improvement Program (ITIP).[19] Their work includes a number of interchange improvements along Interstate 880 and State Route 84 and widening of parts of State Route 84 in Alameda County. In Contra Costa County, work includes interchange improvements along Interstate 80 and Interstate 680, HOV and auxiliary lane work along Interstate 680, and operational improvements along State Routes 4 and 242 running along the northern portion of the RCIS area (Metropolitan Transportation Commission 2017).

Alameda County Transportation Commission

The Alameda County Transportation Commission (Alameda CTC) administers Alameda County's voter-approved sales tax for transportation and also serves as Alameda County's Congestion Management Agency. The mission of the Alameda CTC "is to plan, fund, and deliver transportation programs and projects that expand access and improve mobility to foster a vibrant and livable Alameda County."[20] In addition to countywide planning and programming certain federal, state and local funding for transportation projects within Alameda County, the Alameda CTC manages numerous active capital projects in various stages of delivery at a combined total value of more than $3 billion. Major capital improvements include the following project types.

- Bicycle and pedestrian projects.
- Highway improvement capital projects.
- Local streets and roads projects.
- Multimodal Arterial corridor projects
- Port of Oakland infrastructure projects.
- Transit projects.
- Capital programs.

Specific project details, including project webpages and fact sheets, can be found on Alameda CTC's website.[21] Current highway improvement capital projects include improvements along the I-80, I-680, I-880, and SR-84 corridors.

Contra Costa Transportation Authority

The Contra Costa Transportation Authority,[22] a public planning agency formed in 1988, is responsible for administering the Contra Costa's ½-cent transportation sales tax measure (Measure J). The authority plans, funds, and delivers transportation infrastructure projects and programs through collaborations with local, regional, and state agencies. The Contra Costa Transportation Authority is also the designated Congestion Management Agency responsible for prioritizing federal,

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[18] https://dot.ca.gov/programs/asset-management

[19] https://dot.ca.gov/-/media/dot-media/programs/transportation-programming/documents/2020-ocip-draft-itip-a11y.pdf

[20] https://www.alamedactc.org/

[21] www.alamedactc.org/projects

[22] http://www.ccta.net/

state, and local funding for transportation projects in the county, including the following types of projects.

- Bicycle and pedestrian projects
- Roadway improvement projects
- Transit projects
- Multimodal projects

Specific project details can be found on Contra Costa Transportation Authority's Project website.[23] The website also contains a link to quarterly project status reports, which summarize on-going and completed projects managed by Contra Costa Transportation Authority and others. The July to September 2018 discusses a number of improvements, such as carpool lane, interchange improvements, and bike trail, along SR-4,SR-242, I-680 , and I-80.

Metropolitan Transportation Commission, Bay Area Toll Authority, and the Bay Area Infrastructure Financing Authority

The Metropolitan Transportation Commission (MTC), through its sister agencies the Bay Area Toll Authority (BATA), and the Bay Area Infrastructure Financing Authority (BAIFA), is responsible for implementing a regional Express Lane network in the Bay Area. In addition to the other express/toll lane operators in the region—the Alameda CTC (I-580 and I-680 Sunol Grade) and the Santa Clara Valley Transportation Authority (SR-237/US-101 Connector and US-101)—MTC, BATA, and BAIFA operate and manage the express lanes currently on the I-680 corridor in Contra Costa, and is constructing the I-880 Express Lanes in Alameda County. MTC, BATA, and BAIFA envision additional Express Lanes in the Bay Area, including on I-80 in Alameda, Contra Costa, and Solano Counties. These Express Lanes projects are included in Plan Bay Area 2040 (Metropolitan Transportation Commission 2017), and will be constructed as funding is available, or through financing of existing and/or future toll revenue.

Public Transportation

This section describes public transportation agencies in the RCIS area.

Bay Area Rapid Transit

Bay Area Rapid Transit[24] (BART) is a public transportation metro system serving the Bay Area. The rapid transit elevated and subway system connects San Francisco with cities in Alameda, Contra Costa, and San Mateo Counties. In Alameda County, BART serves the cities of Oakland, Berkeley, Dublin, Fremont, and Hayward. In Contra Costa County, BART serves the cities of Lafayette, Walnut Creek, Richmond, Pleasant Hill, Orinda, Pittsburgh, Concord, and Martinez. BART is currently working on new train cars, train control modernization, the Hayward Maintenance Complex Project, the Station Modernization Program, station brightening, extensions to Silicon Valley, Livermore, and East Contra Costa County, and more (Bay Area Rapid Transit 2017).

[23] http://www.ccta.net/projects/
[24] https://www.bart.gov/

Alameda-Contra Costa Transit District

The Alameda-Contra Costa Transit District[25] (AC Transit) is an Oakland-based bus line serving the western portions of Alameda and Contra Costa Counties in the East Bay. AC Transit is currently working on Plan ACT, which is the short- and long-term vision for improving AC Transit service and for creating a sustainable transportation system in the East Bay. Plan ACT focuses on routes and schedules, major corridors, and the creation of a guiding document. AC Transit is also working on the RM2 (Regional Measure 2) Owl Network and RM2 Express bus, the West Contra Costa County Service Plan, and more (AC Transit 2017).

Airports

There are six airports in the RCIS area, two in Contra Costa County (Buchanan Field Airport and Bryon Airport) and four in Alameda County (Hayward Executive Airport, Livermore Municipal Airport, Naval Air Station Oakland, and Oakland International Airport).

In Contra Costa County, the Buchanan Field Airport, approximately 1 mile west of Concord, currently hosts one private airline, which provides service to Burbank and Las Vegas. The Bryon Airport, approximately 3 miles east of the town of Byron, opened in 1994 to provide greater service to the eastern part of Contra County (Contra Costa County 2017).

In Alameda County, the Hayward Executive Airport was a former U.S. Army airfield that relieves congestion at nearby commercial airports for general aviation flights such as corporate jet flights. The Naval Air Station in Oakland was a naval air base that closed in 1997. The Oakland International Airport, owned by the Port of Oakland, is approximately 10 miles south of downtown Oakland. It is the fourth largest airport in California, with 55 internal and domestic destinations and servicing 11 million passengers annually (Oakland International Airport 2017).

2.1.2.3 Transmission

Transmission lines in the RCIS area include those supporting distribution of natural gas and electricity. Figure 2-4 shows transmission lines and natural gas pipelines in the RCIS area. A concentration of these transportation lines occur in rural and agricultural lands of Eastern Alameda County and across the northern portion of Contra Costa County while the interior of the RCIS area lacks natural gas pipelines and electrical transmission lines (Figure 2-4).

Pacific Gas and Electric Company

Pacific Gas & Electric (PG&E)[26] owns and operates all of the gas and electric transmission lines in the RCIS area. The company provides natural gas and electric service to approximately 16 million people throughout a 70,000-square-mile service area in northern and central California. PG&E also partners with a Community Choice Aggregation program to provide renewable energy through its transmission and distribution infrastructure. PG&E implements projects to maintain and update its transmission and distribution infrastructure. These projects include repairs aimed to improve electric reliability and reduce the risk of fire. In the RCIS area, transmission lines run south of Livermore and Pleasanton to Fremont and north to El Cerrito and Oakland. Transmission lines cross the Oakland hills through Walnut Creek and northern Contra Costa County (e.g., Martinez, Pittsburg,

[25] http://www.actransit.org/
[26] https://www.pge.com/

Antioch, Oakley) ringing the RCIS area (Figure 2-4). Additionally, there are local distribution lines and substations throughout the RCIS and in urban and suburban areas.

2.1.2.4 Renewable Energy Projects

Renewable energy projects are limited in the RCIS area, as shown on Figure 2-5. The Buena Vista Wind Farm, Altamont Pass Wind Resource Area (APWRA), and Bay Area Regional Renewable Energy Project in the RCIS area are described below.

Buena Vista Wind Farm

The Buena Vista Wind Farm[27] is located in southeastern Contra Costa County near the Alameda County line, covering approximately 131 acres. There are approximately 31 active wind turbines covering approximately 20 acres within the Buena Vista Wind Farm (ICF 2018, unpubl.). The original Buena Vista Wind Farm was owned by Int'l Wind Companies and ran from 1981 using 179 Windmaster 211 turbines, along with accompanying overhead collector power lines and transformers. These have been replaced by underground electrical systems. The wind farm now uses Mitsubishi 1000A turbines. The wind turbines have tower heights of 55m or, in the valleys, 60m, with 36m (100ft) long blades (Verdict Media Limited 2018).

Altamont Pass Wind Resource Area

The APWRA is located in the Altamont Hills of eastern Alameda County near the San Joaquin County line, covering an approximately 50,000-acre area. The Altamont Hills are at the geographical interface between the coastal mountains and the Central Valley and has long been recognized as an area supporting favorable conditions for wind energy development. The APWRA has supported numerous wind energy projects operated by numerous companies since the 1980s, after the State of California designated the area for production of renewable energy (in 1980) based on federal legislation passed in 1978 to achieve a range of renewable energy, source diversity, and market goals. The result of the designation was the development of a vast array of windfarms in the APWRA that was the largest of its kind in the United States by the mid-1990s (Alameda County Community Development Agency 2014a and 2014b).

Since 2004 when the Diablo Winds repowering project became operational, the APWRA has been undergoing shutdown of first-generation wind turbines and replacement with larger and more efficient turbines. Currently, there are four repowering projects installed including Diablo Winds (20.5 megawatts [MW]), Buena Vista (38.0 MW), Vasco Winds (78.2 MW), and Golden Hills (88.4 MW), for a total output capacity in the APWRA of 225.1 MW. Other repowering projects are currently under development.

Bay Area Regional Renewable Energy Project

The Bay Area Regional Renewable Energy Project[28] is a major collaborative solar project underway in the Bay Area, which focuses on finding and developing viable solar projects on public agency facilities across Alameda, Contra Costa, San Mateo, and Santa Clara Counties. Solar photovoltaic panels will be located on rooftops, carports, ground-mounted, and shade structures. There are

[27] Buena Vista wind farm
[28] http://www.solarroadmap.com/regional-initiatives/ba-rrep/

currently 187 potential sites vetted and included in the request for proposal, with more than 31 MW of potential capacity. The following East Bay cities and entities have signed up to participate.

Alameda County

- County of Alameda
- Alameda County Fire Department
- City of Berkeley
- City of Emeryville
- City of Fremont
- City of Oakland
- Hayward Area Recreation and Park District
- University of California-Berkeley
- Contra Costa County
- Central Contra Costa Sanitary District
- City of Richmond
- City of Walnut Creek
- County of Contra Costa

East Bay Community Energy

East Bay Community Energy (EBCE) began servicing Alameda County in 2018. EBCE is a public agency that secures and supplies renewable energy, such as from solar and wind, to customers. EBCE serves Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Oakland, Piedmont, San Leandro, Union City, and unincorporated Alameda County. EBCE partners with PG&E, who operates and maintains the power delivery system. Infrastructure for PG&E is described in the transmission section above. EBCE could result in an increase in local renewable energy projects.

Solar One Project

The Solar One Project is a 60-acre solar farm located in north Richmond in Contra Costa County. The Solar One Project is a partnership between the city of Richmond, sPower, and Marin Clean Energy (MCE) to integrate renewable energy and solar facilities. The MCE solar park will generate 10.5 megawatts annually, enough to provide renewable electricity of 3,900 homes and 200,000 customers in Concord, Danville, Martinez, Moraga, Oakley, Pinole, Pittsburg, San Ramon, and unincorporated Contra Costa County. The solar park is expected to eliminate 3,234 metric tons of carbon dioxide and take more than 680 fossil fueled cars of the road annually (Marin Clean Energy 2016). Construction of the solar park was completed on April 18, 2018.

Shadow Cliffs Regional Park Solar Project

Shadow Cliffs Regional Park Solar Project (project) is a small solar farm within the 266-acre Shadow Cliffs Regional Park (park) in Pleasanton, in Alameda County. The park is owned and operated by the East Bay Regional Park District and offsets all of the energy used at its 65 regional parks. The project includes solar panels that generate 1.2 megawatts of energy annually. The project is a solar carport in the park's parking lot, and thus doubles as a shade structure for park users. The project was completed in 2017 (East Bay Regional Park District 2018).

2.2 Natural Environment

2.2.1 Protected Areas

The RCIS area includes existing *protected areas*, which are public or private lands protected from development through legal or other effective means, where the primary intent of land management is to manage the land for open space use or habitat. Protected areas include large parks and open spaces that are managed primarily for their ecological functions and values. Protected areas may also include areas such as recreational parks, agricultural lands, and other areas that maintain some ecological value.

2.2.1.1 Protected Area Data Sources and Methods

A geographic information system (GIS) dataset of protected areas was compiled for this East Bay RCIS to inform the development of the conservation strategy (Chapter 3). This dataset is used to identify gaps in protection from conversion or loss to incompatible land uses (e.g., of focal species populations, habitat, movement corridors, or other natural resources), develop conservation goals and objectives, prioritize conservation opportunities, and identify land acquisition targets.

Data from the following sources were used to compile the dataset.

- GreenInfo Network, California Conservation Easement Database (CCED) (2019).
- GreenInfo Network, California Protected Area Database (CPAD) (2019).
- National Conservation Easement Database (2016).
- GIS data from the East Bay Regional Park District (EBRPD), for the EBRPD's protected areas and ECCC HCP/NCCP reserves.

EBRPD protected areas were used where they overlapped with CPAD so that CPAD's version of EBRPD's protected lands (and the ECCC HCP/NCCP protected lands) were removed from this RCISs protected area database, and replaced with EBRPD's GIS data, except for four parks and trails from CPAD that were not included in EBRPD's data. These parks and trails include Alameda Creek Regional Trail, Middle Harbor Shoreline Park, Tassajara Creek Regional Park, and Oakley (Legless Lizard) Land Bank.

The GreenInfo Network, CCED, CPAD, and National Conservation Easement Database data were clipped to the RCIS area to create the GIS data layer. All protected areas in the CPAD that are owned by cities, counties, and special districts and smaller than 100 acres were removed from the dataset. This was done to remove small city parks, golf courses, and other urban protected areas from the dataset. Small urban parks are frequently dominated by landscaped vegetation, recreation infrastructure (e.g., ball fields), and hardscape, which provides limited ecological value for the focal species. In some cases, however, small urban parks and other protected areas protect streams and riparian areas that provide habitat for aquatic and terrestrial species. Where appropriate, the conservation strategy (Chapter 3) identifies conservation actions and priorities to benefit steelhead, salmon, non-focal species and other native species in stream lengths in urban and non-urban areas, regardless of whether they pass through small urban parks not included in this East Bay RCIS protected areas dataset.

All other protected areas in the CPAD smaller than 100 acres were reviewed for inclusion in this East Bay RCIS protected areas dataset. Areas managed for conservation or resources, as identified by CPAD with a gap status of 1 or 2,[29] were included in the protected areas dataset. Areas managed for multiple uses (gap status 3) were included if the uses are compatible with conservation and resource management and the site has large areas remaining in natural habitats, such as those at the Byron Conservation Bank and the Delta Islands. Most areas smaller than 100 acres identified by CPAD as having no known mandate for protection (gap status 4) were excluded from the East Bay RCIS protected areas dataset. A small number those areas are connected to, or part of, a larger protected area (i.e., larger than 100 acres), such as the San Pablo Bay Regional Shoreline and Carquinez Strait Regional Shoreline and were included in the East Bay RCIS protected areas dataset.

Areas larger than 100 acres and identified by CPAD as having no known mandate for protection or no gap status were not included in the East Bay RCIS protected areas dataset if the predominant use is intensive or active recreation (i.e., recreational uses that require special facilities or fields). Examples include areas designated for off-highway vehicle use such as the Carnegie State Vehicle Recreation Area, intensively used recreation areas with little natural habitat such as the Quarry Lakes Regional Recreation Area, and golf courses. Large, multi-use parks that retain extensive amounts of natural habitats, such as Mount Diablo State Park or the Franks Tract State Recreation Area were included in the East Bay RCIS protected areas dataset.

2.2.1.2 Types of Protected Areas

Protected areas in the RCIS area vary according to the mechanisms by which the land and its conservation values areprotected from conversion or loss to incompatible land uses (e.g., fee title, conservation easement, agricultural easement) and the degree to which land is protected for its ecological values. Some land identified as protected is protected primarily for the conservation of natural resources, such as wildlife refuges, wilderness areas, and conservation and mitigation banks. Other land identified as protected is protected for multiple uses, including conservation and light-use recreation (e.g., hiking, wildlife viewing). In some cases, intensive recreation may conflict with natural resource protection in and adjacent to the footprint of intensive recreational uses. Areas may be protected in perpetuity or through limited-term easements. The following types of protected areas are included in the strategy, although, as noted previously, small city-owned areas are removed from the dataset.

- Mitigation or conservation banks.
- Land with a conservation easement.

[29] The CPAD uses the U.S. Geological Survey (USGS) gap analysis ranking, which define the degree of protection for biodiversity conservation using a 1-4 coding system: 1 - managed for biodiversity – disturbance events proceed or are mimicked; 2 - managed for biodiversity – disturbance events suppressed; 3 - managed for multiple uses, subject to extractive (e.g. mining or logging) or OHV use; 4 - no known mandate for protection.

- Local or regional park districts.
- State or federal wilderness areas.
- State parks.
- Agricultural easements.
- Undeveloped portions of watersheds under ownership by a public agency.

There are 266,323 acres of protected areas in the RCIS area (26% of the RCIS area), comprising land owned in fee title only (251,323 acres), through conservation easement only (12,541 acres), or both (2,459 acres) (Figure 2-6). Collectively, these protected areas provide important habitat for focal species and public recreation opportunities. The largest public landowners in the RCIS area are the East Bay Regional Park District (approximately 118,000 acres), State of California (approximately 40,000 acres), East Bay Municipal Utility District (approximately 26,000 acres), and Contra Costa Water District (approximately 20,000 acres). Publicly owned protected areas total approximately 253,900 acres in the RCIS area. The largest private owners of conservation easements in the RCIS area are the Tri-Valley Conservancy (approximately 3,600 acres), Wildlife Heritage Foundation (approximately 3,000 acres), and Center for Natural Lands Management (1,200 acres).

2.2.1.3 Protected Areas Adjacent to the RCIS Area

Many protected areas extend outside or are adjacent to the RCIS border. These areas provide landscape-level connectivity between the RCIS area and beyond (Figure 2-6). The southwest corner of the RCIS area includes portions of the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge). The Refuge extends outside of the RCIS area into Santa Clara County, providing connectivity across the baylands to the south. Further east along the southern border, extending south into Santa Clara County, is the San Francisco Public Utilities Commission’s Alameda Watershed, an area surrounding the Calaveras Reservoir that is protected for drinking water. This protected area is contiguous with a series of protected lands extending south along the Diablo Range, well into Santa Clara County. In the northeastern corner of the RCIS area, there is a series of approximately 55 human-made islands, within and surrounding the RCIS area. Some of these islands are protected by the California Department of Fish and Wildlife (CDFW) in fee title or conservation easement; Sherman Island and Twitchell Island, which abut the northeastern corner of the RCIS area, are protected in fee title, while Medford Island, approximately 3.5 miles east of the RCIS area boundary, is protected by a conservation easement. North of the RCIS area in Solano County is the Grizzly Island Wildlife Area, managed by CDFW.

2.2.2 Conservation and Mitigation Banks

2.2.2.1 Conservation and Mitigation Banks

CFGC Section 1797.5 defines terms associated with mitigation banking in California (Appendix A, *Glossary*). In summary, a conservation or mitigation bank is privately or publicly owned land that is managed for its natural resource values, with an emphasis on the targeted resource (species or aquatic resources, respectively). Overseeing agencies typically require that the establishment of a mitigation bank include the restoration or creation of aquatic resources. Conservation banks may include restoration projects, but they are more heavily focused on the protection and management of existing occupied habitats of the target species. In exchange for permanently protecting and managing the land—and in the case of mitigation banks, restoring or creating aquatic resources—the bank operator is allowed to sell credits to project proponents who need to satisfy legal requirements for compensating environmental impacts of development projects.

CFGC Section 1852(b)(12) requires that an RCIS provide, "a summary of mitigation banks and conservation banks approved by the department or the U.S. Fish and Wildlife Service (USFWS) that are located within the strategy area or whose service area overlaps with the strategy area." The Program Guidelines further specify that the summary include banks approved by the National Marine Fisheries Service and/or the U.S. Army Corps of Engineers (Corps), as well as information on the types of credits available.

Eighteen conservation banks and mitigation banks with available credits as of the date of this RCIS (or credits that may be available in the future) are either located in, or have service areas that overlap with, the RCIS area.[30]

- **Burke Ranch Conservation Bank** is a 960-acre site in Solano County, 10 miles south of Dixon. Approved by USFWS and CDFW, the bank has credits available for California tiger salamander, with a service area overlapping the RCIS area in Contra Costa County. The bank also has vernal pool preservation credits available; however, with a service area that does not overlap the RCIS area.
- **Deadman Creek Conservation Bank** is a 684-acre site south of Merced and east of State Route 59. The bank has credits for California tiger salamander with a service area overlapping the RCIS area. The bank also has credits for San Joaquin kit fox, Conservancy fairy shrimp, and vernal pool tadpole shrimp; however, the service areas for these species do not overlap the RCIS area.
- **Drayer Ranch Conservation Bank** is a 254-acre site in Merced County and overlapping portions of the RCIS area in Alameda and Contra Costa County. The bank provides credits for California tiger salamander, San Joaquin kit fox and vernal pool ecosystem preservation for Greene's tuctoria, San Joaquin orcutt grass, succulent owl's clover, vernal pool fairy shrimp, and vernal pool tadpole shrimp.
- **Dutchman Creek Conservation Bank** is a 501-acre vernal pool landscape in Merced County. The bank contributes to a large natural-lands matrix composed of several existing conservation banks, conservation easements, and the Merced National Wildlife Refuge, totaling more than 10,000 acres safeguarding species and their habitats. The bank offers breeding and non-breeding habitat credits for the California tiger salamander service area, which overlaps with the RCIS area. The bank also offers credits for San Joaquin kit fox and vernal pool ecosystem preservation, including vernal pool fairy shrimp, vernal pool tadpole shrimp, and conservancy fairy shrimp.
- **Elsie Gridley Multi-Species Conservation Bank** is one of the largest and most diverse banks in California. The 1,800-acres site is in the southern Sacramento Valley. Its service area in the RCIS area offers credits for California tiger salamander and vernal pool ecosystem creation and vernal pool ecosystem preservation (conservancy fairy shrimp, vernal pool fairy shrimp and vernal pool tadpole shrimp).

[30] The number of credits available at these banks can be found at
https://www.wildlife.ca.gov/conservation/planning/banking/approved-banks
https://www.fws.gov/sacramento/es/Conservation-Banking/Banks/In-Area/
https://ribits.usace.army.mil/ribits_apex/f?p=107:2

- **Great Valley Conservation Bank at Flynn Ranch** is a 1,067-acre site in Merced County. The bank's service area for California tiger salamander overlaps with the RCIS area. The bank also has credits for San Joaquin kit fox and vernal pool ecosystem preservation (vernal pool fairy shrimp and vernal pool tadpole shrimp).
- **Liberty Island Conservation Bank** is a 186-acre bank located on the northernmost tip of Liberty Island in Yolo County. The bank's service area for salmonids, delta smelt, and longfin smelt overlap the RCIS area. The bank also has credits for riparian habitat.
- **Mountain House Conservation Bank** is a 147-acre bank in eastern Alameda County. The bank's service area for burrowing owl and Swainson's hawk nest sites overlap the RCIS area.
- **Muzzy Ranch Conservation Bank** is a 1,289-acre portion of the Jepson Prairie east of Fairfield and North of Highway 12 in Solano County. The bank contains some of the last remaining untouched vernal pool habitat in Northern California. The bank is authorized to provide credits to compensate for impacts on California tiger salamander in its service area, which overlaps with the RCIS area, as well as vernal pool ecosystem preservation (conservancy fairy shrimp, San Joaquin Orcutt grass, vernal pool fairy shrimp, and vernal pool tadpole shrimp), north of the RCIS area.
- **Newark Slough Mitigation Bank** is a 65.4-acre site along the San Francisco Bay in the city of Newark, Alameda County, California. The bank is owned by Wildlands and is pending approval by the Interagency Review Team. As a former tidal marsh habitat that was manipulated for the production of salt, with the native soil types and tidal water source still intact, Wildlands believes the property offers exceptional restoration potential. Once approved, the bank will offer credits for wetlands and waters, Ridgway rail, and salt marsh harvest mouse within the RCIS area.
- **Noonan Ranch Conservation Bank** is a 189-acre site along Jepson Parkway, east of Fairfield in Solano County. The bank is authorized by USFWS to provide credits to compensate for impacts on California tiger salamander in the RCIS area, and also provides credits for Contra Costa goldfields in Solano County.
- **North Bay Highlands Conservation Bank** is a 450-acre site in Sonoma County. It provides certified California red-legged frog mitigation credits in a service that overlaps with the RCIS area.
- **North Suisun Mitigation Bank** is a 612-acre site in Solano County. The bank provides conservation and mitigation credits for agency-approved impacts on wetlands (i.e., vernal pool ecosystem preservation, associated endangered vernal pool species (i.e., San Joaquin Orcutt grass, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields), and the California tiger salamander. The service area for the California tiger salamander overlaps with the RCIS area.
- **Ohlone West Conservation Bank** is in southern Alameda County, contiguous with watershed lands owned by the San Francisco Public Utilities Commission and wilderness preserves of the East Bay Regional Park District. The bank has service areas with credits for Alameda whipsnake, California tiger salamander, callippe silverspot butterfly and California red-legged frog in the RCIS areas.

- **Oursan Ridge Conservation Bank** is a 430-acre site in Contra Costa County. The bank offers credits for Alameda whipsnake and California red-legged frog in its service territories for these species, which overlap with the RCIS area.
- **Ridge Top Ranch Wildlife Conservation Bank** is a 745-acre bank in Solano County. The bank has USFWS credits available for California red-legged frog with a service area overlapping the RCIS area. The bank also has credits for callippe silverspot butterfly; however, credits for this species do not overlap the RCIS area.
- **San Francisco Bay Wetland Mitigation Bank** is an 82-acre site in San Mateo County. The bank offers credits for tidal wetlands, non-tidal/seasonal wetlands, and other waters on a case-by-case basis (i.e., for projects with impacts on non-tidal/seasonal wetlands or other waters that may have been historic tidal wetlands or other waters). Its service area overlaps with the RCIS area.[31]
- **Sparling Ranch Conservation Bank** is a 3,281-acre site in Santa Clara County and San Benito County. The bank is owned by Southbay Conservation Resources, LLC. It offers credits for California tiger salamander and California red-legged frog within the RCIS area.
- **Springtown Natural Community Reserve** is a 92.57-acres site in Alameda County. The bank has the potential to expand to approximately 400 acres, however this bank is currently sold out. The bank offers mitigation credits for wetland species.
- **Vieira-Sandy Mush Road Conservation Bank** is a 333-acre site in Merced County. The bank provides credits for California tiger salamander, San Joaquin kit fox, and vernal pool ecosystem preservation (conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The bank's service area for California tiger salamander overlaps with the RCIS area.

The two banks with available credits and located in the RCIS area and with data in GIS format are shown on Figure 2-7.

2.2.2.2 In-Lieu Fee Programs

33 Code of Federal Regulations (CFR) 332, Compensatory Mitigation for Losses of Aquatic Resources (also known as the Mitigation Rule), identifies in-lieu fee program as a preferred approach to meeting compensatory mitigation needs for adverse effects on waters of the United States, second to mitigation banks. As defined in 33 CFR 332.2, an in-lieu fee programs involves the following.

> …the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for DA permits. Similar to a mitigation bank, an in-lieu fee program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the in-lieu program sponsor. However, the rules governing the operation and use of in-lieu fee programs are somewhat different from the rules governing operation and use of mitigation banks. The operation and use of an in-lieu fee program are governed by an in-lieu fee program instrument.

[31] Information on available credits can be found at https://www.spn.usace.army.mil/Missions/Regulatory/Mitigation-Banks/Approved-Banks-for-the-San-Francisco-Regulatory-Di/

No mitigation lands associated with an in-lieu fee program exist within the RCIS area. However, the National Fish and Wildlife Foundation's (NFWF) *Sacramento District California In-Lieu Fee Program* has a service area that overlaps with the eastern edge of the RCIS area under the jurisdiction of the Corps' Sacramento District.

2.2.3 Ecoregions

CFGC Section 1852(c)(2) states that an RCIS shall include ". . . a description of the surrounding ecoregions…. that provide relevant context for the development of the strategy." Furthermore, CFGC Section 1852(c)(14) states that an RCIS shall include "incorporation and reliance on, and citation of, the best available scientific information regarding the RCIS area and the surrounding ecoregion, including a brief description of gaps in relevant scientific information, and use of standard or prevalent vegetation classifications and standard ecoregional classifications for terrestrial and aquatic data to enable and promote consistency among regional conservation investment strategies throughout California." This section provides a description of the ecoregions that overlap and surround the RCIS area, according to the U.S. Department of Agriculture classification (McNab et al. 2007), as required by the Program Guidelines.

Ecoregions are areas of general similarity in ecosystems based on major terrain features such as a desert, plateau, valley, mountain range, or a combination thereof as defined by the U.S. Department of Agriculture. They provide a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregions can be effective units for setting regional conservation goals, as well as developing biological criteria and water quality standards.

Ecoregions are hierarchical and identified based on patterns of biotic and abiotic phenomena, including geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. North America is divided into different ecological units from coarsest to finest (ecoregions (i.e., provinces), subregions (i.e., sections), landscapes, and land units). The RCIS areas overlaps with three ecoregions, and within each of the ecoregions there is one subregion that overlaps the RCIS area (Figure 2-8). The ecoregions and subregions that overlap the RCIS area are described in Section 2.2.3.1, *California Coastal Chaparral Forest and Shrub Province*, Section 2.2.3.2, *California Coastal Range Open Woodland-Shrub-Coniferous Forest-Meadow Province*, and Section 2.2.3.3, *California Dry Steppe,* based on the descriptions provided by the United State Department of Agriculture (McNab et. al. 2007).

2.2.3.1 California Coastal Chaparral Forest and Shrub Province

The California Coastal Chaparral Forest and Shrub Province overlaps with the western and north-central portion of the RCIS area (Figure 2-8). This province covers much of the California coast from San Francisco to Baja. The primary distinguishing characteristic of this ecoregion is its Mediterranean climate of hot dry summers and cool moist winters, and associated vegetative cover comprising primarily chaparral and woodlands. The landscape is composed of coastal plains and high hills. Large areas are ranchland and are grazed by domestic livestock. Relatively little land has been cultivated. The Central California Coast Section occurs within the California Coastal Chaparral Forest and Shrub Province in the RCIS area.

Central California Coast Section

The Central California Coast Section in the RCIS area is comprised of low to moderate elevation ranges and valleys. Bedrock is sedimentary, granitic, and ultramafic formations. The vegetation is composed of a mixture of western hardwoods, chaparral, and California annual grassland land cover types.

2.2.3.2 California Coastal Range Open Woodland-Shrub-Coniferous Forest-Meadow Province

The California Coastal Range Open Woodland-Shrub-Coniferous Forest-Meadow Province overlaps the southeastern portion of the RCIS area (Figure 2-8). This province covers much of California from San Francisco to Baja. The ecoregion has a Mediterranean climate of hot dry summers and cool moist winters, and most precipitation is rain. Associated vegetative cover is comprised of evergreen shrubland, with lesser areas of woodland, consisting of broadleaf species, some of which are drought deciduous. The Central California Coast Ranges Section occurs within the California Coastal Range Open Woodland-Shrub-Coniferous Forest-Meadow Province in the RCIS area.

Central California Coast Ranges Section

The Central California Coast Ranges Section is comprised of low-elevation parallel ranges. Rock formations are of marine and non-marine sedimentary origins. The vegetation is composed of western hardwoods, annual grassland, and chaparral.

2.2.3.3 California Dry Steppe

The California Dry Steppe Province overlaps the northeastern corner of the RCIS area (Figure 2-8). This province covers California's Central Valley from Redding to Bakersfield. The ecoregion has a Mediterranean climate of hot dry summers and mild winters, and most precipitation is rain during the winter. The landscape position is typically alluvial plains with low hills. Associated vegetative cover was historically herbaceous, but now is largely irrigated agriculture crops. The Great Valley Section occurs within the California Dry Steppe Province in the RCIS area.

Great Valley Section

The Great Valley Section has a low-elevation fluvial plain formed on non-marine sedimentary rocks. The land cover has been converted to agriculture, but small areas of natural cover remains with patches of annual grasses, western hardwoods, and wet grasslands.

2.2.4 Watersheds

The U.S. Geological Survey divides and subdivides the U.S. into successively smaller hydrological units, identified by Hydrologic Unit Code (HUC); watersheds become progressively smaller as the HUC code number increases. Four HUC-8 watersheds overlap the RCIS area, with 20 HUC-10 watersheds[32] within the four HUC-8 watersheds that overlap with or occur completely within the RCIS area (Figure 2-9). The East Bay RCIS uses HUC-10 watersheds to organize the landscape into conservation planning units (Section 3.2.3, *Geographic Units of Conservation*). These watersheds catch precipitation and runoff from storm drains and carry the water to the San Francisco Bay either directly or through the Sacramento-San Joaquin River Delta. Table 2-2 summarizes the HUC-8 watersheds overlapping the RCIS area. Table 2-3 summarizes the acres and major streams within each HUC-10 watershed that overlaps with the RCIS area.

[32] For the purpose of this RCIS, major watersheds are identified at the level of the U.S. Geological Survey's 10-digit Hydrologic Unit Code (HUC 10).

Table 2-2. HUC-8 Watersheds Overlapping the RCIS Area (Acres)

Watershed	Total Size of Watershed	Size of Watershed in RCIS Area	Percent of Watershed in RCIS Area
San Francisco Bay	852,760	504,018	59.1%
San Joaquin Delta	788,537	236,143	29.9%
San Pablo Bay	784,404	131,349	16.7%
Suisun Bay	417,251	168,159	40.3%
Total	**3,890,907**	**1,039,671**	**26.7%**

Table 2-3. HUC-10 Watersheds in the RCIS Area

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed (Acres)	Area (Acres) and Percent of RCIS area	Major Creeks in Watershed[a] (Length in Miles)	Ecoregion Section
San Francisco Bay San Pablo Bay	San Francisco Bay	272,274	102,938 (9.9%) (80,805 acres in San Francisco Bay and 22,132 acres in San Pablo Bay HUC-8 watersheds)	Alameda Creek (1.4) Coyote Hills Slough (0.6) Mount Eden Creek (3.2) Plummer Creek (0.93)	Central California Coast
San Joaquin Delta	Old River	155,348	51,992 (5.0%)	Brushy Creek (9.9) Mountain House Creek (7.2) Patterson Run (5.5)	Central California Coast Ranges and Great Valley
San Pablo Bay	San Pablo Bay	146,591	25,764 (2.5%)	Garrity Creek (0.5) Pinole Creek (0.5) Rodeo Creek (0.4) Wildcat Creek (0.4)	Central Valley Coast
San Joaquin Delta	Middle River-San Joaquin River	135,822	49,198 (4.7%)	San Joaquin River (336)	Central Valley Coast and Great Valley
Suisun Bay	Suisun Bay	108,215	16,983 (1.6%)	Hastings Slough (0.5) Kirker Creek (0.3) Mount Diablo Creek (0.6) Seal Creek (1.6)	Central Valley Coast and Great Valley

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed (Acres)	Area (Acres) and Percent of RCIS area	Major Creeks in Watershed[a] (Length in Miles)	Ecoregion Section
San Francisco Bay	Arroyo Valle	107,152	45,612 (4.4%)	Arroyo Valle (18.2) Dry Creek (4.4) South Fork Trout Creek (1.6) Trout Creek (4.3)	Central California Coast Ranges
San Francisco Bay	San Lorenzo Creek-Frontal San Francisco Bay Estuaries	106,234	106,234 (10.2%)	San Leandro Creek (13.3) San Lorenzo Creek (9.3) Crow Creek (8.5) Cull Creek (7.5)	Central California Coast
Suisun Bay	Walnut Creek-Frontal Suisun Bay Estuaries	92,332	92,332 (8.9%)	Las Trampas Creek (11.9) Pine Creek (13.1) San Ramon Creek (12.0) Walnut Creek (7.8)	Central California Coast and Central California Coast Ranges
San Francisco Bay	Alameda Creek	86,620	71,433 (6.8%)	Alameda Creek (24.6) Indian Creek (9.3) La Costa Creek (7.3) San Antonio Creek (8.6)	Central California Coast and Central California Coast Ranges
San Joaquin Delta	Kellogg Creek-Big Break	65,802	65,802 (6.3%)	Kellogg Creek (13.1)	Central California Coast; Central California Coast Ranges; and Great Valley
San Francisco Bay	Arroyo Hondo	63,397	2,915 (0.3%)	Calaveras Creek (0.6)	Central California Coast Ranges
San Francisco Bay	Arroyo Mocho	62,158	58,175 (5.6%)	Arroyo Las Positas (0.9) Arroyo Mocho (24.5) Tarraville Creek (3.9) Tassajara Creek (13.0)	Central California Coast and Central California Coast Ranges
San Pablo Bay	San Pablo Creek-Frontal San Pablo Bay Estuaries	62,065	62,065 (5.8%)	Pinole Creek (10.0) Rodeo Creek (7.8) San Pablo Creek (12.7) Wildcat Creek (10.7)	Central California Coast

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed (Acres)	Area (Acres) and Percent of RCIS area	Major Creeks in Watershed[a] (Length in Miles)	Ecoregion Section
San Pablo Bay	Corte Madera Creek-Frontal San Francisco Bay Estuaries	61,713	21,388 (2.0%)	Cerrito Creek (1.6) Claremont Creek (2.0) Codornices Creek (1.3) Temescal Creek (1.6)	Central California Coast
Suisun Bay	Mount Diablo Creek-Frontal Suisun Bay Estuaries	58,845	58,845 (5.6%)	Donner Creek (3.9) Franklin Creek (4.8) Kirker Creek (8.3) Mount Diablo Creek (13.4)	Central California Coast and Great Valley
San Joaquin Delta	Marsh Creek	55,852	55,852 (5.4%)	Deer Creek (8.3) Marsh Creek (31.0) Sand Creek (11.8) Sycamore Creek (3.7)	Central California Coast; Central California Coast Ranges; and Great Valley
San Francisco Bay	Arroyo Las Positas	51,827	51,827 (4.9%)	Arroyo Las Positas (5.5) Arroyo Seco (9.9) Cayetano Creek (6.8) Cottonwood Creek (5.2)	Central California Coast and Central California Coast Ranges
San Francisco Bay	Arroyo de la Laguna	47,052	47,052 (4.5%)	Alamo Creek (10.0) Arroyo de la Laguna (6.3) Sinbad Creek (7.3) West Branch Alamo Creek (7.8)	Central California Coast and Central California Coast Ranges
San Joaquin Delta	Corral Hollow Creek	41,046	13,300 (1.3%)	Corral Hollow Creek (11.2)	Central California Coast Ranges
San Francisco Bay	Agua Caliente Creek-Frontal San Francisco Bay Estuaries	40,728	39,966 (3.8%)	Agua Caliente Creek (4.8) Agua Fria Creek (4.3) Cañada Del Aliso Creek (2.6) Toroges Creek (3.8)	Central California Coast and Central California Coast Ranges
	Total	**2,031,963**	**1,039,677 (99.9%)[b]**	**---**	

[a] Includes up to four of the longest creeks in each watershed; this is not a comprehensive list of all creeks in each watershed.

[b] The total does not equal 100% because the RCIS area includes small amounts of nine additional watersheds.

2.2.5 Natural Communities and Land Cover Types

All RCISs are required to identify "important resource conservation elements within the RCIS area, including, but not limited to, important ecological resources and processes, natural communities, habitat, habitat connectivity, and existing protected areas, and an explanation of the criteria, data, and methods used to identify those important conservation elements" (CFGC Section 1852 (c)(4)). This East Bay RCIS uses a detailed GIS-based map of land cover types within the RCIS area to spatially characterize the distribution of natural communities and habitat.

A *land cover type* is defined as the dominant character of the land surface discernible from aerial photographs or other remotely sensed imagery, as determined by vegetation, water, or human uses. Land cover types are widely used to describe a variety of landscape characteristics, including natural communities, wetlands and streams, species' habitat, ecosystem function, and biological diversity. Land cover is often a function of a variety of physical and biological factors such as plant and animal associations, soil type, topography, climate, and land uses.

The land cover dataset is an important tool for developing this East Bay RCIS's conservation strategy (Chapter 3). Amongst its many uses, the land cover data were used to model focal species' habitat, identify gaps in conservation of habitat and other natural resources, set measurable conservation goals and objectives, and identify conservation priorities to achieve the goals and objectives.

2.2.5.1 Methods and Data Sources

This East Bay RCIS uses a GIS-based map of land cover types in the RCIS area to characterize the spatial distribution of natural communities and habitat.

This East Bay RCIS land cover dataset was assembled using the following existing land cover data.

- Detailed land cover mapping conducted in 2004 based on aerial photos from 2000, 2003, and 2004 for the ECCC HCP/NCCP in East Contra Costa County (Jones & Stokes 2006).
- Detailed land cover mapping conducted in 2009 based on aerial photos from 2005 and 2007 for the *East Alameda County Conservation Strategy* (EACCS) in eastern Alameda County (ICF International 2010).
- Land cover data compiled by the Conservation Lands Network (CLN) for the entire nine-county Bay Area (from 2011). This land cover map is widely used throughout the Bay Area by open space and planning agencies (Bay Area Open Space Council 2011).
- California Department of Forestry and Fire Protection Fire and Resource Assessment Program (FRAP). This statewide map of best available land cover data from 1990 to 2014 is crosswalked into the California Wildlife Habitat Relationships system. The land cover map is widely used throughout California by open space and planning agencies (CalFire Fire Resource and Assessment Program 2016).
- The Bay Area Aquatic Resource Inventory, version 2.0 (BAARI) and wetlands and baylands datasets. These detailed base maps of the Bay Area's aquatic features were mapped by the San Francisco Estuary Institute from 2009 to 2016 and based on aerial imagery and other data sources (Bay Area Aquatic Resource Inventory 2016a, 2016b).

- National Wetlands Inventory, version 2.0. This version delineates the areal extent of wetlands and surface waters (U.S. Fish and Wildlife Service 2016).
- Serpentine map units from the Soil Survey Geographic (SSURGO) databases covering Alameda County and Contra Costa County (U.S. Department of Agriculture 2016a, 2016b, 2016c), used to identify and classify serpentine land cover types.

These datasets represent the best available information in terms of mapping accuracy, resolution, and consistency within and outside the RCIS area. The East Bay RCIS land cover dataset is intended for planning purposes. Areas identified for potential conservation investments or mitigation will need to be verified with on-the-ground surveys before conservation actions or habitat enhancement actions are made.

2.2.5.2 Terrestrial Land Cover

The land cover data from the ECCC HCP/NCCP and EACCS provide the foundation for the land cover dataset for this East Bay RCIS. These land cover datasets were used to ensure consistency across the regional conservation plans in this RCIS area and this RCIS. However, these land cover data only cover a portion of the RCIS area. CLN (Bay Area Open Space Council 2011) and FRAP (CalFire Fire Resource and Assessment Program 2016) land cover data were used to fill the gap in land cover data for areas outside of the ECCC HCP/NCCP and EACCS boundaries.

To create a unified terrestrial land cover dataset for this RCIS, the land cover classifications from CLN and FRAP were crosswalked to the ECCC HCP/NCCP and EACCS classifications. This was achieved by matching similar land cover types based on comparable species (Table 2-4a). This table also crosswalks the RCIS land cover dataset with natural communities and habitats identified in CDFW's Natural Community List (California Department of Fish and Wildlife 2018b), CDFW's list of Sensitive Vegetation Communities (California Department of Fish and Wildlife 2018c), and California Habitat Wildlife Relationships habitat types (Mayer and Laudenslayer 1988) to show how the land cover data used in this RCIS aligns with other land cover classification systems used in California. The minimum mapping unit ranged from 0.2 acres to 10 acres, depending on the land cover type and data source. Figure 2-10 depicts the source of land cover data used to map land cover in the RCIS area.

Adapting the land cover types from different sources produced the following idiosyncrasies.

- The ECCC HCP/NCCP has a single oak woodland land cover type, so the oak woodland land cover type was used to split the oak woodland polygons in the ECCC HCP/NCCP into each of the East Bay RCIS oak woodland land cover types. Polygons that remained unclassified were coded as blue oak woodlands, the dominant oak woodland type in the area.
- The serpentine rock outcrop and barren/rock were included in the grassland natural community for consistency with the EACCS.
- The ECCC HCP/NCCP future urban land cover category was not used because it represented a projection in 2006, when the plan was approved, of future development under the ECCC HCP/NCCP.
- In the CLN dataset, underlying vegetation types on parcels less than 10 acres are classified as rural residential. For the East Bay RCIS dataset, the rural residential classifications were removed and the original CLN vegetation types were restored.

In addition, the SSURGO database was reviewed to identify soils in the RCIS area with a potential serpentine component (serpentine, ultrabasic, and alluvium derived from serpentine). These areas were overlaid onto the non-serpentine land cover types, and land cover types were reclassified into serpentine land cover types where the extent of serpentine soils in each GIS mapping unit was greater than or equal to 30% (Figure 2-11). This approach is consistent with the EACCS mapping of serpentine soils, which generally corresponds to a cutoff of 30% or greater of the soil map unit being serpentine. See Section 2.2.8.6, *Soils* for more details on serpentine soils in the RCIS area.

2.2.5.3 Wetland and Bayland Land Cover

Data from the following six sources were used to develop a wetland and baylands land cover layer that was integrated into the terrestrial land cover data (Figure 2-10).

- BAARI Wetlands, version 2.0.
- BAARI Baylands, version 2.0.
- ECCC HCP/NCCP wetland types.
- EACCS wetland types.
- National Wetlands Inventory, version 2.0.
- SSURGO.

BAARI wetlands data were used as the primary building block for the wetlands and baylands land cover layer, due to its currency (published in 2015) and high-quality mapping standards. BARRI wetland types were crosswalked into the East Bay RCIS land cover types (Table 2-4b). Types such as seeps or springs were overlaid with select SSURGO map units representing potential serpentine soils to identify serpentine seeps and springs, among other types. This modified BARRI dataset served as the foundation of the wetland land cover layer. Additional datasets were needed to provide wetland data where not covered by the BAARI data.

Wetland types were then crosswalked from the ECCC HCP/NCCP and EACCS land cover and added only in areas not already covered by BAARI Wetlands. Select types from the National Wetlands Inventory, version 2.0 data were removed, and the remaining types were added in areas not already covered by BAARI wetlands or ECCC HCP/NCCP and EACCS land cover. Types removed included select linear-shaped palustrine and riverine features primarily mapped in the higher elevations in the RCIS area. Linear aquatic resources in these areas were captured in a separate stream dataset represented as lines. The following wetland types were removed.

- Palustrine emergent (PEM).
- Palustrine forested (PFO).
- Palustrine scrub-shrub (PS).
- Riverine intermittent (R4).
- Riverine upper perennial (R3).
- Riverine unknown perennial (R5).
- Other (Pf).

BAARI baylands data were added to the dataset to provide coverage in the baylands portion of the RCIS area. All BAARI baylands types were added and crosswalked to East Bay RCIS land cover types. Overlapping wetlands from the above datasets were overwritten. Minor errors were corrected, including changing Los Vaqueros Reservoir from aquatic-undefined to reservoir and changing modified canals in east Alameda County to urban. This compilation of wetlands and baylands was then integrated into the terrestrial land cover dataset and imposed on overlapping terrestrial land cover. The minimum mapping unit varies across the source datasets, the smallest being less than 0.025 acre for small features such as seeps and springs (BAARI wetlands) and 25 meters (82 feet) for minimum mapping length of freshwater unnatural channels. Table 2-5 summarizes the amount of each wetland and baylands land cover type in each watershed in the RCIS area.

2.2.5.4 Stream Layer

High-resolution flowlines from the National Hydrography Dataset (U.S. Geological Survey 2016) were used to represent hydro lines in the RCIS area. This dataset includes stream attributes necessary to model aquatic species' habitat (e.g., identification of perennial, ephemeral, and intermittent stream status). The National Hydrography Dataset was also selected to provide continuity in the stream layer data across the entire RCIS area. All records that fell within the RCIS area were used. Figure 2-12 shows the streams in the RCIS area.

Table 2-4a. Crosswalk of East Bay RCIS Land Cover Type Classification to Other State and Local Classification Systems

East Bay RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	East Alameda County Conservation Strategy Land Cover Type[c]	East Contra Costa County HCP/ NCCP Land Cover Type[d]	Conservation Lands Network Land Cover Type[e]	Fire and Resource Assessment Program Land Cover Type[f]
Grassland					
California annual grassland	Wild oats and annual brome grasslands semi-natural alliance	California annual grassland	Grassland/Oak savanna/ Pasture/Wind turbines	Hot grassland/ moderate grassland/ warm grassland/ non-native/ ornamental grass	Annual grassland/pasture
Serpentine grassland	California annual and perennial grassland macrogroup	Serpentine bunchgrass grassland	N/A	Serpentine grassland/Moderate grasslands/warm grasslands	N/A
Barren/ Rock		Rock outcrop	Rock outcrops	Barren/ Rock	Barren
Alkali grassland	Alkali weed-salt grass playas and sinks alliance	Alkali meadow and scalds, Valley sink scrub	Alkali grassland	N/A	N/A
Shrubland					
Northern mixed chaparral/chamise chaparral	California xeric chaparral group	Northern mixed chaparral/ chamise chaparral/ semi-desert scrub/desert scrub	Chaparral	Mixed chaparral/ chamise chaparral/ mixed montane chaparral/ semi-desert scrub/ desert scrub	Chamise-redshank chaparral/mixed chaparral
Serpentine chaparral	California chaparral macrogroup	Mixed serpentine chaparral	N/A	Serpentine leather oak chaparral, serpentine scrub	N/A
Northern coastal scrub/ Diablan sage scrub	Central and south coastal Californian coastal sage scrub group	Northern coastal scrub/ Diablan sage scrub	N/A	Northern coastal scrub/ Diablan sage scrub	Coastal scrub

East Bay RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	East Alameda County Conservation Strategy Land Cover Type[c]	East Contra Costa County HCP/ NCCP Land Cover Type[d]	Conservation Lands Network Land Cover Type[e]	Fire and Resource Assessment Program Land Cover Type[f]
Woodland					
Blue oak woodland	Blue oak woodland alliance	Blue oak woodland	N/A	Blue oak woodland forest/woodland	Blue oak woodland
Coast live oak forest and woodland	Coast live oak woodland alliance	Coast live oak forest and woodland	N/A	Coast live oak woodland	Coastal oak woodland
Valley oak woodland	Valley oak woodland alliance	Valley oak woodland (not mapped)	N/A	Valley oak forest/woodland	Valley oak woodland
Mixed oak woodland and forest	Mixed oak forest and woodland alliance	Mixed evergreen forest/ oak woodland	N/A	N/A	N/A
Cismontane juniper woodland	California juniper woodland alliance	N/A	N/A	Juniper Woodland and Scrub/Cismontane Juniper Woodland	N/A
Foothill pine/ oak woodland	Foothill pine woodland alliance	Foothill pine-oak woodland	N/A	N/A	N/A
Montane hardwoods	California bay forest alliance	N/A	N/A	California bay forest/montane hardwoods	Montane hardwood
Serpentine hardwoods	Foothill pine woodland alliance	Foothill pine-oak woodland	N/A	Coast live oak woodland/Serpentine hardwoods	N/A
Conifer Forest					
Coulter pine forest	Coulter pine woodland and forest alliance	Coulter pine forest	Not present	Coulter pine forest	N/A
Knobcone pine forest	Knobcone pine forest and woodland alliance	N/A	N/A	Knobcone pine forest	N/A

East Bay RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	East Alameda County Conservation Strategy Land Cover Type[c]	East Contra Costa County HCP/ NCCP Land Cover Type[d]	Conservation Lands Network Land Cover Type[e]	Fire and Resource Assessment Program Land Cover Type[f]
Ponderosa pine woodland	Ponderosa pine forest and woodland alliance	N/A	N/A	N/A	N/A
Redwood forest	Redwood forest and woodland alliance	Not present	N/A	Redwood forest	N/A
Sargent cypress woodland	Sargent cypress woodland alliance	Sargent cypress woodland	N/A	N/A	N/A
Serpentine conifer	N/A	N/A	N/A	Serpentine conifer	N/A
Riparian Woodland					
Mixed riparian forest and scrub[b]	Southwestern North American riparian, flooded and swamp forest macrogroup	Mixed riparian forest and woodland/mixed willow riparian scrub	Riparian	Central coast riparian forests	Riverine/valley foothill riparian
Sycamore alluvial woodland	California sycamore woodland alliance	Sycamore alluvial woodland	N/A	Sycamore alluvial woodland	N/A
Serpentine riparian	N/A	N/A	N/A	N/A	N/A
Cultivated Agriculture					
Cropland	N/A	Cropland	Cropland	N/A	Cropland/Irrigated grain crops/irrigated hayfields
Orchard	N/A	Orchard	Orchard	N/A	Deciduous orchard
Vineyard	N/A	Vineyard	Vineyard	N/A	N/A
Cultivated-undetermined	N/A	N/A	N/A	Cultivated/ cultivated agriculture	N/A

East Bay RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	East Alameda County Conservation Strategy Land Cover Type[c]	East Contra Costa County HCP/ NCCP Land Cover Type[d]	Conservation Lands Network Land Cover Type[e]	Fire and Resource Assessment Program Land Cover Type[f]
Urban					
Urban	N/A	Urban-suburban/golf courses/urban parks/landfill ruderal	Urban/future urban/landfill/ ruderal/turf	Urban	Urban
Rural residential	N/A	Rural-residential (<1 unit per 2.5 acres)	N/A	Rural residential	N/A
Ornamental woodland	Eucalyptus- tree of heaven – black locust groves	Ornamental woodland	Non-native woodland	Eucalyptus/ Monterey pine forest/non-native, ornamental conifer/non-native, ornamental hardwood, non-native, ornamental conifer-hardwood mixture	Eucalyptus

Notes:

HCP = Habitat Conservation Plan; NCCP = Natural Community Conservation Plan; RCIS = regional conservation investment strategy.

N/A = The corresponding classification system does not have a similar land cover type that can be cross walked to the RCIS type.

[a] California Department of Fish and Wildlife (2018b).

[b] CDFW Natural Communities List complies with the National Vegetation Classification Standard (NVCS) (Federal Geographic Data Committee 2008). NVCS is a hierarchical classification consisting of eight levels. Table 2-4a includes three CDFW natural community levels: macrogroup, group, and alliance. Macrogroup is the broadest of the three and is defined by moderate sets of diagnostic plant species and growth forms that reflect biogeographic differences in composition. Groups are grouped into macrogroups. Groups are defined by relatively narrow sets of diagnostic plant species, broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition. Alliances are grouped into groups. Alliances are the lowest, most granular of the three levels. Alliances are defined by diagnostic plant species and moderately similar composition that reflects regional to subregional environmental factors such as climate, hydrology and disturbance regimes (Federal Geographic Data Committee 2008). When two or more California Department of Fish and Wildlife Natural Communities List (California Department of Fish and Wildlife 2018a) alliances correspond to a single East Bay RCIS land cover type, the next higher (i.e., broader) level from the National Vegetation Classification Hierarchy (NVCH) that includes all corresponding alliances is given (i.e., group or macrogroup).

[c] ICF International(2010).

[d] Jones & Stokes (2006).

[e] Bay Area Open Space Council (2011).

[f] CalFire Fire Resource and Assessment Program (2016).

Table 2-4b. Crosswalk of East Bay RCIS Wetland and Baylands Land Cover Types to Other State and Local Classification Systems

East Bay RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	BAARI Baylands Land Cover Type[c]	BAARI Wetlands Land Cover Type[d]	East Alameda County Conservation Strategy[e]	East Contra Costa County HCP/NCCP[f]	Conservation Lands Network[g]	FRAP[h]	National Wetland Inventory Land Cover Types[i]
Baylands								
Deep bay	N/A	Deep bay	N/A	N/A	N/A	N/A	Estuarine	E1UBL
Shallow bay	N/A	Shallow bay	Fluvial unvegetated flat (in-channel)	N/A	N/A	N/A	N/A	E1UBL, E2SBNh, E2SBNx, E2SMh, E2USNh, L1UBH, L1UBHh, L1UBK, L1UBV, R1UBV
Tidal bay flat	N/A	Lagoon perennial unvegetated flat unnatural/ tidal bay flat	N/A	N/A	N/A	N/A	N/A	E2SBN, E2SBNh, E2SBNx, E2USM, E2USN, E2USNh
Modified tidal channel/ managed pond	N/A	Lagoon perennial open water unnatural/ tidal ditch/ tidal engineered channel	N/A	N/A	N/A	N/A	N/A	N/A
Tidal vegetation	Temperate Pacific tidal salt and brackish meadow group	Lagoon perennial vegetation unnatural/ tidal marsh flat/ tidal nascent vegetation/ tidal panne/ tidal vegetation	Fluvial vegetated (in-channel)	N/A	Slough/ channel	Coastal salt marsh/ coastal brackish marsh	Saline emergent vegetation	E2EM1N, E2EM1Nh

East Bay RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	BAARI Baylands Land Cover Type[c]	BAARI Wetlands Land Cover Type[d]	East Alameda County Conservation Strategy[e]	East Contra Costa County HCP/NCCP[f]	Conservation Lands Network[g]	FRAP[h]	National Wetland Inventory Land Cover Types[i]
Wetland and Pond								
Alkali wetland	Salt grass flats	N/A	N/A	Alkali wetland	Alkali wetland	N/A	N/A	N/A
Aquatic-undefined	N/A	N/A	N/A	N/A	Aquatic	N/A	N/A	R2UBH, R2USA, R2USC
Modified channel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	R1ABVx, R1UBVx, R2UBHr, R2UBHx
Perennial freshwater marsh	Arid West freshwater emergent group	N/A	Depressional vegetated natural, depressional vegetated unnatural/ lacustrine vegetated unnatural	Perennial freshwater marsh	Permanent wetland	Permanent freshwater marsh/ wetland	N/A	L2EM2Fh
Seasonal wetland	California warm temperature marsh/seep group	N/A	Playa open water unnatural/ playa unvegetated flat unnatural/ playa vegetated unnatural	Seasonal Wetland	Seasonal wetland	N/A	Fresh emergent wetland	N/A
Seep or spring (non-serpentine)	N/A	N/A	Seep or spring natural/seeps or spring unnatural	N/A	N/A	N/A	N/A	N/A

East Bay RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	BAARI Baylands Land Cover Type[c]	BAARI Wetlands Land Cover Type[d]	East Alameda County Conservation Strategy[e]	East Contra Costa County HCP/NCCP[f]	Conservation Lands Network[g]	FRAP[h]	National Wetland Inventory Land Cover Types[i]
Seep or spring (serpentine)	N/A	N/A	Seep or spring natural/seeps or spring unnatural	Pond/seasonal wetland	N/A	N/A	N/A	N/A
Pond	Cattail marshes alliance	N/A	Depressional open water natural/ depressional open water unnatural,	Pond/quarry pond	Pond	N/A	Lacustrine, water	PABF, PABFh, PABFx, PABH, PABHh, PABHx, PUBF, PUBFh, PUBFx, PUBH, PUBHh, PUBHx, PUBK, PUBKx, PUSA, PUSAh, PUSAx, PUSC, PUSCh, PUSCx, PUSKx
Reservoir	N/A	N/A	Lacustrine open water unnatural/ lacustrine open water natural	Reservoir (defined by management)	Aquatic	Water	N/A	L1UBHh, L1UBHx, L1UBKx, L2UBHh, L2UBK1 L2UBKx
Vernal Pool	Californian mixed annual/perennial freshwater vernal pool/swale bottomland group	N/A	Vernal pool, vernal pool complex/ playa unvegetated flat natural	N/A	N/A	N/A	N/A	N/A

Notes:

BAARI = Bay Area Aquatic Resource Inventory; FRAP = of Forestry and Fire Protection Fire and Resource Assessment Program; HCP = Habitat Conservation Plan; NCCP = Natural Community Conservation Plan; RCIS = regional conservation investment strategy.

N/A = The corresponding classification system does not have a similar land cover type that can be cross walked to the RCIS type.

[a] California Department of Fish and Wildlife (2018b).

[b] CDFW Natural Communities List complies with the National Vegetation Classification Standard (NVCS) (Federal Geographic Data Committee 2008). NVCS is a hierarchical classification consisting of eight levels. Table 2-4b includes two CDFW natural community levels: group and alliance. Groups are defined by relatively narrow sets of diagnostic plant species, broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition. Alliances are grouped into groups. Alliances are defined by diagnostic plant species and moderately similar composition that reflects regional to subregional environmental factors such as climate, hydrology and disturbance regimes (Federal Geographic Data Committee 2008). When two or more California Department of Fish and Wildlife Natural Communities List (California Department of Fish and Wildlife 2018a) alliances correspond to a single East Bay RCIS land cover type, the next higher (i.e., broader) level from the National Vegetation Classification Hierarchy (NVCH) that includes all corresponding alliances is given (i.e., group or macrogroup).

[c] San Francisco Estuary Institute and Aquatic Science Center (2015a).

[d] San Francisco Estuary Institute and Aquatic Science Center (2015b).

[e] ICF International (2010).

[f] Jones & Stokes (2006).

[g] Bay Area Open Space Council (2011).

[h] CalFire Fire Resource and Assessment Program (2016).

[i] U.S. Fish and Wildlife Service (2016).

Table 2-5. Wetland and Baylands Land Cover Types in Each Watershed (Acres)

	Wetlands and Ponds								Baylands				
Watershed	**Alkali Wetland**	**Perennial Freshwater Marsh**	**Seasonal Wetland**	**Seep/ Spring Non-Serpentine**	**Seep/ Spring Serpentine**	**Pond**	**Reservoir**	**Vernal Pool**	**Shallow Bay**	**Tidal Bay Flat**	**Modified Tidal Channel/Managed Pond**	**Tidal Vegetation**	**Total**
Agua Caliente Creek-Frontal San Francisco Bay Estuaries		471.4	101.8	3.6		137.9	79.8	153.6	<0.1	16.5	842.5	195.1	2,002.2
Alameda Creek		115.9	2.5	8.2	1.3	375.6	1,243.1		12.7		59.4	49.9	1,868.5
Arroyo de la Laguna		20.8	5.5	1.2		208.7	28.0					1.4	265.5
Arroyo Hondo		2.2		0.1		5.7	204.2						212.2
Arroyo Las Positas	152.9	35.4	122.4	8.5		119.2	0.8	1,727.2	0.2			9.5	2,176.1
Arroyo Mocho	2.6	61.9	27.1	27.9	1.2	608.5	864.1	316.3					1,909.6
Arroyo Valle		40.6	5.4	0.8	1.8	233.2	770.6					4.8	1,057.2
Corral Hollow Creek						22.1							22.1
Corte Madera Creek-Frontal San Francisco Bay Estuaries		2.1				21.0					0.8	1.7	25.6
Kellogg Creek-Big Break	135.7	356.0	68.5			585.7	1,677.6		2,078.6		36.0	296.2	5,234.3
Marsh Creek	58.7	41.5	13.6			143.3	5.0		0.8			69.9	332.7
Middle River-San Joaquin River		136.7	3.2			202.3	3.3		8,281.0	18.1	499.3	56.3	9,558.4
Mount Diablo Creek-Frontal Suisun Bay Estuaries	3.8	112.1	21.4	16.4		92.7	224.2	2.4	19.4	0.5	15.1	142.9	650.8
Old River	669.8	100.3	86.			226.5	177.9		3,382.7		108.3	30.3	4781.7
San Francisco Bay		1,019.7	2,709.4	0.0		649.6	55.3	12.6	44,525.2	10,068.9	12,993.4	6,688.7	8,2310.0
San Lorenzo Creek-Frontal San Francisco Bay Estuaries		53.1	3.4	4.4		109.9	1,230.5		4.6	4.9	14.9	19.2	1,445.0
San Pablo Bay		119.5	1.6	0.4		317.9			12,752.9	1,458.7	58.1	653.7	2,3064.5
San Pablo Creek-Frontal San Pablo Bay Estuaries		158.6	0.0	113.4		147.6	1,546.1		1.0	6.4	9.7	27.8	2,010.6
Suisun Bay		641.1	143.3			327.0	0.7		2,748.3	242.6	389.3	6,081.7	1,3960.1
Walnut Creek-Frontal Suisun Bay Estuaries		14.8		26.6		104.4	121.4		1.1	1.0	0.6	11.4	281.3

2.2.5.5 Natural Communities and Land Cover Types in the RCIS Area

Natural communities are the assemblage of species that co-occur in the same habitat or area and interact through trophic and spatial relationships. Communities are typically characterized by reference to one or more dominant species (Lincoln et. al 1998). Natural communities are defined by the vegetative communities, as identified by land cover types for this East Bay RCIS.

In addition to the seven natural communities and respective land cover types, the RCIS area also includes two categories of non-natural land cover types.

- Cultivated agriculture.
- Urban.

Table 2-6 presents the amounts of natural communities and land cover types in the RCIS area. Figure 2-13 depicts the natural communities in the RCIS area and Figure 2-14 depicts the land cover types in the RCIS area. The natural communities and the land cover types associated with each community, as well as cultivated agriculture and urban land cover types, are described below. These descriptions are based on the descriptions of land cover from CLN (Bay Area Open Space Council 2011) and the ECCC HCP/NCCP.

Table 2-6. Extent of Natural Communities and Land Cover Types in the RCIS Area

Easy Bay RCIS Land Cover Type	Acres in RCIS Area	Percent of RCIS Area
Grassland	**297,222**	**28.6%**
California annual grassland	292,545	28.1%
Serpentine grassland*	1,268	0.1%
Alkali grassland*	3,009	0.3%
Barren/ Rock	400	<0.1%
Shrubland	**30,126**	**2.9%**
Northern mixed chaparral/chamise chaparral*	19,231	1.8%
Northern coastal scrub/ Diablan sage scrub*	6,768	0.7%
Serpentine chaparral*	4,127	0.4%
Woodland	**161,657**	**15.2%**
Blue oak woodland	35,860	3.4%
Cismontane juniper woodland*	67	<0.1%
Coast live oak forest and woodland	42,117	4.1%
Foothill-pine oak woodland	22,634	2.2%
Valley oak woodland*	306	<0.1%
Mixed oak woodland and forest	57,184	5.5%
Montane hardwood*	2,352	0.2%
Serpentine hardwood*	1,137	0.1%
Conifer Forest	**2,250**	**0.2%**
Redwood forest*	1,375	0.1%
Serpentine conifer*	98	<0.1%
Coulter pine forest*	142	<0.1%
Knobcone pine forest*	80	<0.1%

Easy Bay RCIS Land Cover Type	Acres in RCIS Area	Percent of RCIS Area
Ponderosa pine woodland*	544	0.1%
Sargent cypress woodland*	11	<0.1%
Riparian Woodland	**4,470**	**0.4%**
Mixed riparian forest and scrub*	3,841	0.4%
Serpentine riparian*	34	<0.1%
Sycamore alluvial woodland*	595	0.1%
Wetland and Pond	**24,466**	**2.4%**
Alkali wetland*	1,023	0.1%
Aquatic-undefined	630	0.1%
Modified channel	695	0.1%
Perennial freshwater marsh*	3,504	0.3%
Spring/seep (non-serpentine)*	211	<0.1%
Spring/seep (serpentine)*	4	<0.1%
Seasonal wetland*	3,315	0.3%
Pond*	4,639	0.4%
Reservoir	8,233	0.8%
Vernal pool*	2,212	0.2%
Bayland	**130,026**	**12.5%**
Deep bay	15,033	1.4%
Shallow bay	73,809	7.1%
Tidal vegetation*	14,340	1.4%
Tidal bay flat*	11,817	1.1%
Modified tidal channel/managed Pond	15,027	1.4%
Cultivated Agriculture	**64,198**	**6.2%**
Cropland	28,626	2.8%
Cultivated-undetermined	26,956	2.6%
Orchard	4,022	0.4%
Vineyard	4,594	0.4%
Urban	**325,261**	**31.3%**
Ornamental woodland	3,993	0.4%
Rural residential	3,200	0.3%
Urban	318,068	30.6%
GRAND TOTAL	**1,039,677**	**100%**

* Identified as a rare/unique land cover type in the RCIS area (Section 2.2.8.5, *Unique Land Cover Types*).

Grassland

The grassland natural community (Figure 2-13) consists of herbaceous vegetation dominated by grasses and forbs. Grasslands are the dominant land cover type outside of urban areas in the RCIS area and are found in upland topographic locations, generally irrespective of landscape position, slope, and aspect. Grassland provides many ecosystem services such as carbon sequestration, nutrient cycling, and agricultural benefits (Jones and Donnelly 2004). Areas devoid of vegetation but located within grasslands are also included in this natural community as individual land cover types.

Grassland in the RCIS area is classified into four land cover types.

- California annual grassland
- Serpentine grassland
- Alkali grassland
- Barren/rock

California Annual Grassland

The California annual grassland land cover type (Figure 2-15) is an herbaceous plant community dominated by non-native annual grasses (Holland 1986, Sawyer and Keeler-Wolf 1995). California annual grassland is defined as areas where grasses and forbs occur as extensive stands without an overstory. The dominant grasses generally consist of introduced annual grasses, including barbed goat grass (*Aegilops triuncialis*), foxtail chess (*Bromus madritensis*), harding grass (*Phalaris aquatica*), hare barley (*Hordeum murinum* ssp. *leporinum*), nit grass (*Gastridium phleoides*), oats (*Avena barbata* and *A. fatua*), rattail sixweeks grass (*Festuca myuros*), ripgut grass (*Bromus diandrus*), rye grass (*Festuca perennis*), silver hair grass (*Aira caryophyllea*), small fescue (*Festuca microstachys*), soft chess (*Bromus hordeaceus*), and water beard grass (*Polypogon viridis*). The associated herbaceous cover includes native and non-native forbs. Common species in the RCIS area include black mustard (*Brassica nigra*), California poppy (*Eschscholzia californica*), clover species (*Trifolium* spp.), common fiddleneck (*Amsinckia menziesii*), common yarrow (*Achillea millefolium*), filaree species (*Erodium* spp.), four-spot (*Clarkia purpurea* ssp. *quadrivulnera*), Ithuriel's spear (*Triteleia laxa*), knapweed species (*Centaurea* spp.), lupine species (*Lupinus* spp.), purple owl's-clover (*Castilleja exserta*), and soap plant (*Chlorogalum pomeridianum*).

Native, non-serpentine grasslands are patchily distributed within the larger California annual grassland land cover type. Accordingly, native grassland cover may be dominated by non-native annual grasses interspersed with diverse native perennial grasses and forbs. Thus, native grassland cannot readily be distinguished from California annual grassland at the mapping scale for the RCIS area. Consequently, native grass patches are included in the California annual grassland land cover type.

California annual grassland occupies an estimated 292,545 acres (28%) of the RCIS area. This land cover type dominates the majority of the RCIS area outside of developed areas.

Serpentine Grassland

The serpentine grassland land cover type (Figure 2-15) is grassland that occurs on serpentine soils. Many serpentine species are partially or completely confined to growing on this substrate (Safford et al. 2005). Native bunchgrass species composition in serpentine grasslands are generally similar to those in non-serpentine habitats, although serpentine populations may be more tolerant of heavy metals present in the soil and may have lower growth rates compared to non-serpentine populations (Huntsinger et al. 1996).

Serpentine grassland is considered a sensitive biotic community by CDFW. Serpentine grassland is generally a mosaic of perennial bunchgrass stands and mixed assemblages of perennial and annual grass and herbaceous wildflower species (McCarten 1987). Characteristic grass species in serpentine grassland include big squirreltail (*Elymus multisetus)*, California melic (*Melica californica)*, California oat grass (*Danthonia californica*), fringed checkerbloom (*Sidalcea* *diploscypha*), jeweled onion (*Allium serra*), June grass (*Koeleria macrantha*), one sided bluegrass (*Poa secunda*), purple needle grass (*Stipa pulchra*), San Franciscan wallflower (*Erysimum franciscanum*), serpentine leptosiphon (*Leptosiphon ambiguus*), and squirreltail (*Elymus elymoides*) (Evens and San 2004 , Hobbs and Mooney 1985, Holland 1986, Hooper and Vitousek 1998, McCarten 1987). California goldfields (*Lasthenia californica* ssp. *californica*), California poppy, hayfield tarweed (*Hemizonia congesta*), purple owl's-clover (*Castilleja exserta*), rosin weed (*Calycadenia truncata*), and tidy-tips (*Layia platyglossa*) are wildflowers that often form patches of color within the grassland matrix. The flora is composed primarily of native species (although non-native species such as soft chess can also be common) and is generally more diverse than the flora of grasslands on non-serpentine substrates (McNaughton 1968).

Serpentine grassland occupies approximately 1,268 acres (0.1%) of the RCIS area. This land cover type is found strictly on serpentine soils or bedrock. In the RCIS area, serpentine grassland is found in small, scattered patches in the Oakland/Berkeley Hills, near Mount Diablo, and in the hills in the southeastern corner of the RCIS area.

Alkali Grassland

The alkali grassland land cover type (Figure 2-15) occurs on alkali soils, which are defined as soils with elevated levels of sodium, calcium, and magnesium, in areas with high levels of groundwater. Dominant grasses in alkali grassland include salt grass (*Distichlis spicata*) and barley (*Hordeum* spp.). The associated herbaceous cover consists of halophytes including alkali heath (*Frankenia salina*), alkali-mallow (*Malvella leprosa*), alkali weed (*Cressa truxillensis*), common tarplant (*Centromadia pungens*), and saltbush (*Atriplex* spp.). Alkali grassland can also include small stands of alkali sink scrub (also known as Valley sink scrub) and iodine bush (*Allenrolfea occidentalis*).

Alkali grassland is found on 3,009 acres (0.3%) of the RCIS area in small patches in eastern Livermore and in eastern Contra Costa County, mostly east of the Diablo Range crest.

Barren/Rock

The barren/rock land cover type (Figure 2-15) includes non-agricultural areas that are devoid of vegetation. Barren areas are historically and recently disturbed land in urban areas. Land uses in barren areas can include aggregate facilities and mine tailings. Rock areas are non-serpentine rock outcrops, which are exposures of bedrock that typically lack soil and have sparse vegetation. Within the RCIS area, several types of rock outcrops are present and are derived from sedimentary, volcanic, and metamorphic sources. They are primarily found in California annual grassland although they also can be present in chaparral and oak woodlands.

The barren/rock land cover type occupies approximately 400 acres (less than 0.1%) of the RCIS area and is scattered in small patches in the northeastern portion of the RCIS area and near eastern Fremont.

Shrublands

The shrublands natural community (Figure 2-13) is composed of two distinct vegetation communities, chaparral and scrub land cover types. Chaparral occurs on rocky, porous, nutrient-deficient soils on steep slopes up to 2,000 meters in elevation (Keeley 2000). These communities are dominated by densely packed and nearly impenetrable drought-adapted evergreen woody shrubs with small, thick, leathery sclerophyllous leaves (Hanes 1988, Keeley 2000). In comparison, the scrub land cover types generally consist of low "soft" shrubs in open to dense shrublands, interspersed with grassy openings or little to no herbaceous layer. Shrublands provide many ecosystem services such as carbon sequestration, nutrient cycling, forage for wildlife, and passive recreational open space values (Garnache et al. 2018).

Shrublands in the RCIS area are classified into three land cover types.

- Northern mixed chaparral/chamise chaparral
- Northern coastal scrub/Diablan sage scrub
- Serpentine chaparral

Northern Mixed Chaparral/Chamise Chaparral

The northern mixed chaparral/chamise chaparral land cover type (Figure 2-16) includes a variety of shrubs with thick, stiff, sclerophyllous leaves where no one species is clearly dominant. At maturity, this community can be dense and nearly impenetrable with greater than 80% absolute shrub cover. Stand structure is dependent on age since last burn, precipitation, aspect, and soil type. Dominant species include chamise (*Adenostoma fasciculatum*), mountain mahogany (*Cercocarpus betuloides*), hollyleaf cherry (*Prunus ilicifolia*) and several species of ceanothus (*Ceanothus cuneatus, C. greggii, C. leucodermis, C. velutinus*), manzanita (*Arctostaphylos glandulosa, A. glauca, A. viscida*), and oak (*Quercus chrysolepis, Q. dumosa, Q wislizenii*). Chamise chaparral supports pure or nearly pure stands of chamise. Due to the density of the vegetation, there is usually little or no understory. This community generally occurs below 3000 feet elevation on mountain ranges in northern California. This land cover type is often found on dry, rocky, steep slopes with little soil (Mayer and Laudenslayer 1998, Holland 1986).

The northern mixed chaparral/chamise chaparral land cover type occupies approximately 19,231 acres (1.8%) of the RCIS area scattered throughout areas where woodland natural communities are present.

Northern Coastal Scrub/Diablan Sage Scrub

The northern coastal scrub/Diablan sage scrub land cover type (Figure 2-16) is composed primarily of evergreen shrubs with an herbaceous understory in openings. This land cover type is usually found at elevations below 300 feet (California Partners in Flight 2004). The northern coastal scrub/Diablan coastal scrub land cover type is typically dominated by California sagebrush (*Artemisia californica*) and black sage (*Salvia mellifera*), with associated species including coyote brush (*Baccharis pilularis*), California buckwheat (*Eriogonum fasciculatum*), poison oak (*Toxicodendron diversilobum*), and bush monkey flower (*Diplacus aurantiacus*) (Holland 1986). Northern coastal scrub/Diablan coastal scrub occurs on both serpentine and non-serpentine substrate. The dominant woody plants in this land cover type are nearly the same among different soil types.

Northern coastal scrub/Diablan coastal scrub occupies approximately 6,768 acres (0.7%) of the RCIS area in one small area at Mount Diablo, in the Oakland Hills, and in the immediate southeastern corner of the RCIS area.

Serpentine Chaparral

The serpentine chaparral land cover type (Figure 2-16) is also dominated by shrubs with thick, stiff, sclerophyllous leaves but which tend to be of shorter stature and more open than in the northern mixed chaparral/chamise chaparral land cover type (Hanes 1988, California Partners in Flight 2004). In addition, species composition is restricted to those shrubs that are adapted to shallow, stony, infertile soils derived from serpentine. Serpentine chaparral usually occurs below 5,000 feet elevation. Dominant species include chamise, toyon (*Heteromeles arbutifolia*), Mount Tamalpais manzanita (*Arctostaphylos montana*), California juniper (*Juniperus californica*), foothill pine (*Pinus sabiniana*), yerba santa (*Eriodictyon californicum*), leather oak (Quercus durata), and multiple species of ceanothus (*C. ferrisae*, *C. jepsonii*, *C. pumilus*, *C. divergens*) (Holland 1986).

The serpentine chaparral land cover type occupies approximately 4,127 acres (0.4%) of the RCIS area in one small area in the Oakland Hills adjacent to the redwood forest land cover type.

Woodland

The woodland natural community (Figure 2-13) is an upland vegetation community dominated by hardwood tree species, characterized by a prevalence of various species of oaks (*Quercus* spp.). The composition of this natural community can range from open savannas with grassy understories to dense woodlands with persistent leaf litter that precludes much herbaceous understory or shrubby understories. The canopy can vary from pure stands of oak trees to stands intermixed with other broadleaf and coniferous trees. Woodlands provide many ecosystem services such as carbon sequestration, nutrient cycling, erosion control, forage for wildlife, and passive open space values (U.S. Department of Agriculture 2018).

Woodland in the RCIS area is classified into eight land cover types.

- Blue oak woodland
- Cismontane juniper woodland
- Coast live oak forest and woodland
- Foothill-pine oak woodland
- Valley oak woodland
- Mixed oak woodland and forest
- Montane hardwoods
- Serpentine hardwoods

Blue Oak Woodland

Blue oak woodland land cover type (Figure 2-17) is dominated by blue oak (*Quercus douglasii*), a highly drought-tolerant species adapted to growth on thin soils in the dry foothills. Blue oaks grow slowly in these soils and may take decades to reach maturity, forming open savanna-like woodlands. They generally occur on sites that are drier and have lower levels of nitrogen, phosphorus, and organic matter than those where valley oak (*Quercus lobata*), or coast live oak (*Quercus agrifolia*) are found (Griffin 1973, Baker et al. 1981). Although blue oaks can become established on south-facing slopes during wetter years or where mesic conditions are present, they are generally found on north-facing slopes throughout their range (Griffin 1971). However, in the Central California Coast Ranges, blue oak woodland is more common on south-facing slopes (Miles and Goudey 1997). California buckeye (*Aesculus californica*) and foothill pine *are* associate tree species in this community.

The understory varies from shrubby to open, with a composition similar to that of the adjacent California annual grassland. Understory species include California annual grasses, California coffeeberry, holly leaf cherry, and poison oak. Blue oak woodland is considered a sensitive natural community by CDFW when blue oak, valley oak, and coast live oak are present (California Department of Fish and Wildlife 2018c).

Blue oak woodland occupies approximately 35,860 acres (3.4%) of the RCIS area and is scattered throughout wooded portions of the RCIS area except it is primarily absent from the Berkeley/Oakland hills on the west side of the Diablo Range.

Cismontane Juniper Woodland

Cismontane juniper woodland land cover type (Figure 2-17) is characterized by areas dominated by open to dense stands of grasses with many forbs and widely scattered shrubby California junipers (*Juniperus californica*) (Holland 1986, Mayer and Laudenslayer 1998). Denser stands of junipers are more strictly associated with a grassy understory whereas open stands allow for more forb and scrub growth (Holland 1986, Mayer and Laudenslayer 1998). Cismontane juniper woodland is found in dry areas on ridges, slopes, alluvial fans, and valley bottoms on soils that are porous, rocky, coarse, sandy, or silty, and often very shallow (Mayer and Laudenslayer 1998). This land cover type is similar to juniper-oak cismontane woodland but has a lower tree count and relatively low tree density. Associated species include blue oak, California buckwheat, California matchweed (*Gutierrezia californica*), chaparral yucca (*Hesperoyucca whipplei*), ephedra (*Ephedra* spp.), golden yarrow (*Eriophyllum confertiflorum*), mountain mahogany (*Cercocarpus betuloides*), narrowleaf goldenbush (*Ericameria linearifolia*), and needlegrass (*Stipa* spp.)(Holland 1986).

Cismontane juniper woodland occupies approximately 67 acres (less than 0.1%) of the RCIS area in one small patch in Mount Diablo State Park.

Coast Live Oak Forest and Woodland

The coast live oak forest and woodland land cover type (Figure 2-17) mostly includes stands of coast live oak, although California bay (*Umbellularia californica*) is often a major component, and other interior live oaks (*Quercus wislizeni*) and scattered deciduous trees are often present. Across the Central Coast Ranges, stands occur at lower elevations (200 to 3,250 feet, mean elevation of 1,205 feet) on north and northeast aspects. Slopes are generally steep (36% slope, on average), and parent material is primarily sedimentary sandstone and shale, with loam soils (Allen-Diaz et al. 1999).

Grasses and herbs are common in this land cover type. Other species are bush monkey flower, California coffee berry, California sagebrush, and spiny redberry (*Rhamnus crocea*) (Allen-Diaz et al. 1999). Bugle hedge nettle (*Stachys ajugoides*), California blackberry (*Rubus ursinus*), California wood fern (*Dryopteris arguta*), and poison oak are often present.

Coast live oak forest and woodland occupies approximately 42,117 acres (4.1%) of the RCIS area. It dominates the Diablo Range along the length of Contra Costa and Alameda Counties and is found on the western side of Mount Diablo.

Foothill-Pine Oak Woodland

Foothill pine-oak woodland land cover type (Figure 2-17) is a mixture of foothill pine and blue oak. Pure stands of either tree occur, but mixed stands are much more common (Holland 1986). At lower elevations, blue oaks dominate whereas at higher elevations foothill pines dominate the landscape (Mayer and Laudenslayer 1998). This land cover type occurs on well-drained sites with rocky or exposed soils along ridges or canyon (Holland 1986). This habitat typically includes a mix of hardwoods, conifers, and shrubs. The shrub component is typically composed of several species that tend to be clumped, with interspersed patches of California annual grassland (Mayer and Laudenslayer 1998). Associated species include California buckeye, various species of oak trees and manzanita shrubs, poison oak, California coffeeberry, silver bush lupine (*Lupinus albifrons*), blue elderberry (*Sambucus nigra* ssp. *caerulea*), and western redbud (*Cercis occidentalis*) (Holland 1986, Mayer and Laudenslayer 1998).

Foothill-pine oak woodland occupies approximately 22,634 acres (2.2%) of the RCIS area and dominates the landscape in the southeastern corner of the RCIS area.

Valley Oak Woodland

The valley oak woodland land cover type (Figure 2-17) is characterized by a fairly open canopy of mature valley oaks with a grassy understory, generally on valley bottoms and north-facing slopes (Griffin 1971, Holland 1986, Sawyer and Keeler-Wolf 1995). Valley oak woodland often forms a mosaic with annual grasslands, and is found adjacent to other land cover types, including mixed oak woodland, blue oak woodland, and riparian woodland types. Valley oak woodland is generally denser on valley bottoms, where the tree roots can penetrate to the groundwater, and less dense on ridges where trees need wider spacing to develop larger root systems (Griffin 1973). Although valley oak woodland is typically found in alluvial soils in California, it occurs in non-alluvial sites on broad ridgetops and midslope benches.

Trees in the valley oak forest and woodland land cover type are typically mature and well-spaced. They are usually the only trees present in this open-canopy woodland, have no shrub layer, and the understory is dominated by California annual grassland. In many areas, livestock grazing maintains this open understory and limits recruitment of seedlings and saplings. As with most oak communities, regeneration typically is episodic, occurring periodically in "mast years" when acorn production is high and some acorns germinate by avoiding acorn predators such as acorn woodpeckers and California ground squirrels. Beardless wild rye (*Elymus triticoides*), California rose (*Rosa californica*), mugwort (*Artemisia douglasiana*), and poison oak are common native species in riparian portions of valley oak woodland.

Valley oak woodland occupies approximately 306 acres (less than 0.1%) of the RCIS area in small, scattered locations in the hills in the northwestern corner of the RCIS area.

Mixed Oak Woodland and Forest

The mixed oak woodland and forest land cover type (Figure 2-17) contains coast live oak, valley oak, and blue oak trees where no species is clearly dominant or where different types of oak woodlands are present in a small-scale mosaic and each type occurs in patches too small to map. This habitat includes a mixture of interior live oak and deciduous oaks. Evergreen broadleaved trees such as California bay, Pacific madrone (*Arbutus menziesii*), tan oak (*Notholithocarpus densiflorus*), conifers such as Douglas-fir (*Pseudotsuga menziesii*), Coulter pine (*Pinus coulteri*), and foothill pine, and deciduous species such as California buckeye and bigleaf maple (*Acer macrophyllum*) frequently occur in this land cover type.

Mixed oak woodland and forest is the dominant woodland land cover type in the RCIS area and occupies approximately 57,184 acres (5.5%). It is found in the center of Contra Costa County near Mount Diablo State Park and the Los Vaqueros Reservoir, and in eastern Alameda County.

Montane Hardwoods

The montane hardwood land cover type (Figure 2-17) is dominated by broadleaved trees, often with taller conifers interspersed, forming a closed forest. Montane hardwood forests occur on a wide range of slopes with soils that are rocky, alluvial, coarse textured, poorly developed, and well drained. Tree height tends to be uniform except where conifers are present. Typical montane hardwood species include white alder (*Alnus rhombifolia*), coast live oak, black oak (*Quercus kelloggii*), bigleaf maple, California bay, Pacific madrone, tanoak, and occasionally valley oak and blue oak. Associated conifer species may include Coulter pine, Douglas-fir, foothill pine, knobcone pine (*Pinus attenuata*), and ponderosa pine (*Pinus ponderosa*). The scattered understory vegetation can consist of manzanita, mountain mahogany, and poison oak, as well as patches of forbs and grasses (Mayer and Laudenslayer 1998).

Montane hardwood occupies approximately 2,352 acres (0.2%) of the RCIS area and dominates Mount Diablo and wooded areas in southern Alameda County.

Serpentine Hardwoods

The serpentine hardwood land cover type (Figure 2-17) is composed of species associated with the montane hardwood land cover type on serpentine soils. Leather oak, which is often a serpentine endemic, often grows as a component of the serpentine chaparral community (Section 2.2.5.2, *Natural Communities and Land Cover Types in the RCIS Area*) but would be classified as serpentine hardwood when intermixed with other hardwood species. Serpentine tolerant hardwood species include California buckeye, California bay, western redbud (*Cercis occidentalis*), and canyon live oak (*Quercus chrysolepis*) (Frazell et al. 2009).

Serpentine hardwood occupies approximately 1,137 acres (0.1%) of the RCIS area and occurs in small, scattered patches on Mount Diablo and the Oakland/Berkeley Hills and dominates Cedar Mountain in the southeastern corner of the RCIS area.

Conifer Forest

The conifer forest natural community (Figure 2-13) is an upland vegetation community dominated by cone-bearing, needle-leaved or scale-leaved evergreen trees. The canopy can range from open to continuous with one or two tiers. Shrub layers are sparse to continuous, and herbaceous cover can be sparse to abundant. Landforms associated with conifer forest include slopes, ridges, headlands, maritime terraces, rocky ridges, and sand dunes. Conifer forest provides many ecosystem services such as carbon sequestration, nutrient cycling, erosion control, forage for wildlife, and passive recreational open space values (U.S. Department of Agriculture 2018).

Conifer forest in the RCIS area is classified into six land cover types.

- Redwood forest
- Serpentine conifer
- Coulter pine forest
- Knobcone pine forest
- Ponderosa pine woodland
- Sargent cypress woodland

Redwood Forest

The redwood forest land cover type (Figure 2-18) is dominated by an overstory of redwood with a variety of associated tree, shrub, and forb species in the understory. Most redwood forests have been logged since the second half of the 19th century, and most of the existing trees are stump sprouts. However, in many areas, particularly along creeks, dense cover of redwood trees has been maintained. Areas that were burnt following logging now support chaparral or oak-dominated communities.

Redwood forests occur in areas that receive substantial rainfall, generally more than 35 inches per year. Common plants associated with these forests include trees such as California bay, madrone, and tan oak; the shrub layer includes species such as black huckleberry (*Vaccinium ovatum*), California hazelnut (*Corylus cornuta* var. *californica*), and thimbleberry (*Rubus parviflorus*). In riparian areas, California bay and bigleaf maple are common. California-nutmeg (*Torreya californica*) may occur, and ferns such as sword fern (*Polystichum munitum*) often form a dense layer.

Redwood forest occupies approximately 1,375 acres (0.1%) of the RCIS area. This land cover type is uncommon in the RCIS area but dominates the localized areas of Joaquin Miller Park and Redwood Regional Park in the city of Oakland, with scattered patches to the south near Lake Chabot Regional Park.

Serpentine Conifer

The serpentine conifer land cover type (Figure 2-18) consists of coniferous forest in arid landscapes on serpentine soils. Dense to open mono-dominant stands of conifer trees are strongly associated with serpentine soils but also occur on other soil types. Knobcone pine forms dense single-aged stands, usually on serpentine or other shallow rocky soils, on hilltops that receive moisture from clouds or fog. Sargent cypress (*Cupressus sargentii*), which is a broad serpentine endemic, forms stands along streams or on mountaintops that receive cloud or fog moisture. California juniper, Coulter pine, ponderosa pine, and foothill pine are widespread on non-serpentine soils but can occur on isolated stands of dry rock serpentine outcrops (Alexander et al. 2006, Frazell et al. 2009). This land cover type supports a shrubby understory comprised of species similar to those representative of the serpentine chaparral land cover type which includes species such as chamise, manzanita species, buckbrush, leather oak, and grey pine (Holland 1986). Serpentine conifer usually occurs in areas with more xeric exposure but integrates with the serpentine conifer land cover type.

Serpentine conifer occupies approximately 98 acres (less than 0.1%) of the RCIS area in small patches on the western edge of Joaquin Miller Park in the city of Oakland.

Coulter Pine Forest

The Coulter pine forest land cover type (Figure 2-18) is typically dominant in closed canopy stands. Other tree species that are commonly associated with Coulter pine woodlands include Douglas-fir, black oak, canyon live oak, coast live oak, interior live oak, foothill pine, and ponderosa pine. The shrub layer can range from sparse to dense and the ground layer is typically sparse. Topographically, Coulter pine woodlands occur in uplands on all aspects. The soils tend to be shallow and well drained (Sawyer and Keeler-Wolf 1995).

Coulter pine woodland occupies approximately 142 acres (less than 0.1%) of the RCIS area in three small patches on Mount Diablo.

Knobcone Pine Forest

The knobcone pine forest land cover type (Figure 2-18) consists of dense stands of knobcone pines (*Pinus attenuata*) that regenerate following fire. This land cover type is uncommon in the RCIS area, often occurring on serpentine-derived soils. It is thought that the water-retaining properties of serpentinite, combined with the pine's ability to intercept marine fog, allow knobcone pine to persist in these locations (Vogl 1973). Knobcone pine is an obligate fire-climax species—fire is required to melt the resin that seals the cones, releasing the seed. Fire also creates the bare mineral soil required for the seeds to germinate. Stands of knobcone pine are therefore even-aged, dating back to the last stand-replacing fire. Knobcone pine is fast growing, with a relatively short lifespan of 75 to 100 years, although approximately half the trees may die by 60 years of age (Vogl 1973). Knobcone pine forest is replaced by chaparral at lower elevations and by conifers (e.g., redwood or Douglas-fir) at higher elevations. Knobcone pine may occur in a mosaic with chaparral, conifer and oak dominated woodlands. Although knobcone pine usually occurs as dense, mono-dominant stands, it can also be associated with chaparral species such as manzanitas, bush chinquapin (*Chrysolepis chrysophylla* var*. minor*), and bush poppy (*Dendromecon rigida*) that form a sparse to dense understory layer.

Knobcone pine forest occupies approximately 80 acres (less than 0.1%) of the RCIS area in two small patches in Canyon, an unincorporated community between the cities of Oakland and Moraga.

Ponderosa Pine Woodland

The ponderosa pine woodland land cover type (Figure 2-18) is dominated by an overstory of ponderosa pine with oaks trees in the understory. On ridges, ponderosa pine trees are often large and well-spaced, forming open stands over annual grassland. Regeneration is often common, and many age classes are present. Associated tree species include black oak, coast live oak, and Pacific madrone. Few shrubs are present, although bigberry manzanita is common in some areas. Ponderosa pine is uncommon in the Coast Ranges; these stands are likely relicts of a wider distribution in the past when the climate was cooler.

Ponderosa pine woodland occupies approximately 544 acres (0.1%) of the RCIS area and occurs only on Mount Diablo.

Sargent Cypress Woodland

Sargent cypress (*Hesperocyparis sargentii*) is a common or dominant species in the Sargent cypress woodland land cover type (Figure 2-18). Sargent cypress woodland stands typically occur on ultramafic soil, and trees are generally less than 50 feet tall. The tree canopy of these stands is typically open and the shrub layer ranges from sparse to dense. The most common shrub in Sargent cypress woodland is leather oak. The ground layer is typically sparse (Sawyer and Keeler-Wolf 1995, Barbour et al. 2007). Because of the inaccessibility of the Sargent cypress stand in the RCIS area, exact species associates are uncertain. Other species that may be associated with Sargent cypress woodland include bigberry manzanita, California bay, foothill pine, interior live oak, knobcone pine, leather oak (*Quercus durata*), silk tassel (*Garrya congdonii*), and valley oak.

Sargent cypress occupies approximately 11 acres (less than 0.1%) of the RCIS area in one location on the north side of Cedar Mountain at 2,000 to 3,400 feet in elevation (Figure 2-18). Sargent cypress woodland is likely overestimated on Cedar Mountain, because, in order to ensure that all of the land cover types were captured, the area was mapped as one single polygon.

Riparian Woodland

The riparian woodland natural community (Figure 2-13) is dominated by trees and an understory of shrubs and forbs associated with riverine water sources. From the foothills to the valley floor, riparian woodland land cover types thrive along stream banks and floodplains in the RCIS area. Riparian woodlands provide many ecosystem services such as improved water quality, erosion control, flood management, forage for wildlife, movement corridors for fish and wildlife, and passive open space values (U.S. Department of Agriculture 2018).

Riparian woodland in the RCIS area is classified into three land cover types.

- Mixed riparian forest and scrub
- Serpentine riparian
- Sycamore alluvial woodland

Mixed Riparian Forest and Scrub

The mixed riparian forest and scrub land cover type (Figure 2-19) is found in and along the margins of the active channel on intermittent and perennial streams. Generally, no single species dominates the canopy, and composition varies with elevation, aspect, hydrology, and channel type. The major canopy species throughout the RCIS area are California bay, California sycamore, coast live oak, Arroyo willow, red willow, and valley oak. Associated trees and shrubs include bigleaf maple, California buckeye, Fremont cottonwood, Northern California black walnut (*Juglans hindsii*), and other species of willow. Non-native invasive species that may be present include giant reed (*Arundo donax*) and Himalayan blackberry (*Rubus armeniacus*).

Mixed riparian forest and scrub occupies approximately 3,812 acres (0.4%) of the RCIS area in association with streams throughout the RCIS area.

Serpentine Riparian

The serpentine riparian land cover type (Figure 2-19) is composed of species associated with the mixed riparian forest and scrub land cover type on serpentine rocks.

Serpentine riparian occupies approximately 34 acres (less than 0.1%) of the RCIS area in one small patch along the Alameda-Santa Clara County boundary in the southeastern corner of the RCIS area.

Sycamore Alluvial Woodland

The sycamore alluvial woodland land cover type (Figure 2-19) is generally present on broad floodplains and terraces along low-gradient streams with deep alluvium. Areas mapped as sycamore alluvial woodland are generally open canopy woodlands dominated by California sycamore, often with white alder and willows (*Salix* spp.). Other associated species include bigleaf maple, valley oak, coast live oak, and California bay.

The understory is disturbed by winter flows and herbaceous vegetation is typically sparse or patchy. Typically, plants such as blackberry (*Rubus* spp.), California buckeye, common chickweed (*Stellaria media*), coyote brush, goose grass (*Galium aparine*), Italian thistle (*Carduus pycnocephalus* ssp. *pycnocephalus*), mule fat, poison oak, and willows populate the stream banks.

Sycamore alluvial woodland occupies 595 acres (0.1%) of the RCIS area in Sycamore Grove Regional Park in the city of Livermore, and along Coyote Creek and Alameda Creek in Alameda County.

Wetland and Pond

The wetland and pond natural community (Figure 2-13) includes open water and aquatic habitats subject to seasonal or perennial flooding or ponding and may have hydrophytic herbaceous vegetation. Wetlands and ponds generally differ in their surface area to volume ratio, water level fluctuations, and vegetation cover. Wetlands typically support emergent vegetation while ponds do not. Wetlands and ponds provide ecosystem services such as improved water quality, flood management, and forage for wildlife (Mitsch et al. 2015).

The wetland and pond natural community includes ten land cover types.

- Alkali wetland
- Aquatic-undefined
- Modified channel
- Perennial freshwater marsh
- Spring/seep (non-serpentine)
- Spring/seep (serpentine)
- Seasonal wetland
- Pond
- Reservoir
- Vernal pool

Alkali Wetland

The alkali wetland land cover type (Figure 2-20) supports ponded or saturated soil conditions and occurs as perennial or seasonally wet features on alkali soils. The vegetation of alkali wetlands is composed of halophytic plant species adapted to both wetland conditions and high salinity levels. Typical species include those common to both seasonal and alkali wetlands, such as salt grass, alkali heath (*Frankenia salina*), and common tarplant (*Centromadia pungens*). Alkali wetlands are generally located where wetlands occur in the alkali grassland land cover type. In areas covered by the ECCC HCP/NCCP, alkali wetlands were mapped as wetlands greater than 1 acre on alkali soils.

Alkali wetlands occupy 1,023 acres (0.1%) of the RCIS area in small patches in eastern Livermore and in eastern Contra Costa County, mostly east of the Diablo Range crest.

Aquatic-Undefined

The aquatic-undefined land cover type (Figure 2-20) consists of very small areas where the land cover data and aerial imagery were too vague to categorize into a specific land cover type in the wetland and pond natural community.

Aquatic-undetermined land cover occupies approximately 630 acres (0.1%) of the RCIS area mainly in southern Alameda County and the northeastern corner of Contra Costa County.

Modified Channel

The modified channel land cover type (Figure 2-20) is areas of modified channels that include any extensions to or straightening or rerouting of the natural stream network. These features can include flood control channels as well as canals contributing to the watershed drainage.

The modified channel land cover occupies approximately 695 acres (0.1%) of the RCIS area mainly in the northwestern and southeastern perimeter of the RCIS area.

Perennial Freshwater Marsh

Perennial freshwater marsh land cover type (Figure 2-20) is dominated by emergent herbaceous plants (e.g., reeds, sedges, grasses) with either intermittently flooded or perennially saturated soils. Perennial freshwater marshes are found throughout the coastal drainages wherever flowing water slows down and accumulates, even on a temporary or seasonal basis. A perennial freshwater marsh usually features shallow water that is often clogged with dense masses of vegetation, resulting in deep peaty soils. Plant species common perennial freshwater marsh predominantly consist of cattails (*Typha* spp.), bulrushes (*Schoenoplectus* and *Bolboschoenus* spp.), sedges (*Carex* spp.), and rushes (*Juncus* spp.) (Mayer and Laudenslayer 1998).

Perennial freshwater marsh occupies approximately 3,504 acres (0.3%) of the RCIS area. It is found throughout the RCIS area.

Spring/Seep (Non-serpentine)

The seeps/springs land cover type (Figure 2-20) is otherwise dry areas where water penetrates the root zone or ground surface and creates small wetlands that support wetland vegetation. They usually form on hillside or along the base of hills or alluvial fans. They lack well-defined channels and are almost entirely dependent on groundwater (slope wetlands) (San Francisco Estuary Institute 2011). These provide a source of drinking water for wildlife in the area.

Spring/seep (non-serpentine) occupies approximately 211 acres (less than 0.1%) of the RCIS area. It is found in small patches throughout the RCIS area.

Spring/Seep (Serpentine)

The serpentine spring/seep land cover type (Figure 2-20) is similar to non-serpentine spring/seep except that it occurs on serpentine soils. Serpentine spring/seep typically occurs in a matrix of serpentine grassland. It is supports species adapted to serpentine soils such as two-tooth sedge (*Carex serratodens*), irish-leaved rush (*Juncus xiphioides*), seep monkeyflower (*Erythranthe guttata*), Italian wildrye (*Festuca perennis*), rabbitfoot grass (*Polypogon monspeliensis*), and hoary coffeeberry (*Frangula californica* ssp. *tomentella*) (Alexander et al. 2006).

Spring/seep (serpentine) occupies approximately 4 acres (less than 0.1%) of the RCIS area in the immediate southeastern corner of the RCIS area.

Seasonal Wetland

The seasonal wetland land cover type (Figure 2-20) supports ponded or saturated soil conditions during winter and spring and is dry through the summer and fall until the first substantial rainfall. Seasonal wetlands consist of relatively low-growing vegetation similar to perennial freshwater marsh, such as rushes, sedges, and grasses (Bay Area Open Space Council 2011). Common species in seasonal wetlands within the RCIS area include yellow cress, water speedwell (*Veronica anagallis-aquatica*), and smartweed (*Persicaria* spp.) (Jones & Stokes 2001).

Seasonal wetland occupies approximately 3,315 acres (0.3%) of the RCIS area. It is found throughout the RCIS area.

Pond

The pond land cover type (Figure 2-20) consists of small (less than 20 acres) perennial or seasonal water bodies with little or no vegetation. If vegetation is present, it is typically submerged or floating. Ponds may occur naturally or may be created or expanded for livestock use (stock ponds). Pond vegetation is influenced by surrounding land use, livestock and wildlife activity, and underlying soil, and hydrology. Plants often associated with ponds include floating plants such as duckweed (*Lemna* spp.) or rooted plants such as cattails, bulrushes, sedges, rushes, watercress, and water-primrose. Stock ponds are often surrounded by grazing land with grazing livestock. Immediately adjacent to a stock pond, usually a narrow belt adjacent to a pond, soil may be exposed where livestock or wildlife (e.g., feral pigs) access the pond for drinking water, depending on the intensity and seasonal timing of grazing. As a result, stock ponds in the RCIS area may be devoid of vegetation. This effect can be readily managed by strategically fencing areas around ponds and providing off-pond water sources to attract more heavy use away from ponds and creeks (L. Ford, pers. comm.). Stock ponds, removed from grazing pressures or excessive wildlife activity, may be surrounded by wetland vegetation including willows, cattails, reeds, bulrushes, sedges, and tules (*Schoenoplectus* [*Scirpus*] *californicus*) if the appropriate soil and hydrology is present.

Ponds occupy approximately 4,639 acres (0.4%) of the RCIS area. they are found throughout the RCIS area.

Reservoir

The reservoir land cover type (Figure 2-20) consists of large, open water bodies that are managed for water storage, water supply, flood protection, or recreational uses. Plants often associated with reservoirs include those plants common to deepwater systems. Algae are the predominant photosynthetic organisms found in the open waters of reservoirs. Depending on reservoir temperature, water level, and other environmental conditions, algal blooms may occur, resulting in thick algal mats on the surface of the reservoir. Where reservoir edges are shallow, plant species similar to those found in ponds may be present. If the reservoir has steeper edges, water depth and fluctuations in reservoir height may prevent the establishment of vegetation. Upland and riparian trees that were not removed during the construction of the reservoir, or that were planted afterwards, may be present around the perimeter of the reservoir.

Reservoirs occupy an approximately 8,233 acres (0.8%) of the RCIS area. They are found throughout the RCIS area.

Vernal Pool

The vernal pool land cover type (Figure 2-20) consists of seasonal wetlands that pond water on the surface for extended durations during winter and spring and dry completely during late spring and summer due to an underlying hardpan. This hardpan restricts the percolation of water and creates a “perched” seasonal water source. These ephemeral wetlands support rare and unique flora and fauna that are adapted to the drastic changes in hydrologic regime, such as coyote thistle (*Eryngium* spp.), goldfields (*Lasthenia* spp.), downingia (*Downingia* spp.), and navarretia (Navarretia spp.). Vernal pools generally occur within grasslands.

Vernal pools occupy an estimated 2,212 acres (0.2%) of the RCIS area. This land cover type is locally dense in eastern Livermore and in the Don Edwards National Wildlife Refuge in the City of Fremont.

Baylands

The baylands natural community (Figure 2-13) consists of tidally influenced wetland and open water habitats and diked areas no longer under tidal influence. Tidally influenced areas may be natural or muted due to constructed structures such as levees, tidal gates, or culverts (San Francisco Estuary Institute 2011). Baylands provide ecosystem services such as improved water quality, flood management, and forage, resting, and nesting habitat for wildlife (Mitsch et al. 2015). The baylands natural community is located primarily along the western and northern perimeter of the RCIS area.

Baylands in the RCIS area consists of five land cover types.

- Deep bay
- Shallow bay
- Tidal vegetation
- Tidal bay flat
- Modified tidal channel/managed pond

Deep Bay

The deep bay land cover type (Figure 2-21) consists of open water areas in the bay (including other estuarine channels) that are deeper than 18 feet below mean lower low water (San Francisco Estuary Institute 2011). The sediments of deep bay vary widely in character, from coarse sand to very fine clays and silts. Where the currents are strong, the bottom is mostly coarse sand. Deep bay habitat is important for aquatic invertebrates, including California bay shrimp, Dungeness crab and rock crab, and for fish such as green sturgeon, white sturgeon, and brown rockfish. They are also migratory corridors for anadromous fish, including green sturgeon, Chinook salmon, steelhead, and lamprey. Deep bay is habitat for several species of water birds, including brown pelican, double-crested cormorant, greater and lesser scaup, surf scoter and Caspian tern. Marine animals such as harbor seal and California sea lion also use this habitat.

Deep bay occupies approximately 15,033 acres (1.4%) of the RCIS area.

Shallow Bay

The shallow bay land cover type (Figure 2-21) consists of open water areas in the bay (including other estuarine channels) entirely between 18 feet below mean lower low water and mean lower low water (Goals Project 1999). These areas are submerged during even the lowest tide; they are too deep to support the types of vegetation found in tidal marsh habitats. The sediment of shallow bay is primarily mud. Eelgrass (*Zostera* marina) can grow underwater along the fringes of shallow bay (generally at an average of 6.5 feet) where enough light is available. However, wave action and desiccation prevent eelgrass from growing in very shallow areas.

Shallow bay is important for many invertebrates, fish, and water birds. The rich environment is an especially productive feeding area for many fish, including northern anchovy, sturgeon, and jacksmelt. The eelgrass beds are a particularly productive part of the shallow bay and provide refuge for organisms to escape from predators. Shallow bay habitat serves as an important migratory corridor for anadromous fish such as Chinook salmon, steelhead, green sturgeon, and lamprey. Harbor seals and sea lions also use this habitat (Goals Project 1999, San Francisco Estuary Institute 2011).

Shallow bay occupies approximately 73,998 acres (7.1%) of the RCIS area.

Tidal Vegetation

The tidal vegetation land cover type contains halophytic wetland vegetation (i.e., plants that grow in high-salinity water) below the high tide line, subject to the ebb and flow of daily tides, commonly referred to as marsh plain. Tidal vegetation colonizes microhabitats along the Bay, dependent upon tidal elevations and drainage patterns. Vegetated areas are locations with greater than 10% vascular vegetation cover. Tidal vegetation in the lowest, wettest portion of the marsh, where inundation/saturation is nearly permanent, typically includes California cordgrass (*Spartina foliosa*), pickleweed (*Salicornia* spp.), saltmarsh bulrush (*Bolboschoenus robustus)* and tules (*Schoenoplectus* spp.). Tidal vegetation is typically most expansive in the middle marsh. In these broad, nearly flat areas, dense woody pickleweed vegetation dominates the landscape mixed with scattered patches of salt marsh dodder (*Cuscuta salina*), jaumea (*Jaumea carnosa*) alkali-heath (*Frankenia salina*), and saltgrass. Often referred to as tidal plains, the middle marsh typically floods during higher tides but is not continually inundated or saturated. Higher marsh occurs in drier areas above the mean high water level along elevated or better-drained sediment deposits. These areas can be dominated by marsh gumplant, non-native grasses, marsh bacchris, and coyote brush, and can integrate with the coastal freshwater habitats. Tidal vegetation also includes unnatural perennial tidal lagoons, which are man-made impoundments (e.g. levees with tide gates) of water that receive at least occasional full or muted tidal action, but would only include the portion that includes 10% or more vegetation cover (Goals Project 2015) (U.S. Fish and Wildlife Service 2013, San Francisco Estuary Institute 2011).

Tidal vegetation occupies approximately 14,340 acres (1.4%) of the RCIS area.

Tidal Bay Flat

The tidal bay flat land cover type (Figure 2-21) occurs in intertidal areas with less than 10% vegetation cover (other than eelgrass). Tidal bay flats have areas of soft sediment that lie between the elevations of the lowest tides to the mean lower low water tidal datum, as dictated by the current tidal epoch. Tidal bay flats form when mud and other fine-grained sediments are deposited by tides or rivers on gently sloping beds. Tidal bay flats are extremely productive, supporting diatoms, worms and shellfish, fish, algae, eelgrass, shorebirds, and harbor seals. Mudflats are the most common type of tidal bay flat. Tidal bay flat also includes the unvegetated (i.e. less than 10% vegetated) flat portion of unnatural perennial tidal lagoons (Goal Project 2015, San Francisco Estuary Institute 2011, San Francisco Bay Conservation and Development Commission 2015).

Tidal bay flat occupies approximately 11,817 acres (less than 1.1%) of the RCIS area.

Modified Tidal Channel/Managed Ponds

Modified tidal unnatural/managed pond land cover type (Figure 2-21) includes constructed and modified tidal channels that convey tidal water and runoff within tidal wetlands, former salt ponds, and ponds actively used for salt production. The tidal channels include tidal ditches as well as flood control channels and canals (San Francisco Estuary Institute 2011). Many of the areas included in this land cover category are former salt-production ponds that are diked and managed primarily to provide habitat for waterbirds. These managed ponds have gravity intakes and discharges and are operated at variable water depths and salinities. Some of the ponds are operated to dry seasonally so they provide nesting habitat for western snowy plovers and California least terns. Additionally, this land cover category also includes ponds that are actively managed for salt production. Most of the salt production ponds are located around Highway 84 in the southernmost part of the Bay. A description of these areas is provided in Section 2.2.8.2, *Working Landscapes*.

Modified tidal channel/managed pond occupies approximately 13,435 acres (1.4%) of the RCIS area.

Cultivated Agriculture

The cultivated agriculture natural community (Figure 2-13) consists of cultivated row crops, vineyards, orchards, and other crops that require soil tillage. This land cover provides agricultural values as an ecosystem service to the region (U.S. Department of Agriculture 2018) and contributes to the local economy, tourism, food-shed, and culture. Depending on the crop, cultivated agriculture can provide foraging habitat for birds such as Swainson's hawk and tricolored blackbird. In the RCIS area, cultivated agriculture is located primarily in the northeast portion of the RCIS area, with a lesser amount in the south-central portion of the RCIS area.

Cultivated agriculture is classified into four land cover types.

- Cropland
- Cultivated-undetermined
- Orchard
- Vineyard

Cropland

The cropland land cover type (Figure 2-22) consists of tilled land not supporting orchards or vineyards and includes hay and pasture and a small amount of rice. Row crops are those areas tilled and cultivated for agricultural crops such as corn, lettuce, peppers, and pumpkins. Irrigated or dry crops are usually harvested in rows as edible or useful herbaceous products such as cereals or vegetables for stock or human use. Agricultural crop fields are occasionally planted to provide animal forage and to improve nitrogen levels, as with legumes such as alfalfa or sweet clovers. This land cover type includes ruderal areas and barren areas that have been left fallow for several growing seasons. Ruderal sites may be dominated by weeds such as black mustard or thistles.

In the RCIS area, hay is also produced for grain. Common vegetation includes fast-growing forage grasses such as oats (*Avena* spp.) and Italian ryegrass, as well as irrigated legumes such as alfalfa (*Medicago sativa*), sweetclover (*Melilotus* spp.), and clover (*Trifolium* spp.). In some areas, non-native weedy vegetation, such as thistles, mustards, and a variety of other weedy forbs are common.

Cropland occupies approximately 28,626 acres (2.8%) of the RCIS area and is the dominant cultivated agriculture land cover type in the north-northeastern corner of the RCIS area.

Cultivated-Undetermined

The cultivated undetermined land cover type (Figure 2-22) consists of areas where the land cover data and aerial imagery were too vague to categorize into a specific land cover type in the cultivated agriculture natural community.

Cultivated-undetermined occupies approximately 26,956 acres (2.6%) of the RCIS area. It is found in small, scattered patches throughout the RCIS area but is dominant around the Delta in the immediate northeastern corner of the RCIS area along the Contra Costa-San Joaquin County boundary.

Orchard

The orchard land cover type (Figure 2-22) consists of areas planted in fruit-bearing trees. Orchards are evergreen or deciduous small trees producing fruit or nut crops, usually planted in rows with or without irrigation channels, such as apples, cherries, walnuts, peaches, and olives. Orchard is distinguished by its tree cover, canopy characteristics, and distinctive production rows.

Orchards occupy approximately 4,022 acres (0.4%) of the RCIS area in Contra Costa County near the cities of Oakley and Brentwood.

Vineyard

The vineyard land cover type (Figure 2-22) is characterized by a row production pattern and open canopy. Vines or shrubs may dominate vineyards on agricultural or horticultural lands, which produce fruit such as grapes, blueberries, raspberries or kiwi fruit.

Vineyards occupy approximately 4,594 acres (0.4%) of the RCIS area in Alameda County near the cities of Livermore and Pleasanton, and in Contra Costa County near the cities of Brentwood and Oakley.

Urban

Urban lands (Figure 2-13) consists of areas where native vegetation has been replaced with residential, commercial, industrial, transportation, or with structures, paved and impermeable surfaces, horticultural plantings, turf, and lawn.

Urban in the RCIS area is classified into three land cover types.

- Ornamental woodland
- Rural residential
- Urban

Ornamental Woodland

The ornamental woodland land cover type (Figure 2-14) consists of areas where ornamental and other introduced species of trees, including *Eucalyptus* (usually *E. globulus*) and Monterey pine (*Pinus radiata*), have been planted or naturalized and dominate, forming an open-to-dense canopy. Ornamental woodland was included as a separate land cover type because some stands could provide nesting habitat for raptors.

Ornamental woodlands occupy approximately 3,993 acres (0.4%) of the RCIS area. They are scattered in small patches throughout the RCIS area but dominates large portions of the Oakland/Berkeley Hills.

Rural Residential

The rural residential land cover type (Figure 2-14) consists of areas that have structures, paved and impermeable surfaces, horticultural plantings, and lawns smaller than 10 acres (irrigated lawns larger than 10 acres were mapped as urban parks). Rural residential areas of less than 10 acres that were adjacent to or surrounded by agriculture and/or natural land cover types were mapped as the adjacent land cover type. Vegetation in the rural residential land cover type is usually in the form of landscaped residences, planted street trees (elm, ash, liquidambar, pine, palm), and parklands.

The rural residential land cover type occupies approximately 3,200 acres (0.3%) of the RCIS area in small patches in the southern portion of Alameda County.

Urban

The urban land cover type (Figure 2-14) consists of areas dominated by residential, commercial, industrial, transportation, recreational structures, or other developed land use elements such as highways, city parks, and cemeteries. Vegetation in the urban land cover type is similar to that of the rural residential land cover type, except that these areas are expansive and include large areas of turf and lawn.

The urban land cover type occupies approximately 318,068 acres (30.6%) of the RCIS area. It dominates the East Bay landscape outside of undeveloped areas.

2.2.6 Focal Species

The Program Guidelines define *focal species* as "[s]ensitive species that are identified and analyzed in an RCIS and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Focal species may benefit through both conservation investments and [Mitigation Credit Agreements] MCAs."[33] The conservation priorities of this RCIS, including land protection, enhancement, and restoration are described in the context of the conservation needs for focal species, as well as other conservation elements such as natural communities, habitat connectivity, working landscapes, and non-focal species. Therefore, selecting the species that are addressed in this RCIS was one of the first and most important decisions to determine the scope of the RCIS planning process.

2.2.6.1 Selection Process

The focal species selection process consists of a three-step screening procedure.

- Step 1. Identify potential focal species.
- Step 2. Apply screening criteria.
- Step 3. Finalize focal species list.

[33] MCAs may also be created for non-focal species. See Section 2.2.7, *Non-focal Species*, for more details.

Step 1. Identify Potential Focal Species

The first step in developing the list of species was to compile a comprehensive list of declining and vulnerable native species that occur or may occur in the RCIS area or species that are not declining or vulnerable but provide additional conservation benefits as described below. This list was compiled from a variety of publicly available sources such as the State Wildlife Action Plan (California Department of Fish and Wildlife 2015) and the California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife, California Natural Diversity Database (2016a) (Appendix E, *Evaluation of Species for Inclusion as Focal Species*).

The following sources were also considered when identifying potential species to be addressed in the East Bay RCIS.

- ECCC HCP/NCCP.
- EACCS.
- The Complete List of Amphibian, Reptile, Bird, and Mammal Species in California (California Department of Fish and Wildlife 2016).
- CNDDB Special Animals List (California Department of Fish and Wildlife, Natural Diversity Database 2016b).
- CNDDB Special Vascular Plants, Bryophytes, and Lichens List (California Department of Fish and Wildlife, Natural Diversity Database 2016c).
- California Native Plant Society Inventory of Rare and Endangered Plants of California (California Native Plant Society, Rare Plant Program 2017).
- A list of federally listed endangered and threatened species obtained from the U.S. Fish and Wildlife Service for the RCIS area (Information for Planning and Consultation tool[34]).
- Personal communication with local species experts, including wildlife agency staff and representatives of local environmental groups.

Step 2. Apply Screening Criteria

Once the potential focal species were identified, the following criteria were applied to each species to determine if it should be further considered for inclusion as a focal species in this East Bay RCIS. To be addressed, the species should meet the following occurrence and data criteria, and meet either the status, rarity, or conservation benefit criteria.

- **Occurrence.** The species is known or likely to occur in the RCIS area. Occurrence data should be based on credible evidence. Some species may not be present in the RCIS area at the time this RCIS is developed but could have a reasonable expectation to expand their range into the RCIS area within 10 years following RCIS development.
- **Data.** Drawing on best available science and emerging data, sufficient data on the species' life history, habitat requirements, and occurrence in the RCIS area are available to propose viable conservation actions.

[34] https://ecos.fws.gov/ipac/

- **Status.** The species is listed by state or federal resource agencies as threatened or endangered, or is a candidate for such listing; or the species is reasonably expect to be considered for listing within 10 years of East Bay RCIS approval. This includes species covered by a regional NCCP or HCP that overlaps the RCIS area.
- **Rarity.** The species is recognized by NatureServe as Critically Imperiled (G1) or Imperiled (G2) globally, or is described as a Species of Greatest Conservation Need (SGCN) or Climate Vulnerable (CV) in the State Wildlife Action Plan, or is recognized by CNPS as Rare, Threatened, or Endangered in California and elsewhere (1B) or Rare, Threatened or Endangered in California but is more common elsewhere (2B).
- **Provides Other Conservation Benefit.** If a species does not meet the above criteria but provides some other conservation benefit, it can be included as a focal species. These species may not necessarily be declining or vulnerable, but they can help inform the conservation strategy in ways that declining species may be unable to do. These species may include area-dependent species, umbrella species, indicator species, or keystone species, defined as follows.
    - **Area-dependent species.** The species requires large, contiguous blocks of habitat and may therefore inform the placement of protected areas on the landscape.
    - **Umbrella species.** Conservation of an umbrella species would indirectly conserve multiple other species dependent on the same ecological conditions.
    - **Indicator species.** The species' abundance in a given area indicates the presence of certain environmental or ecological conditions suitable for a group of other species. This may include species that are particularly sensitive to climate change.
    - **Keystone species.** The species' impacts on a community or ecosystem are much larger than would be expected from the species' abundance.

Step 3: Finalize Focal Species Lists

As in all planning efforts, resources, time, and budget for this RCIS are limited. Because a large number of species met the above criteria, the list was pared to a more manageable number of species to limit the scope of this East Bay RCIS to be consistent with the available resources and schedule. The following factors were considered to further refine the list and prioritize species that would benefit most from this RCIS and add conservation value to the conservation strategy.

- **Prioritize species that are anticipated to have mitigation needs for public infrastructure projects in the next 10 years**. Threatened and endangered species anticipated to need mitigation as the result of public infrastructure projects in the next 10 years were prioritized for inclusion as focal species. Threatened and endangered species anticipated to need mitigation are those that have habitat that is generally widespread throughout the RCIS area (such as California tiger salamander and California red-legged frog), and those that have habitat in areas where future projects are anticipated to occur, and would likely be impacted by public infrastructure projects in the near future. These species were not identified as a result of any project-specific impact analysis.

  The California State Legislature's stated purpose of the pilot regional conservation investment strategy program is to ". . . identify regional conservation and conservation investments and aid the development of critical infrastructure through an open public process and using a science-based approach while also encouraging investments in conservation through advanced mitigation" (Assembly Bill 2087, Section 1). The 10-year horizon was selected because CDFW may approve an RCIS for an initial period of up to 10 years. The RCIS may be amended during or after this period to include additional focal species.[35]

- **Prioritize species in the RCIS area not completely addressed by the ECCC HCP/NCCP over species completely addressed by the ECCC HCP/NCCP.** Some species that meet the above criteria are covered by the ECCC HCP/NCCP and have a global range entirely within its plan area. Those species' conservation and mitigation needs will be fully addressed by that ECCC HCP/NCCP. Including those species in this East Bay RCIS provides little additional conservation benefit. Therefore, species not completely addressed in the ECCC HCP/NCCP were afforded additional consideration.
- **Prioritize species in the RCIS area that occur on unprotected areas and that may be affected by development over species where the only known occurrences are on protected areas.** For a few of the species that meet the selection criteria the only documented occurrences are on protected areas (e.g., Mount Diablo buckwheat [*Eriogonum truncatum*], Antioch Dunes evening primrose [*Oenothera deltoids* subsp. *howellii*], and Lange's metalmark butterfly [*Apodemia mormo langei*]). Because these species have only been documented on federal, state, or regional parkland in the RCIS area, stressors and pressures on those species are expected to be low compared to other species. Therefore, species occurring on unprotected areas were afforded additional consideration.
- **Prioritize species in the RCIS area that are not addressed by other regional conservation strategies, such as EACCS.** Many overlapping conservation or other planning strategies in the Bay Area address one or more species. For example, species that occur only in the baylands portion of the RCIS area (e.g., Ridgway's rail, salt marsh harvest mouse) were not included as focal species because they are addressed in other conservation strategies. Instead, this East Bay RCIS addresses species that occur in the baylands by summarizing those conservation strategies and programs that address baylands (Baylands Ecosystem Habitat Goals). Some baylands species that are anticipated to have mitigation need are included as non-focal species, to ensure that mitigation credits can be created through MCAs for those species (Section 2.2.7, *Non-focal Species*). Therefore, species not addressed by any other regional strategies were afforded additional consideration.

Species that meet the screening criteria, whose needs are not completely addressed by the ECCC HCP/NCCP or other regional conservation strategy, that do not occur only on protected areas, and that are likely to need mitigation for transportation infrastructure projects within the next 10 years were included as focal species. This East Bay RCIS includes 39 focal species, of which 20 are wildlife species and 19 are plant species.

The screening criteria and evaluation process for each species evaluated for potential inclusion in the East Bay RCIS as a focal species are presented in Appendix E. Tables 2-7 and 2-8 show the focal wildlife and focal plant species selected for this RCIS, respectively. Life history, ecological requirements, distribution, and habitat distribution models (Section 2.2.6.2, *Habitat Distribution Models*) can be found in Appendix F, *Focal Species Profiles*.

[35] The potential focal species developed after applying the criteria in Step 2 but excluded in Step 3 are excellent candidates for a future addition to this East Bay RCIS.

Table 2-7. East Bay RCIS Focal Wildlife Species

Scientific Name	Common Name	Status[a] Federal	Status[a] State	Global	Focal Species[b] Covered in EACCS	Focal Species[b] Covered in ECCC HCP/NCCP
Invertebrates						
Branchinecta longiantenna	Longhorn fairy shrimp	E	–	G1	X	X
Branchinecta lynchi	Vernal pool fairy shrimp	T	–	G3	X	X
Lepidurus packardi	Vernal pool tadpole shrimp	E	–	G4	–	X
Speyeria callippe callippe	Callippe silverspot butterfly	E	–	G5T1	X	
Fish						
Oncorhynchus mykiss	Central California Coast steelhead	T	SSC	G5T2Q	X	–
Oncorhynchus mykiss	Central Valley steelhead	T	–	G5T2T3Q	–	–
Oncorhynchus tshawytscha	Winter-run Chinook salmon	E	E	G5	–	–
Amphibians						
Ambystoma californiense	California tiger salamander (Central CA Distinct Population Segment)	T	T	G2G3	X	X
Rana boylii	Foothill yellow-legged frog (west/central coast clade)	*	E	G3	X	X
Rana draytonii	California red-legged frog	T	SSC	G2G3	X	X
Reptiles						
Anniella pulchra	Northern California legless lizard	–	SSC	G3G4T2T3Q	X	-
Masticophis lateralis euryxanthus	Alameda whipsnake	T	T	G4T2	X	X
Thamnophis gigas	Giant garter snake	T	T	G2G3	–	X
Birds						
Agelaius tricolor	Tricolored blackbird	–	T	G5T1T2	X	X
Aquila chrysaetos	Golden eagle	–	FP; SSC	G5	X	X
Athene cunicularia	Burrowing owl	–	SSC	G4	X	X
Buteo swainsoni	Swainson's hawk	–	T	G5	–	X
Laterallus jamaicensis coturniculus	California black rail	–	T; FP	G3G4T1	–	–
Mammals						
Vulpes macrotis mutica	San Joaquin kit fox	E	T	G4T2	X	X
Puna concolor	Mountain lion (central coastal California population)	–	C	G5	–	–

[a] Status
Federal
E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
* = Under review for listing under the federal Endangered Species Act.
– = no listing.
State
E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
C = a candidate for listing under the California Endangered Species Act.
SSC = listed as a California special of special concern by the California Department of Fish and Wildlife.
FP = listed as a fully protected species by the California Department of Fish and Wildlife.
– = no listing.
Global Conservation Status (Nature Serve 2018)
G1 = critically imperiled- high risk of extinction due to extreme rarity (often 5 or fewer populations).
G2 = imperiled- high risk of extinction due to very restricted range, very few populations (often 20 or fewer populations).
G3 = vulnerable- moderate risk of extinction due to restricted range and very few populations (often 80 or fewer populations).
G4 = apparently secure- uncommon but not rare.
G5 = secure- common, widespread and abundant.
G#G# = Range rank; numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community.
? = inexact numeric rank.
Q = Questionable taxonomy; taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid.
T# = Infraspecific taxon; the status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.
Rules for assigning T-ranks follow the same principles outlined above for global conservation.

[b] Focal Species.
ECCC HCP/NCCP = *East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan* (Jones & Stokes 2006); EACCS = *East Alameda County Conservation Strategy* (ICF International 2010).

X = Covered by the ECCC HCP/NCCP or EACCS; – = not covered by the ECCC HCP/NCCP or EACCS.

Table 2-8. East Bay RCIS Focal Plant Species

		Status[a]				Focal Species[b]	
Scientific Name	**Common Name**	**Federal**	**State**	**Global**	**CRPR**	**Covered in EACCS**	**Covered in ECCC HCP/ NCCP**
Arctostaphylos pallida	Pallid manzanita	T	E	G1	1B.1	–	–
Atriplex depressa	Brittlescale	–	–	G2Q	1B.2	–	X
Blepharizonia plumose	Big tarplant	–	–	G2	1B.1	X	X
Fritillaria liliacea	Fragrant fritillary	–	–	G2	1B.2	–	–
California macrophylla	Round-leaved filaree	–	–	G2	–[c]	–	X
Calochortus pulchellus	Mount Diablo fairy lantern	–	–	G2	1B.2	–	X
Centromadia parryi subsp. *congdonii*	Congdon's tarplant	–	–	G3T2	1B.2	X	–
Chloropyron palmatum	Palmate-bracted bird's-beak	E	E	G1	1B.1	X	–
Clarkia franciscana	Presidio clarkia	E	E	G1	1B.1	–	–
Deinandra bacigalupii	Livermore tarplant	–	E	G1	1B.2	X	–
Delphinium recurvatum	Recurved larkspur	–	–	G3	1B.2	X	X

		Status[a]				Focal Species[b]	
Scientific Name	Common Name	Federal	State	Global	CRPR	Covered in EACCS	Covered in ECCC HCP/ NCCP
Extriplex joaquiniana	San Joaquin spearscale = San Joaquin saltbush	–	–	G2	1B.2	X	X
Hesperolinon breweri	Brewer's western flax	–	–	G2	1B.2	–	X
Hoita strobilina	Loma Prieta hoita	–	–	G2	1B.1	–	–
Lasthenia conjugens	Contra Costa goldfields	E	–	G1	1B.1	–	–
Lilaeopsis masonii	Mason's lilaeopsis	-	R	G2	1B.1	–	–
Madia radiata	Showy madia	–	–	G2	1B.1	–	X
Sanicula saxatilis	Rock sanicle	–	R	G2	1B.2	–	–
Streptanthus albidus subsp. *peramoenus*	Most beautiful jewelflower	–	–	G2T2	1B.2	–	–

[a] Status
Federal
E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
– = no listing.
State
E = listed as endangered under the California Endangered Species Act.
R = listed as rare under the California Endangered Species Act
– = no listing.
Global Conservation Status (NatureServe 2016)
G1 = Critically imperiled; at very high risk for extinction.
G2 = Imperiled; at high risk for extinction.
G3 = Vulnerable; at moderate risk for extinction.
G4 = Apparently secure; uncommon but not rare.
G5 = Secure; common, widespread and abundant.
G#G# = Range rank; numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community.
T# = Infraspecific Taxon; the status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.
Q = Questionable taxonomy; taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid.
Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1.
California Rare Plant Rank (CRPR) (California Native Plant Society 2017).
1B = plants rare, threatened or endangered in California and elsewhere.
0.1 - seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)
0.2 - moderately threatened in California (20-80% of occurrences threatened/moderate degree of immediacy of threat)

[b] Focal Species
Covered in the EACCS
Covered in the ECCC HCP/NCCP
ECCC HCP/NCCP = *East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan* (Jones & Stokes 2006); EACCS = *East Alameda County Conservation Strategy* (ICF International 2010)

[c] Changed by CNPS from 1B.2 to CBR on 2017-12-11

2.2.6.2 Habitat Distribution Models

Habitat distribution models were developed for most of the focal plant and wildlife species to predict where they could occur, based on known habitat requirements and locations of occurrences. The habitat distribution models were used to inform development of the conservation strategy, including the conservation goals, objectives, and priorities for focal species. Habitat distribution models for the focal species are described in detail in the respective focal species profiles in Appendix F. Methods used for all the models are described below.

Habitat distribution models were developed for 19 of the 20 focal wildlife species. A model was not developed for mountain lion because this species has such a broad distribution in the RCIS area that modeling suitable habitat would not be informative. Habitat distribution models were developed for 13 of the 19 focal plant species. Models could not be created for six species because there are too few known occurrences within the RCIS area to evaluate suitable habitat with confidence.

The habitat models for this RCIS were designed to be consistent and compatible with the ECCC HCP/NCCP, EACCS, and the draft Antioch HCP/NCCP. Twenty-three of the 32 habitat distribution models were adapted from the habitat models for focal species covered or addressed by the ECCC HCP/NCCP, EACCS, draft Antioch HCP/NCCP (ICF in-development), and Santa Clara Valley HCP/NCCP (ICF International 2012) (for two plant species not covered by the ECCC HCP/NCCP or addressed in EACCS). This RCIS generally classifies the same, or similar, types of habitat for focal species as these conservation plans and EACCS using the same, or similar, land cover type associations and modifiers, such as distance of upland habitat from aquatic habitat for giant garter snake. Other habitat distribution models (four) were created by adapting USFWS designated critical habitat or were originally developed for this RCIS (five). The source of the habitat model adapted for this RCIS is provided in the Model Parameters sections in Appendix F.

Model Structure and Development Methods

The habitat distribution models were designed to estimate the extent and location of key habitat characteristics of each species and to be repeatable and scientifically defensible, while remaining as simple as possible. The models are spatially explicit, GIS-based "expert opinion models"[36] based on identification of suitable land cover types in the RCIS area and location of known species occurrences. Land cover types are the basic unit of evaluation for habitat modeling and developing conservation strategies for the focal species. See Section 2.2.5.1, *Methods and Data Sources*, for a description of the methods and data sources used to compile the land cover data (including data for wetlands, baylands, and streams) used in this RCIS. Land cover types were identified as suitable habitat based on the known or presumed habitat requirements and use patterns of each species. When supported by appropriate data, the models also incorporate physical parameters, such as the elevation limits of known occurrences or soil type. In some cases, perimeter zones used to designate habitat are defined by a certain distance from a suitable land cover type. For example, California tiger salamander potential upland habitat extends up to 1.3 miles from aquatic land cover types defined as breeding habitat.

Habitats for wildlife were designated according to type of habitat use, such as breeding, foraging, aestivation, and movement habitat. Primary and secondary habitats for plants were designated according to the associated land cover types that characterize the locations of known occurrences, with occurrences more likely to occur in primary habitat than secondary habitat. Determination of suitable land cover types and additional physical parameters were based on available data from

[36] The models developed for the ECCC HCP/NCCP, EACCS, draft Antioch HCP/NCCP, and the Santa Clara Valley HCP/NCCP were developed by consultant biologists in coordination with CDFW and USFWS biologists as part of the ECCC HCP/NCCP and EACCS development process. The East Bay RCIS habitat distribution models were also reviewed by consultant biologists not involved in the RCIS development process and refined based on their feedback.

peer-reviewed scientific literature. When data were inconclusive or contradictory, conservative values were used in estimating suitable habitat (e.g., models were developed to be more inclusive of potential habitat than exclusive of potential habitat). Overall, the habitat distribution models likely overestimate the actual extent of suitable habitat for most focal species because some important habitat features cannot be spatially mapped at the scale of the RCIS area, or such mapping was beyond the scope of this East Bay RCIS. Areas identified for potential conservation investments or mitigation will need to be verified with on-the-ground surveys before conservation actions or habitat enhancement actions are made.

Focal Species Locations

The data used to identify locations of occurrence of focal species, and to evaluate the focal species' habitat models come primarily from the California Natural Diversity Database (California Department of Fish and Wildlife, Natural Diversity Database 2016a) with some additional data from the Biodiversity Information Serving Our Nation (BISON) database (U.S. Geological Survey 2016). Occurrence data for round-leaved filaree came from Calflora observation data (Calflora: Information on California plants for education, research and observation 2014) because occurrence data for this species were not available from CNDDB. These occurrence records are also displayed in each species' habitat distribution map (Appendix F). Only CNDDB occurrences presumed extant were used. Calflora observation data records from 1998 and later were used. This cutoff was used because this was a natural break in the data for this species, with 89 observation records since 1994, with the rest (11) from 1941 or earlier. BISON data were filtered to use specific observations documented between 1977 and 2016, rather than records from literature and other sources that have not been field verified. This filter was used to exclude non-specific, historical records from unauthenticated sources.

Most of the BISON occurrence records for birds are originally from eBird (83%) and iNaturalist (11%). These records are provided as observations without additional information such as the breeding status or habitat where the bird was observed. For many of the focal bird species, there are considerably more BISON occurrence records than CNDDB occurrence records. This is likely because BISON uses citizen science data, such as those from eBird, which are considerably easier to report than observations to CNDDB.

Data reported to the CNDDB are done so with varied precision. Some occurrences are well documented with explicit locations (e.g., GPS coordinates), while other are reported with more general location information. Precise occurrences are those that have sufficient information to be located on a standard U.S. Geological Survey 7.5 minute quadrangle map, either at specific location or with an accuracy of 80 meters. General occurrences have been documented in very general terms and include non-specific records (such as the boundary of a park where an occurrence is known to occur) or records with an accuracy of 0.1, 0.2, 0.4, 0.6, 0.8, or 1.0 mile. Precise occurrences were assumed extant unless they were on sites that have obviously been converted to other land uses and were used to verify habitat distribution models. Additionally, CNDDB occurrences that are listed as extirpated were excluded from the dataset.

Similarly, Calflora reports location quality for observation data as being either high, medium, or low, based on the level of accuracy in which the location is provided to Calflora. High-quality observations are those that fall within an area of less than or equal to 4.5 acre; medium-quality data fall within an area greater than 4.5 acres and less than 185 acres; low-quality data fall within an area greater than 185 acres.

Precise CNDDB occurrences and specific BISON occurrences were used to inform the development of the focal species' habitat models by comparing the overlap between the models and occurrence data to assess how well the model represented the distribution of known occurrences. Occurrences that fell outside of a model's predicted habitat distribution were evaluated to determine whether they indicated flaws in the model or were an anomalous occurrence (e.g., the occurrence no longer reflects current conditions if the location of the occurrence has been developed). Anomalous points were retained but were not used to adjust the model results. Aerial photographs were examined to assess the significance of extreme outliers. When a model did not adequately capture enough occurrences, the model was modified to better reflect the species' habitat relationships by modifying one or a few elements of the model (e.g., adding a land cover type to the model, increasing the slope or elevational range limits).

Occurrence Data Limitations

CNDDB records represent the best available statewide data but are limited in their use for conservation planning. CNDDB data document presence only; the absence of an occurrence data point does not indicate that the species is not present. CNDDB records rely on field biologists to submit survey and monitoring data voluntarily. As a result, the database is biased geographically toward areas where surveys have been conducted or survey efforts are greater (many areas have not been surveyed at all and this is not reflected in the database). The database may also be biased toward species that receive more survey effort. For example, there have been more surveys for California red-legged frog than other special-status amphibians because California red-legged frog is a listed species. Conspicuous diurnal species such as raptors receive greater survey effort than nocturnal species such as bats. Plants typically receive less survey effort than wildlife.

Model Uses and Limitations

The habitat distribution models are intended to be used for planning purposes at the scale of the RCIS area. The use of these models by project proponents is voluntary. The models impose no regulatory requirements. If used for site planning, the models should only be used as a guide. All species' habitat and occurrences should be verified in the field. As discussed above, occurrence data are incomplete and limited by where field surveys have been conducted. Some occurrence points from CNDDB may also be geographically general or inaccurate.

The precision of the habitat distribution models is limited by several factors, including minimum mapping units (e.g., 0.2 acres) of the underlying existing land cover datasets (Section 2.2.5.2 and Section 2.2.5.3, *Wetland and Bayland Land Cover*). Areas of suitable habitat smaller than the mapping thresholds were not mapped and therefore could not be incorporated into the models. This constraint limited the degree of resolution of some habitat features potentially important to some species. This presented challenges for focal plant species, which are often associated with unmapped microhabitats such as swales, ditches, or rock outcrops smaller than the minimum mapping unit.

The habitat distribution models were limited to distinguishing habitat uses based on key life history requirements such as breeding, foraging, or dispersal that are tied to land cover types. The data do not allow for further distinctions of habitat quality on a regional scale. To account for these limitations, conservative estimates of habitat parameters were used. This approach tends to overestimate the actual extent of suitable habitat but was used to minimize eliminating potentially suitable habitat where conservation investments and mitigation actions could occur.

2.2.7 Non-focal Species

The Program Guidelines define *non-focal species* as "[s]pecies that are not 'focal species', as defined in these Guidelines, but which are associated with a focal species or other conservation element and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Non-focal species may benefit through both conservation investments and MCAs" California Department of Fish and Wildlife 2018a). Mitigation credits may be created through an MCA for a non-focal species if the RCIS includes 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 the actions for the associated focal species or other conservation element would benefit the non-focal species" (California Department of Fish and Wildlife 2018a).

Many species that were not selected as focal species for this East Bay RCIS (i.e., "non-focal species") (Section 2.2.6.1, *Selection Process*) have conservation needs similar to the focal species, and may also be addressed through the conservation strategy for other conservation elements (e.g., serpentine soils, unique land cover types, and others; Section 3.9, *Conservation Strategy for Other Conservation Element*). The East Bay RCIS Core Team selected 11 species to be included in this RCIS as non-focal species based on the potential need for mitigation credits for these species. Non-focal species include the following.

- Longfin smelt (*Spirinchus thaleichthys*)
- Delta smelt (*Hypomesus transpacificus*)
- Western pond turtle (*Emys marmorata*)
- Western snowy plover (*Charadrius alexandrinus nivosus*)
- Ridgway's rail (*Rallus obsoletus obsoletus*)
- Northern harrier (*Circus cyaneus*)
- Bald eagle (*Haliaeetus leucocephalus*)
- American badger (*Taxidea taxus*)
- Townsend's big eared bat (*Corynorhinus townsendii*)
- Salt marsh harvest mouse (*Reithrodontomys raviventris*)
- Hoover's button celery (*Eryngium aristulatum* var. *hooveri*)

Appendix G, *Non-focal Species*, includes brief descriptions of the habitat requirements for the 11 non-focal species and how conservation strategies for focal species and other conservation elements would benefit each non-focal species. Tables G-1a and G-1b in Appendix G show the habitat relationships between non-focal species and this RCIS's land cover types, and Tables G-2a and G-2b highlight the general similarities in habitat use and overlap between non-focal species and wildlife focal species (Table G-2a) and non-focal species and plant focal species (Table G-2b), identified by similarities in use of land cover types. Land cover is the basis for the focal species habitat models (Section 2.2.6.2) and the conservation strategy (Chapter 3), and can be used as a common currency when considering how conservation goals, objectives, actions, and priorities for focal species will also benefit non-focal species. As such, this RCIS contemplates the conservation needs of the focal species and non-focal species with similar habitat needs. It is assumed that MCAs that memorialize protection and habitat improvements for land cover types that support focal and non-focal species alike, could result in mitigation credits for both focal and non-focal species.

2.2.8 Other Conservation Elements

CFGC Section 1852(c)(4) states that an RCIS will include, "important resource conservation elements within the strategy area, including, but not limited to, important ecological resources and processes, natural communities, habitat, habitat connectivity, and existing protected areas, and an explanation of the criteria, data, and methods used to identify those important conservation elements." This section identifies important conservation elements other than focal species, natural communities, soils, and existing protected areas that occur within the RCIS area. Other conservation elements were identified based on guidance from the Core Team and Stakeholder Group, as well as from existing literature and data relevant to the RCIS area, as described in each section that follows. These conservation elements are addressed in this section, rather than under Section 2.2, *Natural Environment*, because this RCIS includes conservation strategies and priorities for these other conservation elements (Chapter 3).

2.2.8.1 Habitat Connectivity

Loss of habitat connectivity is one of the leading threats to biodiversity in the RCIS area. Movement is essential for wildlife to find mates, seasonal habitat, shelter, and food, and adapt to climate change. An interconnected landscape can help to maintain ecosystem services such as pollination of crops and the flow of genes that helps to maintain biodiversity (Mitchell et al. 2013). Wildlife also need to be able to move beyond their home ranges to find new habitat. Movement is essential to gene flow, which is necessary to maintain genetic diversity and increase the likelihood of long-term persistence of plant and animal populations. When populations are isolated in habitat patches, and individuals are unable to move through the landscape to other habitat patches and populations, populations are more susceptible to reduced genetic diversity (and associated deleterious effects), localized loss of habitat, disease, and ultimately extirpation. Although effects will vary for different species, landscape features can influence plant and wildlife's ability to move at a range of scales. Rugged topography, land cover types, and human development can all affect the ability of organisms to move through an area. Furthermore, as climate change alters habitats, animals and plants will be under increasing pressure to disperse to new areas to adapt to climate change. In fragmented habitats, such as the RCIS area, wildlife can be struck by vehicles or get stuck in fences as they attempt to cross roads and other anthropogenic barriers to reach suitable habitat. As climate change alters habitat conditions, the ability of wildlife to move across the landscape will become increasingly threatened without concerted efforts to maintain habitat connectivity and increase permeability across the landscape.

Most of the information about connectivity in the region is from high-level regional modeling (*Critical Linkages: Bay Area and Beyond* [Penrod et al. 2013]) and statewide modeling (*California Essential Habitat Connectivity Project* [Spencer et al. 2010]). Localized assessments of key points of connectivity have been conducted within the EACCS and the ECCC HCP/NCCP permit area. Each of these information sources are discussed below and shown in Figures 2-23a and 2-23b.

California Essential Habitat Connectivity Project

The California Essential Habitat Connectivity Project (CEHCP) (Spencer et al. 2010) is a statewide assessment of large, intact blocks of natural habitat and connections between them. The project was commissioned by more than 60 federal, tribal, state, local agencies, and non-governmental organizations to facilitate incorporating natural resources consideration into regional analysis and land use planning. This analysis is intended to inform infrastructure planning and conservation investments statewide, as a means to improve connectivity for ecosystems and organisms.

The CEHCP used a GIS-based modeling approach to create a statewide wildlife habitat connectivity map and to identify the biological value of connectivity areas. CEHCP identified natural landscape blocks, which include a combination of protected areas and other areas with intact natural communities at low risk of conversion to non-natural communities over time. The analysis determined which natural landscape blocks to connect and modeled least cost path corridors to identify essential connectivity areas.

The CEHCP identifies natural landscape blocks east and south of Mount Diablo, extending southeast through Alameda County and into San Joaquin County outside the RCIS area; smaller natural landscape blocks interspersed along a north-south axis in the hills that rise above the San Francisco Bay in the western portion of the RCIS area and extending southeast to include most of the southeastern half of Alameda County, and continuing along the Diablo range into Santa Clara County; and along the baylands in the southwest corner of the RCIS area in the Don Edwards National Wildlife Refuge (Figure 2-23a). The natural landscape block in Don Edwards National Wildlife Refuge extends south, outside of the RCIS area into Santa Clara County, and north into San Mateo County on the southwestern edge of the San Francisco Bay. Natural landscape blocks in the Central Coast Ecoregion (the RCIS area is located within the Central Coast Ecoregion as described in the CEHCP) are restricted to more rugged areas, with smaller, fragmented blocks on gentler slope, terraces and valleys due to urban and agricultural conversion (Spencer et al. 2010).

Essential connectivity areas span nearly the entire length of the Diablo Range (and the length of the RCIS area), connecting the natural landscape blocks in the hills above San Francisco Bay to a natural landscape block in Santa Clara County. A smaller essential connectivity area connects natural landscape blocks across Interstate 580 in the northeastern corner of Alameda County.

Critical Linkages: Bay Area and Beyond

Critical Linkages: Bay Area and Beyond (Critical Linkages) (Penrod et al. 2013) represents the best available data on wildlife linkages that are vital to connectivity in the nine-county Bay Area. These linkages were designed through an extensive scientific and stakeholder-driven process from 2012 to 2013. Critical Linkages identifies 14 landscape-level connections crucial to maintaining connectivity for wildlife between large landscape blocks within and adjacent to the nine-county Bay Area. Critical Linkages assessed and modeled movement routes for six of the East Bay RCIS focal species (mountain lion, burrowing owl, California tiger salamander, California red-legged frog, foothill yellow-legged frog, and steelhead trout) across the Bay Area and surrounding counties based on suitable habitat between large blocks of land under existing protections (Penrod et al. 2013). Critical Linkages identified the following two linkages in the RCIS area (Figure 2-23b).

- East Bay Hills: Diablo Range
- Mount Diablo: Diablo Range

The East Bay Hills critical linkage connects habitats in the East Bay hills south of the Town of Moraga, through the Diablo Range southeast into Santa Clara County. The Mount Diablo: Diablo Range critical linkage extends along the interior Diablo Range southeastern Contra County, through Alameda County and into San Joaquin County.

This East Bay RCIS primarily uses Critical Linkages, rather than the CEHCP, to inform conservation strategies to protect and enhance habitat connectivity because Critical Linkages analyzed landscape connectivity at a finer, local scale (i.e., the San Francisco Bay Area) than the CEHCP (i.e., throughout California), resulting in a more detailed analysis of connectivity than the CEHCP. While the CEHCP and Critical Linkages identify similar landscape-level linkages along the western edge of the Diablo Range and the interior Diablo Range, Critical Linkages identifies smaller, more localized landscape blocks and narrower linkages that can be used to better focus conservation and habitat enhancement actions to protect and enhance landscape connectivity (Figures 2-23a and 2-23b).

The conservation goals and objectives for landscape connectivity are discussed in Section 3.9.1, *Habitat Connectivity and Landscape Linkage*, as they relate to focal species and other conservation elements focused on wildlife connectivity and landscape permeability.

East Alameda County Conservation Strategy Corridors

EACCS broadly describes the linkages with its study area primarily in two categories: grassland corridors and aquatic-upland corridors. These linkages were determined based on the movement needs of EACCS focal species such as San Joaquin kit fox, golden eagle, and California red-legged frog.

Grassland Corridors

San Joaquin kit fox was used as a model species to assess connectivity of grasslands in eastern Alameda County. The Altamont Hills are believed to provide an essential link to suitable kit fox habitat in the northern extreme of the species' range (H. T. Harvey & Associates 1997), allowing for genetic exchange between kit fox in Contra Costa and Alameda Counties and those further south in San Joaquin, Stanislaus, and Merced Counties. The main "corridor" is the wide grassland flanking I-580 between Vasco Road and Grant Line Road. There are two sizeable underpasses along the stretch of freeway between Livermore and the Contra Costa – Alameda county line: near Greenville Road in Livermore, and near the San Joaquin County line at the Grant Line Road exit and North Midway Road (ICF International 2010).

Aquatic-Upland Corridors

EACCS assessed gaps in aquatic-upland corridors for California red-legged frog and California tiger salamander. Aquatic habitats such as streams and ponds provide breeding habitat, while the matrix of upland habitats between those aquatic habitats and riparian corridors provides dispersal habitat. EACCS concluded that areas with a higher density of aquatic features are more connected than those with a low density of aquatic features. Areas with low densities of aquatic features were dominated by steep topography that supported relatively fewer stock ponds than areas with flat or rolling terrain. Unnatural features such as highways and reservoirs also create barriers to movement and could fragment California red-legged frog and California tiger salamander populations in east Alameda County. Some of the areas where gaps between aquatic features emerge include the following.

- **Between Livermore and Dublin across Cayetano Creek.** Low pond density in this area may isolate populations between Cottonwood Creek and Cayetano Creek from those in the eastern Alameda County.
- **East of Livermore and south of I-580.** This area has a low density of ponds relative to the rest of the EACCS study area, which may limit dispersal.

- **North of Dublin, between Alamo Creek and Cottonwood Creek.** This area has a low density of ponds; improving connectivity across this area would facilitate dispersal between habitats in northwest Alameda County into Contra Costa County.
- **East Bay Hills north of Alameda Creek**. Sinbad Creek provides an aquatic connectivity through this part of the East Bay Hills that is relatively devoid of ponds.

East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan

An important regional goal of the ECCC HCP/NCCP is to provide connectivity for San Joaquin kit fox between the large block of public lands in and around the Los Vaqueros Watershed and Black Diamond Mines Regional Preserve. The ECCC HCP/NCCP identified the following potential movement routes between the Los Vaqueros Watershed and Black Diamond Mines Regional Preserve (Figure 2-23b)

- **Round Valley.** The southernmost route, the Round Valley is comprised primarily annual grasslands connecting Round Valley to Black Diamond Mines Regional Preserve. This route is the longest identified in the ECCC HCP/NCCP, at 7.5–8 miles, approximately 6.5 miles of which crosses private land. This route is also the narrowest, with long stretches 0.25 mile wide or less.
- **Briones Valley.** This potential movement route through Briones Valley is approximately 5 miles long, 4.5 miles of which traverses private land. Because Marsh Creek Road runs through a portion of this relatively narrow valley (0.2–0.25-mile wide), the viability of this valley for kit fox movement is uncertain. In addition, development of rural ranchettes in lower Briones Valley threatens to fragment grassland habitat within the valley.
- **Deer Valley.** This potential movement route through Deer Valley is approximately 4 miles long and is partially protected by the dedication of development rights on and around the Roddy Ranch Golf Course. Suitable habitat through most of Deer Valley is more than 0.5-mile wide and is continuous from end to end. Suitable habitat narrows to approximately 0.3 mile near Black Diamond Mines Regional Preserve where oak savanna and oak woodland may constrain kit fox movement (Orloff 2003).
- **Horse and Lone Tree Valleys.** Horse and Lone Tree Valleys together form the widest potential movement route for San Joaquin kit fox between Black Diamond Mines Regional Preserve and Cowell Ranch State Park and may use this area to move between the Los Vaqueros Watershed lands and Black Diamond Mines. The route is wide enough (1–3 miles) and long enough (approximately 5 miles) to potentially support breeding of one or several kit fox pairs within the route.

Stream and Riparian Connectivity

Streams and associated riparian habitat play important roles as corridors connecting habitats within and beyond the RCIS area, connecting aquatic habitats up- and downstream, and as transition zones between stream channels, floodplains, and upland habitats. In the RCIS area, many streams are channelized for flood control, separating channels from floodplains, which can no longer provide rearing habitat for fish, among other ecosystem services (National Marine Fisheries Service 2016). Stream and riparian ecosystems also promote ecological processes and flows, including transport of water, sediment, and nutrients (Spencer et al. 2010). In addition to providing movement corridors and cover for terrestrial species and nesting and foraging habitat for birds, stream and riparian are biodiverse ecosystems, and provide habitat for a number of focal species, including spawning and rearing habitat for Central California coast steelhead distinct population segments, year-round habitat for foothill yellow-legged frog, breeding and foraging habitat for California red-legged frog, and nesting habitat for Swainson's hawk (Appendix F). As such, the CEHCP considers riparian corridors as critical in connecting natural areas and stresses the importance of riparian and riverine restoration projects to restore lost connections (Spencer et al. 2010). Stream and riparian corridors also provide connectivity that spans elevation gradients and can therefore be important in helping terrestrial species adapt to climate change.

Historically, RCIS area streams supported considerably more populations of Central California coast steelhead than presently supported (National Marine Fisheries Service 2016). Barriers to passage, as well as channel modifications for flood control, urbanization, agricultural uses, among other factors, have significantly reduced the extent and quality of streams available for spawning and rearing. Multiple barriers block passage, either partially or completely, to upstream habitat in streams occupied by Central California coast steelhead in the RCIS area (CalFish 2017, Figure F-6, and Appendix F).

2.2.8.2 Working Landscapes

CFGC Section 1852 (e)(1) requires that an RCIS consider ". . .the conservation benefits of working lands for agricultural uses." To support this analysis, the following section describes the extent of farmland and *rangeland* in the RCIS area. Rangeland is defined by California Public Resources Code Section 4789.2(i) as follows.

> *Rangeland* means land on which the existing vegetation, whether growing naturally or through management, is suitable for grazing or browsing of domestic livestock for at least a portion of the year. Rangeland includes any natural grasslands, savannas, shrublands (including chaparral), deserts, wetlands, and woodlands (including Eastside ponderosa pine, pinyon, juniper, and oak) which support a vegetative cover of native grasses, grasslike plants, forbs, shrubs, or naturalized species.

The information on farmland and rangeland in this section is based on the latest annual report of agricultural production in Alameda and Contra Costa Counties (Alameda County 2018, Contra Costa County 2018), compiled by each county, and each county's general plan (Alameda County 1994, Contra Costa County 2005).

While this section focuses on the agricultural and natural resource production and habitat values provided by working lands, this East Bay RCIS acknowledges that infrastructure and allied industries are vital to maintaining economically viable working lands.

Farmland

In Alameda County, as of 2017, 7,124 acres,[37] or a little more than 1% of the land area in Alameda County, is harvested cropland (Alameda County 2018). In 2017, the total gross value of Alameda County's agricultural production from harvested cropland was $$20,054,000 (not including nursery

[37] This value is reported from the 2017 Alameda County Crop Report (Alameda County 2018). This value differs from the amount depicted in Figure 2-22 and in Table 2-6, *Extent of Natural Communities and Land Cover Types in the RCIS Area*, due to the different methods used to report and calculate harvested cropland by the Alameda County Community Development Agency (Alameda County 2018) vs. those used by the various sources of land cover data to map cultivated agriculture land cover types (Section 2.2.5.1).

products and livestock and poultry production) , (Alameda County 2018). Most farmland in Alameda County is concentrated around the Livermore Valley and, in the northeastern corner of the RCIS area, the Delta. Grapes for winemaking have long been produced in the Livermore Valley as well as other row crops. The Fremont-Alvarado area is one of only four areas in California where lettuce can be raised throughout the summer, due to its coastal climate.

In Contra Costa County, farmland dominates the northeast corner of the RCIS area adjacent to the Delta (Figure 2-22) and consists of irrigated agriculture (cropland, orchards, and vineyards). As of 2017, 199,388 acres,[38] or 39% of the land area in Contra Costa County is harvested cropland (Contra Costa County 2018). In 2017, the total gross value of Contra Costa County's agricultural production from harvested cropland was $85,847,000 (not including nursery products and livestock and livestock products) (Contra Costa County 2018). Agricultural lands east and southeast of Oakley and Brentwood consist of row crops. Immediately east of Brentwood and extending east and south of Oakley, the agricultural land is extremely productive. This area is defined as Agricultural Core by the Contra Costa General Plan. The designation is intended to preserve and protect the most productive farmlands in the county. Much of the Agricultural Core is under active cultivation with intensive row crops (e.g., tomatoes and berries) (Contra Costa County 2005). Contra Costa County has approximately 130 agriculture preserves (i.e., protected farmland) and 42,000 acres enrolled under these Williamson Act contracts

In addition to food production, farmland can provide additional ecosystem services, depending on management practices, including regulation of soil and water quality, carbon sequestration, and habitat for native wildlife (Power 2010, U.S. Department of Agriculture 2018). Farmlands can support water supply and groundwater recharge through man-made infrastructure, such as dams, reservoirs, and canals, as well as through functioning watersheds and managed aquifers. Aquatic channels on farmlands can provide habitat for native species, while provisioning groundwater recharge areas downstream. In addition, the per-acre emissions from California's farms are an average of 58 times lower than those from urban areas (Shaffer and Thompson 2015).

Farmlands, including those within the RCIS area, provide important habitat for some native birds and other wildlife, including foraging habitat for focal species such as tricolored blackbird and Swainson's hawk. Some native bird species derive cover, forage, reproduction, and dispersal functions from agricultural lands (Central Valley Joint Venture 2006, Golet et al. 2018, Reynolds et al. 2017). Agricultural lands with enhanced field borders or hedge rows (i.e., planted with vegetation that provides food and cover plants) provide habitat for wildlife in the agricultural landscape (Staley et al. 2012, Graham et al. 2018).

Farmland can provide movement corridors for wildlife species such as San Joaquin kit fox, depending on crop type and farming practices (i.e., when farms are fenced, wildlife-friendly fences are used to reduce barriers to wildlife movement through farmland), where they abut natural open spaces. Farmland is often bisected by streams, creeks, and sloughs, which can provide riparian habitat for a variety of songbirds, raptors, amphibians, and reptiles, as well as movement corridors (Section 2.2.8.1, *Habitat Connectivity*). Many amphibians and wildlife utilize these linear aquatic features and adjacent upland habitat. This is particularly true for giant garter snake, which occurs in

[38] This value is reported from the 2017 Contra Costa County Crop Report (Contra Costa County 2018). This value differs from the amount depicted in Figure 2-22 and in Table 2-6, *Extent of Natural Communities and Land Cover Types in the RCIS Area*, due to the different methods used to report and calculate harvested cropland by the Contra Costa County Department of Agriculture/Weights & Measures (Contra Costa County 2018) vs. those used by the various sources of land cover data to map cultivated agriculture land cover types (Section 2.2.5.1).

high density farmland in the northeastern corner of the RCIS strategy area and utilizes sloughs and channels in farmland.

Rangeland

Rangeland, as mapped as grazing land by the California Department of Conservation Farmland Mapping and Monitoring Program[39] (California Department of Conservation 2014), is located throughout the RCIS area, particularly in the eastern areas, outside of the major cities (Figure 2-24). In Alameda County, there are 177,798 acres of rangeland, which generate an annual income of approximately three million dollars (Alameda County 2018). Livestock production has now eclipsed fruit and nut crops as the top-grossing commodity group in Alameda County in 2015. In Contra Costa County there are 169,000 acres of rangeland, which generate an annual income of approximately three to five million dollars (Contra Costa County 2016)

In eastern Contra Costa County, both the East Contra Costa Habitat Agency and the Contra Costa Water District implement grazing programs. In eastern Contra Costa County, rangeland is located on a variety of terrains, some with steep slopes and rugged terrain and others with moderate to gentle slopes. Wind turbines are often positioned on those gentle slopes. In eastern Alameda County, most grazed rangelands are private lands. In both Contra Costa and Alameda Counties, most open space areas (Figure 2-1) contain a large amount of rangeland that is actively managed for livestock grazing.

Rangelands provide many ecosystem services such as habitat and movement corridors for wildlife (Hunting 2003, Jantz et al. 2007, Hobbs et al. 2008), carbon sequestration (Schuman et al. 2002, Derner and Schuman 2007), nutrient cycling, groundwater recharge (Havstad et al. 2007), and food production (Jones and Donnelly 2004, Murray et al. 2012). Furthermore, the economic viability of rangelands helps to secure the ecosystem services provided by livestock grazing while preventing rangeland conversion to land uses with less ecological values (e.g., urban development, orchards, vineyards) (Huntsinger and Oviedo 2014, Byrd et al. 2015). The grasslands and oak woodlands used as rangelands in the RCIS area evolved under the influence of prehistoric herbivores—including herds of deer, elk, pronghorn, and other grazing animals—and without competition from non-native annuals, which currently dominate much of the region. In the absence of these large native herbivores, appropriate livestock grazing of cattle, sheep, and goats is a valuable range management tool, used to manage infestations of invasive plants, promote populations of native plants and animals, and reduce wildfire fuel loads (Marty 2005, Pyke and Marty 2005, Bartolome et al. 2014).

Livestock grazing is the most widespread land management practice in the world, affecting 70% of the land surface of the western United States (Krausman et al. 2009). Grazing reduces the amount of accumulated plant litter, thereby favoring native plant establishment and growth and enhancing the overall composition of native plant communities. Non-native annual grasses and herbs tend to rapidly monopolize landscapes and can inhibit the germination of seeds and growth of native species through the capture of water and mineral resources and the physical and chemical effects of accumulated plant litter (Bartolome et al. 2014). Moderate levels of grazing are generally ideal for maintaining and enhancing native vegetation by reducing competition from more aggressive, non-native annual plants. Moderate grazing can also improve conditions for covered species by reducing dense ground cover, which can impede movement and decrease populations of burrowing rodents, which provide burrows and are prey for some covered species (e.g., burrowing owl, California tiger

[39] https://www.conservation.ca.gov/dlrp/fmmp

salamander, and Swainson's hawk) (Ford et al. 2013, Bartolome et al. 2014). Specific grazing practices in any given location should be selected based on site-specific goals.

Salt Production

Roughly 8,000 acres along the South San Francisco Bay are devoted to salt evaporation ponds. Operated by Cargill, bay water is collected and pumped through a series of evaporation or concentration ponds. As fresh water evaporates, over approximately three years, the brines slowly concentrate as water moves through the pond system. When the brines reach full saturation, they are pumped into crystallizer beds to facilitate the mechanical harvesting of salt. The evaporation ponds provide habitat for more than 70 species of birds (Cargill 2018). The low- and mid-salinity ponds provide important forage while the dry ponds and levees can support nesting of species, including for the endangered western snowy plover and California least tern.

2.2.8.3 Baylands

In Section 2.2.5, *Natural Communities and Land Cover Types*, the baylands include tidally influenced and managed areas, primarily along the western and northern perimeter of the RCIS area. Due to land conversion, much of the area that historically would have been classified as baylands habitat is now mapped as urban development. Urbanization in the western portion of the RCIS area along the San Francisco Bay has resulted in the loss of, and major alterations to, tidal marsh habitat. The tidal-terrestrial transition zone, which occupies the gradient between the intertidal zone and terrestrial habitat (i.e., the transition between pickleweed-dominated salt marsh to salt pans and saltgrass) is one of the most heavily affected San Francisco Bay ecosystems and is now limited to a narrow strips of land along the boundary of artificial levees (Beller et al. 2013). As such, the baylands in the RCIS area were historically much more extensive and supported higher levels of habitat diversity than they do today.

The remaining baylands habitats in the RCIS area are critically important refuges for populations of rare species. Threatened and endangered species such as the salt marsh harvest mouse, California black rail, Ridgway's rail, western snowy plover, and California least tern rely on a narrow range of baylands habitat conditions (including tidal marshes, tidal sloughs, man-made salt ponds, and levees) for successful breeding and foraging. Areas with high quality physical structure (e.g., tidal channel, flats, and marshes), hydrology, and habitat connectivity provide healthy ecosystems for these species where they are able to thrive (Goals Project 2015, U.S. Fish and Wildlife Service 2013).

The baylands provide critical migratory stopover habitat for large populations of shorebirds and waterfowl along the Pacific Flyway, one of four major migratory bird pathways between Alaska to Mexico and South America. Important habitats for migratory birds include estuarine areas, tidal flats, managed wetlands, large persistent seasonal wetlands, and salt ponds. Migrating land birds benefit from transition zones into riparian and upland habitats (Goals Project 2015, U.S. Fish and Wildlife Service 2013).

The baylands provide numerous ecosystem services, including improving water quality, cycling nutrients, providing recreation opportunities, reducing flooding by dissipating waves and spreading out and slowing down high water, providing nurseries for fish and shellfish, and habitat for wildlife and plants, as described above. Baylands reduce anthropogenic nutrient inputs to the estuary by retaining and sequestering nitrogen (Goals Project 2015, U.S. Fish and Wildlife Service 2013). Bayland ecosystems transport sediments to support tidal wetlands and the species that depend on them. Channel networks within baylands provide a mixing zone of fresh and saltwater, creating aquatic habitat of varying salinity that support a multitude of species. Flood events, primarily associated with heavy rain but also potentially in combination with high tide events, are a particularly important ecological process in the baylands, as they transport organisms, sediment and nutrients to the baylands, increase the mixing process, and create productive brackish water habitats. Flood events can trigger reproduction and migration for many estuarine fishes and for anadromous species like salmon that migrate between the ocean and rivers through the bay (San Francisco Estuary Institute 2011).

2.2.8.4 Bat Habitat

The RCIS area includes foraging and roosting habitat for a number of insectivorous North American bat species. These bats seek shelter in caves, mines, trees, and various other structures such as barns, buildings, and bridges. The use of these roosting sites can vary during different times of the day or year. Some sites may be used year-round while others may be used seasonally as diurnal roosts, nocturnal roosts, hibernation sites, and by maternity colonies. The need to maintain a variety of roosting habitat is important to support these species. In addition to protecting areas with roosting habitat, it is equally important to minimize disturbance at roost sites, particularly those known to be used as maternity colonies and for hibernation. These types of roost sites are typically less numerous, and minor disturbances can cause colonies to abandon the location for extended periods, limiting their ability to persist and reproduce in the area. Foraging occurs across the entire landscape, with concentrations along riparian corridors, waterways, and along ecotones.

2.2.8.5 Unique Land Cover Types

Unique land cover types are locally rare (i.e., within the RCIS area) land cover types that support native vegetation and one or more focal plant or wildlife species. Many of these land cover types have been historically developed and are currently under threat from invasive exotic species, human disturbance, or disease. This RCIS includes conservation strategies for unique land cover types to protect, enhance, and restore the diversity of natural communities in the RCIS area, particularly those that may not otherwise benefit from local conservation efforts.

Each unique land cover type was identified from the list of land cover types in the RCIS area (Section 2.2.5). The following criteria were used to define unique land cover types. These criteria are not mutually exclusive, in most cases multiple criteria apply to each unique land cover type. A land cover type was considered unique if it is the following.

- Included on CDFW's list of California Sensitive Natural Communities[40] (California Department of Fish and Wildlife 2018b, California Department of Fish and Wildlife, Natural Diversity Database 2016a).
- A locally rare vegetation type accounting for 2% (Table 2-6) or less of the total land area of the RCIS area.

[40] This RCIS uses CDFW's list of California Sensitive Natural Communities (California Department of Fish and Wildlife 2018b) to inform the identification of unique land cover types in the RCIS area, for the purposes of this RCIS only. Classification of unique land cover types in this RCIS is not intended to imply that those land cover types should be included on the list of California Sensitive Natural Communities.

- Associated with serpentine soils or rock (California Native Plant Society 2017). See Section 2.2.5.1, for an explanation of how land cover – serpentine soil or rock associations were identified and classified as land cover types.
- An irreplaceable habitat for focal species (e.g., critical to survival and recovery).[41]

Each land cover type was evaluated against these criteria, using the sources indicated in this section, to determine whether or not the land cover type qualifies as unique to the RCIS area. The following land cover types were identified as unique for the purposes of this RCIS.

- Serpentine grassland
- Alkali grassland
- Northern mixed chaparral/chamise chaparral
- Northern coastal scrub/ Diablan sage scrub
- Serpentine chaparral
- Cismontane juniper woodland
- Valley oak woodland
- Montane hardwood
- Serpentine hardwood
- Redwood forest
- Serpentine conifer
- Coulter pine forest
- Knobcone pine forest
- Ponderosa pine woodland
- Sargent cypress woodland
- Mixed riparian forest and scrub
- Serpentine riparian
- Sycamore alluvial woodland
- Alkali wetland
- Perennial freshwater marsh
- Spring/seep (non-serpentine)
- Spring/seep (serpentine)
- Seasonal wetland

[41] Multiple sources, dependent on the species (Section 2.2.6, *Focal Species*), were used to determine whether the land cover type provides irreplaceable habitat for focal species.

- Pond
- Vernal pool
- Tidal vegetation
- Tidal bay flat

2.2.8.6 Soils

The wide diversity of soil units across the RCIS area are a result of the variety of geologic, climatic, and topographic features across the landscape. The RCIS area includes Mount Diablo, one of the highest peaks (3,849 feet) in the region, a number of northwest-trending echelon ridges and valleys, as well as large expanses of lowlands and tidal flats (Helley and Graymer 1997). Another important factor contributing to the soils in the RCIS area are the active faults associated with the San Andreas system where the North American and Pacific tectonic plates meet (Norris and Webb 1990).

The more important soil types from a conservation perspective are those with limited distribution that create unique habitats. In the RCIS area, these include clay lenses, sandy soils, alkali soils, and serpentine soils. Clay lenses occur in limited distribution and support narrowly distributed species such as round-leaved filaree. Sandy soils such as the Antioch dunes have been created by alluvial depositions over long periods. Alkali soils, including alkali wetlands and grasslands in the RCIS area, support rare and endemic species that are adapted to the high salinity of these soils. Serpentine soils are shallow, nutrient poor, and high in magnesium and other heavy metals, creating an environment for highly specialized flora. Collectively, these narrowly distributed soil types serve as areas of high biological value, supporting species not commonly found throughout the RCIS area. Table 2-9 summarizes the serpentine soils in the RCIS area.

Table 2-9. Serpentine Soils, by Series, in the RCIS Area

Serpentine Soil Series	Soil Series Amount (acres)	Percent in the RCIS Area
Climara	521	5%
Henneke	9,429	91%
Montara	383	4%
Grand Total	**10,333**	**100%**

Source: U.S. Department of Agriculture. 2016a, SSURGO Database

2.2.9 Ground Squirrel

California ground squirrel (*Spermophilus beecheyi*) plays a critical role in the grassland natural community. These burrowing rodents, often referred to as fossorial mammals, provide one of the most common forms of natural disturbance in California grasslands. The disturbance caused by their burrowing activities creates structure and habitat for a multitude of animal species, including species reliant on burrows, such as burrowing owls and California tiger salamander. In addition to this key function of creating disturbance and habitat for burrow-dwelling species, ground squirrels also serve as a primary source of food for larger raptors and mammals, including San Joaquin kit fox. Ground squirrels contribute to the primary ecosystem processes of soil disturbance, seed dispersal, granivory, and herbivory (Schiffman 2007). While critically important for these reasons, ground squirrel burrows can also negatively impact structures, such as levees and stock ponds, that can impound water and provide breeding habitat for special status species, such as California tiger salamander and California red legged frog (Van Vuren et al. 2014).

This RCIS does not include a conservation strategy in Chapter 3 specifically for ground squirrel. Rather, conservation actions and habitat enhancement actions that improve habitat conditions for ground squirrels are included within the conservation strategies for focal species for the focal species that rely on ground squirrels contributing to habitat conditions (e.g., California tiger salamander and burrowing owl).

2.3 Pressures and Stressors on Conservation Elements

CFGC Section 1852(c)(5) requires that an RCIS include a summary of historic, current, and projected future stressors and pressures in the RCIS area, including climate change vulnerability, on the focal species, habitat, and other natural resources, as identified in the best available scientific information, including the State Wildlife Action Plan (SWAP) (California Department of Fish and Wildlife 2015). The Program Guidelines define *stressor* and *pressure* as the following.

> Stressor is a degraded ecological condition of a focal species or other conservation element that resulted directly or indirectly from a negative impact of pressures such as habitat fragmentation. A 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 a pressure to the target focal species or other conservation elements is likely to be significant.

Understanding the pressures and stressors experienced by the focal species and their habitats within the RCIS area is one of the critical steps necessary to define conservation actions to counteract them. This East Bay RCIS identifies 10 general categories of pressures on focal species, their habitat, and other natural resources in the RCIS area. Within these 10 categories, 21 of the 22 pressures identified in the SWAP are addressed. The 10 categories include:

- Housing and urban areas.
- Livestock, farming, and ranching.
- Climate change and its influence on sea-level rise, drought, and wildfire.
- Non-native species and disease.
- Loss of habitat connectivity (also known as habitat fragmentation).
- Disruption of natural fire disturbance regime.
- Dams and water management/use.
- Mining, quarrying, and renewable energy.
- Air pollutants.
- Tourism and recreation.

One pressure from the SWAP, wood and pulp plantations, was not addressed in the East Bay RCIS because it is not a significant stressor on ecosystems in the strategy area.

Each of these pressures is summarized below and discussed in detail in relation to the focal species and other conservation elements discussed in this chapter with discussion relying heavily on the SWAP (California Department of Fish and Wildlife 2015). While the East Bay RCIS organizes this discussion of pressures and stressors by type of pressure as described in the SWAP, these pressures and stressors interact, often with compounding effects. Some of these interactions are briefly discussed within the context of each type of pressure.

A matrix showing the association between pressures and stressors and each focal species is included in Table 2-10. The focal species and other conservation elements discussed in the following sections below can be referenced in Appendix F, and Section 2.2.8, *Other Conservation Elements*, respectively.

Table 2-10. Pressures and Stressors on Each Focal Species

Pressures and Stressors	Housing and Urban Areas	Livestock and Ranching	Farming	Climate Change	Non-native species and disease	Loss of Habitat Connectivity	Disruption of Natural Fire Disturbance Regime	Dams and Water Management/ Use	Mining, Quarrying, and Renewable Energy	Airborne Pollutants	Tourism and Recreation
Focal Species											
Longhorn Fairy Shrimp	X	X	X	X	X	X	X	X	X	--	X
Vernal Pool Fairy Shrimp	X	X	X	X	X	X	X	X	X	--	X
Vernal Pool Tadpole Shrimp	X	X	X	X	X	X	X	X	X	--	X
Callippe Silverspot Butterfly	X	X	X	X	X	X	X	X	X	X	X
Central Valley Steelhead	X	X	X	X	X	X	X	X	X	--	X
Central California Coast Steelhead	X	X	X	X	X	X	X	X	X	--	X
Sacramento River Winter-run Chinook Salmon	X	X	X	X	X	X	X	X	X	--	X
California Tiger Salamander	X	X	X	X	X	X	X	X	X	X	X
Foothill Yellow-legged Frog	X	X	X	X	X	X	X	X	X	X	X
California Red-legged Frog	X	X	X	X	X	X	X	X	X	X	X
Northern California Legless Lizard	X	X	X	X	X	X	X	--	--	--	--
Alameda Whipsnake	X	X	X	X	X	X	X	X	--	--	--
Giant Garter Snake	X	X	X	X	X	X	X	X	X	--	--
Tricolored Blackbird	X	X	X	X	X	X	X	X	X	--	--
Golden Eagle	X	X	X	X	X	X	X	--	X	--	X
Burrowing Owl	X	X	X	X	X	X	X	X	X	--	--
Swainson's Hawk	X	X	X	X	X	X	X	--	X	--	--
California Black Rail	X	X	X	X	X	X	--	X	--	--	--
San Joaquin Kit Fox	X	X	X	X	X	X	X	X	X	--	--
Mountain Lion	X	X	X	X	X	X	--	--	--	--	--
Pallid Manzanita	X	X	X	X	X	X	X	X	--	X	X
Brittlescale	X	X	X	X	X	X	X	X	--	X	X

Pressures and Stressors	Housing and Urban Areas	Livestock and Ranching	Farming	Climate Change	Non-native species and disease	Loss of Habitat Connectivity	Disruption of Natural Fire Disturbance Regime	Dams and Water Management/ Use	Mining, Quarrying, and Renewable Energy	Airborne Pollutants	Tourism and Recreation
Big Tarplant	X	X	X	X	X	X	X	--	X	X	X
Congdon's Tarplant	X	X	X	X	X	X	X	X	X	X	X
Palmate-bracted Bird's Beak	X	X	X	X	X	X	X	X	--	X	X
Presidio Clarkia	X	X	X	X	X	X	X	--	--	X	X
Livermore Tarplant	X	X	X	X	X	X	X	--	X	X	X
Fragrant Fritillary	X	X	X	X	X	X	X	--	--	X	X
Recurved Larkspur	X	X	X	X	X	X	X	--	--	X	X
San Joaquin Spearscale	X	X	X	X	X	X	X	--	--	X	X
Rock Sanicle	X	X	X	X	X	X	X	--	--	X	X
Brewer's Western Flax	X	X	X	X	X	X	X	--	--	X	X
Loma Prieta Hoita	X	X	X	X	X	X	X	X	--	X	X
Contra Costa Goldfields	X	X	X	X	X	X	X	X	--	X	X
Mason's Lilaeopsis	X	X	X	X	X	X	X	X	--	X	X
Showy Madia	X	X	X	X	X	X	X	--	--	X	X
Most Beautiful Jewelflower	X	X	X	X	X	X	X	--	--	X	X

2.3.1 Housing and Urban Areas

Economic and population growth is a driver of development, leading to an increased demand for housing, commercial development, services, transportation, and other infrastructure, which in turn puts increasing pressure on the state's land, water, and other natural resources. The primary cause of habitat loss and degradation in the RCIS area is the increasing human population and its high demand for a limited supply of land, water, and other natural resources. Natural habitats in the RCIS area have been converted to a variety of land uses, including high-density urban, rural residential, weedy pastureland, dryland farming, irrigated cropland, and orchards and vineyards. Wildlife species differ in their tolerances of each of these land uses, with many unable to adapt to the more intensive land uses. Beyond direct habitat loss, converting land to more intensive land uses create additional stressors, including invasive species, human disturbance, wildfire suppression, and insect control, that further degrade ecosystem health and wildlife viability.

Growth and development, including urban, commercial, and industrial development, can apply major stresses on focal species and habitat within the RCIS area. Housing and urban areas include the following pressures that could impact focal species in the RCIS area. Each are further described below, including how they may affect species and conservation elements (California Department of Fish and Wildlife 2015).

- Land conversion and habitat fragmentation.
- Commercial and industrial areas (including industrial effluents).
- Garbage and solid waste.
- Household sewage and urban wastewater.
- Roads and railroads (also reference wildlife connectivity section).
- Utility and service lines.
- Shipping lanes.

Urban and suburban development, infrastructure projects, the conversion of natural communities and habitats to agricultural uses, and subsequent conversion of agricultural land to development are primary pathways of land conversion in the RCIS area. Urban development has resulted in the loss, degradation, and fragmentation of natural habitats (both terrestrial and aquatic) and agricultural land in the RCIS area. For example, historically, much of the RCIS area consisted of a patchwork of chaparral, savanna, grassland, oak woodlands; intermittent and ephemeral streams drained into wet meadows; dense interior dune scrub and alkali wetland complexes spread toward tidal marsh (San Francisco Estuary Institute 2011). Although substantial portions of the RCIS area remain relatively undeveloped, extensive landscape change has occurred over the past 200 years. Many habitats have been lost or altered, particularly in the more intensively developed lower elevations, such as the loss of much of the rock outcrop, dunes, alkali habitats, and tidal marsh in East Contra Costa County (San Francisco Estuary Institute 2011). With approximately 235,000 acres of the RCIS area developed, urbanization has caused irrevocable loss of historic open space and species habitat in the past two decades.

The baylands natural community has lost the most habitat since the 1800s. Tidal marsh along the San Francisco Bay in the RCIS area is approximately 30% or less of its historic acreage; only 16,346 acres remain in the North Bay, 946 acres in the Central Bay, and 13,561 acres in Suisun Bay. Much of this loss has been due to diking and conversion for agriculture, duck hunting, grazing and other agriculture practices, and urban/suburban development (Callaway et al. 2011).

Beyond direct habitat loss, converting land to more intensive human-related increases the potential for release of commercial and industrial waste and pollutants from point and non-point sources, garbage, and solid waste. With increased population, there is also an increase in garbage and solid waste that can pollute habitats. Runoff from residential and commercial areas, landscaped yards, roads and parking lots, and domesticated animal feces include pollutants and pathogens that can end up in aquatic and terrestrial ecosystems. Discharges from power plants, sewage plants, and other industrial facilities are also high in pollutants and pathogens.

Continued population growth increases the demand for transportation and utility facilities for urban and regional areas. The capacity of existing rail, air, and highway transportation systems will need to be increased to accommodate a growing population in the Bay Area (Caltrans 2016). The California Transportation Plan calls for an increase in intermodal transportation systems, including increased freeway reliability, express and high occupancy vehicle lanes, and increased connectivity between transportation types and across modes of transportation. The majority of these connections will occur along existing transportation corridors and increase mobility between existing modes of transportation including intercity bus and rail (Caltrans 2016).

In addition to terrestrial pressures, California has numerous shipping lanes along its coast connecting ports to the rest of the world. The Port of Oakland is located within the RCIS area and is the fifth busiest port in the U.S., handling 99% of all containerized goods in Northern California. With increased growth and development projected in the San Francisco Bay Area, shipping lanes will become more congested, leading to increased pollutions, and chances of spills and wildlife strikes.

2.3.1.1 Effects on Focal Species and Habitats

All of the focal species are impacted by housing and urban development (Table 2-10). Population growth that leads to increased land conversion for housing, commercial, industrial, and other infrastructure has the potential to affect focal species in the following ways.

- Loss of habitat.
- Fragmentation of habitat and populations, leading to increased vulnerability and disruption of ecosystem functions.
- Exposure to and potential mortality from increased pollution and/or pathogens.
- Mortality or disturbance associated with construction, transportation, power lines, or recreation.
- Changes in species behavior or distribution in response to disturbances such as noise and light.

Direct loss of habitat may be the easiest effect to measure as land cover types that support focal species are converted to other uses. Focal species may lose foraging, breeding, nesting, or migration habitat that support various stages of their life cycle, resulting in a decline in population sizes. For example, California tiger salamander, California red-legged frog, and burrowing owl populations have experienced dramatic declines in the RCIS area due to widespread habitat loss and habitat fragmentation, resulting the conversion of grassland habitat to the urban uses described above

(Gervais et al. 2008). In addition, burrowing owl has also lost suitable agricultural lands to development. Equally important for this species is the loss of burrowing habitat as fossorial rodents, such as ground squirrels, near developing areas where rodent populations are controlled.

Growth and development fragment habitats into small patches, isolating individuals with limited dispersal ability, and altering the remaining fragments. These smaller fragments often become dominated by species more tolerant of habitat disturbance, while less-tolerant species decline. Populations of less-mobile species often decline in smaller habitat patches due to reduced habitat quality, extreme weather events, or normal population fluctuations. Natural recovery following such declines is difficult for mobility-limited species. Such fragmentation also disrupts or alters important ecosystem functions, such as predator-prey relationships, competitive interactions, seed dispersal, plant pollination, and nutrient cycling (Bennett 1999, Environmental Law Institute 2003, as cited in the California Department of Fish and Wildlife 2015). Habitat fragmentation and degradation also has additional consequences, including the introduction and spread of invasive species, noise, and light pollution. The spread of dwellings into the wildlands interface has resulted in long-term fire suppression, resulting in a build-up of fuels and increased vulnerability of human-caused catastrophic fire (Syphard et al. 2019), with fire frequency increasing at low- to medium- population and housing density (Syphard et al. 2007, Mann et al. 2016) (Section 2.3.7*, Disruption of Natural Fire Disturbance Regime*).

Increased pollutants and pathogens resulting from increased commercialization, industrialization, and population, can directly impact species and their habitats. Garbage and solid waste from housing and urban development may directly affect wildlife by entangling or poisoning individuals. Nutrients that enter the bay from urban or agricultural runoff can cause harmful algal blooms and may be a factor in pelagic fish declines. Mercury, PCBs, other chemicals can directly kill aquatic species, particularly focal amphibians that are especially sensitive to pollutants, or impact reproduction or resiliency of these species to withstand other stressors. Additionally, ships can introduce pollutants (e.g., toxic chemicals, oil, garbage, and sewage) through accidental spills and operational discharges and can also introduce pathogens and invasive species to California marine ecosystems (California Department of Fish and Wildlife 2015). Urban sprawl into the urban-wildlife interface can bring pathogens such as *Phytophthora* species, through nursery container plants and other means, which can spread to native plants. See Section 2.3.5.2, *Disease* for further discussion about *Phytophthora* species. Air borne pollutants are further described in Section 2.3.10, *Air Pollutants*. Roads and traffic can result in direct mortality of species. According to Caltrans and California Highway Patrol statistics, there are about 1,000 reported accidents each year on state highways involving deer, other wildlife, and livestock (Shilling 2015, as cited in California Department of Fish and Wildlife 2015). Ships can also strike marine mammals (California Department of Fish and Wildlife 2015). Power lines present a threat to eagles, with electrocution on power poles recognized as a leading cause of death for the golden eagle (Mojica et al. 2018). Direct mortality can also occur during construction of new development within habitat areas that support the species. Species, particularly plants such as Presidio clarkia, in natural areas that are open to recreation are threatened by trampling that may compact soils or erode occupied sites by removing vegetation (U.S. Fish and Wildlife Service 1998).

Wildlife may alter their behavior, such as their feeding, breeding, and migration strategies, in response to increased noise, light, vibration, and movement. Increased urbanization, including increased roadways and construction, increase the effects. In marine environments, ships can cause noise and wave disturbances as they travel at rapid speeds through the water.

2.3.1.2 Effects on Other Conservation Elements

All of the other conservation elements in the RCIS area could be affected by land conversion, and the effects are similar to those described above for focal species (e.g., loss of habitat, fragmentation, exposure to pollution, direct mortality, and changes in behavior). These effects are described for impacts to working lands, habitats (i.e., unique land cover types, baylands, and soils), connectivity, and bat habitat.

Urban development can convert farmland and rangeland to urban uses, resulting in loss of habitat for species that use working lands and also livelihoods and cultures associated with working lands. Subdividing and developing parcels may result in the remaining undeveloped lands being too fragmented to be economically viable for larger scale operations, such rangelands for cattle. Small and fragmented working lands also provide less habitat value for the species supported by these habitats, as described above.

When new development converts natural and low-intensity agricultural habitats to developed or higher-intensity agricultural land, unique land cover types and serpentine soils may be lost. Additionally, a conversion to greater amounts of impervious surfaces (e.g., concrete or asphalt), can increase polluted runoff into streams, estuaries, and other waters. In marine environments, increased ship traffic in shallower areas near ports can affect sensitive habitats including eelgrass, salt marsh, coastal wetlands, and mudflats. Particulates, pollutants, and pathogens deposited from the air can degrade aquatic and terrestrial ecosystems and marine habitats.

Habitat conversion may further isolate areas of remaining natural habitat, increasing the edge (i.e., boundary) and the distance between habitats, limiting habitat connectivity and wildlife linkages. For example, habitat fragmentation may disconnect streams and their tributaries, change hydrologic regimes, and limit or obstruct natural interactions between wetland systems. Fragmentation and associated land management activities like fire suppression modify the natural disturbance regime necessary to sustain the unique land cover types in the RCIS area.

Urban development adjacent to the baylands has converted extensive amounts of upland habitats into hardscapes. This not only fragments tidal zones and low lying areas from habitats further upslope; development and hardscapes adjacent to tidal areas also limit the ability of marshes to migrate inland in response to sea-level rise (Section 2.3.4.1, *Sea-Level Rise*).

Impacts to bat habitat would be similar to the effects described for focal species above.

2.3.2 Livestock and Ranching

Ranching and livestock grazing, mostly with beef cattle, is a widespread land use in the RCIS area (Section 2.2.8.2). Working lands, which include livestock grazing on rangelands, are identified as an important conservation element, and their value for conservation is described in Section 2.2.8.2. Livestock and ranching include the following pressure that could impact focal species in the RCIS area (California Department of Fish and Wildlife 2015).

- Water quality and hydrology.
- Riparian habitats.

2.3.2.1 Effects on Focal Species and Habitats

Livestock grazing is an essential conservation tool in California rangelands. Well-managed livestock grazing can benefit sensitive plant and animal species, particularly by controlling invasive annual grasses and forbs as well as fire fuels in grasslands and other natural communities where these have become established. Well-managed livestock grazing is essential to conserving and managing focal species' habitats, as well as diversity and cover of native forbs and grasses, though livestock grazing can also result in an increase in the cover of exotic grasses and forbs (Hayes and Holl 2003, Marty 2005, Stahlheber and D'Antonio 2013, Bartolome et al. 2014, Larson et al. 2015). Properly managed grazing is also a vital tool for maintaining hydrological conditions and native plant and animal diversity in vernal pools. Conversely, a lack, or cessation of grazing can result in build-up of thatch and a reduction in native plant species diversity (Marty 2005, Pyke and Marty 2005). High amounts of cattle waste (i.e., feces and urine), however, in vernal pool mesocosms can cause a reduction in plant cover and species richness through increase nutrient loading (Croel and Kneitel 2011).

When livestock grazing is poorly managed, livestock grazing can affect water quality and aquatic focal species through erosion and sediment transport, nutrient loads, and pathogens from urine and feces dropped by livestock, flows in streams, channel morphology, riparian zone soils, and in-stream and streambank vegetation (e.g., Belsky et al. 1999, George et al. 2004, Hubbard et al. 2004). Even with moderate grazing, if the cattle are allowed to remain in the riparian area and move along the stream, they can have a serious impact on native fish, amphibians, and aquatic macroinvertebrates and can contribute to erosion, affecting groundwater levels and surface vegetation. Livestock can consume and trample riparian plants, which decreases shade and can increase water temperatures, reducing habitat for focal fish species and other native species that depend on cool water. Some of these impacts, such as effects to riparian vegetation can be reduced or eliminated by separating the riparian zone as a "special use riparian pasture", timing grazing to the least vulnerable seasons (Kauffman and Krueger 1984) and providing off-channel water sources (California Department of Fish and Wildlife 2015). The alternative of exclusionary fencing is usually not necessary, except in high-impact or sensitive areas, and can cause other problems, such as pest plant infestations and cattle trailing in worse locations (L. Ford, personal communication). However, in arid areas where catastrophic flow from exceptional winter storms is necessary to establish riparian seedlings after many years or decades of drier years, grazing can severely diminish or even eliminate the next generation of riparian trees by destroying the saplings before they can grow above the cattle. Elimination of grazing can have detrimental effects, such as excess build-up of litter, an increase in fuel load and fire risk, and an increase in invasive plant species. These issues can be reduced with intermittent or periodic grazing of riparian areas and must be balanced depending on whether sensitive resources are present (Miller et al. 2018).

2.3.2.2 Effects on Other Conservation Elements

Livestock grazing provides conservation benefits for unique land cover types similar to those discussed in Section 2.3.2.1, *Effects on Focal Species and Habitats*. Livestock grazing can help maintain the diversity of endemic and other native plants found in serpentine soils. While serpentine soils provide harsh growing conditions for non-native species not adapted to serpentine conditions, nitrogen deposition sourced from air pollution greatly increases the success of non-native plant invasions into serpentine areas (Weiss 1999; Section 2.3.10). Livestock grazing reduces the effects of plant invasions, helping to alleviate the effects of nitrogen deposition on endemic serpentine plant species (Weiss 1999).

Populations of ground squirrels tend to increase in grazed areas (ground squirrels are another conservation element in this RCIS), which in turn creates upland burrowing habitat for California tiger salamander and California red-legged frog (Ford et al. 2013, Bartolome et al. 2014).

Intensive livestock grazing can affect riparian woodland structure with consequent effects on composition and abundance of resident bird communities (e.g., Tewksbury et al. 2002).

Soils can be affected as livestock trample stream channels, causing stream banks to collapse. Some of these impacts can be reduced or eliminated by exclusionary fencing in high-impact or sensitive areas or other management practices such as providing alternative sources of water away from sensitive habitats (California Department of Fish and Wildlife 2015). Negative effects of excluding grazing can be alleviated with periodic grazing, as described above (Miller et al. 2018).

2.3.3 Farming

As described in the SWAP (California Department of Fish and Wildlife 2015), cultivated agriculture is an essential component of California's economy. Although cultivated agricultural lands no longer support native vegetation, it can provide valuable habitat for native species (e.g., ricelands provide habitat for waterfowl and giant garter snake, field crops such as alfalfa provide foraging habitat for Swainson's hawk and tricolored blackbirds). Conversions of native habitat to cultivated agriculture across the state have been significant. Conversion of natural lands, including rangelands used for grazing, into intensively managed cultivated agricultural uses such as orchards, vineyards, and row crops eliminates and fragments natural habitats (e.g., Dudley and Alexander 2017). Conversion of cultivated agricultural types (e.g., alfalfa, row crops) to more intensive uses (e.g., orchards and vineyards) further reduces and eliminates the remaining or replacement habitat values provided by agricultural lands. Agricultural water diversions can alter hydrologic regimes while sediment and nutrient laden runoff can degrade aquatic habitats. Specifically, deep ripping to create the necessary subsurface conditions for orchards and vineyards can drain wetlands. Similar soil preparation activities can degrade essential upland habitats for species such as the California tiger salamander. Further, the use of chemical fertilizers, herbicides, and rodenticides may have unintended negative consequences that adversely affect focal species.

2.3.3.1 Effects on Focal Species and Habitats

All of the focal species are impacted by farming (Table 2-10). Agricultural practices can have a range of direct and indirect consequences to focal species and native biodiversity, positive or negative, based on timing, duration, and intensity. Different cropping systems (e.g., organic versus conventional farming, or highly diversified fields versus large monocultures) can have different levels of impacts to natural ecosystems across the landscape. Agricultural land uses can result in the following effects, positive and negative, on focal species and their habitat.

- Air and water pollution of habitat.
- Sedimentation and water quality impacts.
- Habitat loss and fragmentation associated with land conversion.
- Mortality from harvesting and maintenance activities.
- Increase in available forage for some species.
- Control of invasive species and maintenance of open understory habitats.

Herbicides and pesticides can have toxic effects on aquatic plants and animals (e.g., California tiger salamander, foothill yellow-legged frog [California Department of Fish and Wildlife 2019], and focal fish species), and chemical contaminants can alter the ecological composition and chemistry of aquatic systems. For example, fertilizer runoff can increase growth of aquatic plants and algae, resulting in lowered oxygen levels when excessive plant matter decomposes. Sedimentation in aquatic habitats can cause increased temperature, decreased visibility, and reduced oxygen when the sediment contains additional nutrients from fertilizers, all of which can negatively affect aquatic target species Application of rodenticides affects important keystone species such as ground squirrels, as well as predators that consume affected rodents. Activities that remove ground squirrels also negatively affect species that depend on the burrows they create, such as burrowing owl and California tiger salamander (Section 2.2.8.4, *Bat Habitat*).

Historic conversion of natural communities to cultivated agriculture is a leading cause of habitat loss and fragmentation in California (California Department of Fish and Wildlife 2015). Land conversion from one type of agriculture to another, including conversion of field and row crops or grazing lands to orchards or vineyards, can also affect focal species and native wildlife that use the existing crop. For example, field crops can provide foraging habitat for raptors, such as Swainson's hawk, and stock ponds can provide foraging and aquatic habitat for California red-legged frog, California tiger salamander, and tricolored blackbird. Conversion of field crops to orchards and vineyards dramatically reduces the quality of foraging habitat for Swainson's hawk and tricolored blackbird (California Department of Fish and Wildlife 2015). Farming practices can also affect wildlife movement, particularly where crops such as vineyards, are fenced to prevent access by wildlife.

2.3.3.2 Effects on Other Conservation Elements

Working lands, which include farming, are identified as an important conservation element, and their value for conservation is described in Section 2.2.8.2. The conversion of natural habitat to agricultural lands can affect unique land cover types and soils. Unique land cover types can be lost and fragmented by conversion to cultivated agriculture. Intensive.

Agricultural runoff with fertilizers and pesticides can pollute aquatic habitat. Rain and irrigation runoff carry silt and agricultural chemicals, degrading surface water quality and reaching groundwater. Significant amounts of nitrogen fertilizers applied for agricultural use have been shown to contaminate the underlying groundwater in agricultural areas throughout the state (Viers et al. 2012). Herbicides and pesticides can have toxic effects on focal species if they are broad range. Nutrients from fertilizer in agricultural runoff increase plant and algal growth in the waterbodies that they drain to. When the plants and algae die, the process of their decomposition can drastically reduce the levels of dissolved oxygen in the system, which would negatively impact aquatic focal species. Elevated nutrient levels have been shown to favor parasitic flat worms that cause deformities in many frog species, indicating that increases in nutrients would also have negative effects on amphibians. California tiger salamanders have been shown to be less competitive in areas with pesticide drift, where hybrid tiger salamanders are favored over the native California tiger salamander (Ryan et al. 2012). Silt and sediment degrade aquatic systems by increasing turbidity and temperature and shading out aquatic vegetation. They also can smother stream-bottom sediments that are habitats for the invertebrates that form the base of the food chain, and important spawning habitat for salmonids and other fish. Sediment in runoff is especially severe in areas with steep slopes, erodible soils, and where high soil disturbance crops such as strawberries, artichokes, and vineyards are located.

Furthermore, recently emerging farm practices documented in Salinas Valley farmlands meant to promote food safety is influencing land-use practices that may be causing loss and degradation of riparian habitats (Gennet et al. 2013). Practices include reducing wildlife and habitat to reduce perceived risk of crop exposure to food-borne pathogens.

2.3.4 Climate Change

Climate change is a major challenge to the conservation of natural resources in California and the RCIS area.[42] Climate models predict that the Californian Mediterranean climate will continue, with various models predicting slightly wetter winters, while others project slightly drier winters with a 10 to 20% total decrease in annual precipitation. In the RCIS area, climate models predict warmer average annual temperatures, with slightly more precipitation. By 2070, minimum and maximum annual average temperatures (projected annual average from 2040-2069) are expected to increase 3.6° and 3.8°F, respectively, relative to historic (1950-2000) minimum and maximum annual average temperatures. Over the same time periods, annual precipitation is projected to increase by 1.3 – 1.6 inches.[43]

Changes in temperature and precipitation can affect the vegetative composition of a region. Climatic water deficit (CWD) quantifies the evaporative demand that exceeds available soil moisture. CWD is an estimate of water stress on soils and plants, which may contribute to regulating vegetation in the San Francisco Bay Area (Cornwell 2010, as cited by California Landscape Conservation Partnership, Climate Commons 2018). In the RCIS area, under a range of scenarios, CWD is expected to increase 3.4 to 14.5% by 2070 (averaged from 2040-2069) relative to the 1981-2010 climatic period.[44]

Climatic changes are already occurring in the state and have resulted in observed changes in natural systems. For example, small mammal distributions were found to shift upwards along an elevational gradient in Yosemite National Park, consistent with an increase in minimum changes in temperature over the last century (Moritz et al. 2008). Projected changes in climate, including extreme events such as fire, drought, flood, extreme temperatures, and storm events, are likely to continue to have significant impacts on habitats, species, and human communities in the near future. Sea-level rise, drought, and wildfire are discussed below in the context of climate change.

2.3.4.1 Sea-Level Rise

The San Francisco Bay, which includes more than 1,000 miles of shoreline, is vulnerable to a range of natural hazards, including storms, extreme high tides, and rising sea levels resulting from global climate change. Sea level along the California coast has increased by about 15 centimeters (6 inches) over the last 100 years (California Energy Commission 2006), while the longest-running tide gauge

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[42] A number of websites provide valuable tools and resources to project change in climatic variables, assess impacts, and plan for change, including: http://www.adaptingtorisingtides.org/ , https://cal-adapt.org/ , http://data.pointblue.org/apps/ocof/cms/

https://www.wildlife.ca.gov/Conservation/Climate-Science/Resources

[43] Change in annual average minimum and maximum temperatures and precipitation were projected using climate tools available at Cal-Adapt: https://cal-adapt.org/tools/. Annual averages are the minimum and maximum for Contra Costa and Alameda counties (values were very similar) projected under the RCP 4.5 scenario, where emissions peak around 2040, then decline.

[44] The range of percent increase in CWD represents the minimum and maximum percent change under a combination of two climate scenarios: warm, wet climate and hot, dry climate; and two land-use – land cover change scenarios: wealth and technology, and populations. For more information about these scenarios, see: http://climate.calcommons.org/aux/rangeland/help.html

in the nation, located in San Francisco Bay, indicates 2.01 millimeters (0.08 inches) of rise per year, or approximately 20.1 centimeters (0.66 feet) over the last 100 years (Largier et al. 2010). According to the National Research Council's 2012 sea-level rise projections for north-central California, 12 to 61 centimeters (4.7 to 24.0 inches) of sea-level rise is expected by 2050 and 42 to 167 centimeters (16.5 to 65.8 inches) is expected by 2100 (Hutto et al. 2015). A conservative estimate for the RCIS area is 12 centimeters (4.7 inches) by 2050 and 160 centimeters (63.0 inches) by 2100 (National Oceanic and Atmospheric Administration 2017).

With projected sea-level rise in the RCIS area, approximately 50,472 acres of land in Alameda and Contra Costa Counties will be vulnerable to flooding, compared to approximately 15,556 acres with no sea-level rise by 2100 (Cal-adapt 2017). Most of the RCIS area along the San Francisco Bay has a high level of vulnerability to sea-level rise and flooding compared to other parts of the Bay Area. The most vulnerable areas within the RCIS area are adjacent to the San Francisco Bay, particularly the City of Martinez and the area between Hayward and the southern boundary of the RCIS area (National Oceanic and Atmospheric Administration 2017, Cal-adapt 2017).

Sea-level rise will have the most significant effect on tidal vegetation and other land cover types in the baylands natural community in the RCIS area. Marshes around San Francisco Bay are particularly vulnerable to the anticipated increase in sea-level rise. Coupled with limited natural sedimentation, marsh and mudflats may be unable to accrete quickly enough to keep pace with sea level rise, resulting in habitat conversion from marsh to mudflat and mudflat to open water. Areas for marshes to migrate inland are limited by adjacent development across much of the RCIS area. Ultimately, marshes may be reduced to narrow, fragmented habitat patches along the shoreline. The marshes currently serve an important ecosystem function of attenuating wave action and providing resilience to flooding; loss of the marsh habitat could exacerbate flooding. With remaining patches limited to fragments adjacent to developed areas, deleterious edge effects could be amplified (e.g., spread of invasive species and predators), and populations of marsh-supported species could become isolated and disconnected.

Sea-level rise and changes in timing and volume of flow are projected to increase salinity intrusion into freshwater aquifers and the RCIS area. Estuarine inflows are projected to increase an average of about 20% from October through February and decrease by about 20% from March through September. Higher winter inflows could result in higher watershed runoff to estuaries in winter, but reduced inflows in the spring and summer have the largest projected impact on estuarine waters, reducing the amount of watershed runoff by a maximum of 8% by late June (California Department of Fish and Wildlife 2015).

2.3.4.2 Drought

Seasonal dry periods are a natural part of a Mediterranean climate system to which species and natural communities have adapted. However, a prolonged drought could cause serious impacts on focal species in the RCIS area. Climate models predict that extreme climate events (e.g., really wet years or multi-year droughts) will increase in California and the RCIS area,[45] which can result in secondary impacts including wildfires and insect-pest outbreaks.

Whether drought causes a species to decline toward extinction depends on a number of factors, including how widely distributed the species is relative to extreme drought conditions, the degree to which microhabitats remain available to serve as refugia, and the ability for animals to relocate to

[45] https://cal-adapt.org/tools/extended-drought/

less impacted areas. With adequate behavioral or genetic diversity and enough time, some animals can adapt to or evolve with changing conditions.

2.3.4.3 Wildfire

Climate change is expected to contribute to significant changes in fire regimes, including shifts in the timing, frequency, and intensity of wildfire events. Fire is a natural component of many ecosystems and natural community types, including grasslands, chaparral/northern coastal scrub, oak woodlands, and conifer woodlands. Under controlled conditions, prescribed fire is a valuable tool for managing fuel load, invasive species, and vegetation community structure. For each of these natural communities, fire frequency and intensity influence community regeneration, composition, and extent. Although wildfire can provide beneficial ecosystem services, more frequent, intense fires could have grave effects on human development, particularly at the urban-wildlands interface. Wildfire can also negatively affect vegetative community composition by favoring early successional species. Frequent, intense fires could cause type conversion, increasing the extent of certain natural communities, such as grassland, at the expense of others, such as chaparral or oak woodlands.

CAL FIRE has rated the fire probability in undeveloped portions of the RCIS area as moderate to high, with the following cities rated as very high fire hazard severity zones: Berkeley, Oakland, Piedmont, Pleasanton, San Leandro, Danville, El Cerrito, Lafayette, Martinez, Orinda, Pinole, and Richmond (CalFire Fire Resource and Assessment Program 2019). Fires in the RCIS area often recur in the same general areas under similar environmental conditions. Recent fire history (1900 to 2009) indicates that most fires have occurred in the eastern portion of the RCIS area, in the East Bay Hills and near Martinez. Within a 2-mile radius of the Caldecott Tunnel, 15 major fires have burned since the first was documented in 1923.

The RCIS area has become increasingly more prone to fires over time, with increased densities of invasive plant species and expansion of development into wildland spaces. The RCIS area's worst fire weather is created by the seasonal Diablo winds – strong, hot, and dry winds coming from the east. Between 1923 and 1998, 11 Diablo wind fires have burned (East Bay Regional Park District 2017). The most devastating fire in the RCIS area was the 1991 Oakland-Berkeley Hills Tunnel Fire that burned 1,600 acres (East Bay Regional Park District 2017).

Wildfire frequency, size, and intensity are expected to increase throughout the RCIS area. Wildfire risk may increase four to six times the current conditions (California Department of Fish and Wildlife 2015). The number of escaped fires is projected to increase by 51%, while total area burned by contained fires is projected to increase 41% despite enhancement of fire suppression efforts (California Department of Fish and Wildlife 2015).

2.3.4.4 Non-Native Species and Disease

Climate change can cause a change in the distribution and abundance of non-native species within a region, with novel species invading new regions or populations of resident non-native species increasing (Clark et al. 2003, Hijmans and Graham 2006, Kurz et al. 2008, Willis et al. 2010, Smith et al. 2012). Climate change may allow non-native species to persist in areas where they previously weren't able to due to climatic tolerances and physiological constraints (Zerebecki and Sorte 2011). Climate change may allow niches to be invaded by non-native species as populations of native species shift geographically or decline in numbers (McNeely 2000).

Climate change may also affect the spread of diseases and pathogens such as *Phytophthora ramorum*, which causes Sudden Oak Death, or may make ecosystems more susceptible to invasion (Garret et al. 2009, Pautasso et al. 2012). See Sections 2.3.5.3 and 2.3.5.4 for discussions on the *Effects on Focal Species and Habitats* and *Effects on Other Conservation Elements*, respectively.

2.3.4.5 Effects on Focal Species and Habitat

All focal species are expected to be affected by climate change (Table 2-10). Climate change may alter habitats in the RCIS area as temperatures and precipitation levels change, which could lead to the reduction in population sizes or extirpation of focal species that rely on those habitats, or require focal species to migrate to other areas. Many of the focal species are of special conservation concern because of their risk of extinction; some of these species are particularly vulnerable to climate change (California Department of Fish and Wildlife 2015). Some specific effects of climate change include the following.

- Extirpation or reduced population size due to habitat loss and fragmentation.
- Habitat loss, fragmentation, and decrease of habitat quality associated with land conversion due to change in precipitation and temperature regimes and increase in sea levels.
- Exposure to extreme weather.
- Change in species behavior or distribution in response to shifts in seasonal timing.
- Change of distribution of species in response to an increase in disturbance events and/or intensity of disturbance events such as wildfire or drought.
- Increase in the distribution and abundance of invasive non-native species and pathogens.
- Increase in the distribution of disturbance-dependent land cover types.

Species that are particularly vulnerable often occur within a limited geographic range, exist in small populations, have specialized habitat requirements, and have low dispersal ability, making it difficult for them to migrate to more suitable areas as habitats shift with climate change. For example, wildlife dependent on tidal habitats in the baylands will likely lose habitat to sea-level rise, as migration of tidal habitats is restricted by existing development.

Extended drought could have significant effects on the focal species and their habitats in the RCIS area, affecting habitat features such as vegetation, soil availability (for plants), and food resources, among other factors (PRBO Conservation Science 2011, Thorne et al. 2016, National Oceanic and Atmospheric Administration 2017). Climatic changes may be outside the range of historic variability or outside the range of suitable conditions for plants and animals, limiting their available habitat and resources through changes in temperature, precipitation, and disturbance events such as wildfire and drought. In 2016, a climate change vulnerability analysis was conducted on California's terrestrial vegetation communities to evaluate the vulnerability of vegetation communities to environmental conditions projected by four different climate change models. The analysis identified areas where existing vegetation will be increasingly stressed, under the influences of climate change (Thorne et al 2016). This analysis was adapted to evaluate the exposure of California Wildlife Habitat Relationship vegetation types (Mayer and Laudenslayer 1998) to future climate change. Figure 2-25 shows vegetation exposure for one of four climate change scenarios (MIROC ESM , mid-century, representing a hot and dry climate scenario) evaluated by Thorne et al. Areas with climate exposure values less than 80% are considered by Thorne et al. to be more resilient to the effects of climate change projected under the modeled climate change scenario, such that a specific vegetation type or habitat is projected to have a higher likelihood of persisting, despite environmental conditions in a changing climate.

Some of California's native species are more vulnerable to extended or frequent severe drought and may be at risk of extirpation. Small population size, short life expectancy relative to drought duration, and inability to cope with extreme events are reasons some taxa, including several of the East Bay RCIS focal species, are more vulnerable than others. Aquatic species are particularly at risk (e.g., California tiger salamander or Central Valley steelhead) of being extirpated by loss of aquatic breeding habitat during extended periods of drought. Under most climate change scenarios, the RCIS area will get hotter and drier, meaning that the ponds that are functioning well for species today may not function in the same way tomorrow. Shorter ponding durations may reduce reproductive success of species such as California tiger salamander and California red-legged frog if ponding durations become too short to successfully complete reproduction and emergence from aquatic habitats. Many adult amphibians (e.g., California tiger salamander and California red-legged frog) can survive during periods of drought, but most require water for the egg and larval/tadpole life stages. Other more terrestrial species are only able to successfully breed when food, such as vegetation or prey species that feed on vegetation, is available for the young (California Department of Fish and Wildlife 2015). Severe, extended absence of precipitation can lead to population declines through lack of development and survival of young. By identifying species most at risk from the effects of climate change, conservation and management efforts can be targeted to reduce and mitigate these impacts, such as by protecting and restoring existing habitat and linkages between habitats and climate change refuges.

The State Wildlife Action Plan (California Department of Fish and Wildlife 2015) identifies seven of the focal wildlife species as climate vulnerable: both steelhead runs (Central California Coast steelhead and Central Valley steelhead), Sacramento River winter-run Chinook salmon, California tiger salamander, foothill yellow-legged frog, Northern California legless lizard, black rail and Swainson's hawk (Table 2-10). Both distinct population segments of steelhead and Sacramento River winter-run Chinook salmon have been identified as extremely likely to become extinct in the wild before 2100 due to a decrease in cool, flowing river water and an increase in exotic fish that compete for resources or are predators of steelhead and Chinook (Moyle et al. 2012). Amphibians are particularly vulnerable to climate change due to their reliance on aquatic and/or moist habitats. California tiger salamander and California red-legged frog are two of several species with an intermediate to high risk of extinction due to climate change because of significant losses in the suitability of occupied and potential habitat by 2050. Foothill yellow-legged frog and Northern California legless lizard are also vulnerable to effects from climate change, though to a lesser extent, likely due to their dispersal ability and distribution of available future habitat (Wright et al. 2013).

Terrestrial species will also be affected by climate change. Gardali et al. (2012) identify Swainson's hawk as a species with moderate vulnerability to climate change because of its use of specific habitats and long-distance migratory patterns (i.e., the timing of their migration needs to align with suitable climate conditions). California black rail is identified as a species with high vulnerability to climate change because of its high degree of habitat specialization, lack of ability to disperse, likelihood to be exposed to extreme weather (e.g., drought, high temperatures, storms outside of the normal season), and anticipated decreases in habitat suitability (Gardali et al. 2012).

CDFW has also identified the following focal plant species as highly (i.e., significant decline) or moderately (i.e., declining) vulnerable to climate change by 2050: fragrant fritillary, Brewer's western flax, brittlescale, recurved larkspur, San Joaquin spearscale, most beautiful jewelflower, Mount Diablo fairy lantern, and Loma Prieta hoita.[46] Climate vulnerability in plant species was found to be significantly related to anthropogenic barriers to dispersal and narrow temperature tolerance (Anacker et al. 2012).

Focal species in the RCIS area could also be impacted by temporal changes that cause a mismatch in events that need to occur together or in a specified order. The timing of seasonal events, such as migration, flowering, and egg laying, may shift earlier or later. Such shifts may affect the timing and synchrony of events that must occur together, such as butterfly emergence and nectar availability. For example, callippe silverspot butterfly could be affected if butterfly emergence and nectar availability do not coincide due to shifts that occur as a response to climate changes. Other focal species could be more vulnerable to disease or predation if shifts occur in the timing of breeding or migration.

Range and distribution of focal species may shift (Walther et al. 2002). Historically, some focal species could shift their ranges across the landscape. Today, urban and rural development prevents the movement of many species across the landscape. Species or natural communities that occur only at high elevation (e.g., ponderosa pine woodland in the RCIS area) or within narrow environmental gradients (e.g., Mount Diablo fairy lantern) are particularly vulnerable to changing climate because they likely have nowhere to move if their habitat becomes less suitable (Thorne 2006).

Increases in disturbance events, and/or the intensity of disturbance events, such as fire or drought, may also occur. This could increase the distribution of disturbance-dependent land cover types, such as California annual grassland, in the RCIS area (Rogers and Westfall 2007). This conversion of habitat could be a net benefit to species that use the disturbance-dependent land cover type or could negatively affect species that are supported by the habitat type that is reduced. An increase in the frequency and intensity of disturbance could increase the likelihood that these events will harm or kill individual focal species, many of which are already quite rare. Events that occur with unpredictable or random frequency (stochastic events) can have an inordinately negative effect on the focal species.

Focal species-specific climate change-related stressors, vulnerabilities, and descriptions of how the RCIS provides opportunities for adaptation to climate change are described for each species or group of species in sections titled *Opportunities for Adaptation to Climate Change* in Section 3.8, *Conservation Strategy for Focal Species*.

2.3.4.6 Effects on Other Conservation Elements

Climate change will also affect all other conservation elements in some ways but will most affect serpentine soils and unique land cover types, including baylands, in the RCIS area. The serpentine soils and unique land cover types in the RCIS area are particularly at risk from climate change because of their narrow distribution in the RCIS area. Development has put increased pressure on the ranges of these land cover types, and this pressure will only increase in the context of climate change. As the climate changes, the unique land cover types may shift in range and distribution in response. Given that serpentine land cover types are restricted to areas containing serpentine soils, conservation of large patches of serpentine habitat is important to provide those areas with climate resiliency.

In addition, some unique land cover types may be severely reduced in range and distribution or even extirpated with prolonged, extreme climate-driven events, such as a severe drought or

[46] Several of the focal plant species were not included in this evaluation.

increased fire frequency. In a climate change vulnerability assessment of California's terrestrial vegetation (Thorne et al. 2016), coastal salt marsh and freshwater marsh are unique land cover types in the RCIS area with high vulnerability to climate change. In addition, several other unique land cover types such as California forest and woodland, coastal scrub, and California rock outcrop vegetation, are identified as have a high to moderate level of climate vulnerability.

Hotter, drier summers, combined with lower river flows, will further stress water resources available to people, wildlife, and vegetation. This is likely to translate into less water for wildlife, especially fish and wetland species. Lower river flows will allow saltwater intrusion into the rivers and the increasing salinity and disrupting the complex food web of aquatic systems. As freshwater aquatic systems in the RCIS area become stressed from sea-level rise, the ecological functioning of upland habitats is also likely to be disrupted as individual species respond differently to climate change.

2.3.5 Non-native Species and Disease

This section provides background on each pressure and then summarizes how the consequent stressor impacts the focal species and other conservation elements. This section addresses the following.

- Non-native invasive plants.
- Non-native animals.
- Hybridization.
- Nuisance native animal species.
- Plant pathogens focused on *Phytophthora* spp*.*
- Amphibian and reptile diseases.

2.3.5.1 Non-native Species

Non-native invasive plants can be found in many different habitats within the RCIS area. The California Invasive Plant Council (Cal-IPC) evaluates species' impacts to wildland habitats and provides ecological impact ratings. They maintain a watch list of species that are anticipated to become a problem for natural habitats.[47] Not all non-native plants are problematic for habitats but those that are considered ecologically-damaging are given a rating showing their ability to disrupt and permanently alter the habitat they are invading.

Non-native fish and wildlife species are also extensive in California. Many non-native fish species have become established in California, dominating many of the rivers and streams in this province. Examples of non-native terrestrial animal species include European starling (*Sturnus vulgaris*), domestic dog (*Canis lupus familiaris*) and cat (*Felis catus*), introduced red fox (*Vulpes vulpes*), Norway rat (*Rattus norvegicus*), and feral pig (*Sus scrofa*). Non-native fish species include, but are not limited to, striped bass (*Morone saxatilis*), white catfish (*Ameiurus catus*), channel catfish (*Ictalurus punctatus*), American shad (*Alosa sapidissima*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), and bluegill (*Lepomis macrochirus*). Many fish were

[47] Cal-IPC's website can be used to obtain the most current data on non-native invasive plants with the RCIS area: www.cal-ipc.org

historically introduced (via stocking) by federal and state resource agencies to provide sport fishing or forage fish to feed sport fish.

Non-native species may also hybridize with closely related native species, diluting the native composition of genes in populations. In the RCIS area, non-native barred tiger salamanders hybridize with native California tiger salamanders, reducing the distribution of fully native California tiger salamanders. Barred tiger salamanders (*Ambystoma tigrinum mavortium*) were introduced to California over 50 years ago. The number and range of these non-native salamanders and their hybrid progeny have expanded since introduction, likely from introduction sites in the Salinas Valley (Fitzpatrick and Shaffer 2007).

2.3.5.2 Disease

Disease may be broadly defined as a physiological disturbance that compromises health. If applied on a wildlife population or ecosystem scale, it can be defined as a physiological disturbance resulting in disruption of demographic functions that compromise population or ecological health. If affected substantially by disease, wildlife and plant populations can become unhealthy, losing resilience and self-sustainability (California Department of Fish and Wildlife2015). Several diseases are known to be problematic for some of the focal species in the RCIS area, which include diseases caused by *Phytophthora* species (known to kill pallid manzanita and could affect other covered plant species), chytrid fungus (could affect California red-legged frog, California tiger salamander, and foothill yellow-legged frog), and possibly ranavirus (could affect California tiger salamander). These diseases are discussed in more detail below.

Phytophthora species are microscopic water molds that live in soil and water (U.S. Fish and Wildlife Service 2015, Swiecki and Bernhardt 2018). Diseases caused by *Phytophthora* species include root rots, stem cankers, and blights of fruit and leaves. *Phytophthora ramorum*, which causes sudden oak death, was inadvertently introduced to California, likely through nursery stock was first recognized in the mid-1990s. Sudden oak death kills some oak species, primarily coast live oak (*Quercus agrifolia*) and tan oak (*Notholithocarpus densiflorus*), among other native species, as well as many common horticultural plants. Sudden oak death has caused widespread morality of coast live oak and other oak species, with estimates ranging to approximately 50 million (Cobb 2018). *P. ramorum* thrives in the cool, moist climates of coastal evergreen forests and tanoak-redwood forests, and infestations have been found in Alameda and Contra Costa counties (California Oak Mortality Task Force 2019). Other species of *Phytophthora* kill or otherwise damage other native and ornamental vegetation in California; *P. cinnamomi,* for example, causes crown and root rot in many native and introduced woody species (Swiecki and Bernhardt 2018). *Phytophthora* can be spread by water and soil through water runoff, soil erosion, or through nursery container plants, as well as transferred by humans and vehicles (U.S. Fish and Wildlife Service 2015); urban and suburban sprawl can facilitate human-caused spread. Phytophthora species are naturally occurring throughout the RCIS area in urban environments, nurseries, restoration sites, and wildlands.

Chytrid fungus (*Batachochytrium dendrobatidis*), which causes the disease Chytridiomycosis, is one cause for large, global declines in amphibian populations (Stuart et al. 2004, Wake and Vredenburg 2008). *B. dendrobatidis* is found in water or soil and infects individual frogs or salamanders when their skin comes into contact with water containing chytrid spores in the RCIS area. The fungus kills infected animals by disrupting normal function of the skin (California Center for Amphibian Disease Control 2007). Disease outbreaks typically occur during the cooler months (October to February) and again postmetamorphosis (California Center for Amphibian Disease Control 2007). In some populations, the disease can cause 100 percent mortality while in others it causes only some deaths.

Amphibians have been found to be infected by *B. dendrobatidis* in the RCIS area (e.g., Weinstein 2009, Sette et al. 2015), and a Chytridiomycosis mass mortality event of foothill yellow-legged frog within the Alameda Creek watershed occurred in 2013 (Adams et al. 2017).

Ranavirus is an infectious disease of amphibians, reptiles, and fish caused by viruses from the genus *Ranavirus*. Ranaviruses are common in the RCIS area. One east bay study found that a third of tested amphibians and 67 percent of wetlands tested were positive for Ranaviruses (Tornabene et al. 2018). Ranaviruses are capable of infecting amphibians from at least 14 families and over 70 individual species (Miller et al. 2011). There are several different species of ranavirus that cause varying levels of disease in affected animals. Transmission of ranavirus occurs through direct contact, ingestion of the virus, ingestion of infected animals, or exposure to infected soil or water sources (Northeast Wildlife Disease Cooperative no date). Ranaviruses infect multiple cell types, often culminating in organ necrosis and massive hemorrhaging (Miller et al. 2011). Because ranaviruses most severely affect amphibians and reptiles in the larval stage, mortality events tend to be seasonal. In amphibians, mortality events due to ranavirus are most frequently seen in the spring and summer, while in turtles they are most common in the late summer and autumn. Though it is poorly understood at present, ranaviruses are believed to be able to persist in the environment for a period of time and can likely survive for months in water under favorable conditions. Ranavirus is believed to be the cause of several recent massive mortality events in amphibian populations across the globe. With a mortality rate of 90%-100%, the disease has the potential to eliminate entire species if not controlled. Ranavirus outbreaks can affect multiple species at the same time (Northeast Wildlife Disease Cooperative, no date). Mortality is often the only clinical finding reported in cases of ranaviral disease; however, erratic swimming, buoyancy problems, lethargy, and anorexia frequently occur. Translocation of infected amphibians through commercial trade (e.g., food, fish bait, pet industry) contributes to the spread of ranaviruses (Miller et al. 2011).

2.3.5.3 Effects on Focal Species and Habitats

Non-native species, native nuisance species, and diseases can affect all focal species in the RCIS area. These effects include the following, among others.

- Competition for resources.
- Loss and/or degradation of habitat.
- Competitive exclusion.
- Increased predation.
- Soil damage and erosion.
- Direct mortality, or reduced viability, from disease.
- Decreased fecundity or durability of hybridized populations.

While non-native invasive species, nuisance species, and disease have the potential to impact focal species both directly and indirectly, there are some known direct effects of these pressures on the RCIS focal species. These effects include the following.

- Bass and bullfrog consume California red-legged frogs and California tiger salamanders and, as such, the presence of bullfrogs and bass limits the opportunity for success of these focal species.

- Rooting disturbance from feral pigs allows non-native invasive plants to establish in grassland and aquatic communities (Sweitzer and Van Vuren 2002), making them unsuitable for the focal wildlife and plant species in the RCIS area.
- Hybrid tiger salamanders tend to be more aggressive than native California tiger salamanders and exhibit higher rates of predation on native salamanders than do California tiger salamanders (Ryan et al. 2009). Ryan et al. (2009) observed reduced rates of survival, growth, and development in native California tiger salamander larvae that co-occurred with non-native salamanders and their hybrid progeny. Competition with hybrid tiger salamanders may decrease survival in dry years (when ponds are more likely to dry before salamanders reach minimum size to metamorphose) (Werner 1986, in ICF International 2012). Native tiger salamanders emerging at smaller sizes may have lower adult fitness due to higher rates of desiccation and predation.
- *P. cinnamomi* has killed pallid manzanita (*Arctostaphylos pallida*) plants in two locations in the RCIS area (U.S. Fish and Wildlife Service 2015).

2.3.5.4 Effects on Other Conservation Elements

Invasive, non-native plant and animal species affect the unique land cover types and serpentine soils in the RCIS area. Invasive plant and animal species outcompete and displace native plant communities. For example, the replacement of native grasses and herbs by fast-growing non-native annual grasses and forbs in serpentine grasslands has a profound effect on ecosystem functions (Huenneke et al. 1990, U.S. Fish and Wildlife Service 1998b). Large accumulation of non-native plant biomass, particularly in aquatic systems, can change habitat (e.g. by converting open water to wetland habitat) or chemical processes, such as water quality and alter wildfire dynamics (Lambert et al. 2011). Exotic annual grasses grow faster, deplete the soil of nutrients, and reduce light availability. Similar effects from invasive plant species on other serpentine land cover types can occur. Similarly, feral pigs can degrade unique land cover types from excessive use and rooting, which can lead to loss of emergent vegetation, erosion, and flooding. In oak woodlands, feral pigs can inhibit the germination and growth of young oaks by eating acorns and oak seedlings and removing leaf litter, causing soils to dry out (California Department of Fish and Game 2005).

Plant diseases, such as those caused by *Phytophthora*, have potential to make widespread changes on the landscape, affecting numerous native plant communities. While oak woodlands have been a focus due to the presence of *P. ramorum* (i.e., sudden oak death) in the RCIS area, other unique land cover types, including scrubland and wetland habitats, have the potential to experience plant die off or increased vulnerability to climatic changes as a result of exposure to plant pathogens. The mortality of common woodland canopy species can have significant effects on the composition, structure, and habitat provided by these vegetation communities.

2.3.6 Loss of Habitat Connectivity

This RCIS identifies habitat connectivity as a conservation element (Section 2.2.8.1). The loss of habitat connectivity, including habitat fragmentation, can occur through the following ways, among others.

- Conversion of natural habitat to urban, suburban and agricultural uses (Section 2.3.1, *Housing and Urban Area* and Section 2.3.2, *Livestock, Farming, and Ranching*)

- Loss of habitat connection through climate change events, such as sea level rise (Section 2.3.4, *Climate Change*)
- Construction of linear structures like roads, canals, and power lines that impede movement

Growth and development can fragment habitats into small patches, which cannot support as many species as larger patches. These smaller fragments often become dominated by species more tolerant of habitat disturbance, while less-tolerant species decline. Such fragmentation also disrupts or alters important ecosystem functions, such as predator-prey relationships, competitive interactions, seed dispersal, plant pollination, and nutrient cycling (California Department of Fish and Wildlife 2015).

Growth and development, along with associated reservoirs and linear structures like roads, canals, fencing, and power lines impede or prevent movement of a variety of animals. Loss or reduction of habitat connectivity makes it more difficult for wildlife to move across habitats and landscapes in search of food, shelter, and breeding or rearing habitat and to escape competitors and predators. Animals restricted to the ground, like mammals, reptiles, and amphibians, face obstacles such as roads, canals, and urban/suburban development. Attempts to cross these obstacles can be deadly, depending on the species and the nature of the gap (four-lane highways with concrete median barriers compared to narrow, rural two-lane roads, for example).

Wildlife-vehicle collisions are a large and growing concern among public transportation departments, conservation organizations and agencies, and the driving public. Wildlife-vehicle collisions are a safety concern for drivers and a conservation concern for most animal species. Recently, Loss et al. (2014) estimated that between 89 million and 340 million birds may die per year in the United States from collisions with vehicles. Many public transportation departments are trying different methods of reducing wildlife-vehicle collisions, including fencing roadways and providing crossing structures across the right-of-way to allow safe animal passage.

The California Roadkill Observation System,[48] a website created by Road Ecology Center at University of California Davis, records the locations of roadkill observations on major highways and freeways and includes records of carcasses cleaned up by Caltrans between 1987 and 2007. Data from the system are used to identify stretches of California highways that are likely to be hotspots (i.e. stretches of highway that are statistically different from other stretches) for wildlife-vehicle collisions. The system accounts for both observed animal carcasses and traffic incidents, which can range from wildlife sightings on the roadway to wildlife-vehicle collisions. In the RCIS area, Interstate 80, Interstate 680, Interstate 580, and California State Route 24 showed several hotspots along these roads, particularly along Interstate 580 between Hayward and Oakland. Most of the observations in the RCIS area are of medium-sized (e.g., American badger, bobcat, coyote, raccoon) and large (e.g., wild pig, mountain lion, mule deer) animals (California Roadkill Observation System 2018).

2.3.6.1 Effects on Focal Species and Habitat

Loss of habitat connectivity affects all of the focal species in the RCIS area (Table 2-10). Effects include, but are not limited to, the following.

- Reduction in genetic diversity.

[48] https://www.wildlifecrossing.net/california/

- Reduction in ability of populations to rebound after population declines.
- Extirpation of species.
- Reduced ability to colonize new areas of suitable habitat.
- Mortality from collision with vehicles.

Loss of habitat connectivity between open space patches that provide habitat for focal species reduces their genetic pool because populations are not able to disperse and intermix. A diverse genetic pool is important for populations to adapt to changing environmental conditions, for disease resistance, and to minimize physiological and behavior problems (Falk et al. 2001). Populations of less mobile species often decline in smaller habitat patches because of reductions in habitat quality, extreme weather events, or normal population fluctuations. Natural recovery following such declines is difficult for mobility-limited species that may not be able to recolonize otherwise suitable habitat.

Barriers to movement could also extirpate local, smaller populations of focal species in the RCIS area. For example, breeding populations of Central California Coast steelhead could be extirpated if these species are prevented from reaching their spawning habitats. Habitat connectivity is also important for the focal plant species to be able to migrate in response to climate change. The loss of habitat connectivity would also restrict the focal plant and wildlife species from colonizing new areas of suitable habitat in the RCIS area.

Roads pose a threat to species that are more susceptible to road-related impacts, such as road mortality and habitat fragmentation, from infrastructure (Brehme et al. 2018). Amphibians and reptiles are particularly susceptible to the negative effects of infrastructure, due to their small body size (thus making them less visible to drivers), reduced mobility (e.g., speed), and lack of behavioral avoidance of roads. Species such as giant garter snake, western pond turtle, California tiger salamander, and California red-legged frog, are at very high risk from the negative effects of roads (Brehme et al. 2018).

2.3.6.2 Effects on Other Conservation Elements

Loss of habitat connectivity affects wildlife linkages and unique land cover types. Loss of habitat connectivity further isolates populations in the increasingly fragmented RCIS area. The loss of connectivity between patches of unique land cover types, such as those on serpentine soils, could result in isolation of small, fragmented patches of habitat with reduced biodiversity and limited ability to adapt to changing conditions.

2.3.7 Disruption of Natural Fire Disturbance Regime

Periodic fire is an important influence on natural communities and focal species in the RCIS area, especially the grassland and shrubland natural communities. Historically and prehistorically, fires caused by lightning strikes and human ignition kept woody vegetation from invading grassland (where the soil conditions are appropriate) and converting it to coastal scrub or oak woodland. Grassland was likely the dominant vegetation community, especially near prehistoric and historic settlements and travel routes, and in association with brush clearing for "rangeland improvements" to increase livestock forage (Reiner 2007, Tyler et al. 2007). The prehistoric burning apparently resulted in spatially patchy grasslands in a mosaic with woody vegetation (Keeley 2002). Grasslands were kept open by fire, drought, and possibly some influence of native grazers, such as tule elk and pronghorn. However, prior to Native American occupancy and their frequent burning, many of the grasslands within the range of coyote brush would have been brushlands (Ford and Hayes 2007). Today, in the absence of frequent extensive fire and moderate or higher intensity livestock grazing, the grasslands within the range of coyote brush have succeeded or will succeed in the future to northern coastal scrub and eventually mixed woodland, except on the hottest south-facing slopes and shallow soils (ICF International 2012). Similarly, chaparral and northern coastal scrub/Diablan sage scrub land cover types are dependent on periodic fires to maintain natural processes such as succession and regeneration. Periodic fires help increase native species diversity and reduce non-native species (ICF International 2012).

Fire suppression allows woody fuels to build up to considerably higher levels than it would when periodic, low intensity fires occurred more frequently. This has resulted in catastrophic fires throughout California, including the RCIS area, such as the East Bay Hills Fires in 1991 which burned 1,520 acres and destroyed over 3,000 homes

2.3.7.1 Effects on Focal Species and Habitats

Fire-suppression policies pose a threat to most of the focal species in the RCIS area to some extent (Table 2-10). Focal species could be affected through the following.

- Mortality from catastrophic fire that occurs due to the fuel load buildup.
- Water quality impacts following catastrophic fire.
- Conversion of habitat.
- Competition from invasive plants.
- Barriers to migration.
- Reduced conditions for propagation of fire-dependent species.

With the buildup of fuel over many years, as described above, the risk of catastrophic fire is greatly increased (U.S. Fish and Wildlife Service 2002). Such a fire can kill focal wildlife species, which might otherwise be able to escape during a less extreme event. Following catastrophic fires, water quality is often reduced, as erosion increases due to the lack of vegetation. This increase in sediment and turbidity following fire, can have direct impacts on aquatic focal species, such as steelhead.

Prescribed burns can be an effective technique for managing invasive plant species that otherwise are difficult to control; fire suppression can allow invasive plant species to flourish, causing habitat quality to decline, creating barriers to movement (e.g., through thick vegetation), and increasing competition with native species. For example, callippe silverspot butterfly relies on grassland habitat that has historically been maintained through periodic fire (U.S. Fish and Wildlife Service 2009). With fire suppression, host plants can be outcompeted by non-native species or the grassland habitat can convert to shrubland habitat. Additionally, species such as California tiger salamander and California red-legged frog may experience barriers to movement as grasslands are overgrown or converted. Focal plant species can also be greatly affected by habitat conversion and invasive plants.

Fire suppression also limits the natural processes that some fire adapted plants require to propagate, such as pallid manzanita, which requires fire for natural seed germination (U.S. Fish and Wildlife Service 2015).

2.3.7.2 Effects on Other Conservation Elements

Fire can impact unique land cover types and soil, habitat connectivity, working lands, and bat habitat. Fire is a natural component of many natural communities and unique land cover types in the RCIS area. For example, many of the plants in the chaparral and northern coastal scrub communities have evolved to be dependent on periodic fire for regeneration (Holland 1986, Hanes 1988, Schoenherr 1992). In the extreme, communities dominated entirely by chamise cannot sustain themselves in the absence of fire (U.S. Fish and Wildlife Service 2002). Some species of chaparral have peeling bark or volatile oils that promote fire (Schoenherr 1992). Many of the dominant shrubs, such as manzanita and ceanothus, have adapted to fire by resprouting from basal burls or woody root crowns following a fire event. Other species have seeds that require fire to initiate growth (U.S. Fish and Wildlife Service 2002, Rundel and Gustavson 2005). Regrowth is triggered by removal of the overstory, typically by fire. Chemicals in smoke and charred wood also stimulate germination in a wide variety of native forbs that lie dormant as seeds in the soil for decades before a fire.

Ford and Hayes (2007) described the dynamic successional relationship between California grasslands and northern coastal scrub. Frequent fire, rodent herbivory, livestock grazing and trampling, and drought tend to maintain grassland and limit succession from grassland to northern coastal scrub as well as the succession from scrub to mixed oak woodland. Succession from grassland to scrub can be as rapid as >5% per year after suppression of fires or removal of livestock grazing, and succession from scrub to woodland can occur within 50 years after that. Returning such sites to grassland typically requires management that includes manual clearing and application of herbicides or repeated burning at times of maximum herbaceous understory and dry weather, followed by at least moderate intensity summer seasonal or yearlong livestock grazing (ICF International 2012).

Oak woodland is also a fire-adapted ecosystem, and fire has likely played a large role in maintaining this community type in the RCIS area. Fire creates the vegetation structure and composition typical of oak woodlands, and this natural community has experienced frequent, low-severity fires that maintain woodland or savanna conditions. In the absence of fire, the low or open understory that characterizes the land cover type can be lost. Ultimately, closed-canopy oak forests are replaced by shade-tolerant species because oaks cannot regenerate and compete in a shaded understory. Soil drought may also play a role in maintaining open-tree canopy in dry woodland habitat (ICF International 2012).

Fire suppression, leading to catastrophic fire can also lead to soil erosion, fragmentation of habitat, and loss of working lands.

2.3.8 Dams and Water Management/Water Use

Water resources are managed to meet water and power supply needs and to accommodate urban communities and agricultural production. Water infrastructure within the RCIS area is described in Section 2.1.2.1, *Water*, and shown on Figure 2-2. Calaveras Dam in Alameda County is currently under expansion and a future expansion of Los Vaqueros Reservoir is being studied.

Dams and water management structures are critical infrastructure for storing and transporting water supply for residential, commercial, and agricultural uses. As described in Section 2.3.1, the East Bay is experiencing population growth, and with it comes an increasing demand for water. Additionally, agricultural water consumption over the last century has increased due to increased production of water-intensive crops like strawberries, lettuce, and grapes. Water is supplied to agriculture by diversion of surface water, by groundwater pumping, and through import from other regions via the State Water Project.

Water management pressures in the RCIS area include water diversions, dams, flood control structures (e.g., levees and bank protection, concrete channels), groundwater pumping, stream and river crossings (e.g., culverts, bridges), and dredging. Rivers and streams suffer from the historic and ongoing conversion of tributary waterways into constructed stormwater infrastructure. Stormwater conveyances are managed to convey urban runoff and floodwater and can alter the hydrologic processes that are important to ecosystem function, such as sediment deposition, water filtration, support of riparian vegetation and wildlife movement corridors. Dams, which alter hydrology and habitat both up and downstream, are located on many streams in the RCIS area.

2.3.8.1 Effects on Focal Species and Habitats

Dams and water management/water use primarily affect aquatic species in the RCIS area (Table 2-10); however, the construction and expansion of dams and water systems can also affect upland species and plants. These effects include the following.

- Conversion of upstream habitat due to construction or expansion of dams.
- Alteration of natural hydrology.
- Barriers to aquatic and terrestrial wildlife movement through both dams and linear water infrastructure (Section 2.3.6, *Loss of Habitat Connectivity*).
- Impacts to water quality through groundwater depletion.

When dams are constructed or expanded, upstream habitat is flooded as the reservoir area behind the dam is inundated. Wildlife may migrate to other areas, if suitable habitat is available. Plant populations are unlikely to adapt to the new reservoir footprint and typically are lost when the new areas are flooded.

Once in operation, dams alter natural hydrology, potentially reducing the amount of water in streams that is needed by fish at critical times, such as during the spawning season when rainwater is captured behind the dam. Diminished flows reduce aquatic systems' capacity to discharge incoming contaminants and sediment and can inhibit migration by focal fish species. Reduced flows can have other significant effects on food webs, non-native species populations, and pollution concentrations downstream in the Bay. Dam operations, including the amount and timing of water release, influence the temperature, depth, and velocity of water downstream, as well as the capacity of the stream to transport sediment and alter channel morphology, potentially constraining breeding opportunities for amphibians and other aquatic species present in downstream environments. Dams can also be managed to benefit species by storing water and then releasing it at times when water is scarce, such as in the summer when rivers start to dry.

One major concern of dams and other in-channel features (such as weirs and culverts) is that they can serve as partial or complete barriers that limit the ability of aquatic species, such as steelhead, to migrate upstream. This reduces access to potentially suitable habitat, and in the case of anadromous fish, potentially access to spawning habitat in upstream areas and tributaries. While some dams contain fish ladders to improve passage, these are not always used effectively by fish and have limited utility for other aquatic species such as invertebrates.

Reservoirs can also serve as a barrier to terrestrial wildlife, such as San Joaquin kit fox , that could potentially cross low flowing rivers, but are unable to cross the expanse of a reservoir. Reservoir development or expansion can also remove habitat (U.S. Fish and Wildlife Service. Similarly, infrastructure, such as water canals, can limit other terrestrial wildlife. These effects are described in Section 2.3.6.

Diversion of water for irrigation can also alter hydrologic regimes, and nutrient-laden runoff can degrade aquatic habitat. As groundwater levels are depleted, saltwater intrusion increases and flows are reduced in streams and rivers. Additionally, groundwater depletion and drought have increased salinity in inland lakes and freshwater/brackish lagoons, which affects habitat conditions for western pond turtle, giant garter snake, California red-legged frog and other species (California Department of Fish and Wildlife 2015).

2.3.8.2 Effects on Other Conservation Elements

In addition to effects on focal species, unique land cover types and baylands habitats can be impacted by altered hydrologic regimes. The effects include the following.

- Isolation of flows from historic floodplains.
- Increased scope and incision of channels.
- Reduction of natural flood events and sediment transport.

Bridges, levees, and bank-protection structures on rivers and streams in the RCIS area prevent flood flows from entering historic floodplains and eliminate or alter the character of floodplain habitats, such as shaded riverine habitat, and floodplain ecosystem processes. Constrained flood-level flows increase scouring and incision of river channels and reduce or halt the formation of riparian habitat, channel meanders, and river oxbow channels (California Department of Fish and Wildlife 2015). In places where there are dams, the opposite can occur as well; dams can hold back extreme floods, reducing natural scour disturbance which is required by some communities, such as California sycamore woodlands.

Sediment is also often trapped behind dams, leading to a reduction in sediment that is transferred downstream to replenish eroded areas and deltas. This sediment source is especially important in the light of sea level rise when downstream marshes in the Baylands will need to accrete sediment in order to keep pace with rising water levels.

2.3.9 Mining, Quarrying, and Renewable Energy

Wind energy accounts for the majority of the renewable energy-related stressors in the RCIS area. There are extensive wind farms in the eastern portion of the RCIS area along the Contra Costa County-Alameda County boundary; specifically, wind turbines are located in northeastern Alameda County and southeastern Contra Costa County (Section 2.1.2.4, *Renewable Energy Projects*). Wind turbines are typically installed in rows for power generation.

The East Bay has a number of mines and quarries where rock, sand, gravel, and various minerals are extracted. At least 10 quarries operate in Alameda County (Neighborhood Preservation and Sustainability Department 2018) with more in Contra Costa County (Contra Costa County 2005).

2.3.9.1 Effects on Focal Species and Habitats

Construction and operation of mining, quarrying, and renewable energy facilities can have the following effects on focal species in the RCIS area. Since most of these effects, such as the conversion of land cover, have been discussed extensively in other sections (Section 2.3.1, Section 2.3.5, *Non-native Species and Disease*, Section 2.3.6), this section will focus on new impacts, primarily of wind turbines, on focal species.

- Conversion of natural habitats.
- Barriers and alterations to movement, including flight patterns.
- Introduction of non-native species and diseases.
- Direct mortality as a result of construction and operation.

Wind turbine operation can result in direct mortality of avian and bat species due to collisions with wind turbines and associated wires (Table 2-10) (Drewitt and Langston 2008, Arnett et al. 2008, California Department of Fish and Wildlife 2015). Additional species can be impacted through the construction, maintenance, and decommissioning of wind turbine facilities.

Wind turbines have for decades injured and killed thousands of birds, and bats including about 60 golden eagles per year, and can be barriers to movement (Smallwood and Thelander 2008, Masden et al. 2009, Smallwood and Karas 2009). The effect of wind turbines on golden eagles in the RCIS area is well studied, as they occur in higher densities in the RCIS area. An analysis of the causes of fatalities of 61 golden eagles radio-tagged and recovered in the Diablo Range from January 1994 to December 1997 showed high levels of golden eagle fatalities in the RCIS area (Hunt et al. 1998). In another study in the Altamont Pass Wind Resources Area and Diablo Range from September to December of 2015, 4 of 18 (22%) radio-tagged and recovered golden eagles were killed by wind turbines. Burrowing owls and other native bird and bat species have also been recorded as being injured or killed by wind turbines in the RCIS area. Additional studies are needed to better understand the mortality rates at the APWRA and consequent effects on bird and bat populations. Initial evidence indicates that the repowering efforts being undertaken to reduce bird strikes may inadvertently increase the number of bat fatalities.

The construction of wind facilities could have additional impacts to other focal species, such as California tiger salamander, and focal plant species. These species can be impacted through direct take during construction, alteration of habitat, or introduction of non-native species and diseases.

Mining activities in aquatic habitats can affect aquatic species such as California red-legged frog. Suction dredge mining can cause siltation, create deep holes in streams which provide habitat for non-native predatory fish. Gravel mining in streams can affect development of soil conditions necessary to support riparian vegetation (U.S. Fish and Wildlife Service 2002). Although red-legged frogs are recognized as having colonized sediment basins associated with both active and inactive quarries (U.S. Fish and Wildlife Service 2002b), whether basins ultimately serve as a source or sink for local populations likely depends on the condition of the site and surrounding activity.

2.3.9.2 Effects on Other Conservation Elements`

Wind turbines may affect wildlife movement, working landscapes, unique land cover types, soil, ground squirrels and bats. Working lands can be lost through the conversion of these lands to wind turbine facilities.

Wind turbines can degrade unique land cover types due to introduction of invasive species from access and service roads. Development of energy infrastructure can remove native vegetation, modify drainages, and increase human activity in remote areas. Large-scale wind energy facilities also have the potential to alter localized micro habitats associated with areas downwind of rotor turbulence zones. The potential impacts range from alterations in wind, surface temperatures, precipitation and evaporation levels, and soil moisture levels (Lovich and Ennen 2013).

As described above, bats are particularly vulnerable to mortality at large wind farms by collisions with turbines (Drewitt and Langston 2008, Arnett et al. 2008, California Department of Fish and Wildlife 2015). Ground squirrels may benefit from reduced populations of predatory birds but may also be targeted with rodenticides in areas where their presence is a concern for infrastructure.

2.3.10 Air Pollutants

Particulates, pollutants, and pathogens deposited from the air can degrade aquatic and terrestrial ecosystems and estuarine habitats. Discharges from power plants, sewage plants, and other industrial facilities are high in pollutants and pathogens. Pollutants, primarily water pollutants, have been discussed in other sections above, including Section 2.3.1, *Housing and Urban Areas* and Section 2.3.2, *Livestock, Farming, and Ranching*. This section specifically mentions air pollutants, nitrogen in particular, not covered elsewhere. Other air pollutants, such as carbon dioxide and methane, can have effects on climate change patterns and associated effects as described in Section 2.3.4, *Climate Change*.

Nitrogen deposition from air pollution is ongoing and increasing (Weiss 1999, California Energy Commission 2006). Nitrogen deposition is predicted to continue to increase as population growth occurs in the RCIS area, which results in an increase in air pollutant emissions from passenger and commercial vehicles and other industrial and non-industrial sources (although it could possibly decrease if future automobile technologies address this issue). Emissions from these sources are known to increase airborne nitrogen, of which a certain amount is converted into forms that can fall to earth as depositional nitrogen.

2.3.10.1 Effects on Focal Species and Habitats

Air pollutants are identified for their effects on focal plant species, callippe silverspot butterfly, and sensitive amphibians (Table 2-10). Effects include the following, among others.

- Increase in competition from non-native, invasive plants.
- Loss of host plants due to competition (callippe silverspot butterfly).
- Direct mortality of amphibians and increased rates of abnormalities or vulnerabilities to other stressors.

Nitrogen deposition has been shown to greatly increase available nitrogen in soils, and in turn, increase the success of plant invasions into serpentine areas (Weiss 1999). Non-native species overtake native serpentine species, including many of the serpentine-endemic focal plant species (e.g., most beautiful jewelflower, fragrant fritillary). Non-native plants may also compete with native plants for water, nutrients, light, and safe sites for germination, crowding out native plants (ICF International 2012). In areas where nitrogen deposition facilitates the spread of non-native plants in grasslands, the callippe silverspot butterfly host plant, Johnny jump-up, may be lost; the loss of the host plant will result in a decrease in the number of host-dependent butterflies (U.S. Fish and

Wildlife Service 2009). Weiss (1999) also found that serpentine areas that are grazed do not suffer as intense effects of plant invasions as ungrazed areas, most likely because cattle selectively graze invasive grasses and, in doing so effectively remove nitrogen from the site.

Chemical contaminants are considered a threat to focal amphibian, including California tiger salamander, California red-legged frog, and foothill yellow-legged frog (U.S. Fish and Wildlife Service 2002, U.S. Fish and Wildlife Service 2004). In the Central Valley, airborne pollutants are considered to be a likely cause of decline of amphibians (U.S. Fish and Wildlife Service 2002). While the sensitivity of these species to air pollutants is largely unknown, there is evidence to suggest that pesticide applications can result in larval die-offs, slow growth, and increased susceptibility to predation and viral infection (U.S. Fish and Wildlife Service 2017). There is also research demonstrating that nitrogen pollution specifically can be lethal to amphibians, as well as their prey sources, and also cause developmental anomalies (Rouse et al. 1999).

2.3.10.2 Effects on Other Conservation Elements

Nitrogen deposition can affect other conservation elements, notably unique land cover types, and serpentine soils, and serpentine grasslands in particular (Weiss 1999, Weiss and Wright 2006, ICF International 2012). California grasslands are believed to be among the most sensitive to nitrogen deposition (Fenn et al. 2010). Serpentine soils are inherently nutrient poor and are particularly limited in available nitrogen. Most serpentine-endemic plant species have evolved to tolerate this condition, while competitive invasive species have not done so (ICF International 2012). This nutrient deficiency is believed to be the primary mechanism by which serpentine soils retain a high degree of native diversity (Harrison 1999). Indirect impacts of continued nitrogen deposition on the unique land cover types and serpentine soils are anticipated to result from future urban development and rural development.

2.3.11 Tourism and Recreation

Outdoor recreation and positive experiences in nature are important to fostering an appreciation of the environment. Intensive (e.g., over-use) or poorly managed recreation, however, could degrade habitats and directly and indirectly affect native biodiversity. With increased population growth, as described in Section 2.1, *Built Environment*, recreation and tourism will likely increase as well in the RCIS area. Tourism and recreation on public lands is likely to have its greatest effect where densities of recreationists are high, such as in public parks in the RCIS area (California Department of Fish and Wildlife 2015), or where recreational activities are new to the environment. The impacts of humans use with dogs can also negatively affect the environment (Hennings 2016). Effects of tourism and recreation include the following, among others.

- Physical and temporal displacement.
- Disturbance and stress.
- Indirect and direct morality.
- Habitat fragmentation and edge effects.
- Health issues and water quality impacts.

2.3.11.1 Effects on Focal Species and Habitats

Tourism and recreation may affect some focal species (Table 2-10), though the actual extent of effects will be specific to those species present near recreation. These effects could include the following.

- Direct mortality due to trampling, being run over by bikes, fishing, or wildflower picking.
- Impaired water quality or habitat conditions due to erosion.
- Introduction and spread of non-native species and diseases (Section 2.3.5).
- Alteration of behavior, including reduced reproductive success.
- Ignition of wildfire.
- Trash dumping.

Direct mortality can occur as focal fish species are caught by people fishing. Additionally, recreationists and dogs may trample or dislodge egg masses of breeding amphibians when recreating in streams, along river edges, or stock ponds. California tiger salamander migrating to aquatic habitat are vulnerable to being trampled in high-use areas. Similarly, recreation can lead to vegetation being trampled, including the focal plant species in otherwise suitable habitat. Wildflower collection in recreation areas, which may include some of the showy focal plant species, can occur in where plant populations are located near recreation trails and scenic vistas.

Off-trail use and camping in undesignated areas can degrade habitats through the creation of informal trails, reducing vegetative cover, compacting soil, increasing rates of soil erosion, and increasing the rate of spread of invasive species and diseases (California Department of Fish and Wildlife 2015). Recreationalists can also affect wildlife behavior, which, in the case of some focal bird species could result in reduced breeding or nest abandonment. This is especially true if the recreational activity leads to a novel experience for the species during a sensitive time, such as what can occur when people pursue the capture of photographs of nesting birds. Human activity in campgrounds can be the source of sparks that ignite wildfire as well as result in the accidental movement of invasive species, such as wood-boring beetles, through the transportation of firewood. Recreationalists can also increase trash and food sources which can make focal wildlife more likely to be attracted to areas of human activity and thus more likely to be hit by vehicles. Focal wildlife can also be killed by consuming trash.

Recreational trails and their use by humans can reduce the extent of habitat and fragment habitat and cause edge effects that affect biotic conditions, including vegetation composition and structure (Pickering et al. 2010, Ballantyne and Pickering 2015, Bötsch et al. 2018), and communities of birds (Miller et al. 1998, Bötsch et al. 2018), mammals (Zhou et al. 2013), and other fauna (Larson et al. 2016). Disturbance caused by recreation activities such as mountain biking or OHV use can also affect animal behavior such as causing mammals to flush away from trails (Taylor and Knight 2003), reduction in reproductive success of birds (Davis et al. 2010), and increase levels of nest predation in birds (Miller et al. 1998, Miller and Hobbs 2000). These impacts are being seen at places such as the Carnegie SVRA and would be expected to occur in the expansion area of the SVRA, including the Tesla portion of Carnegie SVRA (Kupferberg and Fury 2015). While even quiet, non-consumptive recreation can reduce the effectiveness of protected areas (Reed and Merenlender 2008), recreation and habitat protection can be balanced to provide sustainable, multiple land uses (Kays et al. 2017).

2.3.11.2 Effects on Other Conservation Elements

Unique land cover types, including baylands, and soils can be impacted by increased recreation. Large numbers of outdoor recreationists in sensitive areas can directly damage natural systems by reducing vegetative cover, compacting soil, increasing soil destabilization and erosion, contaminating natural lands and waterways through inappropriate disposal of trash and human and pet waste, and by introducing non-native species. Natural areas may be indirectly affected by increased development of recreational access points and supporting infrastructure such as roads, construction and use of visitor facilities and campgrounds. Visitor litter in parks and public lands can encourage increased corvid populations (jay, crow, and raven), which contributes to greater competition with and predation upon other native wildlife (California Department of Fish and Wildlife 2015).

Concentrated recreational use in highly sensitive areas, such as streams and riparian zones by hikers, picnickers, mountain bikers, and equestrians can damage these systems, reducing vegetative cover, lowering breeding success by trampling or dislodging of egg masses and disturbing sensitive natural communities. Concentrated fishing, especially in populated area can lead to localized depletion of fisheries. Illegal trampling, and collecting, can deplete floral and faunal populations, reduce biodiversity, and alter trophic and community structures in frequently visited natural habitats (California Department of Fish and Wildlife 2015).

As described by the SWAP (California Department of Fish and Wildlife 2015) "[r]ecreational off-highway vehicle (OHV) use can have adverse effects on soil conditions, native plant communities, and sensitive species. On public lands, authorized and unauthorized OHV trails open relatively undisturbed areas to increased use. The vehicles can disturb or run over wildlife, crush and uproot plants, spread invasive plants, and disturb soils, contributing to erosion and sedimentation of aquatic habitats."

2.4 Gaps in Scientific Information

The conservation strategy presented in Chapter 3, is based on the best available scientific information. However, there are many gaps in that information, even in the RCIS area, which has been heavily studied. This section includes a discussion about information gaps that, if filled, could change the objectives, actions, and priorities in the RCIS area. Gaps can be created from a lack of information or by shortcomings in how information is disseminated.

2.4.1 Focal Species Occurrence Data

The California Natural Diversity Database (California Department of Fish and Wildlife, Natural Diversity Database 2016a) was the primary source of species occurrence data, along with a few others. While the data are considered high quality, because of the verification process used by CDFW, there are two inherent gaps. First, only positive data are presented (i.e., where an occurrence is found). While positive occurrence data are very useful, there is no way to know where surveys have been conducted for each species with negative survey results (i.e., where an occurrence was not detected). Knowing where species do not occur, in habitat that may appear suitable, is also important for informing where to prioritize conservation actions. Because that information is not available, the species habitat models typically over-predict where species may occur. With negative survey data, those models could be refined by removing areas that had been surveyed where no species were found.

Second, the CNDDB does not include data for large areas of potentially suitable habitat, in part because a large amount of California, including the RCIS area, has not been surveyed. Contra Costa County is fairly well surveyed given that the ECCC HCP/NCCP, Los Vaqueros Reservoir and other protected areas (e.g., East Bay Regional Park District) cover a large portion of the county. Alternatively, eastern Alameda County is predominantly privately owned, and access for survey efforts has likely been limited. The expectation to this is the Springtown Alkali Sink Preserve and surrounding area where surveys have been conducted due to the presence of special- status species.

Oftentimes, surveys are driven by environmental compliance for projects. For example, many CNDDB occurrences fall along gas and electric rights-of-way or roadways; places where infrastructure projects typically happen. As a result, conservation and mitigation projects often focus on limited areas with suitable occurrence data, potentially at the expense of other important areas that are occupied by target species but have not been surveyed.

2.4.2 Rare Plant Distribution

The gaps in survey effort for species is discussed above in Section 2.4.1, *Focal Species Occurrence Data*, but the lack of survey data for rare plant species is an issue throughout the state. Plant species are under-surveyed for two reasons: 1) lack of access to private lands, and 2) plants are not state or federally listed as threatened or endangered at the same rate as wildlife, and therefore regulatory triggers are not in place to require surveys as frequently. Furthermore, when botanical surveys are done in areas, protocols which involve multiple surveys across the full range of blooming periods are often not completed and some species could be missed if they are not flowering at that time.

The lack of survey data for many rare plant species consequently limits planning efforts. For example, the lack of occurrence data for showy madia and rock sanicle limits the identification of priority conservation areas in this RCIS. More surveys on private lands and standardized survey efforts would help fill this data gap and allow for more informed conservation priorities for focal and non-focal plant species.

2.4.3 Wildlife Movement

There have been some studies of wildlife movement in the RCIS area, but there is a gap in data throughout the entire RCIS area regarding wildlife movement and habitat connectivity. For example, the EACCS identifies specific movement corridors for wildlife along Interstate 580 but acknowledges that the importance of these small corridors to the connectivity of San Joaquin kit fox populations in Alameda County is unknown and merits further study. Additionally, barriers to movement of focal species, non-focal species, and other native species along the other major roadways need to be identified, as well as linkages and pinch-points (ICF International 2010). Knowing more about how wildlife move through the RCIS area and which crossings are most important will allow conservation organizations to focus conservation and habitat enhancement actions in the most critical locations.

2.4.4 Effects of Climate Change

While there are numerous models and predictions regarding how the Bay Area will respond to a changing climate, the degree of change as well as the ability of ecosystems to adaptive to this change are still largely speculation. It is understood that some species and habitats will likely be more susceptible or resilient to climate change based on their specific life histories, distribution, adaptability and abundance. Some of the specific data gaps that surround climate change will be the rate and extremity of sea level rise, warming, and extreme weather events. It is unknown whether or not species will be able to migrate or adapt quickly enough to climate change to sustain their populations. Climate change might affect the size, distribution, and functionality of natural communities and land covers as mapped and described in this RCIS. For example, with increased drought, pond functionality and longevity may change, affecting species dependent on this habitat, such as California tiger salamander and California red-legged frog. The potential pressures and stressors associated with climate change are further described in Section 2.3.4.

2.4.5 California Ground Squirrel Distribution

Many native species in California, and in particular in the RCIS area, rely on California ground squirrels as an important element of their life history. California tiger salamanders and burrowing owls rely on ground squirrels, and other fossorial mammals, to provide underground refugia and nest sites, respectively (Appendix F). Many species of raptors and mammals include ground squirrels as a food source. If the distribution of ground squirrels in the RCIS area was better understood, it could influence where priority conservation actions should be implemented.

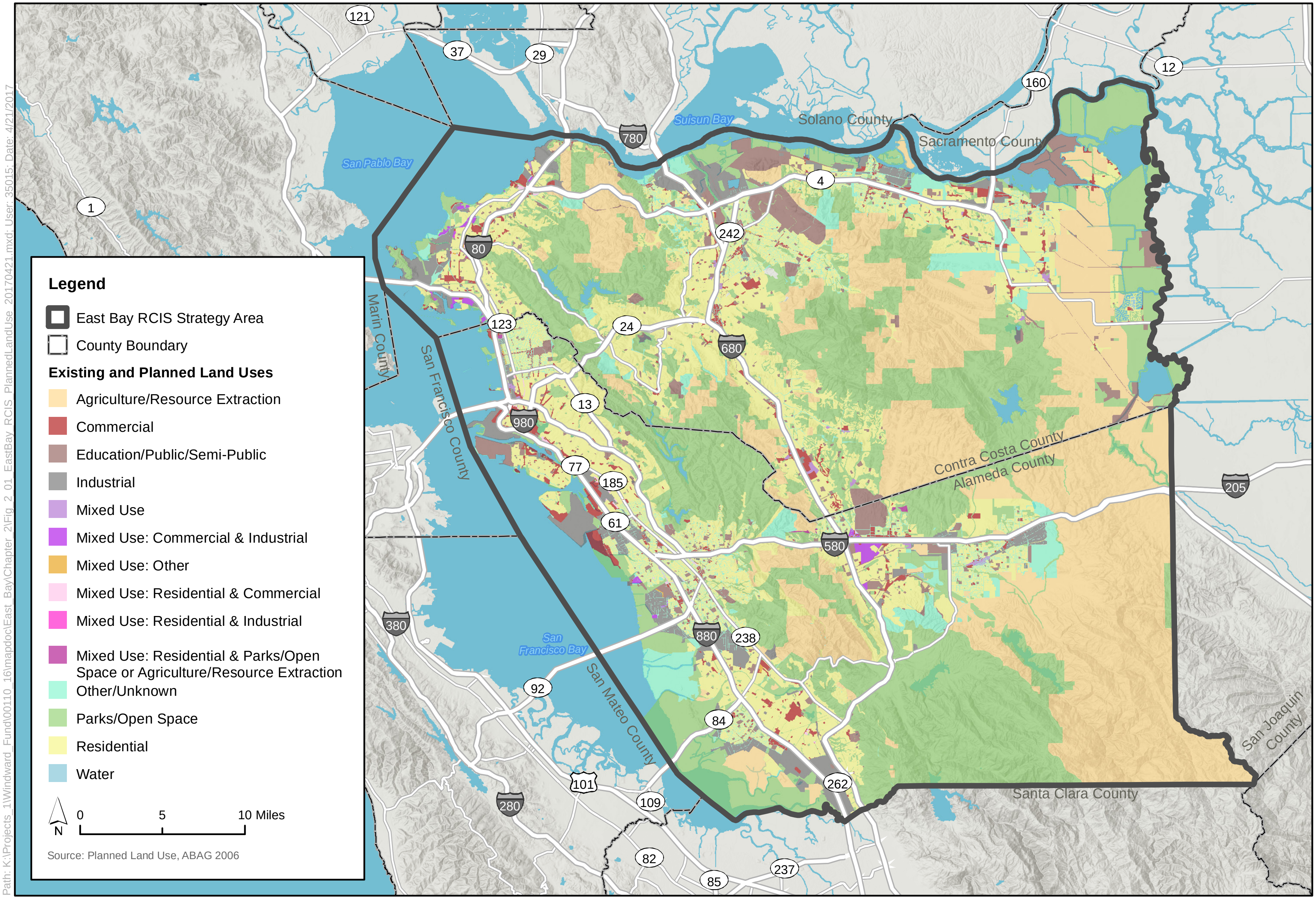

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Figure 2-1
Existing and Planned Land Uses in the East Bay RCIS Area

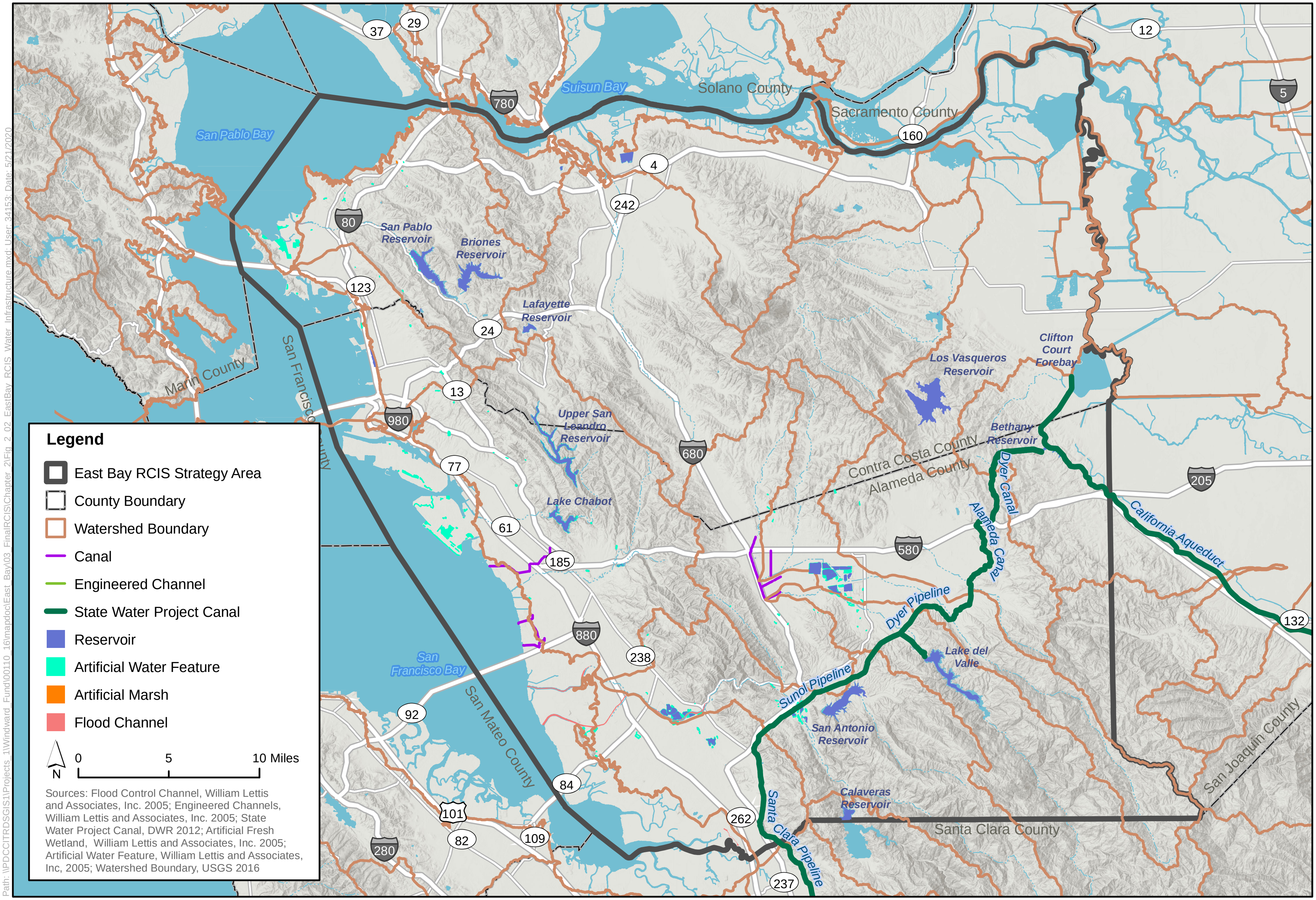

Figure 2-2
Water Infrastructure within the East Bay RCIS Area

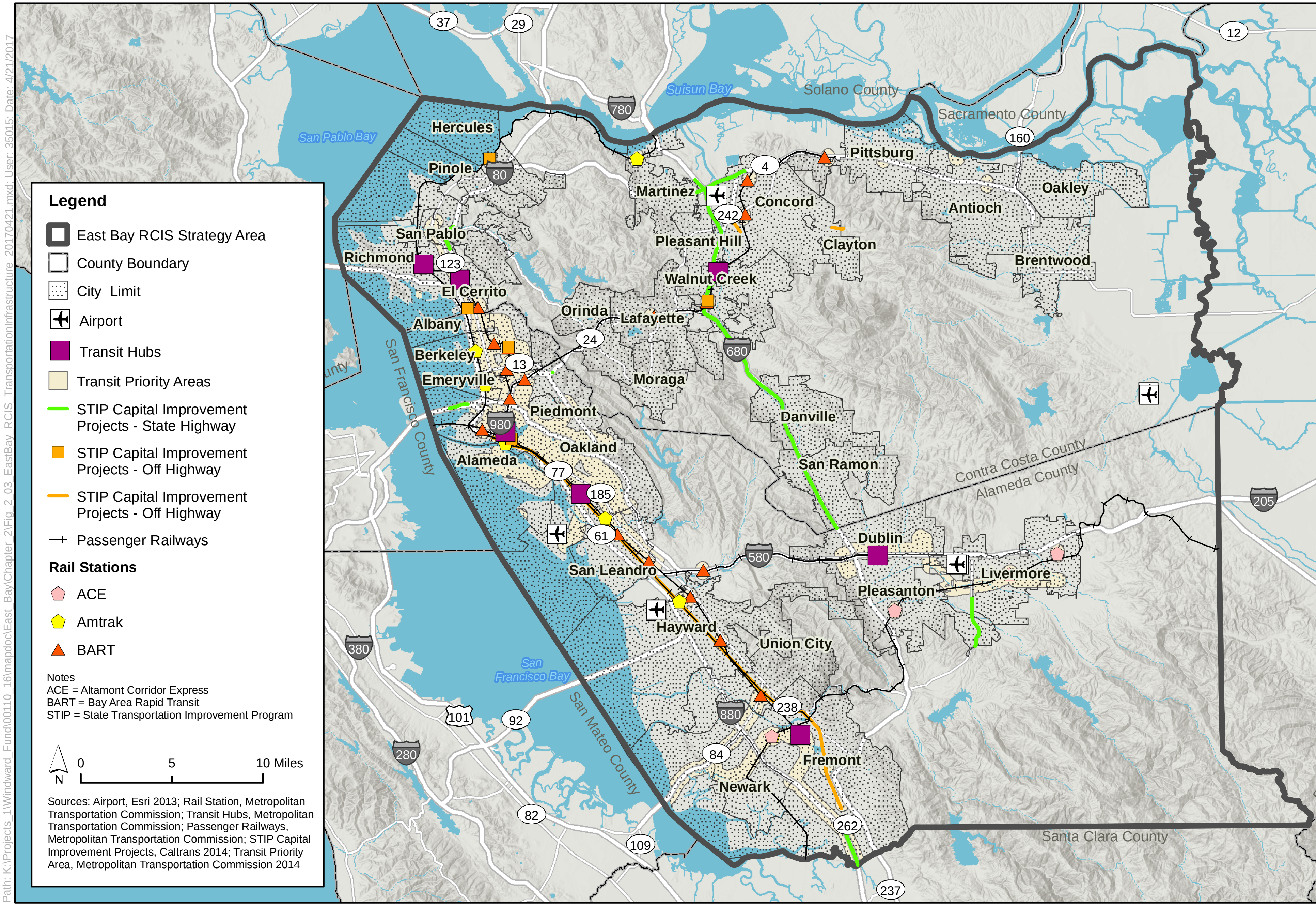

Figure 2-3
Transportation Infrastructure within the East Bay RCIS Area

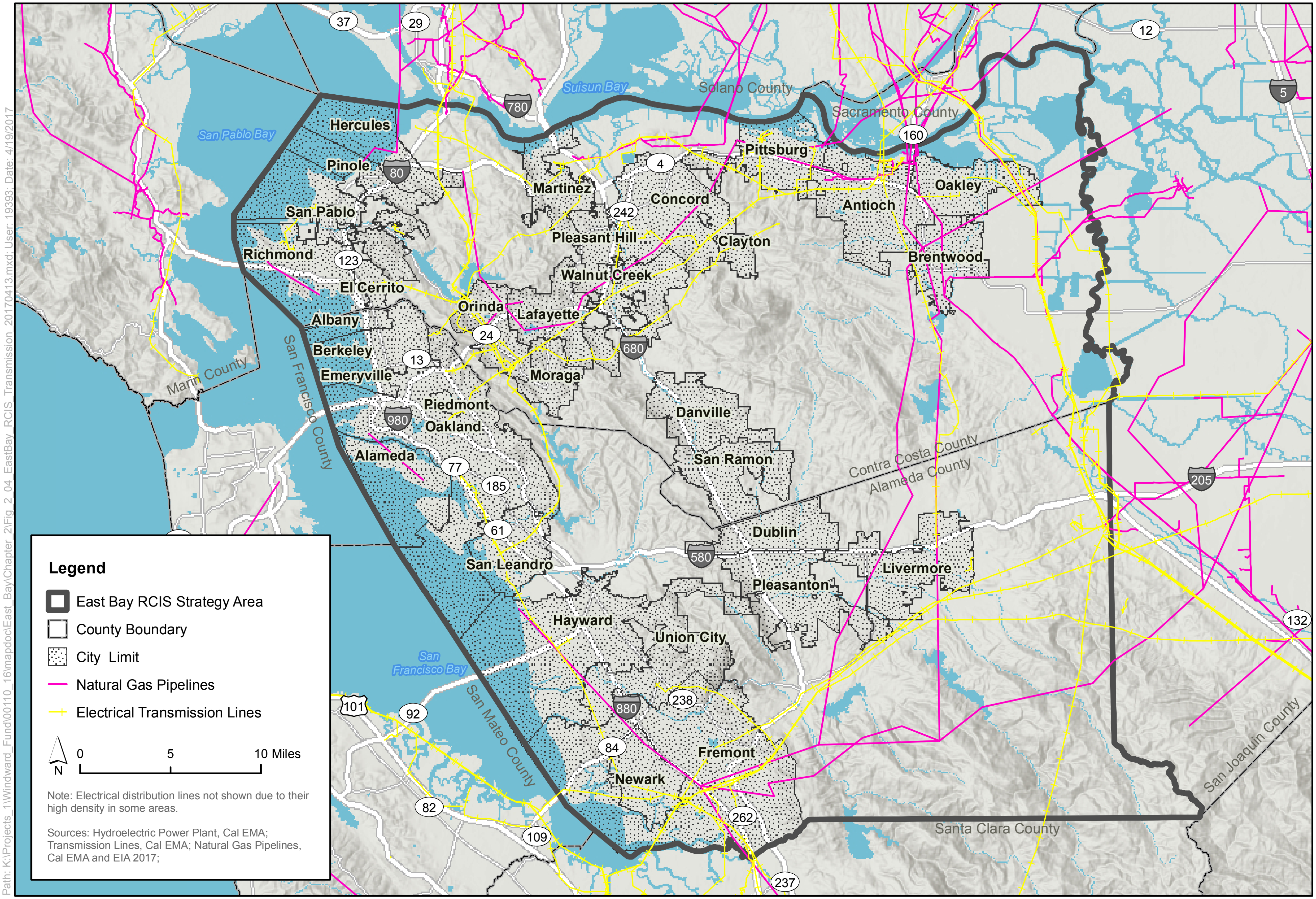

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Figure 2-4
Transmission Facilities within the East Bay RCIS Area

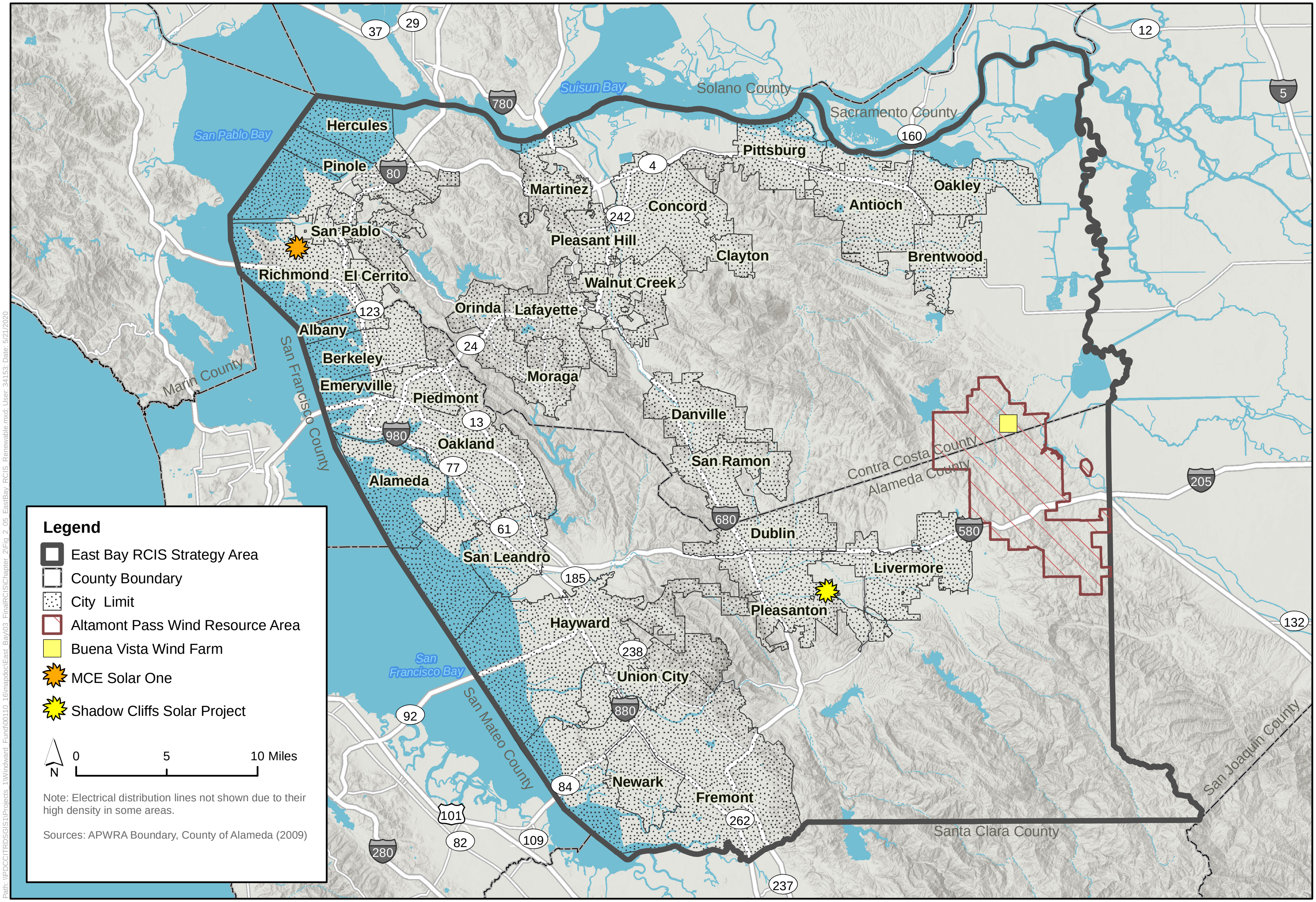

Figure 2-5
Renewable Energy Projects in the East Bay RCIS Area

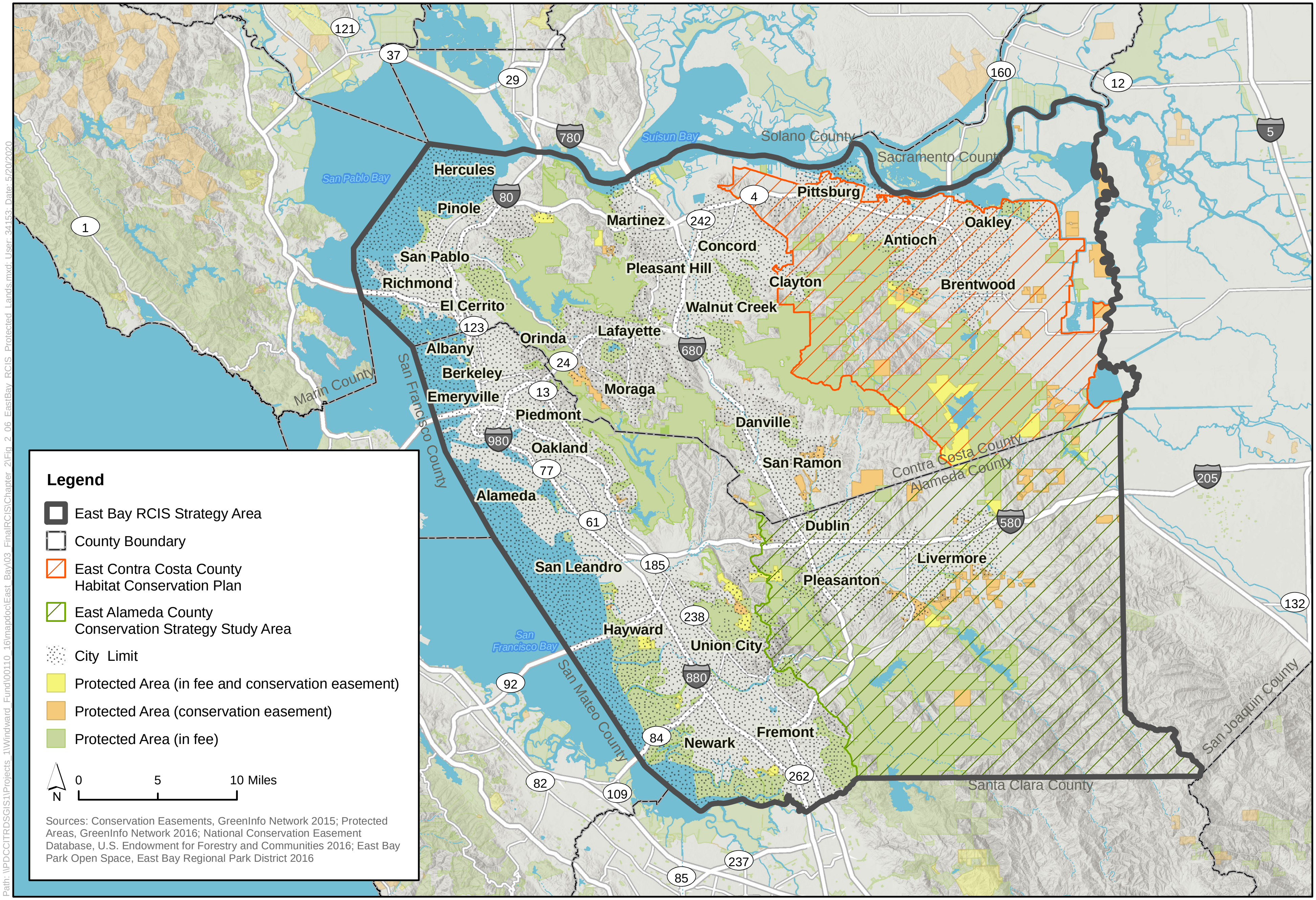

Figure 2-6
East Bay RCIS Protected Areas

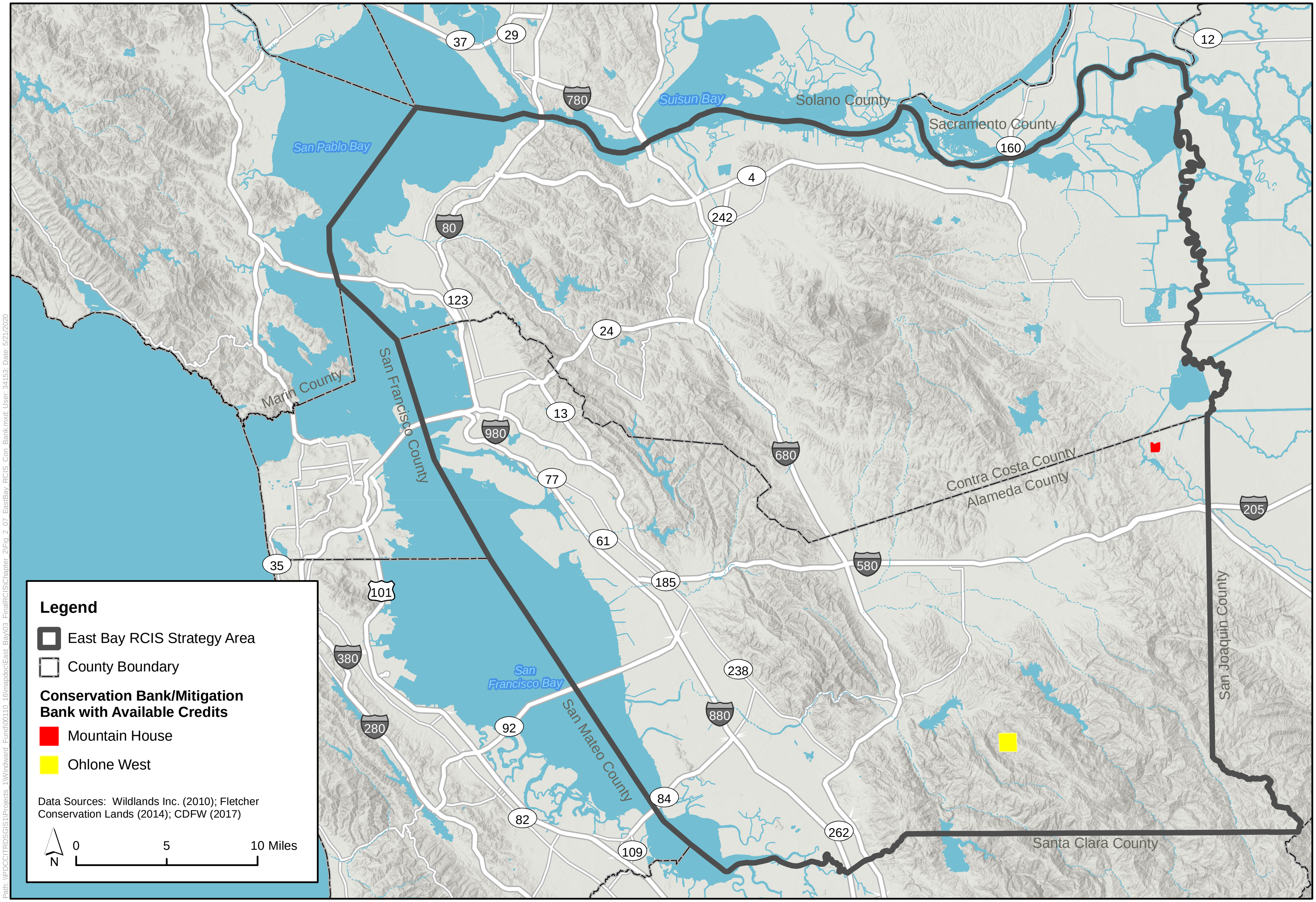

Figure 2-7
Mitigation and Conservation Banks with Available Credits

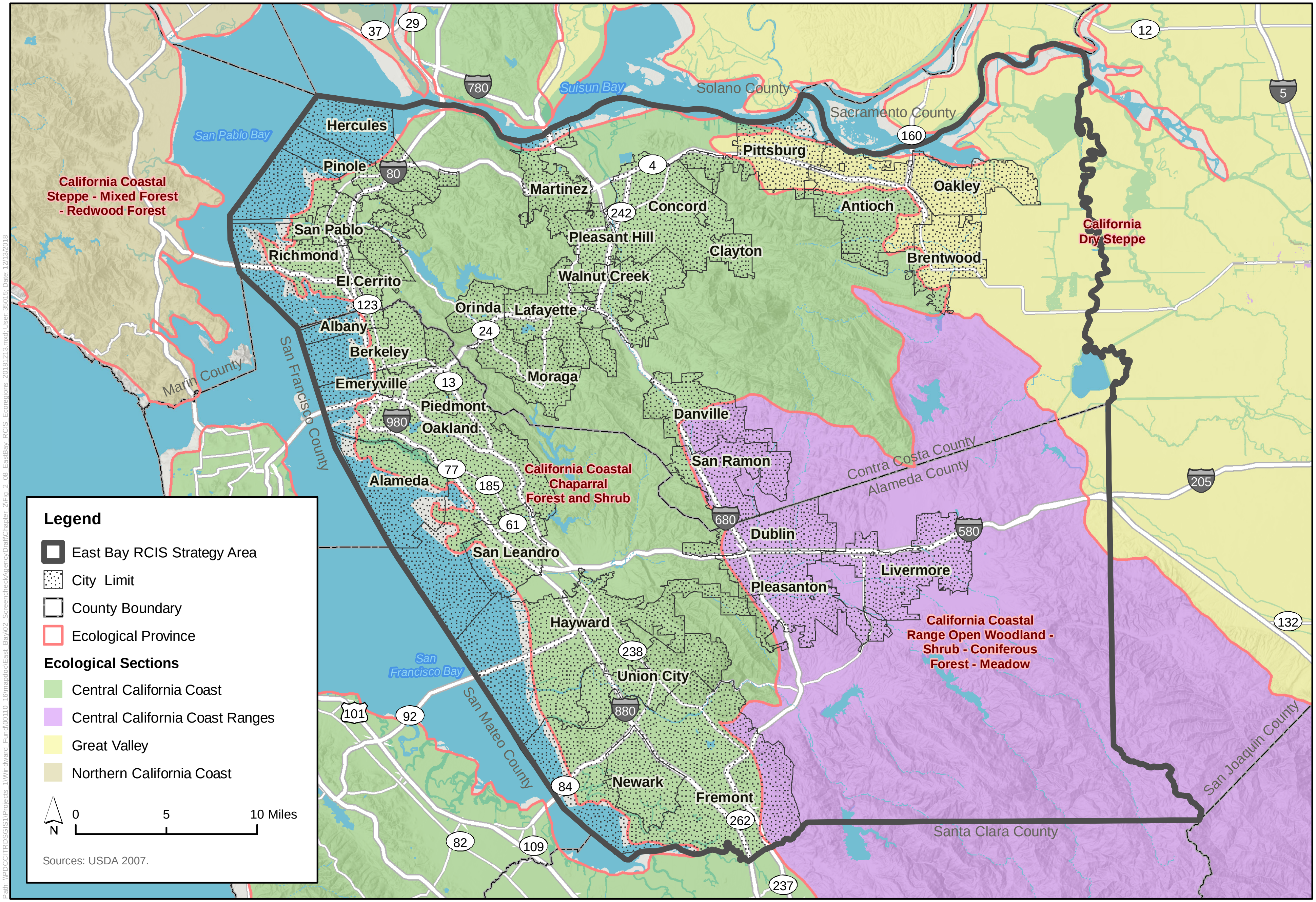

Figure 2-8
Ecoregions of the East Bay RCIS Area

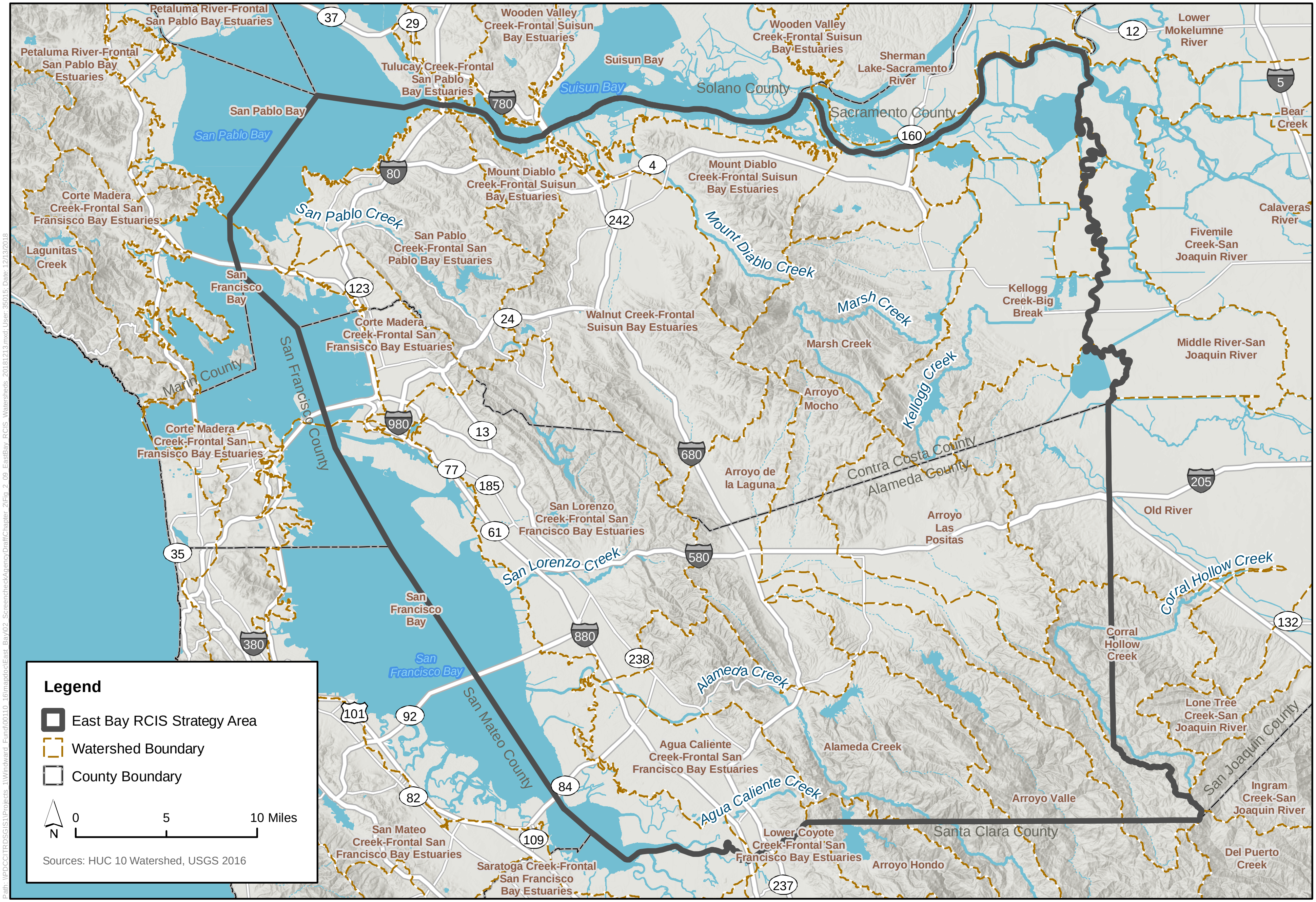

Figure 2-9
Major Watersheds of the RCIS Area

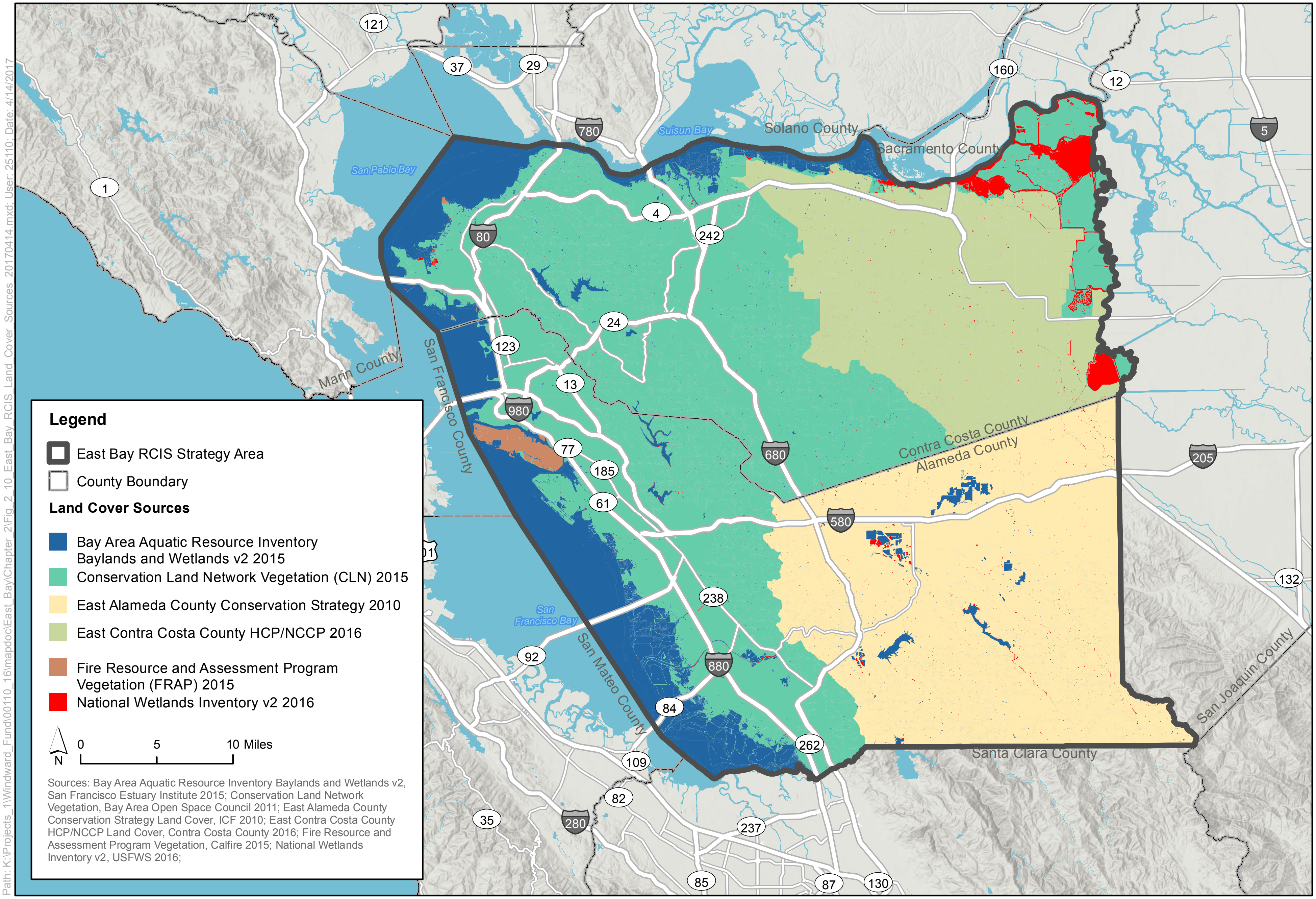

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Figure 2-10
East Bay RCIS Land Cover Data Sources

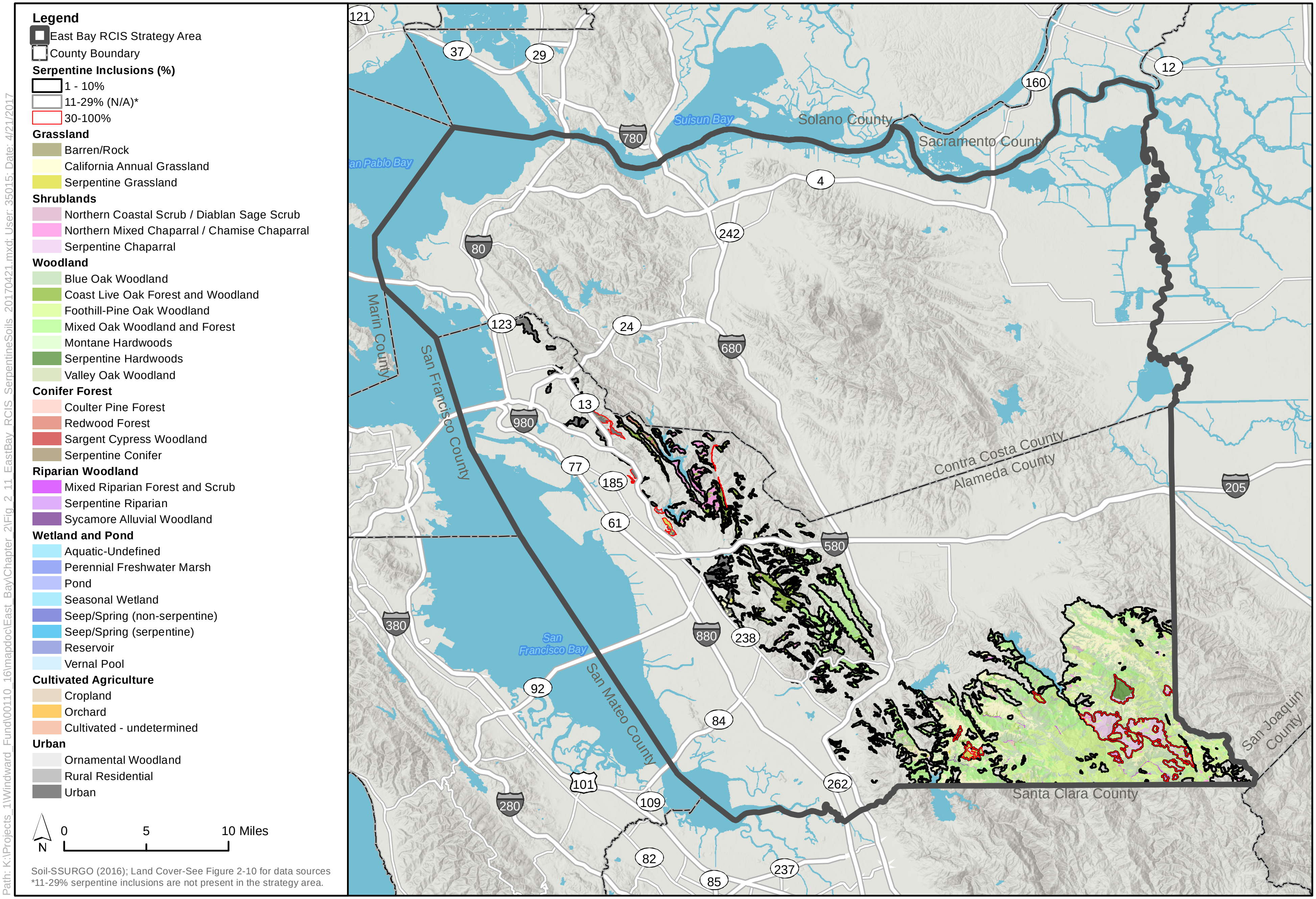

Figure 2-11
Distribution of Serpentine/Ultramafic Soils and Land Cover in the East Bay RCIS Area

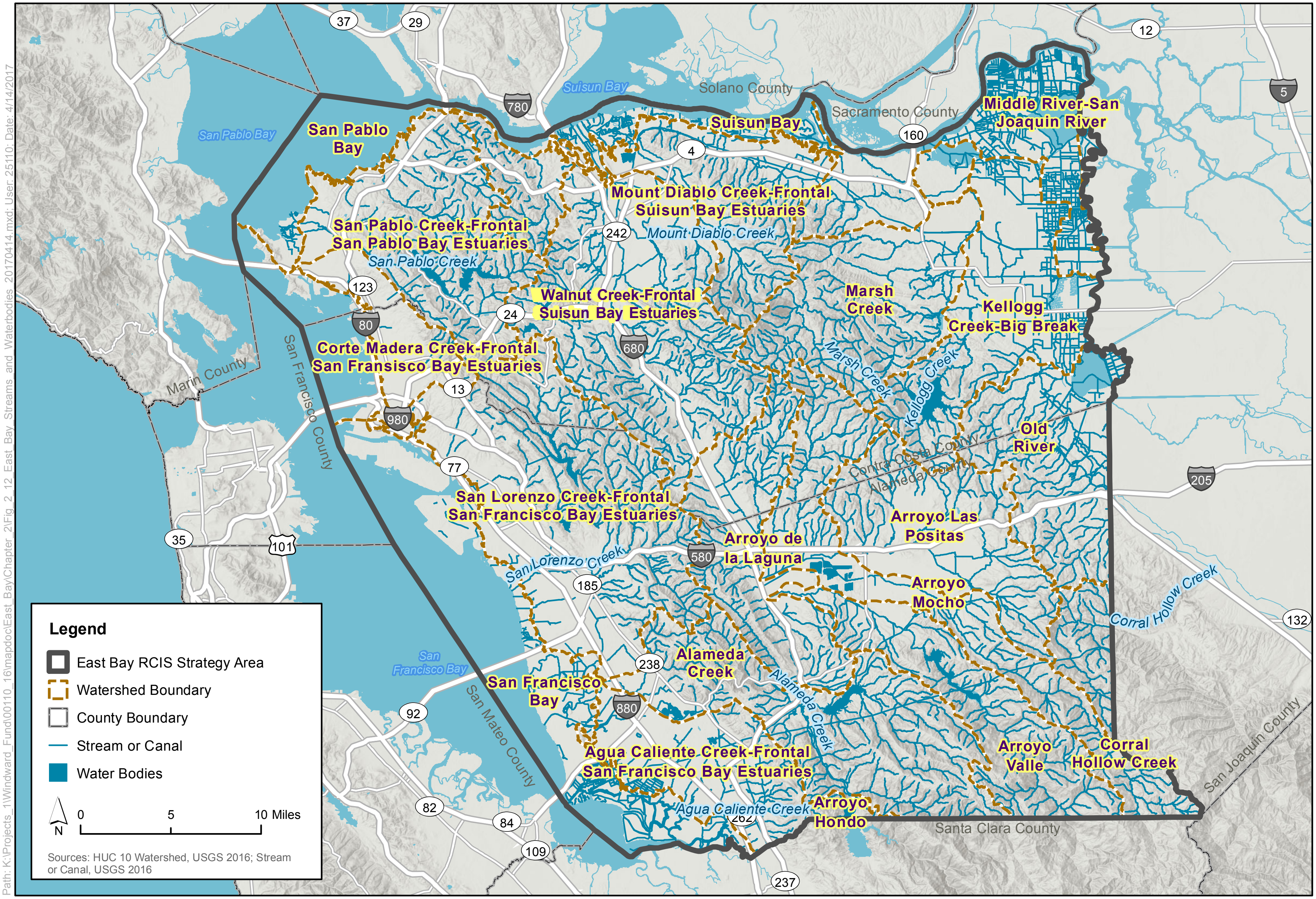

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Figure 2-12
Streams and Water Bodies in the RCIS Area

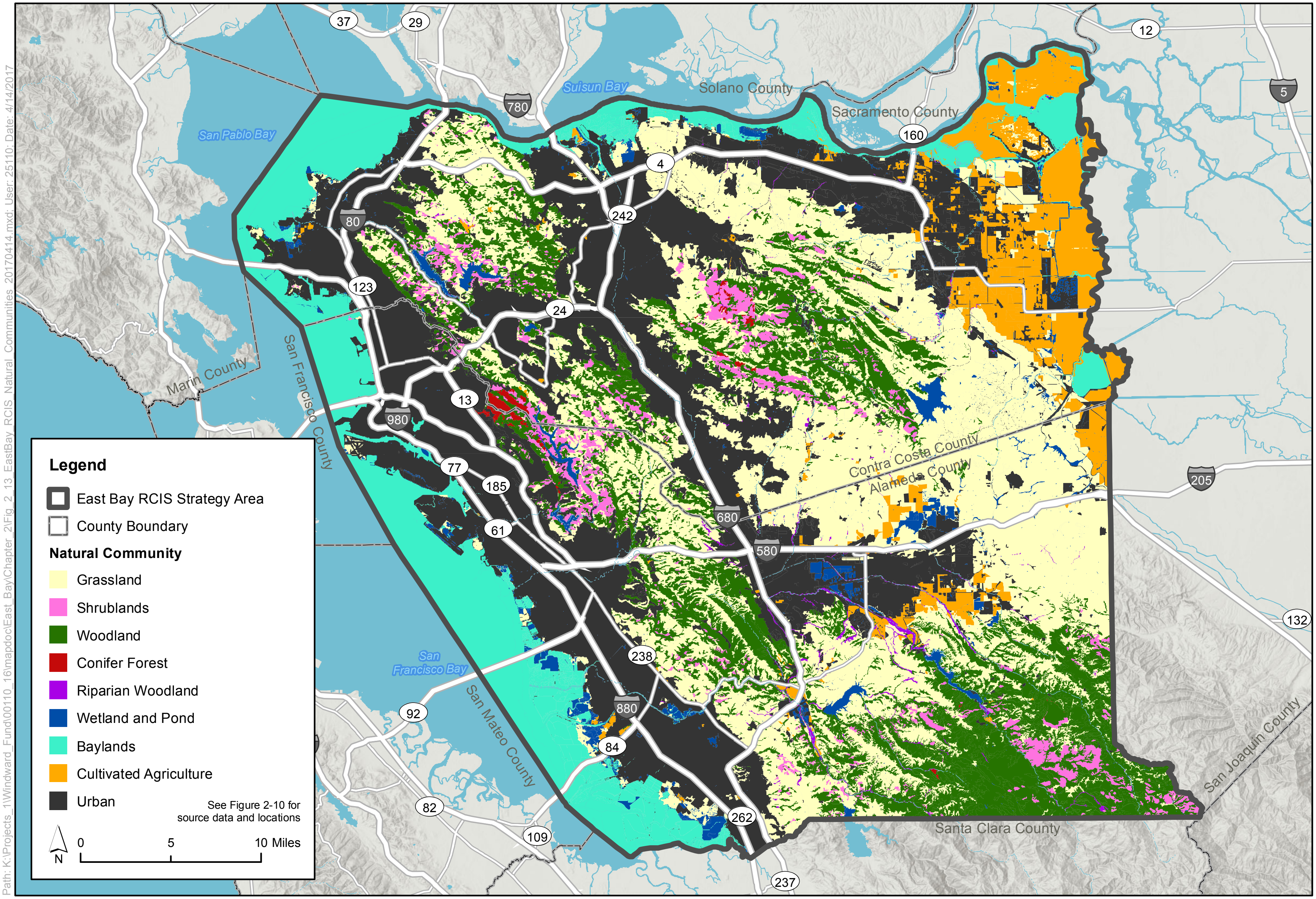

Figure 2-13
East Bay RCIS Natural Communities

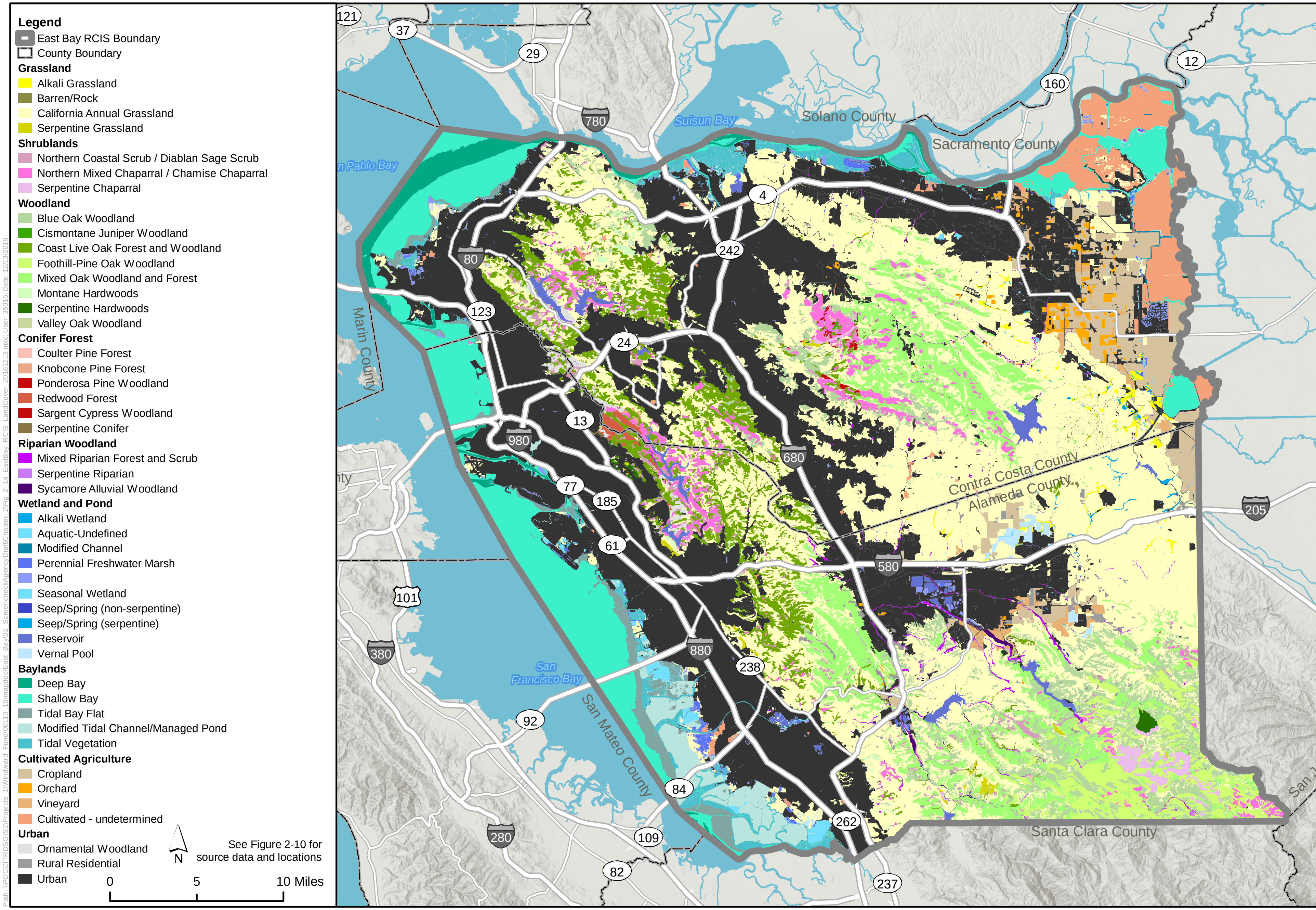

Figure 2-14
East Bay RCIS Land Cover

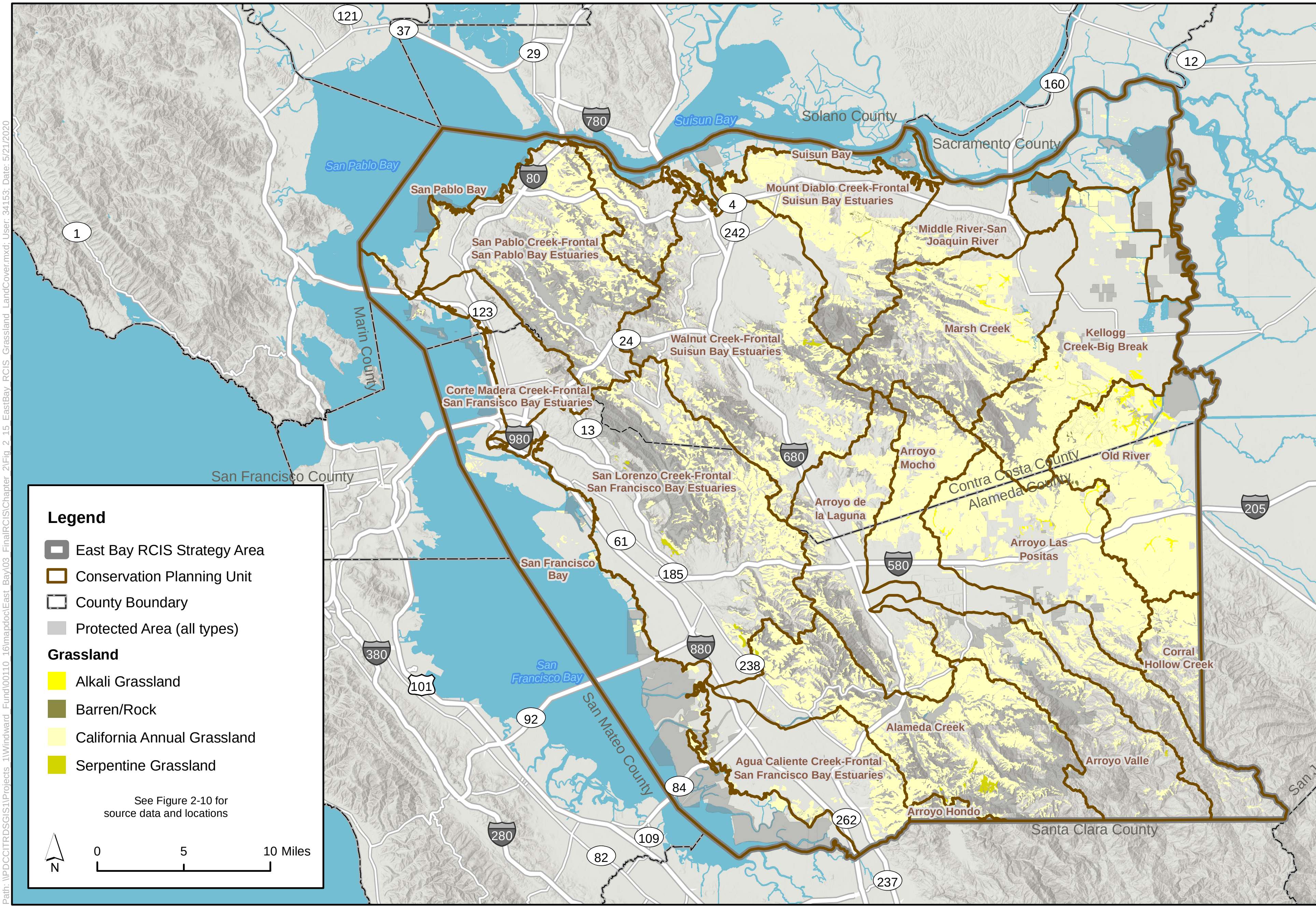

Figure 2-15
Grassland Land Cover in the East Bay RCIS Area

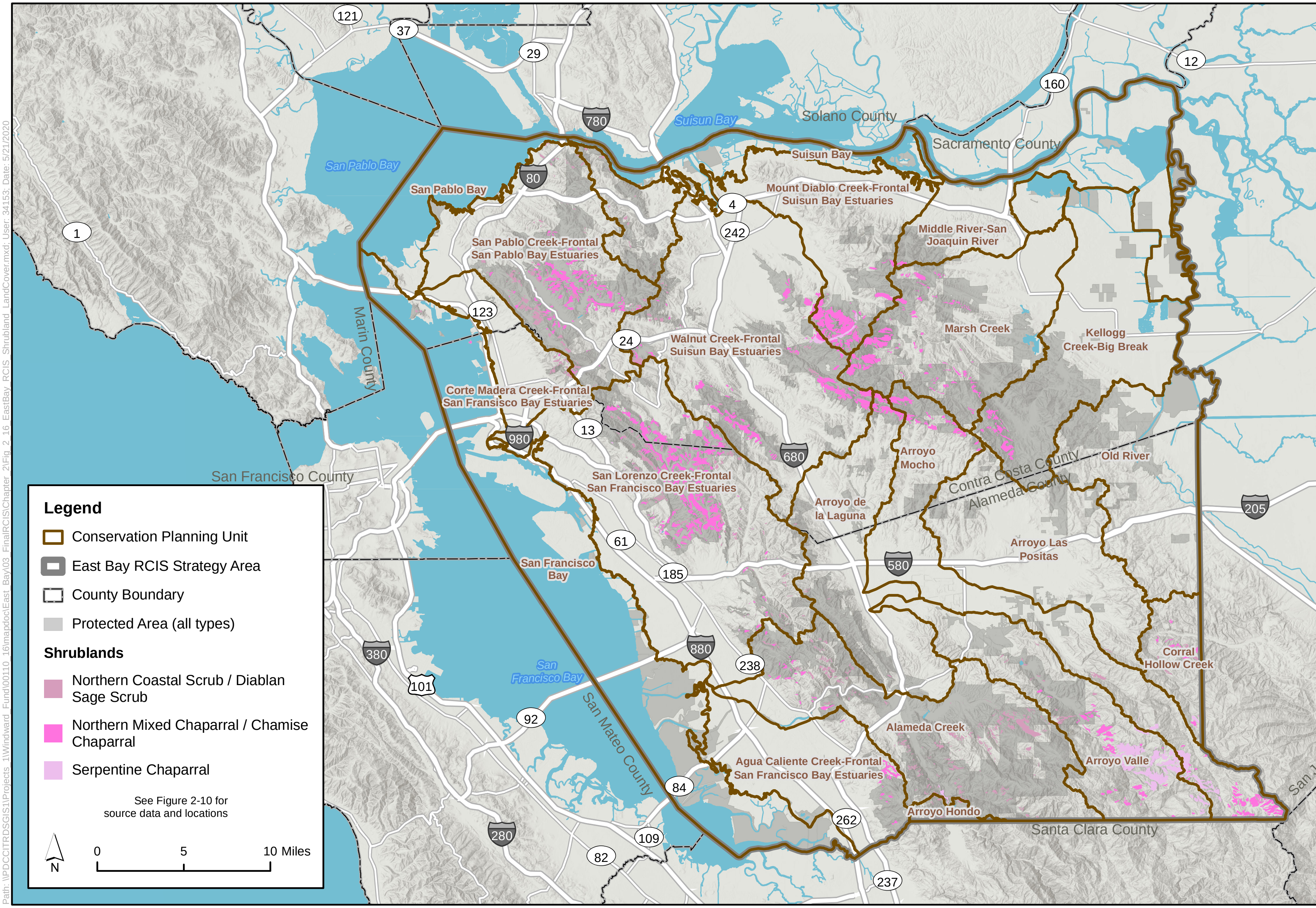

Figure 2-16
Shrubland Land Cover in the East Bay RCIS Area

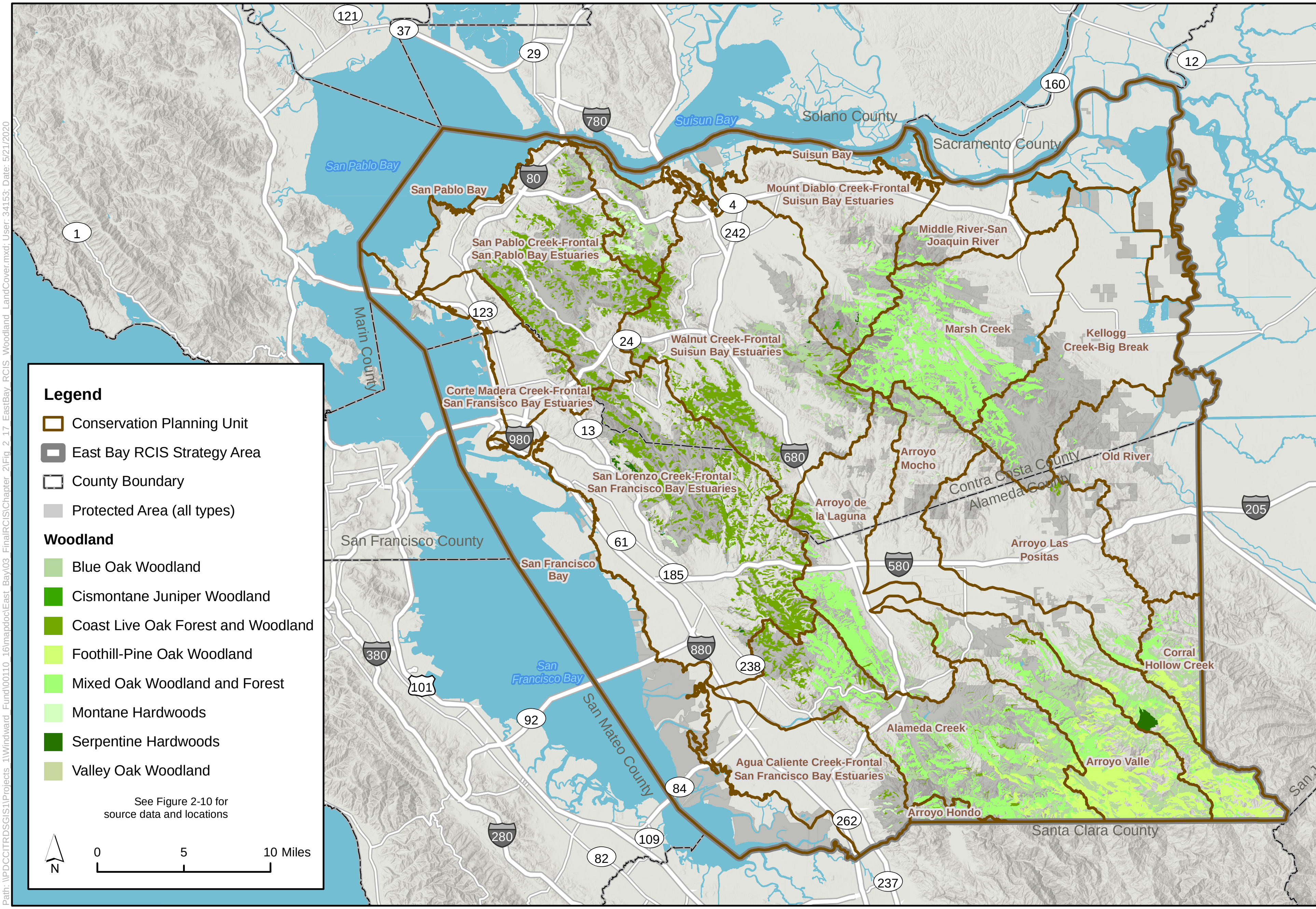

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Figure 2-17
Woodland Land Cover in the East Bay RCIS Area

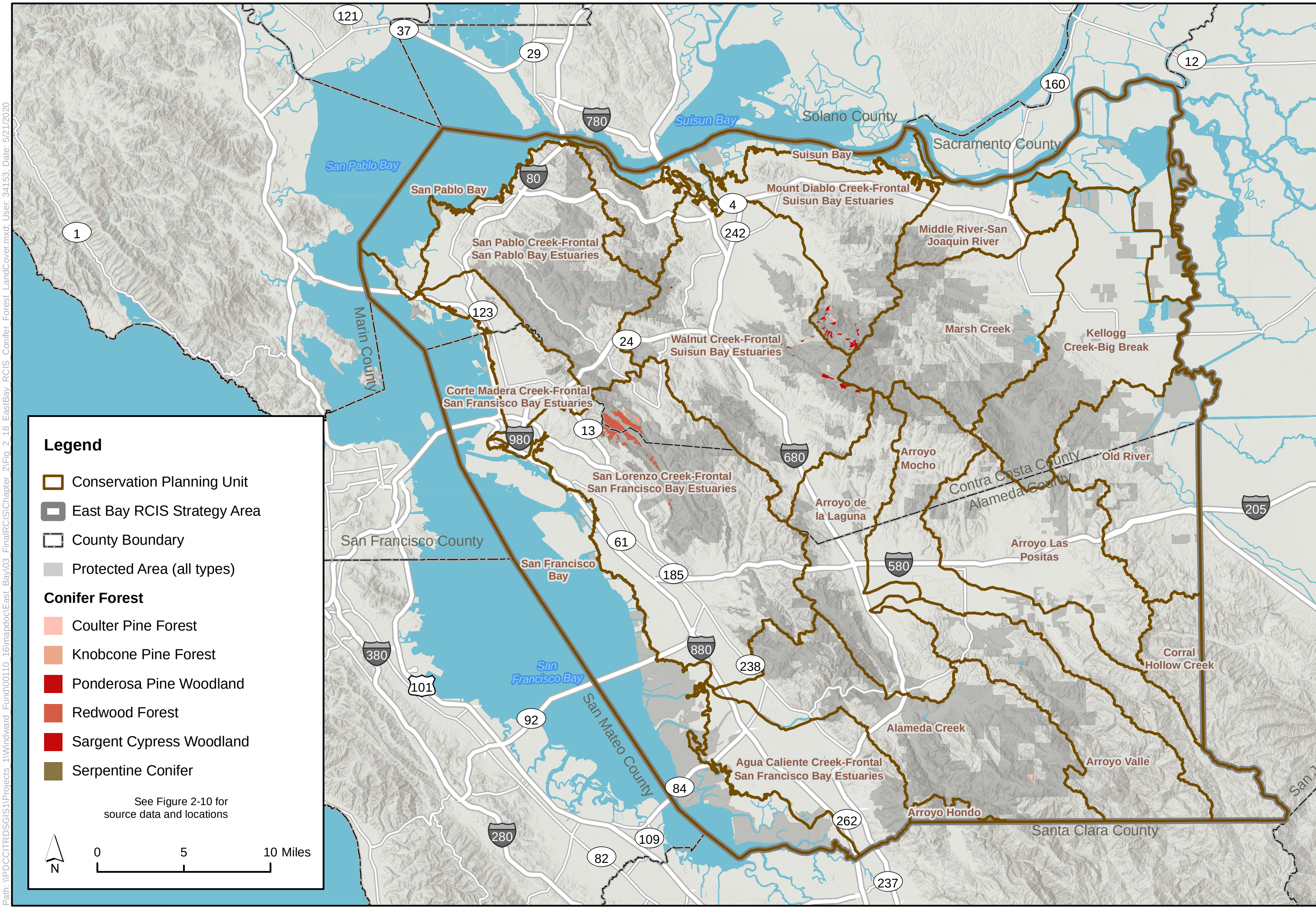

Figure 2-18
Conifer Forest Land Cover in the East Bay RCIS Area

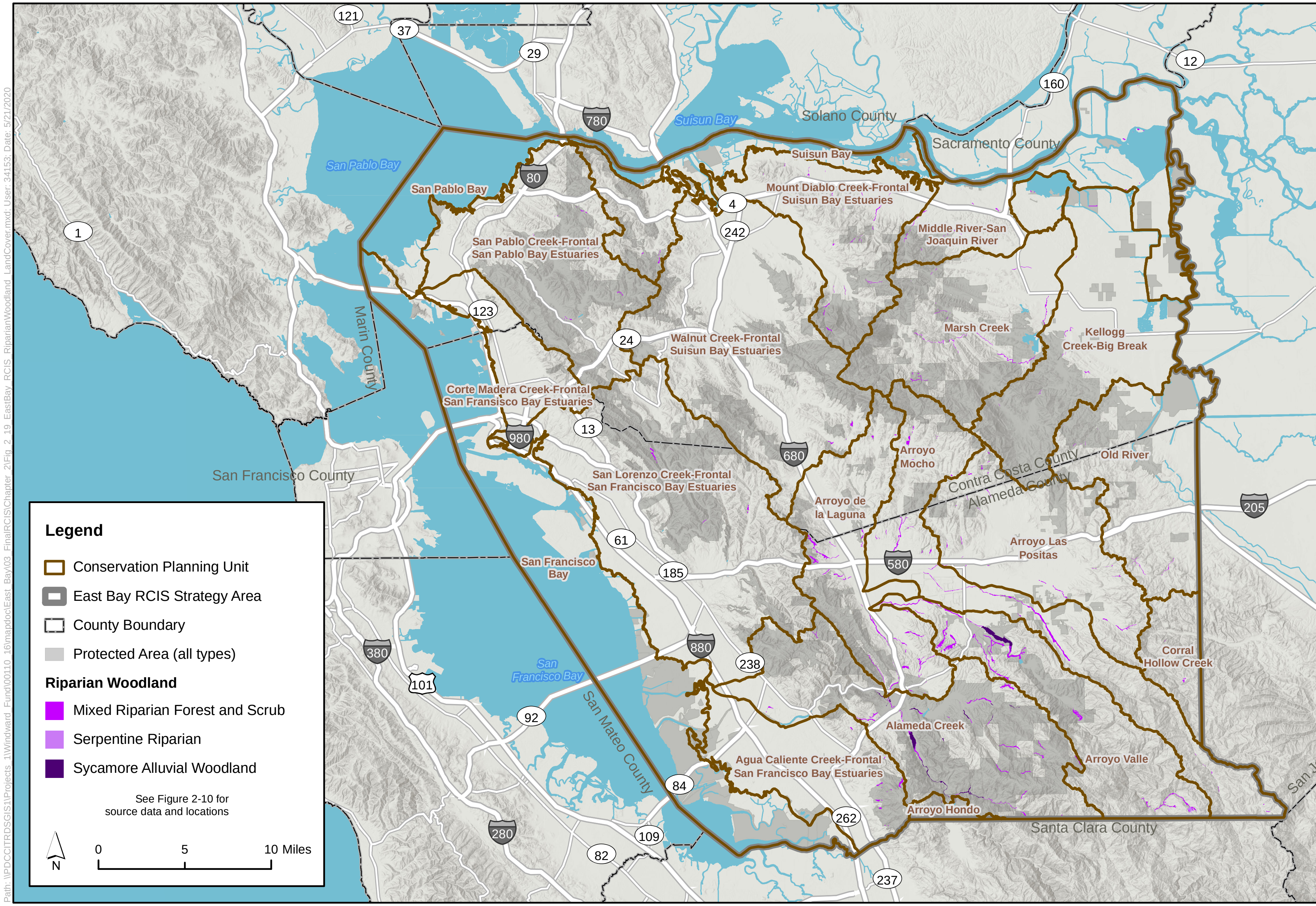

Figure 2-19
Riparian Woodland Land Cover in the East Bay RCIS Area

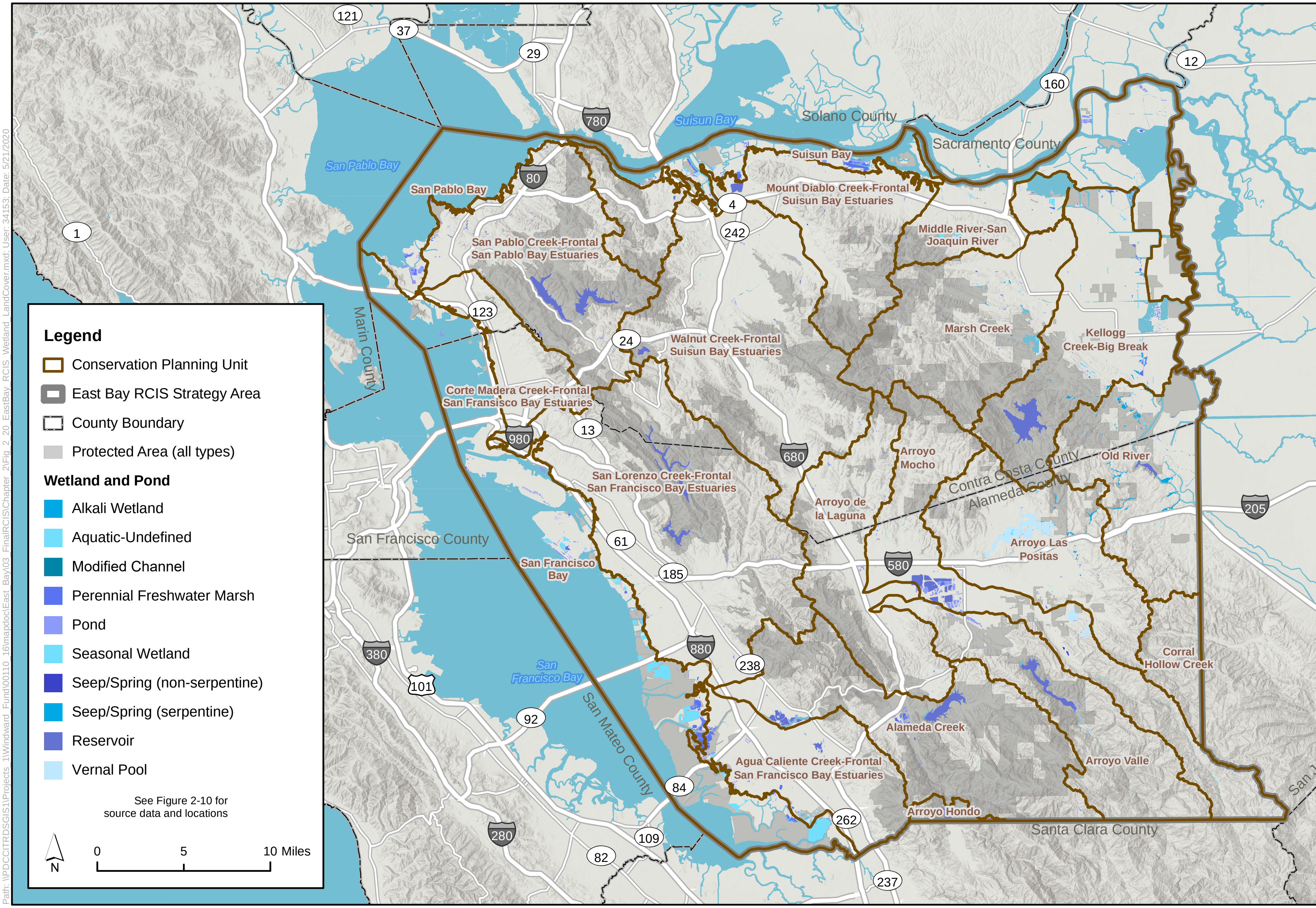

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Figure 2-20
Wetland and Pond Land Cover in the East Bay RCIS Area

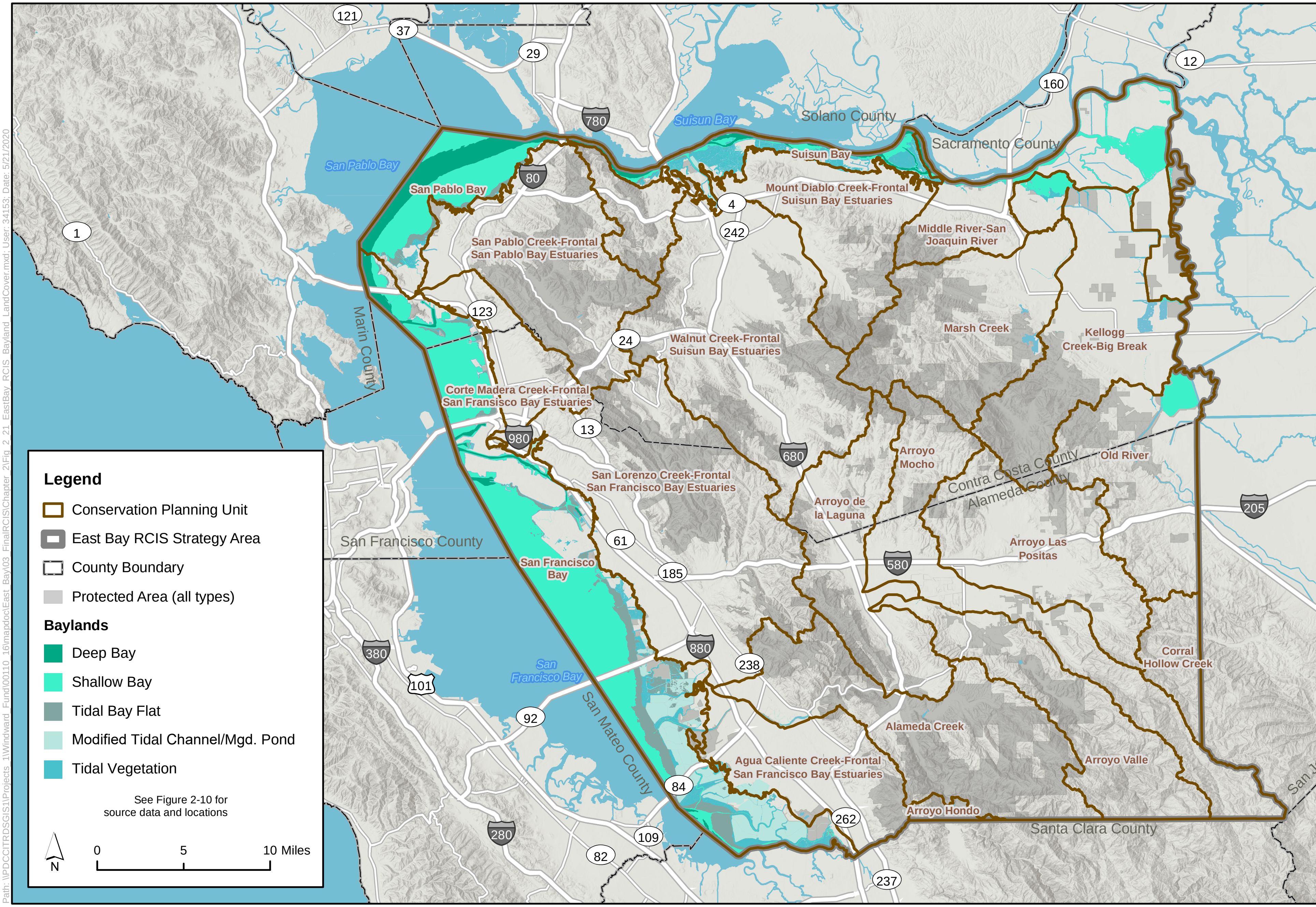

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Figure 2-21
Baylands Land Cover in the East Bay RCIS Area

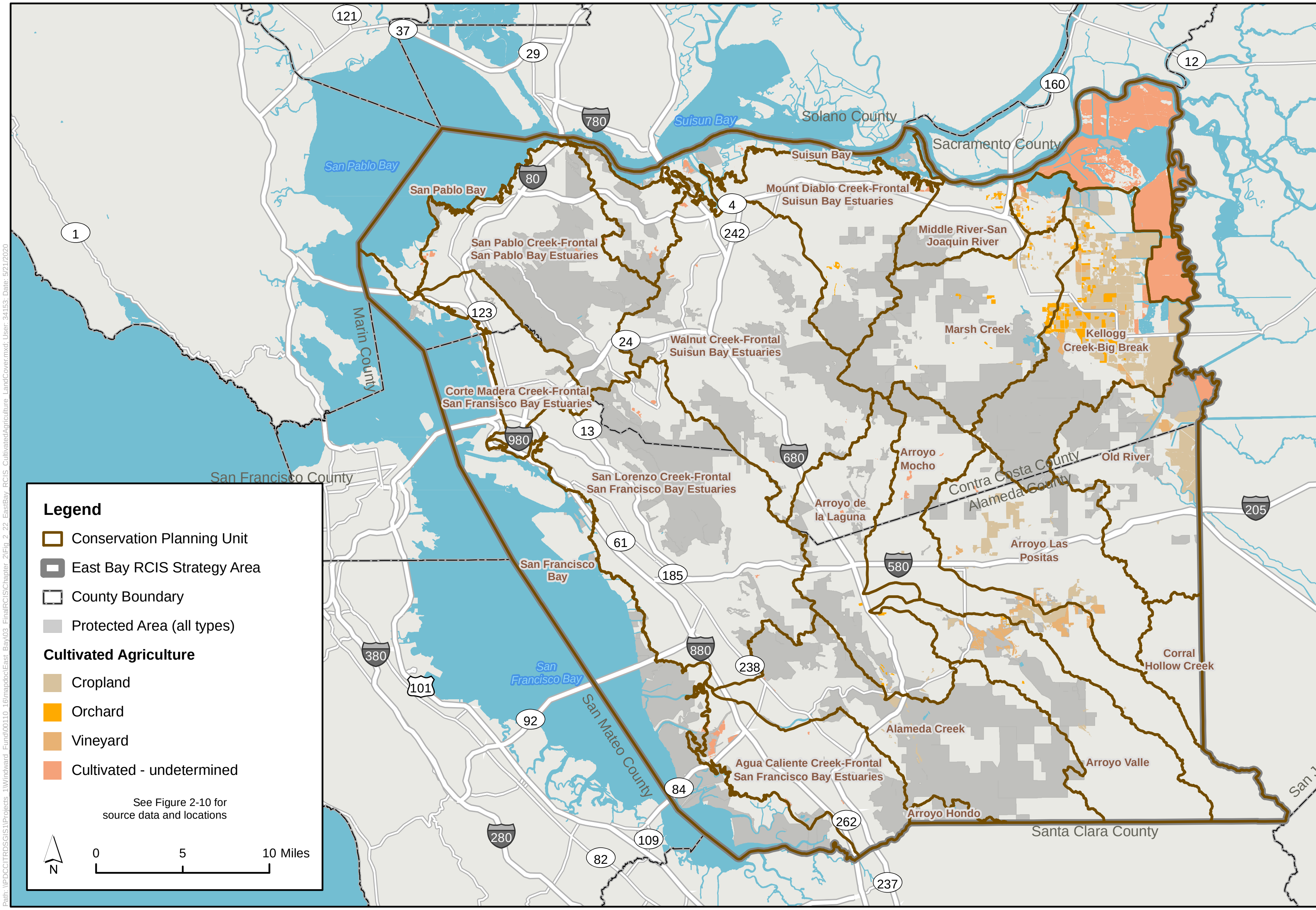

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Figure 2-22
Cultivated Agriculture Land Cover in the East Bay RCIS Area

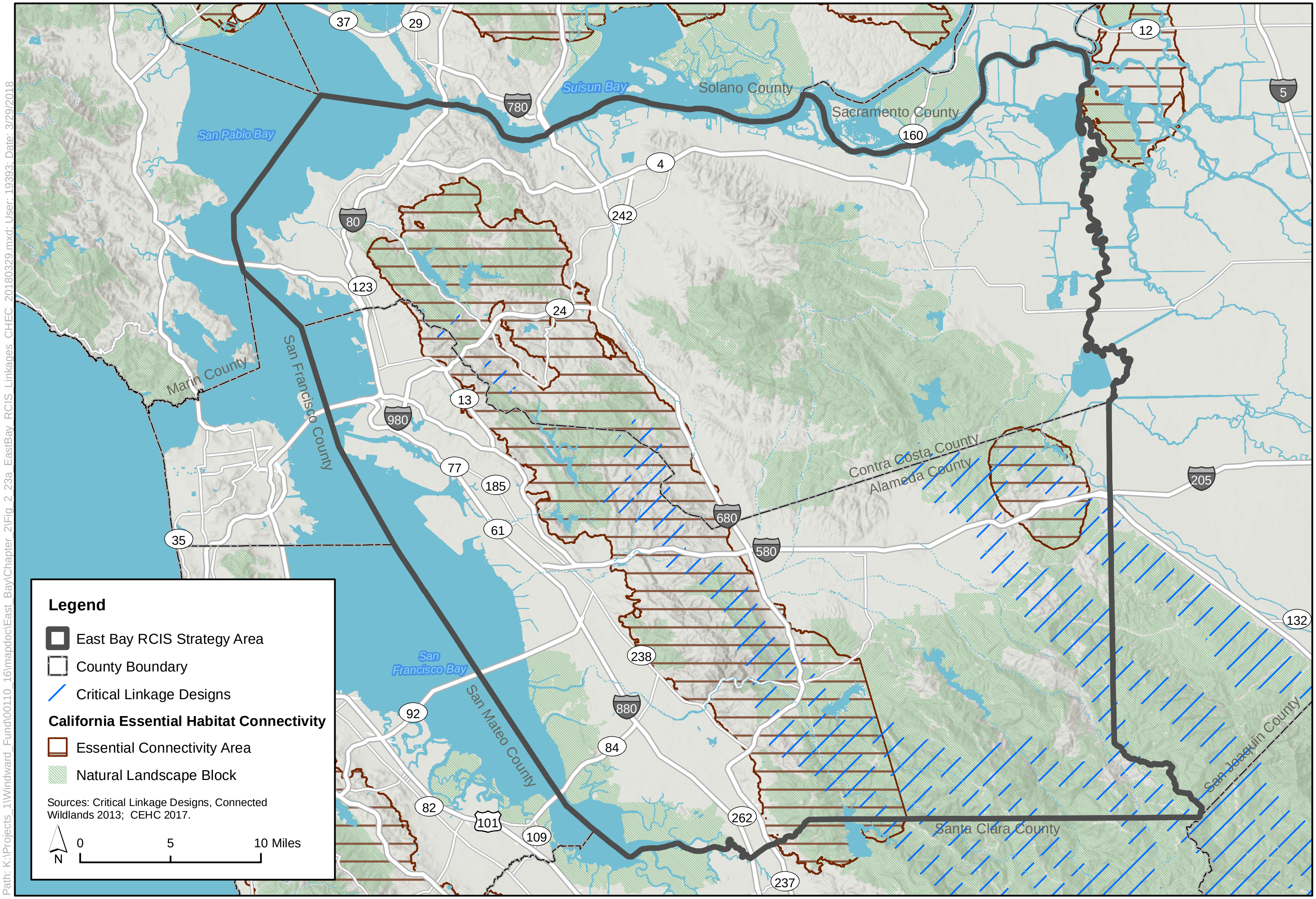

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Figure 2-23a
California Essential Habitat Connectivity Linkages in the RCIS Area

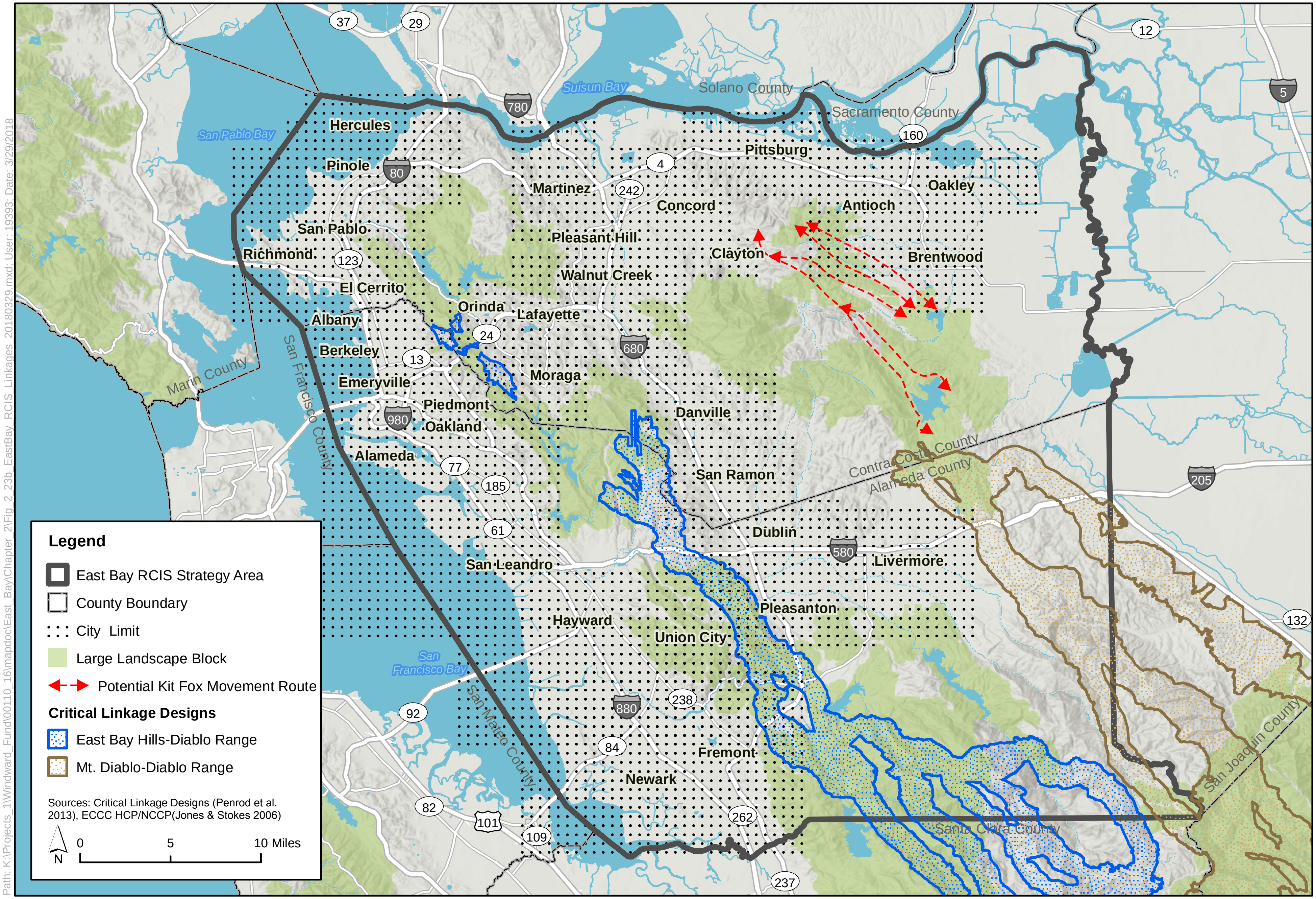

Figure 2-23b
Linkages within the East Bay RCIS Strategy Area

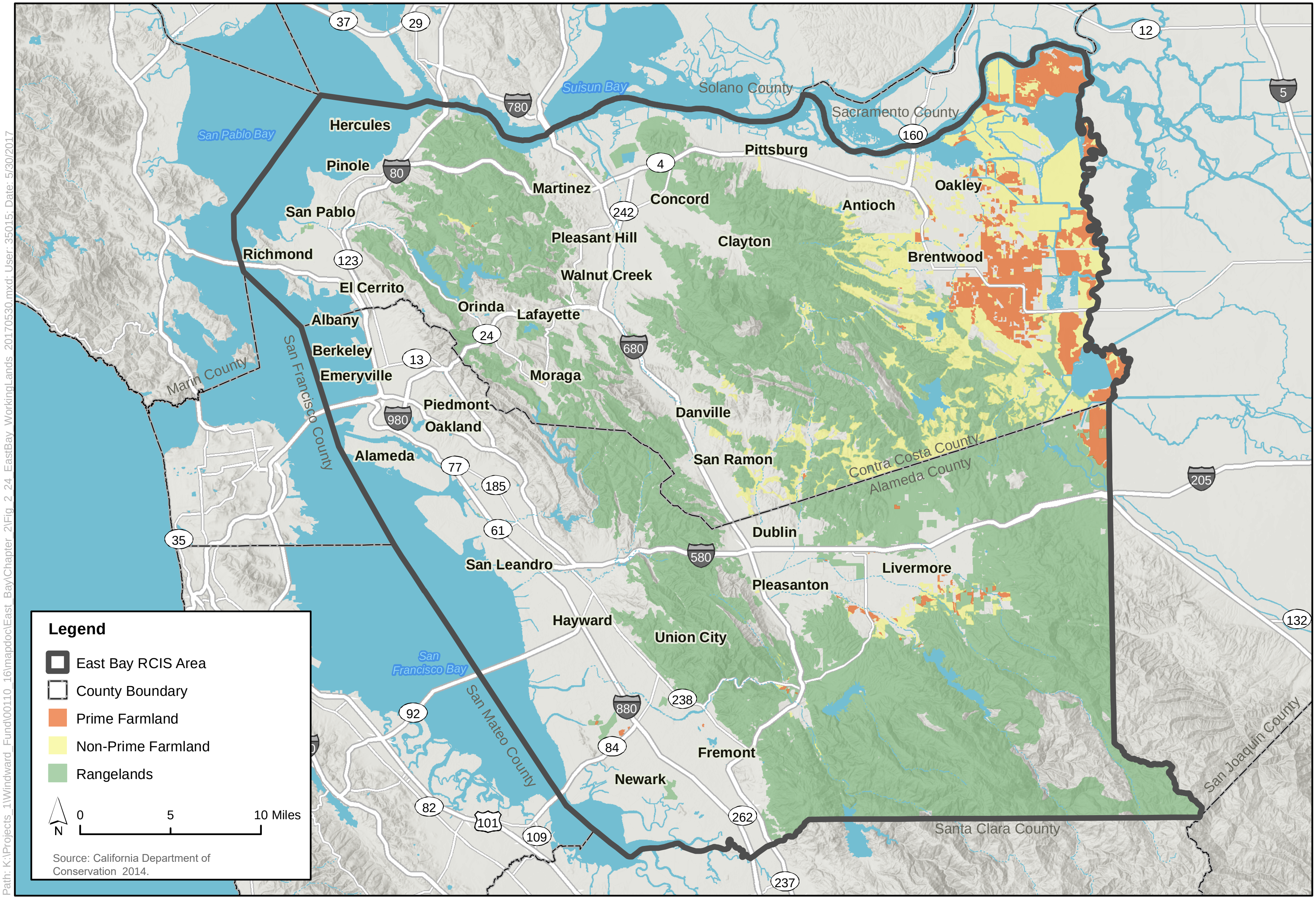

Figure 2-24
Working Lands in the RCIS Area

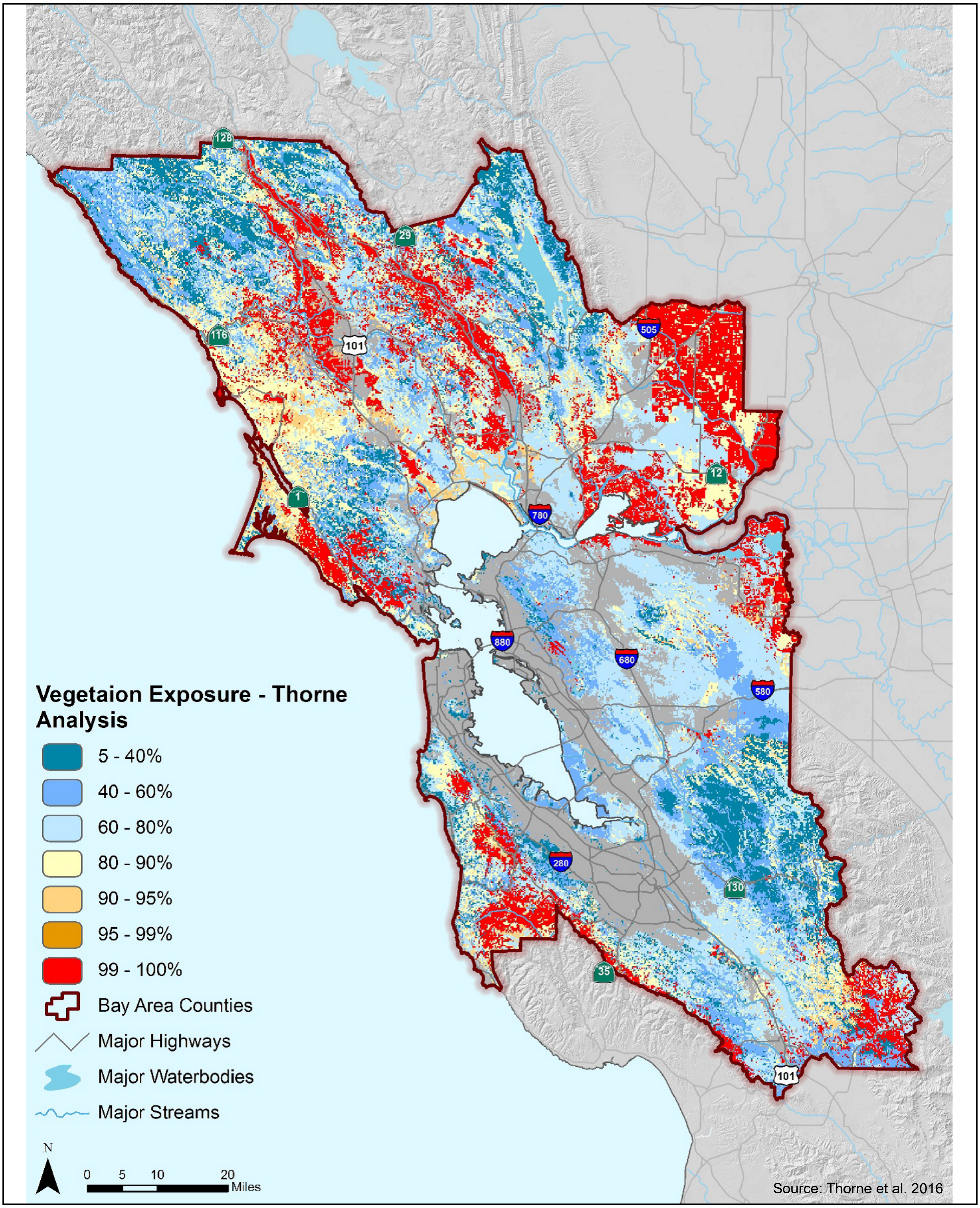

Figure 2-25
Vegetation Exposure to Climate Change

Chapter 3
Conservation Strategy

3.1 Overview

The conservation strategy was designed to meet the requirements of the *Regional Conservation Investment Strategies Program Guidelines* (Program Guidelines) (California Department of Fish and Wildlife 2018a). This chapter describes how conservation opportunities have been identified and prioritized in the regional conservation investment strategy (RCIS) area. This East Bay RCIS uses the best available science to identify conservation goals and objectives, conservation and enhancement actions, and conservation priorities to aid California's declining and vulnerable species by protecting, restoring, creating, enhancing, and reconnecting habitat. This conservation strategy is intended to guide conservation investments and advance mitigation and inform infrastructure and development investments in the RCIS area. Implementation of this strategy will help sustain and enhance species and their habitats, including adapting to climate change and other pressures and stressors, such as habitat fragmentation.

3.2 Framework

The conservation strategy for this East Bay RCIS comprises four elements: conservation goals, conservation objectives, conservation and habitat enhancement actions, and conservation priorities. These elements are presented in the conservation strategy for each focal species (Section 3.8, *Conservation Strategy for Focal Species*) and the conservation strategy for other *conservation elements*[1] (Section 3.9, *Conservation Strategy for Other Conservation Elements*). The conservation strategy provides conservation and habitat enhancement actions and priorities to accomplish the conservation goals and objectives through the following general concepts.

- Protect populations of focal species, non-focal species, and other native species and their habitats to enable these species to persist in the RCIS area and adapt to a changing climate.
- Manage and enhance focal species, non-focal species, and other native species' habitats to maintain and improve habitat quality for these species.
- Protect and enhance landscape linkages (including passage by aquatic species within streams) to facilitate movement through the landscape by fish, wildlife, and plants (e.g., as seeds are dispersed by wildlife).
- Restore habitats and natural communities that have been degraded or lost over time.
- Retain working landscapes for the benefit of focal species, non-focal species, and other native species and agricultural uses.
- Protect land cover types that are uncommon in the RCIS area to maintain the diversity of natural communities and ecological processes representative of the RCIS area.

[1] A conservation element is an element with ecological functions in an RCIS, including focal species and their habitats, wildlife corridors and linkages, and other natural resources.

This RCIS used a conservation gap analysis (Section 3.4, *Conservation Gap Analysis*) to inform the development of quantitative land preservation objectives. The conservation gap analysis was used to determine the amount of land cover types and focal species' habitat currently protected in the RCIS area and that will be protected by the East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan (ECCC HCP/NCCP) (Jones & Stokes 2006), identify gaps in habitat protection, and set quantitative objectives to permanently protect unprotected habitat.

This chapter also presents a framework for monitoring and adaptive management (Section 3.11, *Monitoring and Adaptive Management Strategy*), which can be used to inform development monitoring and adaptive management plans for mitigation credit agreements (MCA) under this East Bay RCIS (Section 4.4.2.5, *Mitigation Credit Agreements*).

The conservation strategy is consistent with previously approved plans and policies in the RCIS area, including the ECCC HCP/NCCP and other Habitat Conservation Plans (HCPs) that overlap the RCIS area (Section 3.6, *Relationship between this RCIS and the East Contra Costa Habitat Conservation Plan and Natural Community Conservation Plan*, and Section 3.10, *Consistency with Approved Conservation Strategies and Recovery Plans*). These plans and policies, identified in Section 1.5, *Relevant Plans and Policies*, were evaluated and utilized as much as possible to create the conservation strategy.

3.2.1 Conservation Goals and Objectives

The East Bay RCIS conservation goals reflect the broad, desired outcomes for the focal species and other conservation elements in the RCIS area and address the stressors on focal species and important conservation elements identified in Section 2.3, *Pressures and Stressors on Conservation Elements*. Each conservation goal is supported by several conservation objectives. Conservation objectives are concise, measurable statements of the target outcome for each focal species and other conservation elements. The conservation objectives focus on protecting and enhancing unprotected land (Section 3.4) and restoring and enhancing land that is already protected in the RCIS area but may lack appropriate management. In some cases, conservation objectives focus on restoration and enhancement of other conservation elements, such as protection of wildlife corridors or removal of movement barriers. Where possible, conservation objectives are quantitative and spatially explicit, and include a description of how they provide for adaptation opportunities to offset the effects of climate change. Conservation objectives are set such that, if implemented, they would accomplish the conservation goals. However, because implementation of this RCIS is voluntary, and resources available to the conservation community and others to invest in conservation and enhancement actions are limited and variable, there is no deadline to achieve these objectives, and all of the conservation goals and objectives will not likely be fully achieved within the next 10 years.

Most of the conservation goals and objectives for focal species are designed to increase the size of their populations. The conservation goals and objectives also provide for the long-term persistence of focal species through protection and enhancement of populations and habitat. Quantitative land protection objectives are provided for all RCIS focal species (Section 3.8), habitats on unique land cover types (Section 3.9.5, *Unique Land Cover Types*), and important soil types (Section 3.9.6, *Important Soil Types*).

All conservation goals and objectives are given unique codes so that they can be easily identified and tracked by those implementing conservation and enhancement actions.

3.2.2 Actions and Priorities

The East Bay RCIS actions and priorities are the strategies that will be employed to accomplish the conservation goals and objectives. Actions include both conservation actions and habitat enhancement actions and are defined by the Program Guidelines as follows.

> *Conservation action* is an action identified in an RCIS that, when implemented, would permanently protect or restore, and perpetually manage, conservation elements, including focal species and their habitats, natural communities, ecological processes, and wildlife corridors. In contrast, a habitat enhancement action would have long-term durability but would not involve acquiring land or permanently protecting habitat – see *habitat enhancement action*. A conservation action is developed to achieve one or more conservation objectives. A conservation action may be implemented through a variety of conservation investments or MCAs. A conservation action that is implemented through an MCA would create conservation credits to be used as compensatory mitigation.

> *Habitat enhancement action* is an action identified in an RCIS that, when implemented, is intended to improve the quality of wildlife habitat, or to address risks or stressors to wildlife. A habitat enhancement action is developed to achieve one or more conservation objectives. A habitat enhancement action would have long-term durability but would not involve acquiring land or permanently protecting habitat. In contrast, a conservation action would permanently protect or restore, and perpetually manage, conservation elements – see Conservation Action. Examples of habitat enhancement actions include improving in-stream flows to benefit fish species, enhancing habitat connectivity, and controlling or eradicating invasive species. A habitat enhancement action may be implemented through a variety of conservation investments or MCAs. A habitat enhancement action that is implemented through an MCA would create habitat enhancement credits intended for use as compensatory mitigation for temporary impacts.[2]

The primary distinction between a conservation action and a habitat enhancement action is the duration in which the land or habitat management action is protected. A conservation action includes permanent protection[3] or restoration and perpetual management. A habitat enhancement action is management action implemented on land (or water) that is protected for a defined period of time, but not in perpetuity. Management actions implemented under a conservation action, such as managing a stock pond to provide habitat for California tiger salamander, may be the same as those implemented as a habitat enhancement action. The primary difference is the contract used to protect the land and management action.

The actions described in the conservation strategies in this chapter are not identified as either conservation actions or habitat enhancement actions to retain flexibility in how the action may be implemented under an MCA, as many of the actions can be implemented on land or water permanently protected under a conservation easement (i.e., conservation action), or on land or water protected under a long-term durability agreement that is not permanently protected (i.e., habitat enhancement action). For example, an action to grow crops that provide high-quality foraging habitat for Swainson's hawk may be implemented on permanently protected land, with the

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[2] CFGC Section 1856(d) states that "…the habitat enhancement action shall remain in effect at least until the site of the environmental impact is returned to pre-impact ecological conditions."
[3] *Permanent protection* means: (1) recording a conservation easement and (2) providing secure, perpetual funding for management of the land, monitoring, legal enforcement, and defense.

land managed in perpetuity to provide foraging habitat for Swainson's hawk, or on land protected under an appropriate durability agreement that is not permanently protected.

A conservation priority is defined by the Program Guidelines as follows.

> *Conservation priority* is a conservation or habitat enhancement action (e.g., land acquisition, restoration, or habitat enhancement) that is identified based on its importance for benefiting and contributing to the conservation of focal species and their habitats, or other conservation elements within an RCIS area.

Conservation priorities are used to highlight important conservation actions and habitat enhancement actions that should be implemented within the next 10 years. If additional actions or new priorities emerge, the RCIS can be amended to include them, as necessary (Section 4.5, *Amending this RCIS*), or they can be added to the RCIS when extending the approval period (Section 4.2.1, *Updating and Extending this RCIS*).

This RCIS includes a toolbox of actions and conservation priorities that can be implemented to achieve this RCIS's conservation goals and objectives. Because this is a voluntary conservation strategy, and because resources available for the conservation community and others to invest in conservation and habitat actions are limited and variable, it is not expected that all of the actions and priority actions will be implemented over the next 10 years.

3.2.2.1 Identifying Conservation Priorities

The conservation priorities in this RCIS emphasize the following types of actions.

- Protection of unprotected occurrences or populations of focal species.
- Protection of unprotected focal species' habitats, prioritizing habitats that are generally more limited, or limiting to a species' persistence. For example, for California tiger salamander, areas with aquatic breeding habitat interspersed within upland habitat is prioritized over upland habitat that does not support aquatic breeding habitat because the availability of aquatic breeding habitat generally limits persistence in an area. Similarly, core or primary habitat is prioritized over secondary habitat (as defined for some plant species).
- Protection and enhancement of unprotected corridors or linkages for movement, to improve connectivity between habitats and enhancement of movement across barriers to movement such as highways (Section 2.2.8.1, *Habitat Connectivity*).
- Management actions to improve habitat conditions (e.g., removal or control of invasive species, vegetation management).
- Surveys of potentially suitable habitat to locate new occurrences, document absences, or identify populations for protection, particularly for species with few known occurrences in the RCIS area.
- Protection of unique land cover types (Section 2.2.8.5, *Unique Land Cover Types*).

This East Bay RCIS uses recovery plans, federally designated critical habitat, the ECCC HCP/NCCP, and the East Alameda County Conservation Strategy (EACCS) (ICF International 2010) to identify conservation priorities. Other information used to identify conservation priorities include the following.

- Documented and recent (within the last 20 years) species occurrences (Appendix F, Focal Species Profiles).
- Recovery areas identified in recovery plans (for federally listed focal species) (Appendix F).
- Locations of wildlife linkages (Section 2.2.8.1).
- Adjacency to protected areas (Section 2.2.1, *Protected Areas*).
- Locations expected to be more resilient to the effects of climate change (California Department of Fish and Wildlife 2017b, Jones & Stokes 2006, ICF International 2010) (Section 2.3.4.5, *Effects on Focal Species and Habitat*).
- Locations of rare or unique land cover types (Section 2.2.8.5).

The focal species' conservation and habitat enhancement actions and priorities in this RCIS are identified based on their importance for contributing to the conservation and recovery of the focal species and their habitats within the RCIS area. Other natural resource conservation co-benefits not addressed by this RCIS may also be used to inform the implementation of actions and priorities identified in this RCIS. Co-benefits may include, but are not limited to, carbon storage, ground water recharge, and water hazard risk reduction.

Users of this RCIS may wish to identify conservation co-benefits not addressed in this RCIS (e.g., groundwater recharge, carbon sequestration, recreation, and other conservation elements) to provide additional context to the conservation actions, habitat enhancement actions, and conservation priorities in this RCIS. The Bay Area Greenprint (The Nature Conservancy, Bay Area Open Space Council, American Farmland Trust, Greenbelt Alliance, and GreenInfo Network 2017) is an online tool[4] that reveals the multiple natural and agricultural values of a region. The nine nature's values and benefits that are assessed in the Bay Area Greenprint are prioritized habitats, habitat connectivity, species and habitats that may require mitigation, water supply, water quality, water hazard risk reduction, food production, carbon storage, and outdoor recreation. The tool offers an interactive conservation assessment that allows users to evaluate the synergies and tradeoffs across the nine nature's values and benefits, a web-map to explore natural and agricultural resource information, and detailed reporting that quantifies the natural and agricultural resources in any given area. Users of this RCIS should also consider using the Greenbelt Alliance's *At-Risk of Development* (Greenbelt Alliance 2017) maps provided through the Bay Area Greenprint to prioritize for protection areas at risk of development (Section 3.7.1, *Guidelines for Prioritizing Sites for Protection*). Understanding the multiple benefits and values that open space provides can foster communication and new partnerships across sectors.

Users of this RCIS may also wish to consult local watershed plans to inform actions and priorities that can be implemented to benefit water quality, as well as the resources addressed in this RCIS. Four watershed plans that overlap the RCIS area are:

- The San Francisco Public Utilities Commission Alameda Watershed Management Plan (EDAW, Inc. 2001).
- City of Berkeley Watershed Management Plan (City of Berkeley 2011).
- Contra Costa County Watersheds Stormwater Resource Plan (Larry Walker Associates et al. 2018).

[4] https://www.bayareagreenprint.org/

- Alameda County Water District South Bay Aqueduct Watershed Protection Program Plan (ESA 2008).

3.2.3 Geographic Units of Conservation

The RCIS area is subdivided into 20 discrete conservation planning units (CPUs) where actions and conservation priorities may be implemented. The geographic units of conservation provide a method for identifying the location of actions without identifying individual parcels. This approach focuses the actions in a spatially explicit manner at a consistent scale, coarser than an individual parcel. The CPUs also provide a mechanism to consistently apply actions at several spatial scales (e.g., within a single unit or combination of units).

The CPUs align with hydrologic unit code (HUC)-10 watershed boundaries (Section 2.2.4, *Watersheds*). Watershed boundaries are used because wetland or other aquatic mitigation is often defined in terms of location within watersheds. Many watersheds at the HUC-10 level occur entirely within the RCIS area (Figure 2-9); however, some have only small portions in the RCIS area. In such cases, these small portions of HUC-10 watersheds are merged with neighboring watersheds so that all CPUs are similarly and reasonably sized. The 20 CPUs are named after the majority watershed in that part of the RCIS area: San Francisco Bay, Old River, San Pablo Bay, Middle River-San Joaquin River, Suisun Bay, Arroyo Valle, San Lorenzo Creek–Frontal San Francisco Bay Estuaries, Walnut Creek-Frontal Suisun Bay Estuaries, Alameda Creek, Kellogg Creek-Big Break, Arroyo Hondo, Arroyo Mocho, San Pablo Creek–Frontal San Pablo Bay Estuaries, Corte Madera Creek–Frontal San Francisco Bay Estuaries, Mount Diablo Creek–Frontal Suisun Bay Estuaries, Marsh Creek, Arroyo Las Positas, Arroyo de la Laguna, Corral Hollow Creek, and Agua Caliente Creek–Frontal San Francisco Bay Estuaries (Table 2-3, Figures 2-9 and 2-12).

3.2.4 Consideration of Development of Major Infrastructure Facilities

RCIS Program Guidelines require that "[a]n RCIS shall indicate how reasonably foreseeable development of major infrastructure facilities, including, but not limited to, renewable energy and housing, was considered in developing the RCIS and its conservation goals, objectives and actions, and in determining conservation priorities. Consideration of the reasonably foreseeable development should result in an RCIS that is reasonably implementable."

One of the intended uses of this RCIS is to identify conservation actions, habitat enhancement actions, and conservation priorities that can be implemented to provide advance mitigation for infrastructure operations, maintenance, and development projects, with a focus on transportation projects (Section 1.2, *Purpose and Need for RCIS*). The conservation strategies in this RCIS were informed by the East Bay RCIS Stakeholder Group, which included representatives from county and local governments, transportation and water agencies, natural resource and agricultural conservation organizations, local watershed groups, business organizations, the East Bay Regional Park District, and resource conservation districts. The East Bay RCIS incorporated valuable feedback and recommendations from the Stakeholder Group and from the Bay Area Regional Advance Mitigation Planning Technical Advisory Committee including the selection of focal species that would likely have mitigation needs (Section 2.2.6.1, *Selection Process*), sources of information and data to use to inform the RCIS, and conservation actions, habitat enhancement actions, and conservation priorities that they anticipate could be implemented as advance mitigation for future projects.

3.3 Protection Targets for Focal Species

The Program Guidelines require that an RCIS include measurable objectives. Quantitative habitat and plant occurrence protection targets enable tracking of conservation and habitat enhancements implemented in the RCIS area (e.g., measured in acres protected).

Established state and federal conservation rankings and level of endemism to the RCIS area were used to inform focal species-specific protection targets. Extent of endemism to the RCIS area highlights the importance of the East Bay RCIS area to conservation of species unique or nearly unique to the region. Extent of endemism to the RCIS area was estimated from publicly available range maps for wildlife species, occurrence records from the CNDDB, or number of documented populations.

The following criteria were used to classify focal species into one of two categories of conservation concern for the purpose of assigning quantitative habitat and occurrence protection targets.

- **Highest Conservation Concern.**
    - Focal wildlife species listed as threatened, endangered, or candidate for listing under the California Endangered Species Act (CESA) or federal Endangered Species Act (ESA), or listed as fully protected by the CDFW.
    - Focal plant species listed as threatened, endangered, or candidate for listing under the CESA or ESA, rare under CESA, or California Rare Plant Rank (CRPR) 1B.1.
- **Moderate Conservation Concern.**
    - Focal wildlife species that do not meet criteria for highest conservation concern; generally equivalent to the California Species of Special Concern (SSC) designation.
    - Focal plant species for which there is a conservation concern; generally equivalent to CRPR 1B.2.

If a species has approximately 50 percent or more of its entire distribution in California within the RCIS area, the species received the highest protection target regardless of state or federal conservation rank.

East Bay RCIS focal species of highest conservation concern were assigned habitat and plant occurrence protection targets of 90%. Focal species of moderate conservation concern were assigned habitat and plant occurrence protection targets of 75%.

Tables 3-1 and 3-2 show the conservation rankings for the wildlife and plant focal species and provides a brief explanation of how extent of endemism was estimated.

Differences between the habitat and occurrence protection targets reflect the need to focus conservation on species receiving the highest rankings in the early stages of East Bay RCIS implementation. Actions taken to protect individual focal species may protect other focal species that have overlapping habitats, as well as other conservation elements.

Actions taken to protect focal species are also expected to contribute toward achieving regional conservation goals of Conservation Lands Network[5] 2.0 (CLN). The CLN is a conservation strategy for the 9-county San Francisco Bay Area (plus Santa Cruz County), with a set of goals and science-based decision-making tools that support conservation (Bay Area Open Space Council 2019).

[5] https://www.bayarealands.org/

Table 3-1. Categories of Conservation Concern for Wildlife Focal Species

Animal Species	Federal Status	State Status	Estimated Range in RCIS Area ≥ 50% of Total	Rationale for Estimated Range	Conservation Concern
Longhorn fairy shrimp	E	–	Yes	Two of four known populations within the RCIS area.	Highest
Vernal pool fairy shrimp	T	–	No	Populations from southern Oregon to Southern California in Central Valley and the west and central Coast Ranges.	Highest
Vernal pool tadpole shrimp	E	–	No	Range across the Central Valley and San Francisco Bay Area.	Highest
Callippe silverspot butterfly	E	–	No	The two known populations are in San Mateo and Solano Counties.	Highest
Central California Coast steelhead	T	SSC	No	Spawn and rear from Russian River in Sonoma County south to Aptos Creek in Santa Cruz County.	Highest
Central Valley steelhead	T	–	No	Spawn upriver from RCIS area; rear in San Francisco Bay and Delta and San Pablo Bay.	Highest
Winter-run Chinook salmon	E	E	No	Spawn upriver from RCIS area. Migrate and rear in San Francisco Bay and Delta estuaries.	Highest
California tiger salamander (Central CA Distinct Population Segment)	T	T	No	Range across 23 counties in coastal regions, Central Valley foothills, and inner coast range.	Highest
Foothill yellow-legged frog	*	C	No	Range throughout Northern California west of Cascades and Sierra Nevada Ranges south to Kern County.	Highest
California red-legged frog	T	SSC	No	Found primarily in coastal drainages of central California, from Marin County south to northern Baja California, though absent from a large portion of its range.	Highest
Northern California legless lizard	–	SSC	No	Range from Antioch in Contra Costa County south through the Coast and Transverse ranges.	Moderate
Alameda whipsnake	T	T	Yes	Restricted to the inner Coast Ranges in western and central Contra Costa and Alameda Counties.	Highest
Giant garter snake	T	T	No	Range throughout the Central Valley from Butte County south to Kern County.	Highest

Animal Species	Federal Status	State Status	Estimated Range in RCIS Area ≥ 50% of Total	Rationale for Estimated Range	Conservation Concern
Tricolored blackbird	–	C	No	Range in California in the Central Valley and coastal areas from Sonoma County to San Diego County.	Highest
Golden eagle	–	FP; SSC	No	Range in California in mountainous and hilly terrain throughout the open areas of the state.	Highest
Burrowing owl	–	SSC	No	Range in California from the northern Central Valley to Mexico; small population in the Great Basin bioregion in northeast California and the desert regions of southeast California.	Moderate
Swainson's hawk	–	T	No	Range in California in the Central Valley and Great Basin bioregions.	Highest
California black rail	–	T; FP	No	Populations in the San Francisco Bay Area, Sierra Nevada foothills, and along the Lower Colorado River; 13% of CNDDB occurrences in RCIS area.	Highest
San Joaquin kit fox	E	T	No	Range in some suitable habitat in San Joaquin Valley and surrounding foothills north to Contra Costa County.	Highest
Mountain lion (central coastal California population)	–	C	No	Widely distributed across suitable habitat in California.	Highest

Notes:

Status

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

* = Under review for listing under the federal Endangered Species Act.

– = no listing.

State (CDFW April 2018, Special Animals List, Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406)

E = listed as endangered under the California Endangered Species Act.

T = listed as threatened under the California Endangered Species Act.

C = a candidate for listing under the California Endangered Species Act.

SSC = listed as a California special of special concern by the California Department of Fish and Wildlife

FP = listed as a fully protected by the California Department of Fish and Wildlife

– = no listing.

Table 3-2. Conservation Rankings for Plant Focal Species

Plant Species	Federal Status	State Status	CRPR	Estimated Range in RCIS Area ≥ 50% of Total	Rationale for Estimated Range	Conservation Concern
Pallid manzanita	T	E	1B.1	Yes	All eight CNDDB occurrences are in the RCIS area.	Highest
Brittlescale	–	–	1B.2	No	Eighteen of 60 (30%) CNDDB occurrences are in the RCIS area.	Moderate
Big tarplant	–	–	1B.1	Yes	Thirty-three of 46 (72%) CNDDB occurrences are in the RCIS area.	Highest
Fragrant fritillary	–	–	1B.2	No	Eight of 81 (12%) CNDDB occurrences are in the RCIS area.	Moderate
Round-leaved filaree	–	–	–	No	Range in California from Shasta County to San Diego County on the Coast Ranges and in the Central Valley. CNDDB does not report occurrences for this species.	Moderate
Mount Diablo fairy lantern	–	–	1B.2	Yes	All fifty-two CNDDB occurrences are in the RCIS area.	Highest
Congdon's tarplant	–	–	1B.2	No	Range along the inner and outer South Coast Ranges between Solano and San Luis Obispo Counties. Thirty-five of 78 (45%) CNDDB occurrences are in the RCIS area.	Moderate
Palmate-bracted bird's-beak	E	E	1B.1	No	One of 18 (6%) CNDDB occurrences are in the RCIS area.	Highest
Presidio clarkia	E	E	1B.1	Yes	Known from two locations in highly urbanized areas of the Bay Area: the Presidio in San Francisco and Redwood Regional Park and surrounding land in the RCIS area.	Highest
Livermore tarplant	–	E	1B.2	Yes	All four CNDDB occurrences are in the RCIS area.	Highest
Recurved larkspur	–	–	1B.2	No	Four of 85 (5%) CNDDB occurrences are in the RCIS area.	Moderate
San Joaquin spearscale = San Joaquin saltbush	–	–	1B.2	Yes	Fifty-nine of 96 (62%) CNDDB occurrences are in the RCIS area.	Highest
Brewer's western flax	–	–	1B.2	Yes	Twenty-two of 25 (88%) CNDDB occurrences are in the RCIS area.	Highest
Loma Prieta hoita	–	–	1B.1	No	Three of 229 (10%) CNDDB occurrences are in the RCIS area.	Highest
Contra Costa goldfields	E	–	1B.1	No	Four of 23 (17%) CNDDB occurrences are in the RCIS area.	Highest

Plant Species	Federal Status	State Status	CRPR	Estimated Range in RCIS Area ≥ 50% of Total	Rationale for Estimated Range	Conservation Concern
Mason's lilaeopsis	-	R	1B.1	No	Sixty-nine of 197 (35%) CNDDB occurrences are in the RCIS area.	Highest
Showy madia	–	–	1B.1	No	Two of 52 (4%) CNDDB occurrences are in the RCIS area.	Highest
Rock sanicle	–	R	1B.2	Yes	Four of seven (57%) CNDDB occurrences are in the RCIS area.	Highest
Most beautiful jewelflower	–	–	1B.2	No	Twenty of 96 (21%) CNDDB occurrences are in the RCIS area.	Moderate

Notes:

Status

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

– = no listing.

State

E = listed as endangered under the California Endangered Species Act.

T = listed as threatened under the California Endangered Species Act.

R = listed as rare under the California Endangered Species Act.

– = no listing.

Global Conservation Status (NatureServe 2016)

G1 = Critically imperiled; at very high risk for extinction.

G2 = Imperiled; at high risk for extinction.

G3 = Vulnerable; at moderate risk for extinction.

G4 = Apparently secure; uncommon but not rare.

G5 = Secure; common, widespread and abundant.

G#G# = Range rank; numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community.

T# = Infraspecific Taxon; the status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.

Q = Questionable taxonomy; taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid.

Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1.

California Rare Plant Rank (CRPR) (California Native Plant Society 2017).
1B = plants rare, threatened or endangered in California and elsewhere.
0.1 - seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)
0.2 - moderately threatened in California (20-80% of occurrences threatened/moderate degree of immediacy of threat)

3.4 Conservation Gap Analysis

A conservation gap analysis was conducted to estimate the amount of habitat that should be protected, in addition to habitat already protected, to contribute to the conservation and recovery of focal species and to protect unique land cover types (Section 3.9.5).

3.4.1 Data Sources

The following geographic information survey (GIS) data layers were used to determine conservation gaps in protection for the focal species and unique land cover types.

- Focal species habitat distribution models (Section 2.2.6.2 and Appendix F).
- Land cover from the data sources identified in Section 2.2.4.1, *Methods and Data Sources*.
- Protected areas (Section 2.2.1 and Figure 2-6) compiled from the California Conservation Easement Database (CCED) (2019) and California Protected Area Database (CPAD)(2019), National Conservation Easement Database 2016, and East Bay Regional Parks District data.

3.4.2 Unique Land Cover Gap Analysis

A conservation gap analysis was used to quantify, in acres, protection objectives for unique land cover types in the RCIS area.

As with focal species (Section 3.3, *Protection Targets for Focal Species*), unique land cover types were assigned a percent conservation target of 90%. The conservation targets identify a percent of the total amount of each unique land cover type in the RCIS area that should be protected. Unique land cover types were given a high protection target because they are relatively uncommon or have been subject to extensive land conversion and degradation (e.g., riparian woodlands, wetlands).

Conservation targets for unique land cover types are intended to be achieved by 2050, to be consistent with the target date for achieving the CLN 2.0 conservation goal to protect 2,500,000 acres in the 10-county Bay Area (Bay Area Open Space Council 2019). The CLN created a collaborative, science-based vision to conserve the San Francisco Bay Area's landscapes and biodiversity and provides a good model for conservation planning and goal setting in the RCIS area.

The following steps were used to determine the conservation gaps for unique land cover types.

1. Calculate in GIS the amount of each land cover type in the RCIS area. This is the amount in the *Total Land Cover* column in Table 3-3.
2. Multiply the total area of each unique land cover type by 90% to quantify unique land cover conservation targets, in acres. These amounts are the RCIS conservation targets for unique land cover types and are identified in the *Conservation Target* column in Table 3-3.
3. Calculate in GIS the area of each land cover type protected by conservation easement, fee title, or both. These amounts are identified in the *Currently Protected* column in Table 3-3.[6]

[6] Many lands are owned by public agencies or private entities for conservation or recreation purposes but are not necessarily protected by a conservation easement.

4. Subtract from the conservation target the amount currently protected to determine the amount of additional unprotected land to protect to achieve the conservation targets for each unique land cover type. These amounts are identified in the *Conservation Gap* column in Table 3-3.

The conservation targets and gaps provided in Table 3-3[7] are incorporated into unique land cover protection objectives in Section 3.9.5. Table 3-3 also includes amounts of all RCIS land cover types, for reference.

[7] Values in Table 3-3 are rounded, and calculated values may reflect rounding errors.

Table 3-3. Extent of Protected Land Cover, Conservation Targets, and Conservation Gaps for Unique Land Cover Types

East Bay RCIS Land Cover Type	Total Land Cover (Acres)	Conservation Target for Unique Land Cover Type (Percent)	Conservation Target (Acres)	Currently Protected (Acres)	Currently Protected (Percent of Total)[b]	Currently Unprotected (Acres)	Conservation Gap (Acres)	Target Currently Protected (Percent)[c]
Grassland								
California annual grassland	292,550	N/A	N/A	105,210	36	187,340	N/A	N/A
Serpentine grassland[a]	1,270	90%	1,140	950	75	320	190	83
Alkali grassland[a]	3,010	90%	2,710	1,180	39	1,830	1,530	44
Barren/ rock	400	N/A	N/A	210	52	190	N/A	N/A
Shrublands								
Northern mixed chaparral/chamise chaparral[a]	19,230	90%	17,310	14,150	74	5,080	3,160	82
Northern coastal scrub/Diablan sage scrub[a]	6,770	90%	6,090	4,880	72	1,890	1,210	80
Serpentine chaparral[a]	4,130	90%	3,720	330	8	3,800	3,390	9
Woodland								
Blue oak woodland	35,860	N/A	N/A	13,190	37	22,670	N/A	N/A
Cismontane juniper woodland[a]	70	90%	60	70	100	0	--	117
Coast live oak forest and woodland	42,120	N/A	N/A	24,740	59	17,380	N/A	N/A
Foothill-pine oak woodland	22,630	N/A	N/A	2,240	10	20,390	N/A	N/A
Valley oak woodland[a]	310	90%	280	110	35	200	170	39
Mixed oak woodland and forest	57,180	N/A	N/A	31,300	55	25,880	N/A	N/A
Montane hardwood[a]	2,350	90%	2,120	940	40	1,410	1,180	44
Serpentine hardwood[a]	1,140	90%	1,030	250	22	890	780	24

East Bay RCIS Land Cover Type	Total Land Cover (Acres)	Conservation Target for Unique Land Cover Type (Percent)	Conservation Target (Acres)	Currently Protected (Acres)	Currently Protected (Percent of Total)[b]	Currently Unprotected (Acres)	Conservation Gap (Acres)	Target Currently Protected (Percent)[c]
Conifer Forest								
Redwood forest[a]	1,380	90%	1,240	1,340	97	40	--	108
Serpentine conifer[a]	100	90%	90	90	90	10	--	100
Coulter pine forest[a]	140	90%	130	140	100	0	--	108
Knobcone pine forest[a]	80	90%	70	70	88	10	--	100
Ponderosa pine woodland[a]	540	90%	490	510	94	30	--	104
Sargent cypress woodland[a]	10	90%	9	0	0	10	9	0
Riparian Woodland								
Mixed riparian forest and scrub[a]	3,840	90%	3,460	1,080	28	2,760	2,380	31
Serpentine riparian[a]	30	90%	30	0	0	30	30	0
Sycamore alluvial woodland[a]	600	90%	540	560	93	40	--	104
Wetland and Pond								
Alkali wetland[a]	1,020	90%	920	330	32	690	590	36
Aquatic-undefined	630	N/A	N/A	160	25	470	N/A	N/A
Modified channel	700	N/A	N/A	60	9	640	N/A	N/A
Perennial freshwater marsh[a]	3,500	90%	3,150	1,090	31	2,410	2,060	35
Seep/Spring (non-serpentine)[a]	210	90%	190	50	24	160	140	26
Seep/Spring (serpentine)[a]	4	90%	4	1	26	3	3	28
Seasonal wetland[a]	3,320	90%	2,990	2,150	65	1,170	840	72
Pond[a]	4,640	90%	4,180	730	16	3,910	3,450	17
Reservoir	8,230	N/A	N/A	6,560	80	1,670	N/A	N/A
Vernal pool[a]	2,210	90%	1,990	260	12	1,950	1,730	13

East Bay RCIS Land Cover Type	Total Land Cover (Acres)	Conservation Target for Unique Land Cover Type (Percent)	Conservation Target (Acres)	Currently Protected (Acres)	Currently Protected (Percent of Total)[b]	Currently Unprotected (Acres)	Conservation Gap (Acres)	Target Currently Protected (Percent)[c]
Baylands								
Deep bay	15,030	N/A	N/A	40	0	14,990	N/A	N/A
Shallow bay	73,810	N/A	N/A	10,600	14	63,210	N/A	N/A
Tidal vegetation[a]	14,340	90%	12,910	6,260	44	8,080	6,650	48
Tidal bay flat[a]	11,820	90%	10,640	4,460	38	7,360	6,180	42
Modified tidal channel/managed pond	15,030	N/A	N/A	10,500	70	4,530	2,900	N/A
Cultivated Agriculture								
Cropland	28,630	N/A	N/A	3,540	12	25,090	N/A	N/A
Cultivated-undetermined	26,960	N/A	N/A	3,980	15	22,980	N/A	N/A
Orchard	4,020	N/A	N/A	360	9	3,660	N/A	N/A
Vineyard	4,590	N/A	N/A	2,120	46	2,470	N/A	N/A

[a] Unique land cover type (Section 2.2.8.5, *Unique Land Cover Types*).

[b] Percent is the percent of the total land cover type protected (currently protected/total land cover X 100).

[c] Percent is the percent of the conservation target that is currently protected (currently protected/conservation target X 100).

Values are rounded to the nearest 10. Values below 10 are not rounded.

3.4.3 Focal Species Gap Analysis

The focal species gap analysis estimates the amount of focal species' habitat in the RCIS area that is already protected, the amount that would be protected if the focal species habitat protection targets described in Section 3.3 are achieved, and the gap between the focal species habitat protection targets and what is currently protected. The focal species gap analysis is based on the habitat distribution models for each of the focal species, described in Section 2.2.6.2. Targets were also developed to protect plant occurrences, in addition to modeled habitat (Section 3.8.17, *Focal Plants with Habitat Distribution Models* and Section 3.8.18, *Focal Plants without Habitat Distribution Models*).

The following steps were used to determine the conservation gaps for each focal species:

1. Calculate in GIS the total modeled habitat in acres (or stream miles, for steelhead) for each individual focal species. This is the amount in the *Total Modeled Habitat* column in Table 3-4, rounded to the nearest ten.
2. Multiply the total modeled habitat for each focal species by the habitat protection target percent (i.e., either 90% or 75%), as described in Section 3.3, to quantify habitat protection targets in acres or stream miles. These amounts are identified in the *Conservation Target* columns in Table 3-4.
3. Calculate in GIS the number of acres or stream miles of modeled habitat for each focal species currently protected by conservation easement, fee title, or both. These amounts are identified in the *Modeled Habitat Currently Protected* column in Table 3-4.
4. Subtract from the conservation target the amount of modeled habitat that is currently protected to determine the amount of additional unprotected land to protect to achieve the conservation target for each focal species. These amounts are identified in the *Conservation Gap* column in Table 3-4.

The conservation targets and gaps provided in Table 3-4[8] are incorporated into habitat preservation objectives for focal species in Section 3.8.

[8] Values in Table 3-4 are rounded, and calculated values may reflect rounding errors.

Table 3-4. Conservation Targets and Conservation Gaps for Focal Species with Habitat Models

Focal Species and Habitat Type	Total Modeled Habitat (Acres)	Conservation Target (Percent)	Conservation Target[a] (Acres)	Modeled Habitat Currently Protected (Acres)	Modeled Habitat Currently Protected (Percent of Total)	Conservation Gap (Acres)[b]	Percent of Target Currently Protected
Longhorn fairy shrimp	790	90	710	500	63	210	70
Vernal pool fairy shrimp	3,590	90	3,230	650	18	2,580	20
Vernal pool tadpole shrimp	7,170	90	6,450	1,300	18	5,150	20
Callippe silverspot butterfly	192,750	90	173,480	77,400	40	96,080	45
Central California Coast steelhead	75 miles	90	68 miles	26 miles	35	41 miles	39
California tiger salamander	492,620	90	443,360	200,670	41	242,690	45
Occupied habitat	231,660	90	208,490	97,850	42	110,640	47
Potential breeding	3,030	90	2,730	470	16	2,260	17
Potential upland	257,930	90	232,140	102,350	40	129,790	44
Foothill yellow-legged frog	12,210	90	10,990	4,310	35	6,680	39
Breeding/foraging	11,110	90	10,000	3,730	34	6,270	37
Low-use habitat	1,100	90	990	590	54	400	60
California red-legged frog	525,330	90	472,800	207,640	40	265,160	44
Breeding habitat	9,010	90	8,110	2,080	23	6,030	26
Dispersal habitat	495,760	90	446,180	197,140	40	249,040	44
Refugia	20,560	90	18,500	8,420	46	10,080	46
Northern California legless lizard	2,810	75	2,110	640	30	1,470	30
Alameda whipsnake	315,150	90	283,640	153,350	54	130,290	54
Core habitat	30,090	90	27,080	19,330	71	7,750	71
Perimeter core habitat	53,500	90	48,150	32,260	67	15,890	67
Movement	231,560	90	208,400	101,770	49	106,630	49
Giant garter snake	40,480	90	36,430	5,440	15	30,990	15
Core habitat	7,220	90	6,500	580	9	5,920	9
Movement habitat	33,260	90	29,930	4,860	16	25,070	16

Focal Species and Habitat Type	Total Modeled Habitat (Acres)	Conservation Target (Percent)	Conservation Target[a] (Acres)	Modeled Habitat Currently Protected (Acres)	Modeled Habitat Currently Protected (Percent of Total)	Conservation Gap (Acres)[b]	Percent of Target Currently Protected
Tricolored blackbird	372,730	90	335,460	121,640	36	213,820	36
Core breeding habitat	4,750	90	4,280	1,360	32	2,920	32
Primary foraging habitat	359,360	90	323,420	117,800	36	205,620	36
Secondary foraging habitat	8,620	90	---[c]	2,480	32	5,280	32
Golden eagle	489,990	90	440,990	202,740	46	238,250	46
Burrowing owl	356,120	75	267,090	117,210	44	149,880	44
Breeding/foraging habitat	300,540	75	225,410	109,700	49	115,710	49
Low use habitat	55,580	75	41,690	7,520	18	34,170	18
Swainson's hawk	77,800	90	70,020	15,630	22	54,390	22
Nesting habitat	1,890	90	1,700	1,190	70	510	70
Natural foraging habitat	27,130	90	24,420	9,040	37	15,380	37
Agricultural foraging habitat	48,780	90	43,900	5,400	12	38,500	12
California black rail	14,340	90	12,910	6,260	48	6,650	48
San Joaquin kit fox – denning/movement	225,870	90	203,280	70,020	34	133,260	34
Pallid manzanita	17,470	90	15,720	15,110	96	610	96
Brittlescale	5,100	75	3,820	1,580	41	2,240	41
Big tarplant	50,700	90	45,630	23,910	52	21,720	52
Primary habitat	39,710	90	35,740	20,420	57	15,320	57
Secondary habitat	10,990	90	9,890	3,500	35	6,390	35
Fragrant fritillary	210,830	75	158,120	85,580	54	72,540	54
Primary habitat	540	75	410	390	95	20	95
Secondary habitat	210,290	75	157,720	85,190	54	72,530	54
Round-leaved filaree	165,180	75	123,890	53,750	43	70,140	43
Primary habitat	164,770	75	123,580	53,750	43	69,830	43
Secondary habitat	410	75	310	8	2	302	2
Mount Diablo fairy lantern	36,060	90	32,450	23,590	73	8,860	73

Focal Species and Habitat Type	Total Modeled Habitat (Acres)	Conservation Target (Percent)	Conservation Target[a] (Acres)	Modeled Habitat Currently Protected (Acres)	Modeled Habitat Currently Protected (Percent of Total)	Conservation Gap (Acres)[b]	Percent of Target Currently Protected
Presidio clarkia	1,460	90	1,310	500	38	810	38
Recurved larkspur	1,130	75	850	590	69	260	69
San Joaquin spearscale	98,740	90	88,870	34,510	39	54,360	39
Primary habitat	3,700	90	3,330	1,470	44	1,860	44
Secondary habitat	95,040	90	85,540	33,040	39	52,500	39
Brewer's western flax	170,800	90	153,720	85,190	55	68,530	55
Mason's lilaeopsis	6,250	90	5,630	970	17	4,660	17
Most beautiful jewelflower	5,680	75	4,260	1,490	35	2,770	35
Primary habitat	5,280	75	3,960	1,280	32	2,680	32
Secondary habitat	400	75	300	210	70	90	70

[a] Species conservation targets are calculated by multiplying the total modeled habitat by the conservation target percentage.

[b] The conservation gap is the species conservation target minus the amount of currently protected modeled habitat.

[c] This RCIS does not include a conservation target for tricolored blackbird secondary habitat (comprised of orchard and vineyard), in order to focus conservation actions on considerably more important core breeding and primary foraging habitat.

Values are rounded to the nearest 10. Values below 10 are not rounded.

As with the CLN, the percentage protection targets for focal species are high compared with other conservation planning efforts (generally ranging from 30-40 percent [Groves 2003, as cited in Bay Area Open Space Council 2011]). One reason the CLN set high goals is because the minimum amount of protected habitat needed for all species within a region to persist varies greatly between regions, and depends on the life history of the species comprising the region, their habitat requirements, and the extent of pressures and stressors in the region (Fahrig 2001, as cited in Bay Area Open Space Council 2011). See Chapter 3, *Approach and Methodology in the Conservation Lands Network: San Francisco Bay Area Upland Habitat Goals Project Report* (Bay Area Open Space Council 2011) for details on the rationale for using high protection goals in the CLN. The East Bay RCIS Core Team applied similar protection percentages in this RCIS because the Core Team's conservation vision for the RCIS area aligns with CLN's rationale for setting high protection goals.

The habitat protection objectives can be achieved by protecting land conservation easements or other approved real estate instrument. Much of the land in the RCIS area is working land used as grazing land, farmland, and salt ponds. These lands support local economies and provide food for people, important ecosystem services, and habitat values for focal species, non-focal species, and other native species; it is essential that these land uses are preserved alongside habitat values. The sale or donation of conservation easements, or creation and sale of credits through a mitigation credit agreement (Section 4.4.2.5) by private landowners can provide incentives to willing landowners to ensure that these land uses are protected while providing habitat for native biodiversity (Bay Area Open Space Council 2011).

3.5 Adaptations against the Effects of Climate Change

California Fish and Game Code 1852(c)(13) states that an RCIS shall include "a description of how the strategy's conservation goals and objectives provide for adaptation opportunities against the effects of climate change for the strategy's focal species." Climate change is expected to increase the frequency of extreme events such as floods and fires, increase temperatures, increase drying, change precipitation patterns, and contribute to sea-level rise (Section 2.3.4, *Climate Change*). This RCIS recommends that users implementing conservation and habitat enhancement actions prioritize areas for protection that may be more resilient to the effects of climate change and provide refuge from the effects of a changing climate (Section 2.3.4.5 and Section 3.7.1).

The conservation strategy's conservation goals and objectives are designed to provide adaptation opportunities against the effects of climate change for the strategy's focal species and other conservation elements. The conservation strategy emphasizes the protection of large blocks of currently unprotected habitat that support occurrences of focal species near protected areas to reduce habitat fragmentation and preserve interconnected habitats. Increasing the amount of protected areas in the RCIS area and retaining and enhancing wildlife corridors will facilitate movement for focal species to future, shifting habitats. The conservation goals and objectives also target enhancement actions to improve the quality of habitats along a range of environmental gradients (e.g., east to west, north to south, and along elevational gradients). This RCIS also identifies management actions to simulate historic disturbance regimes (e.g., wildfire, grazing) that can be used to create a diversity of microhabitats across landscapes. Diverse native plant and animal communities that retain important ecological functions have a greater chance for persistence and change in response to climate shifts. In turn, these persistent communities will allow the focal species to move to areas containing favorable habitat conditions if their current locations become unsuitable (Beller et al. 2015). Each focal species conservation strategy in Section 3.8 includes a subsection describing how the conservation strategy for that focal species provides for adaptations to climate change in the RCIS area.

3.6 Relationship between the East Bay Regional Conservation Investment Strategy and the East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan

The East Bay RCIS area overlaps all of the ECCC HCP/NCCP permit area in Contra Costa County (approximately 174,000 acres). Because the ECCC HCP/NCCP provides regulatory ESA and CESA coverage for 22 species that are also East Bay RCIS focal species (14 wildlife species and eight plant species; Tables 2-7 and 2-8), this RCIS was designed to be consistent with, and complementary to, the ECCC HCP/NCCP to support collaborative conservation efforts that will help the East Contra Costa County Habitat Conservancy (Habitat Conservancy) achieve the ECCC HCP/NCCP biological goals and objectives.

This RCIS and the ECCC HCP/NCCP have conservation and biological goals, objectives, and actions that aim to protect habitat and occurrences of species and enhance and restore habitat and natural communities. This RCIS and the ECCC HCP/NCCP also include conservation and biological goals, objectives, and actions to protect and enhance corridors for movement by organisms through land acquisition. This RCIS' goals, objectives, and actions emulate those in the ECCC HCP/NCCP, which provides a strong strategy for conservation of large landscape blocks, natural communities, and focal species in eastern Contra Costa County. Therefore, all the RCIS conservation goals, objectives, actions, and priorities are consistent with, and complementary to, the ECCC HCP/NCCP's biological goals, objectives, and conservation actions for focal species, habitats, and natural communities that overlap between this RCIS and the ECCC HCP/NCCP.

To build upon the conservation strategy in the ECCC HCP/NCCP, this RCIS incorporates many ECCC HCP/NCCP conservation actions into RCIS actions and priorities. For example, the RCIS prioritizes protection of focal species' habitat within and outside the ECCC HCP/NCCP's permit area. Including and prioritizing actions that overlap the ECCC HCP/NCCP emphasizes the importance of these actions to protecting and enhancing populations of focal species and their habitats through collaborative efforts with the Habitat Conservancy.

Land protected by the ECCC HCP/NCCP, as well as by any other entity in the RCIS area, contributes toward achieving this RCIS's conservation targets. To avoid competing with the Habitat Conservancy's efforts in protecting land to meet the ECCC HCP/NCCP requirements, entities and/or individuals seeking to create mitigation credits within the ECCC HCP/NCCP's permit area must comply with California Fish and Game Code 1856(j). See Section 4.4.2.5 and Section 4.4.2.1, *East Contra Costa County HCP/NCCP*, for details.

This RCIS also prioritizes the protection of any known or newly discovered occurrences for focal species that are covered species under the ECCC HCP/NCCP. Coordination with the Habitat

Conservancy on protection of any known and newly discovered occurrence inside the ECCC HCP/NCCP permit area would be beneficial to the conservation of these species. Occurrences should only be targeted for protection if protecting the occurrence(s) does not affect the Habitat Conservancy's ability to achieve the goals and objectives of the ECCC HCP/NCCP. Close coordination with the Habitat Conservancy will be necessary throughout RCIS implementation.

3.7 Guiding Principles for Implementing Conservation and Habitat Enhancement Actions

While this RCIS includes conservation priorities specific to the focal species and other conservation elements (Section 3.2.2, *Actions and Priorities*), this section provides guiding principles to assist users of this RCIS in further prioritizing and implementing the conservation and habitat enhancement actions in this RCIS. These guidelines identify preferred characteristics of conservation and mitigation sites for permanent protection and restoration, guiding principles for restoration and enhancement, and the appropriate use of transplantation of plant material.

3.7.1 Guidelines for Prioritizing Sites for Protection

When considering sites to protect focal species, users of this RCIS should consider the following guidelines for prioritizing sites for permanent protection.

- **Focal species and habitat.** Protect sites occupied by multiple focal species and other conservation elements (e.g., rare soil types, rare/unique natural communities), including those that are within critical linkages and large landscape blocks or other areas important to landscape level connectivity (Section 2.2.8.1). Prioritize sites with comparatively abundant, robust occurrences of multiple focal species (e.g., sites with multiple, large populations/subpopulations of focal plant species) that support high-quality habitat for important phases of a species' lifecycle (e.g., ponds used for breeding amphibians) over smaller sites with relatively marginal habitat that is not occupied by the target focal species.
- **Size and configuration of site.** Protect large sites with a low ratio of edge to interior (i.e., large convex parcels) to minimize potentially negative effects of adjacent land uses (e.g., development and the spread of invasive plants, and increases in numbers of predators commonly associated with human development). The size and shape of the site should provide for the ecological needs of the target species. For example, sites should be large enough to sustain a population, subpopulation, or multiple territories or nest sites (e.g., of a species with a large home range such as Swainson's hawk) of the target focal species. Sites should have the ecological features necessary for target focal species to complete its life cycle, or the phase or phases of the life cycle that the target focal species needs to complete while in the RCIS area. For example, a site protected for tricolored blackbird should include an active nest colony site and high-quality foraging habitat.
- **Proximity to protected habitat.** Protect sites adjacent or close to existing protected areas to expand and connect protected habitats. For example, sites adjacent to state parks, or the ECCC HCP/NCCP Preserve System, should be prioritized over parcels distant from existing protected areas. Sites that are identified to improve landscape connectivity, such as those described in Section 2.2.8.1 and the Bay Area Critical Linkages (Penrod et al. 2013) shown on the modeled

habitat distribution maps in Appendix F should be prioritized over sites that are not within areas that would improve landscape connectivity.

- **Consideration of adjacent land uses.** Prioritize sites that are buffered by adjacent land uses or prioritize sites that will serve to buffer existing protected areas from adjacent land uses.
- **Climate resilience.** When ecologically appropriate, prioritize sites that may be more resilient to climate change (Section 2.3.4.5), and/or provide refugia from the effects of climate change, as identified in Figure 2-25 and by species-specific habitat models that predict shifts in habitat under future climate change scenarios.
- **Vulnerability to development or other form of land conversion from natural habitats.** Prioritize protecting focal species and their habitats where they are at risk of development, as identified by the Greenbelt Alliance's *At-Risk of Development* (Greenbelt Alliance 2017) maps provided through the Bay Area Greenprint[9] and the accompanying report At Risk: The Bay Area Greenbelt[10] (Greenbelt Alliance 2017) or conversion to more intensive land uses such as orchards and vineyards.
- **Ecosystem service co-benefits.** When ecologically appropriate, prioritize sites that provide desired co-benefits as identified by the Bay Area Greenprint or other source of information about the distribution and quality of ecosystem services in the RCIS area.

3.7.2 Guidelines for Prioritizing Sites for Restoration

When considering sites for restoration, users of this RCIS should consider the following guidelines.

- **Site characteristics.** Prioritize sites with the biological, physical, and chemical characteristics and processes that will support the ecological community to be restored or enhanced and have a high likelihood for successful restoration.
- **Species occupancy.** Prioritize sites that are occupied by target species, but are of low quality, and may currently be population sinks.
- **Likelihood of colonization.** Prioritize sites that have a high likelihood of being colonized by target species. For example, the site could be adjacent to, or near to, a population of the target species, or could be ecologically connected to occupied sites. The level of connectedness will depend on the target species an area is being restored for, and its ability to disperse through landscapes to colonize habitat patches.
- **Proximity to high quality habitat.** Prioritize degraded sites adjacent to high-quality habitats to expand the extent and interconnectedness of high-quality habitat.

3.7.3 Guiding Principles for Habitat Restoration and Management

All sites that are permanently protected will be managed to improve ecological conditions for focal species, conservation elements, and ecological functions. In this RCIS, techniques for enhancing habitat (which can also be applied to restoring habitat) are briefly described in the conservation

[9] https://www.bayareagreenprint.org/about/
[10] https://www.greenbelt.org/at-risk-2017/

strategies for focal species and other conservation elements. The following broad recommendations should apply to all enhancement and restoration actions:

- **Manage at multiple scales.** Biological processes occur at a wide variety of spatial scales across landscapes. Restoration and enhancement activities should be planned and executed with these multiple scales in mind. For example, restoration of plant occurrences may occur within a relatively small area around the occurrence, and could require specific, intensive management actions to restore an occurrence, such as planting and protecting seedlings from herbivores, or irrigating plantings to improve survivorship. The methods used to restore and enhance plant occurrences may depend on the microhabitat features the species relies upon, such as soil texture, soil depth, rockiness, and distance to the nearest occurrence of the same species. However, other processes operating at larger spatial levels—such as the spread of invasive species, generally occur at larger spatial scales than an occupied patch of habitat. Management of invasive species may therefore be better addressed at a larger spatial scale, such as grazing a protected area to manage invasive vegetation. Wildlife lifecycle phases may also occur at more than one spatial scale. For example, breeding habitat may require a relatively small area but highly specific conditions (e.g. pond hydroperiods for amphibian breeding, nest or den sites far from human disturbance for birds and mammals), while estivation (amphibian) and migration/dispersal (birds/mammals) habitat must be larger but may be more varied.
- **Balance conflicting species' needs.** In some cases, management or restoration actions intended to benefit one species or suite of species will have negative effects on another species or suite of species that use the same habitat. For example, drying California tiger salamander ponds can be used as a tool to control invasive predators and hybrid California tiger salamanders. However, pond dry-down should be delayed until late summer to ensure that other species that may use the pond for breeding, such as California red-legged frog, have completed breeding and young have emerged from the pond. Density of emergent vegetation around pond margins can also affect the habitat quality of ponds. Dense vegetation provides good habitat for tricolored blackbird and California red-legged frog but may not be suitable for California tiger salamander or western pond turtle. Management actions should maintain a diversity of emergent vegetation densities within a pond or across multiple ponds to provide suitable habitat for species that rely on ponds for habitat.

  The effects of implementing management and restoration actions, both positive and negative, on native species should be evaluated before management decisions are finalized. When management or restoration actions are necessary to provide habitat for a focal species, non-focal species, or other native species, but negatively affect the habitat quality for another focal or native species, a strategy should be developed to compensate for those negative effects. Protecting multiple, larger sites will allow disparate actions to occur in different places and to benefit a suite of native species.
- **Maintain or mimic natural processes.** This is a management technique that recognizes that natural processes (e.g., hydrologic regimes, wildfire) are the fundamental forces that shape natural systems and create and maintain habitats. Management actions should focus on defining, maintaining or restoring, and enhancing these natural processes (e.g., herbivory via livestock grazing or prescribed burning to manage vegetation). If not feasible, then the effects of those processes can be duplicated by alternative management actions (e.g., mowing or other mechanical or chemical treatments to control invasive vegetation).

- **Account for inherent variability.** It is important to acknowledge that stochastic or chance events can often exert strong effects on natural systems and populations of species that comprise those systems. The most common of these chance events are weather-related factors such as flooding, temperature extremes, and drought; native or invasive pest outbreaks are also common. Other chance events are associated with populations themselves; these may include variation in rates of reproduction and mortality. Such inherently uncontrollable variables and their effects on target focal species are best offset by enhancing and restoring a diversity of microsites and environmental gradients. This ensures that target focal species can take advantage of suitable habitat during good seasons and find refugia in bad seasons.

3.7.4 Transplanting Plants to Create New Populations

Transplantation of plant material (e.g., seeds, cuttings, etc.) is one type of action in the RCIS toolkit to assist in the conservation and recovery of populations of focal plant species. When it is infeasible to permanently protect enough populations of rare plants to secure long-term viability of a species or subspecies, transplantation may be considered as a means to enhance degraded populations or create new populations to increase a species' likelihood of long-term viability.

This RCIS does not intend for transplantation to be used to compensate for impacts to rare plants, unless a transplanted occurrence has been documented to be well established through long-term monitoring, and with approval by the permitting wildlife agency. Transplantation of rare plants is rarely successful in establishing a new occurrence. Because of the low likelihood of successful transplantation of rare plants at a new location, transplantation is opposed by conservation organizations as a primary mitigation tool (Howald 1996, California Native Plant Society 1998).

Transplantation to assist in the conservation and recovery of populations of focal plant species should only be done after developing a thorough plan in coordination with botanists with expertise on the species or subspecies (or closely related taxa) to be transplanted, and with CDFW and USFWS, particularly if the plant is state or federally listed, or considered rare by the California Native Plant Society.

Careful planning for transplantation should include consideration of the plant's biological and environmental requirements, as transplantation can be extremely stressful. Translocation of rare plants should not be done close to an existing population of that species, as measured by the potential for genetic exchange among individuals through pollen or propagule (e.g., seed, fruit) dispersal, unless transplantation propagules are from a local population (i.e., there is genetic exchange between the propagule source and the existing population that will be enhanced through transplantation). Transplanting or seeding receptor sites (i.e., habitat suitable for establishing a new population) should be carefully selected on the basis of physical, biological, and logistical considerations (Fiedler and Laven 1996, ICF International 2012). It is crucial that the soil and habitat requirements of the species must be fully understood before successful establishment can be assured (Fiedler 1991). Both the source location and the receptor site must be carefully prepared, to ensure that plants are removed and planted in a manner that provides them with the best chance of reestablishment, including disease-free soils. Thus, transplantation should only occur on a case-by-case basis using pilot studies and in consultation with CDFW, the USFWS, and species experts in the RCIS area to ensure that both the species' biological requirements and site-specific conditions are fully understood. There is slightly less risk associated with translocation for those species that are locally abundant in the RCIS area (e.g., Mason's lilaeopsis) than species for which there are very few occurrences (e.g., Loma Prieta hoita or rock sanicle) (Clements 2013).

3.8 Conservation Strategy for Focal Species

The conservation strategy for each focal species or group of focal species is subdivided into conservation goals, objectives, and actions; conservation priorities; and opportunities for adaptation to climate change.

The conservation strategy for focal species prioritizes protection of occupied habitat to protect existing populations of focal species. The conservation strategy also emphasizes the protection, enhancement, and restoration of focal species' habitat in the RCIS area, as identified by the focal species habitat models (Section 3.4, *Conservation Gap Analysis* and Appendix F). Figure 3-1 shows the number of conservation priorities, by CPU, to identify watersheds with relatively high numbers of conservation priorities. Users of this RCIS could use the map in Figure 3-1 to locate areas to focus conservation actions and habitat enhancement actions.

3.8.1 Vernal Pool Branchiopods (Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp)

The actions and priorities for vernal pool branchiopods were informed primarily by the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife 2005a), federally designated critical habitat (U.S. Fish and Wildlife 2006) and the ECCC HCP/NCCP.

3.8.1.1 Conservation Goals, Objectives, and Actions

Goal 1. Increase the number of protected occurrences and extent of habitat for vernal pool branchiopods in the RCIS area.

Objective 1-1. Protect occurrences of vernal pool branchiopods in the RCIS area. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action VPInvert-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, known occurrences of vernal pool branchiopods, and suitable habitat, particularly those hydrologically connected to known occurrences.
- ***Action VPInvert-2***. Survey suitable habitat, where access is permitted, to locate additional occurrences of vernal pool branchiopods in the RCIS area.

Objective 1-2. Reduce the threat of habitat loss, and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for longhorn fairy shrimp (710 acres), and the conservation targets for vernal pool fairy shrimp (3,230 acres) and vernal pool tadpole shrimp (6,450 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action VPInvert-3.*** Permanently protect, through a conservation easement or other approved real estate instrument, suitable habitat for vernal pool branchiopods.

Objective 1-3. Enhance habitat for longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp. Measure progress toward achieving this objective in the area of habitat enhanced to benefit longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp.

- ***Action VPInvert-4***. Enhance habitat based on the results of site-specific assessments. Enhancement actions may include, but are not limited to, activities such as implementing or adjusting prescribed grazing to manage invasive and native vegetation, prescribed burning of vernal pool grasslands (where feasible), and minor recontouring of basins to improve hydrological conditions (where possible).
- ***Action VPInvert-5.*** Develop habitat management plans for all protected lands, informed by the best available science.

Objective 1-4. Restore or create habitat (prioritizing restoration over habitat creation) for vernal pool branchiopods (e.g., alkali wetlands, vernal pools, swales, seasonal wetlands) on protected land in the RCIS area. Use the best available science to inform restoration design to tailor habitat characters for target species (e.g., pool size, soil substrate, etc.) (see Appendix F for habitat requirements for the vernal branchiopods). Measure progress toward achieving this objective in the area of habitat restored.

- ***Action VPInvert-6.*** Identify sites that have in the past, or could, support vernal pool branchiopods and identify factors limiting occupancy.
- ***Action VPInvert-7.*** Restore and/or create alkali wetlands, vernal pools, swales, and other aquatic features that provide suitable habitat for vernal pool branchiopods to achieve conditions at reference sites, as identified in restoration/creation-specific success criteria. Restoration and creation actions, such as recontouring basins, will depend on site-specific conditions.
- ***Action VPInvert-8.*** Inoculate restored and created pools with soils and cysts of vernal pool branchiopods from nearby reference pools, as needed, based on site-specific conditions.
- ***Action VPInvert-9.*** Adaptively manage restored and created vernal pools and associated vernal pool aquatic features to meet predetermined success criteria, including sustained occupancy by vernal pool branchiopods.
- ***Action VPInvert-10.*** Identify source populations for potential banking of seed/cysts for use in future introduction/reintroduction to suitable habitat.

3.8.1.2 Conservation Priorities

- When evaluating where and what type of action to implement to benefit vernal pool branchiopods, the order of priority is first permanent protection of existing, natural habitat, restoration of former or degraded habitat, and lastly, creation of vernal pools if necessary, to maintain the range of vernal pool habitat (U.S. Fish and Wildlife Service 2005a).
- Prioritize permanent protection and enhancement of critical habitat designated under the federal endangered species act (U.S. Fish and Wildlife Service 2006), and occurrences of longhorn fairy shrimp in the Old River and Arroyo Las Positas CPUs (Figure F-1, Appendix F).
- Prioritize permanent protection and enhancement of critical habitat designated under the federal endangered species act (U.S. Fish and Wildlife Service 2006), and occurrences of vernal pool fairy shrimp in the Marsh Creek, Kellogg Creek–Big Break, and Arroyo Las Positas CPUs (Figure F-2, Appendix F).
- Prioritize permanent protection and enhancement of critical habitat designated under the federal endangered species act (U.S. Fish and Wildlife Service 2006), and occurrences of vernal

pool tadpole shrimp in the Agua Caliente Creek–Frontal San Francisco Bay Estuaries CPU and Marsh Creek CPUs (Figure F-3, Appendix F).

3.8.1.3 Opportunities for Adaptation to Climate Change

Climate change has the potential to adversely affect vernal pool branchiopods through changes in vernal pool inundation patterns and temperature regimes. Water availability will likely be one of the most significant impacts of climate change on vernal pool branchiopods. Vernal pools are particularly sensitive to slight increases in evaporation or reductions in rainfall due to their shallowness and seasonality (Field et al. 1999, as cited in U.S. Fish and Wildlife Service 2005a). Drought-mediated decreases in water depth and inundation period could increase the frequency at which pools dry before shrimp have completed their life cycle, or cause pool temperatures to more often exceed temperatures suitable for hatching and persistence of the species (U.S. Fish and Wildlife Service 2005a).

Vernal pool branchiopods in the Central Valley have been identified as being moderately to highly vulnerable to climate change (California Landscape Conservation Cooperative 2017). This assessment is the result of moderate sensitivity to climate change and high sensitivity to future exposure. Shifts in precipitation will affect temperatures within the vernal pool branchiopod ranges, resulting in changes in the timing and length of inundation in vernal pools. Smaller, shallower pools have the greatest potential to be affected by climate change (Pyke and Marty 2005). The vulnerability assessment also found that vernal pool branchiopods have low to moderate adaptive capacity due to extensive habitat fragmentation, low landscape occupancy, and limited dispersal ability (California Landscape Conservation Cooperative 2017).

Very little vernal pool habitat remains in the RCIS area (<1%; Table 2-6) and remaining habitat and vernal pool branchiopod occurrences are patchily distributed (Figures F-1 through F-3, Appendix F). Dispersal to suitable habitat is vital to adapting to shifting habitat range; the limited, highly fragmented patches of remaining habitat limit the opportunities for adaptations to climate change in the RCIS area for this species group.

Resilience to the effects of climate change can be improved at the local level, however. This RCIS provides opportunities to improve resilience to climate change for vernal pool branchiopods by emphasizing the protection of existing occurrences and habitat and restoring and creating occurrences and habitat. Protecting existing occurrences and remaining patches of habitat, and restoring occurrences and a diversity of habitats (e.g., pool sizes, depths, soil substrates), can improve likelihood of persistence, by increasing functional redundancy and habitat diversity in protected habitats, which can provide vernal pool branchiopods with a range of conditions that may buffer against the effects of climate change. For example, larger and deeper vernal pools may hold water during periods of drought and can act as source populations for shallower pools.

3.8.2 Callippe Silverspot Butterfly

The actions and priorities for callippe silverspot butterfly were informed primarily by the USFWS' 5-year review for this species (U.S. Fish and Wildlife Service 2009a).

3.8.2.1 Conservation Goals, Objectives, and Actions

Goal 2. Protect or restore populations of callippe silverspot butterfly in the RCIS area.

Objective 2-1. Determine the status of callippe silverspot butterfly on public lands with suitable habitat within the subspecies' historic range. Measure progress toward achieving this objective in the area of habitat surveyed.

- ***Action CSB-1.*** Survey for callippe silverspot butterfly in suitable habitat, where access is permitted.
- ***Action CSB-2.*** Verify the taxonomy of callippe silverspot populations, focusing work on populations in Alameda County that have yet to be taxonomically verified.

Objective 2-2. Protect suitable habitat (or habitat that can become suitable through habitat management actions) for callippe silverspot butterfly to reduce the threat of further habitat loss, and to increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for callippe silverspot (173,480 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action CSB-3.*** Permanently protect, through a conservation easement or other approved real estate instrument, suitable or potentially suitable habitat for callippe silverspot butterfly.

Objective 2-3. Enhance habitat for callippe silverspot butterfly. Measure progress toward achieving this objective in the area of habitat enhanced to benefit callippe silverspot butterfly.

- ***Action CSB-4***. Improve habitat conditions through managed grazing and invasive plant management.
- ***Action CSB-5***. Plant or protect host plants and nectar plants in suitable grassland habitat.

Objective 2-4. Work with public landowners and provide incentives to willing, private landowners to conduct land management practices in a way that will benefit callippe silverspot butterfly. Measure progress toward achieving this objective in the area of habitat managed to benefit callippe silverspot butterfly.

- ***Action CSB-6.*** Provide incentives to public and private landowners for management of grasslands that support callippe silverspot butterfly.

3.8.2.2 Conservation Priorities

- Survey for unrecorded populations of callippe silverspot butterfly at the following locations (U.S. Fish and Wildlife Service 2009a).
    - Briones Regional Park
        - Sunol Regional Wilderness
        - Las Trampas Regional Wilderness
        - Ohlone Regional Wilderness
        - Del Valle Park
        - Joaquin Miller Park
        - Redwood Regional Park

  Surveys for unrecorded populations of butterfly should focus on areas with the following habitat characteristics: 1) grasslands with the appropriate topography (e.g., cooler, north and east facing slopes (Weiss and Murphy 1990, Weiss et al. 1993, and Weiss and Weiss 1998); 2) populations of the larval host plant (*Viola pedunculata*); 3) nectar sources; 4) influence by coastal fog; and 5) hilltops for mating congregations (U.S. Fish and Wildlife Service 2009a).

- Permanently protect habitats supporting newly discovered populations of callippe silverspot butterfly or that have the habitat characteristics described above. Develop management plans to address the ecological needs of the butterfly, host plant, and nectar sources (U.S. Fish and Wildlife Service 2009a).

3.8.2.3 Opportunities for Adaptation to Climate Change

No species-specific vulnerability analysis has been conducted for callippe silverspot butterfly. Callippe silverspot butterfly, however, would most likely be affected by changing climatic factors that impact the resources it needs for survival including the distribution and abundance of host and nectar plants, and factors that result in an increase in predators (U.S. Fish and Wildlife Service 2009a). Changes in climate can affect coverage of coastal fog (Field et al. 1999, as cited in U.S. Fish and Wildlife Service 2009a), as well as precipitation, and temperature, resulting in loss or a geographic shift in habitat. If the remaining callippe silverspot butterfly populations are unable to shift their distribution to track shifting habitats, or if suitable habitat is lost, intensive human intervention would likely be needed to rescue this subspecies.

The callippe silverspot butterfly is endemic to the Bay Area. USFWS recognizes two populations of callippe silverspot butterfly: A San Bruno Mountain population in San Mateo County and a Cordelia Hills population in Solano County. A population previously known to occur at a city park in Alameda County is believed to have been extirpated (U.S. Fish and Wildlife 2009). Three possible callippe silverspot populations (near Sears Point in Sonoma County and near Pleasanton and Milpitas in Alameda County) have not been taxonomically verified (U.S. Fish and Wildlife Service 2009a), as a closely related subspecies, *S. callippe comstocki*, is difficult to distinguish from *S. callippe callippe*. The RCIS provides opportunities for adaptation to climate change for this species by emphasizing efforts to survey for, and protect, unknown populations and habitat for this species within its historic range. Species with few, small populations have a higher likelihood of extinction. Finding unknown occurrences and protecting and managing habitat for those occurrences increases the likelihood of persistence of callippe silverspot butterfly in a changing climate.

3.8.3 Steelhead and Salmon

The actions and priorities for Central California Coast steelhead were informed primarily by the Coastal Multispecies Recovery Plan for the California Coastal Chinook Salmon, Northern California Steelhead, and Central California Coast Steelhead (National Marine Fisheries Service 2016).

The actions and priorities for Winter-run Chinook salmon and Central Valley steelhead were informed primarily by the 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 (National Marine Fisheries Service 2014).

3.8.3.1 Conservation Goals, Objectives, and Actions

Goal 3. Improve habitat quality and access to spawning and rearing habitat for Central California Coast steelhead distinct population segment.

Objective 3-1. Reduce the primary threats of future habitat loss, degradation, and fragmentation, and increase opportunities for beneficial habitat management by protecting stream habitat needed to meet the conservation target for Central California Coast steelhead (68 miles). Measure progress toward achieving this objective in the area (e.g., area of stream, riparian, and floodplain) or length of habitat protected.

- ***Action SS-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, floodplains and riparian corridors.

Objective 3-2. Enhance and restore stream segments and improve access to spawning and rearing habitat in and along fish-bearing streams for Central California Coast steelhead (Figure F-6, Appendix F). Measure progress toward achieving this objective in the area or length of habitat enhanced or restored to benefit Central California Coast steelhead.

- ***Action SS-2.*** Survey Central California Coast steelhead streams and intrinsic potential habitat in the RCIS area, where access is permitted, to identify restoration and enhancement opportunities.
- ***Action SS-3***. Evaluate and, where appropriate, increase the complexity of in-stream habitat, including spawning substrate, in-stream woody debris, and cool, deep pools in streams in the RCIS area.
- ***Action SS-4.*** Restore and enhance shaded aquatic habitat, floodplain habitat, and riparian vegetation along streams used by Central California Coast steelhead and intrinsic potential habitat.
- ***Action SS-5.*** For urban streams, restore engineered channels (e.g., remove concrete if present, restore geomorphic complexity including pool-riffle sequences, installing features that provide refugia, where consistent with flood control needs). Where space allows, also protect adjacent uplands and design restoration to reconnect the stream with the floodplain.
- ***Action SS-6.*** Establish a working group consisting of local flood control agencies (e.g., the Contra Costa Water District, Alameda County Water District, Contra Costa County Flood Control and Water Conservation District), regulatory agencies, and public and private landowners, to develop and implement a guiding document for fish-friendly water operations (e.g., flows and temperatures) for steelhead in the RCIS area.

Objective 3-3. Remove or modify barriers to passage that prevent access of Central California Coast steelhead to spawning and rearing habitat. Measure progress toward achieving this objective in the number of barriers removed or modified to improve access to habitat.

- ***Action SS-7.*** Remove or modify fish barriers to enable access to a wide variety of streams and habitats in the RCIS area. Evaluate barriers to fish passage for remediation in Walnut Creek, Las Trampas Creek, San Ramon Creek, and Marsh Creek (CalFish 2017).
- ***Action SS-8*****.** Design new road crossings and crossing upgrades across streams used by Central California Coast steelhead and intrinsic potential habitat (Figure F-6, Appendix F) in adherence to the NMFS Anadromous Salmonid Passage Facility criteria and guidelines (National Marine Fisheries Service 2011), where feasible, and consult the California Salmonid Stream Habitat Restoration Manual, Part XII - Fish Passage Design and Implementation (California Department of Fish and Game 2009).

Goal 4. Restore and enhance migratory and rearing habitat for winter-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead in the bays, estuary, and Delta within the RCIS area.

Objective 4-1. Restore and enhance estuaries, tidal wetlands and associated ecosystems to improve rearing and migratory habitat (Figure F-5 – F-7, Appendix F). Measure progress toward achieving this objective in the area of habitat restored or enhanced.

- ***Action SS-9.*** Restore tidal marshes and associated shallow subtidal habitat (National Marine Fisheries Service 2014, Goertler et al. 2017).
- ***Action SS-10.*** Evaluate, and if feasible, implement restoration projects that integrate upland, intertidal, and subtidal habitats (National Marine Fisheries Service 2014).
- ***Action SS-11***. Evaluate whether non-native predator (e.g., striped bass, largemouth bass, and smallmouth bass) control actions (e.g., through direct removal programs, fishery management) can be effective at minimizing depredation of juvenile salmon and steelhead, continuing, and possibly increasing investment in such actions in priority areas if found to be effective (National Marine Fisheries Service 2014).

3.8.3.2 Conservation Priorities

- Redesign the Alameda Creek flood control channel to improve fish passage for adult and juvenile Central California Coast steelhead, while maintaining channel stability and flood carrying capacity (Alameda Creek Alliance 2020).
- Prioritize actions described above in Central California Coast steelhead streams (Figure F-6, *Focal Species Profiles*) (National Oceanic and Atmospheric Administration 2016).
    - Pinole Creek
    - Wildcat Creek
    - Codornices Creek
    - San Pablo Creek
    - San Leandro Creek
    - San Lorenzo Creek
- Prioritize the removal of total barriers as far downstream as possible in the following CPUs (CalFish 2017, National Oceanic and Atmospheric Administration 2016).
    - San Pablo Creek
    - San Lorenzo Creek
    - Walnut Creek
    - Las Trampas Creek
    - San Ramon Creek
- Evaluate, and if feasible, implement restoration projects that integrate upland and intertidal habitats. Locations to consider for restoration project include, but are not limited to, the following (California State Coastal Conservancy et al. 2010, as cited in National Marine Fisheries

Service 2014) as described in the Recovery Plan for Central Valley Chinook Salmon and Steelhead (National Marine Fisheries Service 2014).

- Breuner Marsh and Point Molate – connect to Point San Pablo eelgrass bed.
- Eastshore State Park – wetland restoration integrated with oyster and eelgrass restoration and creek daylighting.
- Dutch Slough

3.8.3.3 Adaptation to Climate Change

When considering climate change, the biggest concern for fish species generally, and anadromous species specifically, is that there will be less precipitation, and thus less stream flow, or that precipitation will fall in patterns different from how it has fallen historically and that river flows will not be adequate during key migration and spawning periods (Moyle et al. 2012). In a drier and warmer climate, in-stream habitat quality for fish will decline, especially for fish that require cold water habitats with sufficient levels of dissolved oxygen, as water temperatures become warmer and concentrations of dissolved oxygen decrease (Moyle et al. 2012).

Moyle et al. (2012) ranked the climate vulnerability of 164 California fish species (121 native fishes and 43 alien [i.e., non-native] fish species). Those rankings were divided into two 10-metric modules which evaluated baseline vulnerability (Module 1) and life history characteristics (Module 2). Module 1 was based on existing environmental changes; that is, species already in decline would be more vulnerable to climate change. Module 2 evaluated those life history characteristics that would make a species more or less vulnerable to climate change. The combined vulnerability score indicates the degree of vulnerability, with lower values indicating greater vulnerability (Table 3-5); species with scores of 35 or less are considered extremely likely to become extinct in the wild by the year 2,100. The results of the analysis (Moyle et al. 2012) indicate that Central California Coast steelhead and Sacramento winter-run Chinook salmon are both vulnerable to climate change, with winter-run Chinook salmon being critically vulnerable (Central Valley steelhead was not assessed under Module 1 or 2, so a vulnerability score is not presented).

Table 3-5. Climate Vulnerability Scoring for the Focal Fish Species as Described in Moyle et al. (2012)

Taxa[a]	Baseline	Climate Change	Status[b]
Central California Coast steelhead	23-28	17-24	2.7
Chinook winter-run Salmon	16-18	10-14	2.0

[a] Moyle et al. (2012) addressed all focal fish species except for Central Valley steelhead.

[b] 1.0-1.9 indicates the species is endangered, 2.0-2.9 indicates the species is vulnerable to becoming endangered, as assessed by Moyle et al. (2012).

The overall intent of the conservation strategy for Central California Coast steelhead is to increase access to stream habitat through removal of barriers and enhance and restore riparian and in-stream habitat. If implemented, these actions could help to mitigate the effects of declining habitat conditions due to climate change. Improved water releases and riparian restoration of shade-providing vegetation along fish-bearing streams will help moderate water temperatures and provide cooler-water refuge in a warming climate. Restoring estuary habitat could provide thermal refuge for migrating and rearing steelhead and Chinook salmon.

3.8.4 California Tiger Salamander

The actions and priorities for California tiger salamander were informed primarily by the *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander* (Ambystoma californiense) (U.S. Fish and Wildlife Service 2017a), the *White Paper on Hybridization and Recovery* (U.S. Fish and Wildlife Service 2017b), the *Santa Clara Valley Habitat Plan* (ICF International 2012), and *Managing Rangelands to Benefit California Red-Legged Frogs and California Tiger Salamanders* (Ford et al. 2013).

3.8.4.1 Conservation Goals, Objectives, and Actions

Goal 5. Sustain or increase California tiger salamander populations in the RCIS area.

Objective 5-1. Protect at least 9[11] preserves, each at least 3,398 acres in size, containing at least four breeding ponds in areas not dominated by hybrid or non-native tiger salamanders, within a matrix of upland habitat (e.g., upland habitat within typical movement distance [1.3 miles] of breeding ponds), distributed across the California tiger salamander management units overlapping the RCIS area identified in the Recovery Plan for the Central California Distinct Population Segment (DPS) of the Tiger Salamander (U.S. Fish and Wildlife Service 2017a). Measure progress toward achieving this objective in number of preserves, and area of aquatic and upland habitat and number of breeding ponds protected in those preserves.

- ***Action CTS-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, land with known breeding occurrences of California tiger salamander and upland habitat.

Objective 5-2. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting habitat needed to meet the conservation targets, including 208,490 acres of occupied habitat, 2,730 acres of potential breeding habitat (in addition to occupied breeding habitat), and 232,140 acres of potential upland habitat. Habitat protected to achieve Objective 5-1 also contributes toward achieving Objective 5-2. Measure progress toward achieving this objective in the area of habitat protected.

- ***Action CTS-2***. Permanently protect, through a conservation easement or other approved real estate instrument, California tiger salamander habitat.

Objective 5-3. Enhance California tiger salamander breeding and upland habitat. Measure progress toward achieving this objective in the area of habitat enhanced to benefit California tiger salamander.

- ***Action CTS-3.*** California red-legged frog and California tiger salamander use similar aquatic and upland habitats (e.g., ponds and grasslands), with different characteristics (e.g., ponds with a

[11] Four Central California tiger salamander management units overlapping the RCIS area: the Concord/Livermore and North Diablo Range, with both mostly overlapping the RCIS area; the Northeast Diablo Range, with a small portion overlapping the southeast corner of the RCIS area; and the Northwest Diablo Range, which a very small portion overlapping the southern part of the RCIS area. The Recovery Plan for the Central California Distinct Population Segment of the Tiger Salamander (U.S. Fish and Wildlife Service 2017a) recommends protecting five preserves in each management unit. This RCIS prorates the number of preserves to protect within each management unit in the RCIS area based approximately on the proportion of the management unit overlapping the RCIS area: four preserves in each of the Concord/Livermore and North Diablo Range management units, one in the Northeast Diablo Range management unit, and none in the Northwest Diablo Range management unit.

mix of open and vegetated areas vs. ponds with no or little emergent vegetation, respectively). Tricolored blackbird also nests in emergent vegetation in ponds that may be used by California red-legged frog and California tiger salamander. At preserves and other sites with ponds (e.g., stock ponds) managed for California red-legged frog, California tiger salamander, and tricolored blackbird develop management plans to support the different habitat requirements of each species, either within the same pond or in different ponds (Ford et al. 2013).

- ***Action CTS-4.*** Eradicate exotic wildlife species such as bullfrogs, mosquitofish, other non-native predatory fish, and non-native turtles and salamanders from breeding ponds.
- ***Action CTS-5.*** Improve upland habitat through the reduction of invasive plant growth and by promoting land management practices that will positively benefit California ground squirrels and other fossorial mammals that create burrows used by California tiger salamander.
- ***Action CTS-6.*** Use livestock grazing to maintain vegetation heights low enough to allow for overland movement by California tiger salamander and encourage ground squirrel colonization. Corrals should be located at least 500 feet away from known and potential breeding sites (U.S. Fish and Wildlife Service 2002a).
- ***Action CTS-*7**. Maintain ponds or areas of ponds with no to minimal vegetation by allowing livestock access to ponds or through other means (e.g., mechanical removal, fire) (Ford et al. 2013). If it is determined that livestock are negatively impacting California tiger salamander habitat, decrease grazing intensity throughout the year in suitable habitats. If that does not solve the issue, install fencing to reduce grazing pressure and exclude feral pigs from California tiger salamander aquatic breeding habitat (U.S. Fish and Wildlife 2017a, U.S. Fish and Wildlife, pers. comm.). Fence installation should be carefully applied to avoid negatively affecting small mammal movement and upland habitat.
- ***Action CTS-8.*** Cease the use of rodenticides on protected lands, particularly in grasslands, to maintain a source of burrows for California tiger salamander.
- ***Action CTS-9*.** Incorporate measures in management and monitoring plans to ensure ranaviruses, chytrid fungus, or other pathogens are not introduced to California tiger salamander habitat. Measures include ensuring that pathogen hosts (i.e., hybrid salamanders, fish species) are not introduced, and protocols for sterilization of field equipment (U.S. Fish and Wildlife Service 2017a).
- ***Action CTS-10***. Create safe passages across barriers to dispersal, such as tunnels under roadways to improve successful movement between habitats.

Objective 5-4. Restore and/or create California tiger salamander breeding habitat. Measure progress toward achieving this objective in area of restored or created habitat and number of restored or created breeding ponds.

- ***Action CTS-11.*** Survey suitable habitat, where access is permitted, to locate opportunities for habitat restoration and/or creation.
- ***Action CTS-12.*** Improve the hydroperiod and water quality of ponds by clearing dense stands of non-native vegetation, repairing eroding dams and spillways, and removing sediment, where appropriate (Ford et al. 2013).
- ***Action CTS-13***. Restore degraded upland habitat with native vegetation suitable for aestivation and dispersal by California tiger salamander.

- ***Action CTS-14.*** Create ponds to provide suitable California tiger salamander breeding habitat.

Objective 5-5. Determine the extent of California tiger salamander hybridization in this East Bay RCIS area and manage California tiger salamander – barred tiger salamander hybrids according to wildlife agency guidance. Measure progress toward achieving this objective in the number of ponds monitored for the presence of hybrid tiger salamanders and managed or restored to favor native California tiger salamanders over hybrids.

- ***Action CTS-15***. Monitor ponds to assess the presence of hybrid tiger salamanders.
- ***Action CTS-16.*** Manage and restore ponds and to provide habitat that favors native California tiger salamanders over hybrids, such as drying ponds late summer-early fall, as guided by the best available science (ICF International 2012, U.S. Fish and Wildlife 2017a, 2017b). Because some species, such as tricolored blackbird and California red-legged frog, rely on aquatic habitat with longer-hydroperiods, ponds occupied by California tiger salamander, or ponds near occupied habitat (and not used as nesting habitat by tricolored blackbirds) should be strategically managed to have seasonal ponding durations. Managing ponds to dry out in September – October would discourage bullfrogs, fish, and non-native tiger salamanders while still allowing successful tricolored blackbird and California red-legged frog breeding (U.S. Fish and Wildlife, pers. comm.).

3.8.4.2 Conservation Priorities

- Prioritize permanent protection of large patches of occupied habitat (Figure F-8) containing at least four breeding ponds in areas not dominated by hybrid or non-native tiger salamanders, distributed across the following California tiger salamander management units overlapping the RCIS area in preserves at least 3,398 acres in size (U.S. Fish and Wildlife 2017a).
  - Concord/Livermore Management Unit, which generally corresponds to the Mount Diablo Creek-Front Suisun Bay Estuaries, Marsh Creek, Kellogg Creek-Big Break, Old River, Arroyo Las Positas and Corral Hollow CPUs.
  - North Diablo Range Management Unit, which generally corresponds to the Arroyo de la Laguna, Arroyo Mocho, Alameda Creek, Arroyo Hondo, and Arroyo Valle CPUs.
  - Northeast Diablo Range Management unit, which general corresponds to the Corral Hollow Creek CPU.
- Prioritize permanent protection, restoration, and enhancement of critical habitat in the Arroyo Las Positas CPU (U.S. Fish and Wildlife 2005) (Figure F-8, Appendix F).
- Prioritize for permanent protection habitat between Mount Diablo State Park and Walnut Creek (J. P. Galvan, pers. comm.)
- Enhance and restore protected breeding habitat, using the actions described above, to improve existing breeding habitat (see Section 2.3.5, *Non-native Species and Diseases*) (U.S. Fish and Wildlife 2017).

3.8.4.3 Opportunities for Adaptation to Climate Change

Because California experiences highly variable annual rainfall events and droughts, California tiger salamanders have adapted a life history strategy to deal with these seasonal environmental conditions (U.S. Fish and Wildlife Service 2017a). California tiger salamander breeding success is tied very closely to rainfall amounts and timing, as adults generally migrate to breeding ponds during rainy nights between November and April (Trenham et al. 2001). Drought, and changes in precipitation and temperature, may prevent ponds from filling, or cause ponds to dry out before larvae transform and can emerge from aquatic habitats. Although the longevity of adult California tiger salamander may be sufficient to enable populations to withstand droughts within the historic range of duration and intensity (Barry and Shaffer 1994), it may not be sufficient to withstand extreme droughts that may occur with climate change (U.S. Fish and Wildlife Service 2017a).

Wright et al. (2013) estimated that the California tiger salamander was at "intermediate risk" from climate change. Modeled under four climate change scenarios, it was estimated that 20 - 80% of current California tiger salamander occurrences would persist through 2050, but that 20 - 99% of modeled habitat would no longer be suitable. Across the four climate change scenarios, the prediction of future habitat suitability varied from nearly all of the current habitat in the RCIS area remaining suitable (particularly in the Diablo Range), to a large amount of habitat loss, with a patchy distribution of remaining habitat.

The overall intent of the conservation strategy for California tiger salamander is to protect existing occurrences, improve habitats to improve productivity, and protect and manage larger blocks of habitat so that individuals will have access to other habitat areas, should conditions at historical locations change. Several of the actions are focused on the intensive management of surface water resources used for breeding by California tiger salamander. Ensuring that water is available in breeding ponds long enough during the breeding season to allow young to emerge from aquatic habitat may be necessary to maintain California tiger salamanders in a changing climate.

3.8.5 Foothill Yellow-Legged Frog

The actions and priorities for foothill yellow-legged frog were informed primarily by the ECCC HCP/NCCP and the EACCS.

3.8.5.1 Conservation Goals, Objectives, and Actions

Goal 6. Sustain foothill yellow-legged frog populations and enhance and/or restore suitable habitat in the RCIS area.

Objective 6-1. Protect known breeding locations of foothill yellow-legged frog and allow for expansion of existing populations by protecting breeding and movement habitat upstream, downstream, and into adjacent watersheds. Measure progress toward achieving this objective in the area or length of occupied habitat protected.

- ***Action FYLF-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, breeding occurrences of foothill yellow-legged frog.

Objective 6-2. Reduce the threat of habitat loss, and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for breeding/foraging habitat (10,000 acres) and conservation target for low-use habitat (990) (Figure F-9, Appendix F). Measure progress toward achieving this objective in the area or length of habitat protected.

- ***Action FYLF-2.*** Permanently protect, through a conservation easement or other approved real estate instrument, streams that currently have, or historically had, perennial flows and cobblestone substrate, along with intermittent and ephemeral streams that connect to those perennial streams.

Objective 6-3. Enhance foothill yellow-legged frog habitat within the same watershed of documented occurrences. Measure progress toward achieving this objective in the area or length of habitat enhanced to benefit foothill yellow-legged frog.

- ***Action FYLF-3.*** Enhance seasonal breeding habitat below reservoirs by managing reservoir releases to mimic a natural hydrograph. As releases are scheduled to begin and end, they should be done slowly to avoid scouring or stranding eggs and larvae during the foothill yellow-legged frog egg-laying period.
- ***Action FYLF-4.*** Census egg masses in breeding habitat downstream of reservoirs before and after releases to determine whether egg masses are lost. Census tadpoles in the summer months in suitable habitat to ensure successful recruitment as pulse flows for power generation or rafting can threatened population numbers.
- ***Action FYLF-5.*** Control exotic species such as bullfrogs, mosquitofish, crayfish, non-native predatory fish, and non-native turtles in watersheds with known breeding occurrences.
- ***Action FYLF-6.*** Plant native understory and overstory riparian vegetation within 15 feet of the edge of the low-flow channel to create partially shaded areas with sunny spots for basking and foraging.
- ***Action FYLF-7.*** Increase the amount of cobblestone substrate suitable to support breeding foothill yellow legged frogs in areas close to known occurrences of foothill yellow-legged frog.
- ***Action FYLF-8.*** Evaluate recreational impacts within known breeding habitats and implement seasonal closures in locations where recreation may be directly impacting foothill yellow-legged frog to enhance seasonal breeding habitat.
- ***Action FYLF-9.*** Foothill yellow-legged frogs are sensitive to specific pesticides and herbicides (Kerby and Sih 2015). Minimize or strategically manage herbicide and pesticide use in protected lands adjacent to streams occupied by foothill yellow-legged frog.
- ***Action FYLF-10.*** Evaluate potential impacts from salmonid restoration projects and potential predation from salmonids in watersheds like Alameda Creek.

3.8.5.2 Conservation Priorities

- Permanently protect occurrence of foothill yellow-legged frog in the RCIS area (Jones & Stokes 2006, ICF International 2010).
- Permanently protect and enhance modeled creek segments in the following locations.
    - Arroyo Mocho and tributaries upstream of the city of Livermore.
    - Streams and tributaries in the Corral Hollow Creek CPU.
    - Streams in the Upper Alameda Creek CPU.
    - Streams and tributaries in the Marsh Creek CPU.

3.8.5.3 Opportunities for Adaptation to Climate Change

As with fish species, the biggest concern for amphibians that primarily use stream habitats is that there will be less precipitation, and thus less stream flow, or that precipitation will fall in patterns different from how it has fallen historically, and that stream flow will not be suitable during reproduction periods. In a drier and warmer climate, in-stream habitat quality for foothill yellow-legged frog may decline.

Wright et al. (2013) estimated that the foothill yellow-legged frog was at "neutral risk" from climate change across the state. Modeled under four climate change scenarios, it was estimated that less than 20% of currently suitable habitat would become unsuitable by 2050, and that greater than 80% of current foothill yellow-legged frog occurrences would persist through 2050. There was strong consensus across the models that all of the habitat in the RCIS area that is currently suitable, would remain suitable. Despite that, it is still assumed that the availability of water in stream systems will remain a limiting factor for the species in the future, as it is now, and that conditions could worsen under drier conditions.

The overall intent of the conservation strategy for foothill yellow-legged frog is to improve in-stream habitat through enhancement and restoration actions, including the removal of in-stream barriers to passage to increase access stream habitat, as described in the conservation strategy for habitat connectivity and landscape linkages (Section 3.9.1, *Habitat Connectivity and Landscape Linkage*) and conservation strategy for Central California Coast steelhead (Section 3.8.3, *Steelhead and Salmon*). Actions aimed at improving existing habitat and increasing access to stream reaches will help to mitigate the effects of declining habitat conditions due to climate change.

3.8.6 California Red-Legged Frog

The actions and priorities for California red-legged frog were informed primarily the *Recovery Plan for the California Red-Legged Frog* (Rana aurora draytonii) (U.S. Fish and Wildlife Service 2002a) and *Managing Rangelands to Benefit California Red-Legged Frogs and California Tiger Salamanders* (Ford et al. 2013).

3.8.6.1 Conservation Goals, Objectives, and Actions

Goal 7. Sustain California red-legged frog populations and protect, enhance and/or restore/create suitable habitat in the RCIS area.

Objective 7-1. Protect known breeding locations and allow for expansion of metapopulations by protecting suitable breeding habitat within typical movement distance of known breeding locations (approximately 2 miles). Measure progress toward achieving this objective in the number of breeding locations and area of adjacent upland habitat protected.

- ***Action CRLF-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, known breeding occurrences and adjacent refugia and dispersal California red-legged frog habitat.

Objective 7-2. Reduce the threat of habitat loss, and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation targets, including an additional 8,110 acres of breeding habitat, 18,500 acres of refugia habitat, and 446,180 acres of dispersal habitat (Figure F-10, Appendix F). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action CRLF-2.*** Permanently protect, through a conservation easement or other approved real estate instrument, California red-legged frog habitat.

Objective 7-3. Enhance California red-legged frog habitat. Measure progress toward achieving this objective in the area of habitat enhanced to benefit California red-legged frog.

- ***Action CRLF-3.*** California red-legged frog and California tiger salamander use similar aquatic and upland habitats (e.g., ponds and grasslands), with different characteristics (e.g., ponds with a mix of open and vegetated areas vs. ponds with no or little emergent vegetation, respectively). Tricolored blackbird also nests in emergent vegetation in ponds that may be used by California red-legged frog and California tiger salamander. At preserves and other sites managed for California red-legged frog, California tiger salamander, and tricolored blackbird develop management plans to support the different habitat requirements of each species, either within the same pond or in different ponds (Ford et al. 2013).
- ***Action CRLF-4.*** Maintain ponds or areas of ponds with a mix of open surface water and emergent vegetative cover for California red-legged frogs by allowing livestock access to ponds or other means (e.g., mechanical removal, fire) (Ford et al. 2013). If it is determined that livestock are negatively impacting California red-legged frog habitat, decrease grazing intensity throughout the year in suitable habitats. If that does not solve the issue, install fencing to reduce grazing pressure and exclude feral pigs from California red-legged frog aquatic breeding habitat (U.S. Fish and Wildlife 2002). Fence installation should be carefully applied to avoid negatively affecting small mammal movement and upland habitat.
- ***Action CLRF-5.*** Eradicate exotic species such as bullfrogs, mosquitofish, other non-native predatory fish, and non-native turtles from breeding ponds and stream segments.
- ***Action CLRF-6.*** Increase the amount of California red-legged frog breeding habitat in creeks through the creation of more plunge pools and slow-water habitats, by incorporating these features in restoration designs in creeks.
- ***Action CRLF-7.*** Use livestock grazing that will maintain vegetation heights low enough to allow for overland movement by California red-legged frog and that will encourage ground squirrel colonization. Corrals should be located at least 500 feet away from known and potential breeding sites (U.S. Fish and Wildlife Service 2002a).

Objective 7-4. Restore and/or create California red-legged frog habitat. Measure progress toward achieving this objective in area of restored or created habitat and number of breeding ponds.

- ***Action CRLF-8.*** Survey suitable habitat, where access is permitted, to locate opportunities for habitat restoration and creation.
- ***Action CRLF-9.*** Plant native emergent vegetation around the perimeter of ponds and wetlands to provide breeding habitat for California red-legged frog where little to none exists, while maintaining areas of open water.
- ***Action CRLF-10.*** Improve the hydroperiod and water quality of ponds by clearing dense stands of non-native vegetation, repairing eroding dams and spillways, and removing sediment, where appropriate (Ford et al. 2013).

- ***Action CRLF-11.*** Create ponds to provide suitable California red-legged frog habitat.
- ***Action CRLF-12.*** Use recognized bioengineering techniques, such as the use of rootwad composites and toe wood, to create instream features mirroring the functionality of undercut banks, providing overhanging vegetation and submerged root structures to enhance suitable habitat for California red-legged frog in natural streams and creeks.

3.8.6.2 Conservation Priorities

- Prioritize permanent protection, habitat enhancement actions, and restoration within critical habitat (U.S. Fish and Wildlife Service 2010a) (Figure F-10, Appendix F).

3.8.6.3 Opportunities for Adaptation to Climate Change

California red-legged frog has adapted a life history strategy to deal with California's highly variable annual rainfall events and droughts. California red-legged frog breeding success is tied very closely to rainfall amounts and timing: enough rainfall must fall to provide enough water in streams or ponds during the breeding season, and to ensure that ponding persists long enough for eggs to hatch and young to develop. California red-legged frogs have the added advantage of moving overland for great distances to seek out water sources, but they are restricted by the need for some form of perennial water source. This adaptation itself will allow California red-legged frog to persist in a changing climate, at least at the metapopulation level, though individual frogs or breeding locations may no longer be able to persist. Likely the greatest threat to frogs in the future would be a persistent, regional drought. If that drought persisted for many years it may be difficult for one or more metapopulations of California red-legged frog to persist, particularly if they are facing other stresses.

Wright et al. (2013) estimated that the California red-legged frog was at "neutral risk" from climate change across the state. Modeled under four climate change scenarios, it was estimated that less than 20% of currently suitable habitat would become unsuitable by 2050, and that greater than 80% of current California red-legged frog occurrences were likely to persist through 2050. There was strong consensus across the models, under all four climate change scenarios, that all of the habitat in the RCIS area that is currently suitable, would remain suitable. However, even though current occurrences are likely to persist and habitat that is currently suitable will likely remain so, California red-legged frog was identified as one of five amphibian species likely to see an overall reduction in habitat quality across its range.

The overall intent of the conservation strategy is to improve breeding and upland habitat to sustain California red-legged frog populations in the RCIS area. To achieve this, the conservation strategy focuses on protection, enhancement, and restoration of habitat. Protecting existing occurrences, enhancing those habitats to improve breeding productivity, and protecting and managing larger blocks of habitat so that individuals will have access to other habitat areas - should conditions at historical locations change - are all important tools for land managers to provide adaptations to climate change. Several of the actions are focused on the intensive management of surface water resources used for breeding by California red-legged frog. Ensuring that water is available in breeding ponds long enough during the breeding season to allow young to emerge from aquatic habitat may be necessary to maintain California red-legged frog in a changing climate.

3.8.7 Northern California legless lizard

3.8.7.1 Conservation Goals, Objectives, and Actions

The actions and priorities for Northern California legless lizard were informed primarily by the ECCC HCP/NCCP and *California Amphibian and Reptile Species of Special Concern* (Thomson et al. 2016).

Goal 8. Maintain the Northern California legless lizard population and enhance suitable habitat in the RCIS area.

Objective 8-1. Permanently protect, through a conservation easement or other approved real estate instrument, occurrences of Northern California legless lizard in the RCIS area. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action NCLL-1.*** Survey suitable habitat, where access is permitted, to locate additional occurrences of Northern California legless lizard in the RCIS area.
- ***Action NCLL-2****.* Protect, through fee title purchase, conservation easement, or agricultural easement, land with known occurrences of Northern California legless lizard.

Objective 8-2. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the habitat (2,110 acres) needed to meet the conservation target for Northern California legless lizard. Measure progress toward achieving this objective in the area of habitat protected.

- ***Action NCLL-3-*** Permanently protect, through a conservation easement or other approved real estate instrument, Northern California legless lizard habitat.

Objective 8-3. Enhance habitat for Northern California legless lizard. Measure progress toward achieving this objective in the area of habitat enhanced to benefit Northern California legless lizard.

- ***Action NCLL-4.*** Manage public lands to minimize trails and associated soil compaction in Northern California legless lizard habitat.
- ***Action NCLL-5.*** Prohibit off-road vehicles in Northern California legless lizard modeled habitat.
- ***Action-NCLL-6.*** Manage vegetation in Northern California legless lizard habitat to maintain habitat through grazing or mechanical means.
- ***Action NCLL-7.*** Manage grazing (e.g., fencing, seasonal timing, stocking rates) to reduce impacts from cattle on Northern California legless lizard habitat.
- ***Action NCLL-8.*** Where feasible, minimize impacts to occupied or potentially suitable habitat (i.e., areas with loose or sandy soil) patches in developed areas (e.g., roadsides, utility corridors) or on working lands (e.g., fence lines) (ICF in-development), as some populations have persisted in developed areas (Thomson et al. 2016).
- ***Action NCLL-9.*** Manage invasive plant species in areas with sandy or loose, loamy soil to maintain sparse vegetation cover in habitat for Northern California legless lizard.

3.8.7.2 Conservation Priorities

- Prioritize permanent protection of known occurrences of Northern California legless lizard, and parcels with suitable habitat adjacent to known occurrences to expand protection for protected occurrences (Thomson et al. 2016) in the Kellogg Creek–Big Break, Middle River–San Joaquin River, and Marsh Creek CPUs.
- Control invasive vegetation in occupied habitat (Thomson et al. 2016).

3.8.7.3 Opportunities for Adaptation to Climate Change

Wright et al. (2013) assessed the conservation risk posed by climate change for 153 species of reptiles and amphibians in California. The assessment was conducted when this species was called the California legless lizard (*Anniella pulchra*) and included all currently named *Anniella* species ranging south into northern Baja California. The California legless lizard was deemed to be at "neutral risk" from climate change across the state. Modeled under four climate change scenarios, it was estimated that less than 20% of currently suitable habitat would become unsuitable by 2050, and that greater than 80% of current California legless lizard occurrences would persist through 2050. There was strong consensus across the models that all of the habitat in the RCIS area that is currently suitable, would remain suitable.

A more recent assessment identified climate change as an emerging threat to Northern California legless lizard (Thomson et al. 2016). The Northern California legless lizard's specialization for a fossorial existence in substrates with a high sand fraction in open habitats makes it vulnerable to climate change. Soil moisture, which is essential for the Northern California legless lizard to regulate its body temperature, could be reduced with increasing temperatures and/or declining amounts of precipitation. Such changes to soil moisture may limit the lizard's activity to deeper soil depths or make habitat unsuitable. Changes in vegetation may affect Northern California legless lizard if preferred habitats, such as patches in coastal scrub shift to grasslands (Thomson et al. 2016).

The overall intent of the conservation strategy for Northern California legless lizard is to protect existing occurrences and improve habitats. Protecting occurrences and suitable habitat will help to ensure that habitat can be managed to reduce the effects of climate change. The conservation strategy recommends maintaining open habitat using vegetation management techniques such as controlled grazing or mechanical removal, which would help to reduce the effects of shifting vegetation communities with a changing climate.

3.8.8 Alameda Whipsnake

3.8.8.1 Conservation Goals, Objectives, and Actions

The actions and priorities for Alameda whipsnake were informed primarily by the ECCC HCP/NCCP, the EACCS, and the *Draft Recovery Plan for Chaparral and Scrub Species East of San Francisco Bay, California* (U.S. Fish and Wildlife Service 2002b), and the USFWS' 5-year review for Alameda whipsnake (U.S. Fish and Wildlife Service 2011).

Goal 8. Increase the size of Alameda whipsnake occurrences in designated recovery units and protect and enhance suitable habitat in the RCIS area to a level that allows for long-term viability without human intervention.

Objective 9.1. Protect existing Alameda whipsnake populations and allow for expansion of metapopulations in the RCIS area. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action AWS-1.*** Identify occupied habitat to inform conservation actions by conducting targeted presence/absence surveys with approval from CDFW and USFWS on potentially suitable habitat, where access is permitted. Surveys should be done on both sides of Interstate 580, Interstate 680, State Route 84, State Route 24, State Route 13, and San Pablo Dam Road to identify linkages between recovery units in the recovery plan (U.S. Fish and Wildlife Service 2002b).
- ***Action AWS-2.*** Permanently protect, through a conservation easement or other approved real estate instrument, occurrences of Alameda whipsnake.

Objective 9-2*.* Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for core habitat (27,080 acres) and perimeter core habitat (48,150 acres) and conservation target for movement habitat (208,400 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action AWS-3.*** Permanently protect, through a conservation easement or other approved real estate instrument, Alameda whipsnake habitat adjacent to occurrences with suitable chaparral and scrub habitat to expand protection for protected occurrences and that provide linkages between Alameda whipsnake recovery units.

Objective 9-3*.* Enhance Alameda whipsnake habitat. Measure progress toward achieving this objective in the area of habitat enhanced to benefit Alameda whipsnake.

- ***Action AWS-4.*** Implement pilot projects to investigate population response (e.g. Before/After Impact/Control) to various management techniques (e.g., prescribed burn, mechanical thinning, or grazing), in coordination with USFWS.
- ***Action AWS-5.*** Manage chaparral and scrub stands, grassland, and rock outcrops using moderate levels of grazing or mechanical methods (e.g., to remove eucalyptus) to maintain or improve habitat consistent with the latest understanding of Alameda whipsnake habitat use.
- ***Action AWS-6***. Improve linkages between populations of Alameda whipsnake based on the result of the surveys in *Action AWS-1.* Improvements may include, but are not limited to, the removal or modification of barriers, enhancement of habitat within and/or on either side of the movement corridor, and creating safe passages (e.g., tunnels under roads).
- ***Action AWS-7***. Conduct invasive plant species management in habitat to protect or increase the prey base for Alameda whipsnake.
- ***Action AWS*-8**. Work with public landowners and provide incentives to willing private landowners to cease the use of rodenticides in Alameda whipsnake habitat, to maintain burrowing habitat and prey.

3.8.8.2 Conservation Priorities

- Prioritize permanent protection of all areas where Alameda whipsnake has been documented and suitable habitat persists.

- Identify linkages between recovery units and implement actions to improve connectivity between recovery units. Connectivity is important for maintaining genetic diversity across whipsnake populations (U.S. Fish and Wildlife Service 2002b).
- Prioritize permanent protection of habitat in the recovery units in the Marsh Creek, Arroyo Mocho, and Arroyo Valle CPUs. Additional opportunities exist in the San Lorenzo Creek–Frontal San Francisco Bay Estuaries and San Pablo Bay–Frontal San Francisco Bay Estuaries CPUs.

3.8.8.3 Opportunities for Adaptation to Climate Change

The Alameda whipsnake has already experienced significant habitat loss and habitat fragmentation in the RCIS area (which encompasses its entire range), such that only five populations remain (U.S. Fish and Wildlife Service 2002b). Because it occurs in such localized areas, this species could be highly vulnerable to climate change (U.S. Fish and Wildlife Service 2011). As extreme weather events become more common (IPCC 2007), isolated populations could suffer mass mortality. Where populations are isolated and range contractions occur, a changing climate may result in local extinction, with range shifts precluded by lack of habitat (U.S. Fish and Wildlife Service 2011).

The overall intent of the conservation strategy for Alameda whipsnake is to protect existing occurrences and improve habitats. Protecting occurrences and suitable habitat will help to ensure that habitat can be managed to reduce the effects of climate change. The conservation strategy recommends vegetation management techniques such as moderate levels of controlled grazing or mechanical removal, which would help to reduce the effects of shifting vegetation communities with a changing climate. Another focus of the conservation strategy is to improve connectivity between habitats in recovery units. Improving connectivity would improve opportunities for Alameda whipsnake to disperse to different habitat patches if climate change causes existing patches to become unsuitable.

3.8.9 Giant Garter Snake

The actions and priorities for giant garter snake were informed primarily by the ECCC HCP/NCCP, the draft Antioch HCP/NCCP, and the *Recovery Plan for the Giant Garter Snake* (Thamnophis gigas) (U.S. Fish and Wildlife Service 2017c).

3.8.9.1 Conservation Goals, Objectives, and Actions

Goal 10. Increase the giant garter snake population and protect and enhance suitable habitat in the RCIS area.

Objective 10-1. Protect giant garter snake occurrences in the RCIS area. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action GGS-1.*** Survey suitable habitat, where access is permitted, to locate new occurrences of giant garter snake.
- ***Action GGS-2***. Permanently protect, through a conservation easement or other approved real estate instrument, occurrences of giant garter snake or parcels adjacent to occupied core habitat.

Objective 10-2. Reduce the threat of habitat loss, and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for giant garter snake core habitat (6,500 acres) and movement habitat (29,930 acres) and to contribute toward the recovery plan's goal to contribute to protecting at least two habitat block pairs[12] in the White Slough Management Unit[13] (U.S. Fish and Wildlife Service 2017c). If feasible, protect habitat configured as a block pair, as defined by the recovery plan. Measure progress toward achieving this objective in the area of core and movement habitat protected.

- ***Action GGS-3.*** Conduct targeted studies in the RCIS area to identify corridors linking habitat blocks.
- ***Action GGS-4.*** Permanently protect, through a conservation easement or other approved real estate instrument, corridors containing core and movement habitat with a minimum width of 0.5 mile (U.S. Fish and Wildlife Service 2017c) in the RCIS area.

Objective 10-3. Enhance and restore giant garter snake habitat. Measure progress toward achieving this objective in the area and length of habitat enhanced and restored to benefit giant garter snake.

- ***Action GGS-5.*** Enhance and restore wetland ecosystems that support giant garter snake in the RCIS area.
- ***Action GGS-6.*** Maintain water in canals or ditches within the range of this species in the RCIS area during their active period (early spring through mid-fall).
- ***Action GGS-7.*** Maintain or enhance emergent vegetation in canals for escape cover and foraging habitat.
- ***Action GGS-8.*** Maintain or enhance patches of grassland connected to waterways to provide basking sites.
- ***Action GGS-9.*** Maintain or create upland areas above flood stages to provide a refuge for giant garter snakes during floods.
- ***Action GGS-10.*** Monitor populations of giant garter snake in the RCIS area annually, to assess the status of giant garter snake in the RCIS area and to assess response to enhancement and restoration actions.

Objective 10-4. Provide incentives to private landowners to conduct land management practices in a way that will benefit giant garter snake. Measure progress toward achieving this objective in the area and length of habitat restored or managed to benefit giant garter snake.

- ***Action GGS-11.*** Provide financial or regulatory incentives (e.g., Safe Harbor Agreements) to private landowners on working lands to restore marshes to increase movement habitat for giant garter snake in the RCIS area.

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[12] As described by the recovery plan (U.S. Fish and Wildlife Service 2017c) a "block pair will consist of one 240-hectare (539-acre) block of contiguous buffered perennial wetland habitat (existing, restored or enhanced) and one 639-hectare (1,578-acre) block of contiguous active ricelands separated by no more than 5 miles (8 kilometers)1. Alternatively, a pair of blocks may also consist of two 240-hectare (539-acre) blocks of buffered perennial wetlands."

[13] Only a small fraction of the White Slough Management Unit overlaps the RCIS area in the northeast corner of the RCIS area.

- ***Action GGS-12.*** Provide financial or regulatory incentives (e.g., Safe Harbor Agreements) to private landowners on working lands to provide water for giant garter snake during times of drought.

Objective 10-5. Mitigate the effects of climate change on giant garter snake in the RCIS area. Measure progress toward achieving this objective in the development and implementation of adaptive management guidelines or the number of conservation and habitat enhancement actions implemented to mitigate the effects of climate change.

- ***Action GGS-13.*** Collaborate with the California Climate Change Center to investigate the effects of climate change on the giant garter snake and its habitat. Results of investigations should, in part, inform development of adaptive management guidelines that should be implemented throughout the range of the giant garter snake (U.S. Fish and Wildlife Service 2017c).

3.8.9.2 Conservation Priorities

- Prioritize permanent protection of all known and newly discovered occurrences of giant garter snake in the White Slough Management unit within the Delta Basin Recovery Unit (approximately 70,000 acres overlap the RCIS area) (U.S. Fish and Wildlife Service 2017c).

3.8.9.3 Opportunities for Adaptation to Climate Change

Wright et al. (2013) estimated that the giant garter snake was at “neutral risk” from climate change across the state. Modeled under four climate change scenarios, it was estimated that less than 20% of currently suitable habitat would become unsuitable by 2050, and that greater than 80% of current giant garter snake occurrences would persist through 2050. There was strong consensus across the models that all of the habitat in the RCIS area that is currently suitable, would remain suitable.

Apart from the modeling efforts by Wright et al. (2013), the potential effects of climate change on giant garter snake are poorly known, as focused research on the impacts of climate change and drought for giant garter snake is lacking (U.S. Fish and Wildlife Service 2017c). Action GGS-10 seeks to inform future management actions to benefit giant garter snake in a changing climate by recommending collaborative efforts to investigate potential effects of climate change on giant garter snake.

Water availability is a critical part of the giant garter snake’s ecological requirements, and water availability will likely change with a changing climate. Action GGS-11 recommends providing financial or regulatory incentives to private landowners on working lands to pump water into giant garter snake habitat during times of drought, as has been used elsewhere to provide aquatic habitat during droughts (Shuford 2017).

3.8.10 Tricolored Blackbird

The actions and priorities for tricolored blackbird were informed primarily by the ECCC HCP/NCCP, the EACCS, *Managing Nesting and Foraging Habitats to Benefit Breeding Tricolored Blackbirds* (Meese and Beedy 2015), and locations of aggregations and colonies provided in the Tricolored Blackbird Portal (University of California, Davis 2018).

3.8.10.1 Conservation Goals, Objectives, and Actions

Goal 11. Increase the number of tricolored blackbird nesting colonies and the amount of suitable tricolored blackbird nesting and foraging habitat in the RCIS area.

Objective 11-1. Protect tricolored blackbird breeding colony sites identified in the CNDDB or UC Davis Tricolored Blackbird Portal (University of California, Davis 2018) as current or recently occupied (within the last 15 years). Measure progress toward achieving this objective in the number of current or recently occupied breeding colony sites protected.

- ***Action TRBL-1***. Permanently protect, through a conservation easement or other approved real estate instrument, tricolored blackbird colony sites.

Objective 11-2. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for tricolored blackbird core breeding habitat (4,280 acres) and primary foraging habitat (323,420 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action TRBL-2***. Permanently protect, through a conservation easement or other approved real estate instrument, tricolored blackbird breeding habitat.
- ***Action TRBL-3.*** Permanently protect, through a conservation easement or other approved real estate instrument, tricolored blackbird foraging habitat within 3 miles of occupied or recently occupied (within the last 15 years) colony sites.
- ***Action TRBL-4***. Implement an annual monitoring program in coordination with local conservation groups of tricolored blackbird nesting colonies sites in the RCIS area to supplement the tri-annual statewide survey.

Objective 11-3. Increase the amount of breeding and foraging habitat managed to benefit tricolored blackbird in the RCIS area. Breeding habitat should be managed to achieve conditions[14] described by Meese and Beedy (2015), or otherwise more current information. Measure progress toward achieving this objective in the area of breeding and foraging habitat managed to benefit tricolored blackbird.

- ***Action TRBL-5.*** California red-legged frog and California tiger salamander use similar aquatic and upland habitats (e.g., ponds and grasslands), with different characteristics (e.g., ponds with a mix of open and vegetated areas vs. ponds with no or little emergent vegetation, respectively). Tricolored blackbird also nests in emergent vegetation in ponds that may be used by California red-legged frog and California tiger salamander. At preserves and other sites managed for California red-legged frog, California tiger salamander, and tricolored blackbird, develop management plans to support the different habitat requirements of each species, either within the same pond or in different ponds (Ford et al. 2013).
- ***Action TRBL-6.*** Manage vegetation, sediment, and flow (where possible) to ensure wetlands or ponds retain enough water from March – July or as long as tricolored blackbirds are present, to provide nesting substrate that is partially inundated so terrestrial predators cannot access

[14] Meese and Beedy (2015) describe optimal marsh habitat conditions as including freshwater emergent vegetation at least 4 feet high and submerged in shallow water 6-18 inches deep, with cattail stands at least 50 feet wide. See Meese and Beedy (2015) for detailed management guidance.

nests. Perennial flooding of wetlands is preferred. Vegetation can be managed with methods such as controlled burns, cutting, grazing, discing, or mastication.

- ***Action TRBL-7.*** In ponds, manage vegetation around the fringes of ponds so that enough structure is retained to support a nesting colony, but does not reduce pond capacity to the point where active nests are vulnerable to depredation.
- ***Action TRBL-8.*** Provide incentives (e.g., through Safe Harbor Agreements) private landowners to promote pond and wetland management practices that will improve tricolored blackbird breeding and foraging habitat.
- ***Action TRBL-9.*** Provide incentives (e.g., through agricultural easements or by purchasing crops) to private landowners to manage agricultural land to provide suitable foraging habitat, particularly within 3 miles of active nest colonies and suitable nesting habitat. Crop types have foraging habitat values for tricolored blackbird as follows (natural lands are not listed below) (Meese pers. comm. 2013, as cited in the Yolo Habitat Conservation Plan/Natural Community Conservation Plan [ICF 2018]).
    - Very high value: Native pasture.
    - High value: alfalfa, sunflower, mixed pasture.
    - Medium value: Fallow lands cropped within 3 years; new lands prepared for crop production.
    - Low value: Mixed grain and hay crops.
    - Marginal value: Rice.
- ***Action TRBL-11.*** Use grazing to control invasive vegetation in grassland foraging habitats.

3.8.10.2 Conservation Priorities

- Permanently protect and enhance active nest colony or recently active nest colony sites and foraging habitat adjacent to and within 3 miles of colony sites.

3.8.10.3 Opportunities for Adaptation to Climate Change

Gardali et al. (2012) ranked the climate vulnerability of 358 California bird species. Those rankings were based on both the exposure and sensitivity that a species experiences to climate change, based on the current understanding of their life history. Exposure to climate change was based on expected changes in habitat suitability, changes in food availability, and exposure to extreme weather. Sensitivity to climate change was based on a species' habitat specialization, physiological tolerance, migratory status, and dispersal ability. Analyses were only conducted on the portion of a species' life history spent in California. Each species was given Climate Vulnerability Scores, which ranged from 12 – 72, with a median score of 24. All species with a score of 30 or higher (128 species) were considered prioritized taxa and given a ranking of low, moderate, or high vulnerability to climate change. Tricolored blackbird was given a score of 25 and was not considered a priority with respect to climate vulnerability (Table 3-6).

Table 3-6. Climate Vulnerability Scoring for Tricolored Blackbird as Described in Gardali et al. (2012)[1]

Criteria	Score[2, 3]
Exposure	
Habitat suitability	2 – moderate; habitat suitability is expected to decrease by 10–50%
Food availability	1 - low; food availability for taxon would be unchanged or increase
Extreme weather	2 – moderate; taxon is expected to be exposed to some increase in extreme weather events
Sensitivity	
Habitat specialization	2 – moderate; taxon that tolerates some variability in habitat type or element
Physiological tolerance	1 – low; minimal or no evidence of physiological sensitivity to climatic conditions
Migratory status	1 - low; year-round resident
Dispersal ability	1 – low; taxon with high dispersal ability

1 Additional information about species scoring, including the database of scores is located here: http://data.prbo.org/apps/bssc/index.php?page=climate-change-vulnerability

2 Scores range from 1 – 3; generally low, medium, and high

3 Climate vulnerability score = Sum of exposure score X Sum of sensitivity score

Despite the assessment that tricolored blackbird may not be among the most vulnerable bird species to climate change, in the RCIS area, already marginal breeding habitat could be further stressed under warmer and drier conditions. As described in CDFW's Status Review of the Tricolored Blackbird in California (California Department of Fish and Wildlife 2018b), water availability and precipitation are predicted to decrease in the future, thus likely reducing freshwater emergent wetlands and the availability of nesting habitat in the RCIS area. Climate change impacts to wetlands may also include alterations of recharge timing, changes in plant communities, and changes in the abundance of prey, further stressing the blackbirds (PRBO Conservation Science 2011). Also, nesting substrates that are protected from land predators, because ponded habitat surrounds them, may no longer be surrounded, subjecting nests to higher levels of depredation and rendering habitat unsuitable. Extreme weather, including flooding, wind, and severe spring storms may cause the mass mortality of nests, reducing or eliminating colony reproductive success.

Using climate modeling approaches and multi-sourced bird data, Point Blue Conservation Science created a mapping tool to predict current (1971-2000) and projected (2038-2069/2070) bird species distribution for California terrestrial breeding bird species (Point Blue Conservation Science 2017). The mapping tool includes nearly 200 species and represents seven major habitat types found within California including riparian, oak woodland, scrub, conifer, grassland wetlands, and desert habitat types. Bird species distributions were created using the Maxent modeling technique (Phillips et al. 2006). Due to various sources of uncertainty in climate models and species distribution models, the climate change projections differ depending on which global model is selected: 1)NCAR CCSM3.0 National Center for Atmospheric Research Community Climate System Model, or 2) GFDL CM2.1 Geophysical Fluid Dynamics Laboratory Coupled Climate Model. Both models are based on medium-high emissions projections (615-686 ppm $CO2$ at the upper end).

Projections of tricolored blackbird habitat suitability in the RCIS area under future conditions are equivocal. The projected future distribution model using the GFDL CM2.1 climate model projects a decline in the probability of occurrence, particularly in the northwest and southern portion of the RCIS area, whereas the model using the NCAR CCSM3.0 climate model projects an increase in the probability of occurrence, particularly in the northwest and eastern portion of RCIS area (Point Blue Conservation Science 2017).

By focusing on protection of known nesting locations and expansion of protections and management of foraging habitat surrounding those nesting locations, the conservation strategy aims to provide suitable nesting habitat in locations where this species is known to occur. By expanding protections to new areas, the conservation strategy seeks to build repetition into the region so that if historic nest locations are no longer viable due to warmer and drier conditions, other ponds and wetlands, that remain viable, would be protected and managed for the species. Further, actions to actively manage ponds and wetlands to ensure that the proper nesting substrate is present and that ponds retain the proper ponding duration will help to offset any negative effects that warmer and drier conditions might have on nest locations.

Strategies to mitigate the impacts of climate change on tricolored blackbird populations in the RCIS area include protecting breeding colonies and maintaining the resilience of their foraging and nesting habitats by reducing stressors that potentially interact with climate change and magnify its impact. The conservation strategy emphasizes the protection of active colony sites and adjacent foraging habitat to maintain populations that can shift to new areas under a changing climate. The conservation strategy also seeks to increase and restore areas of protected freshwater emergent wetland, which will serve to maintain, if not expand, functional nesting habitat for tricolored blackbird in the RCIS area and buffer existing tricolored blackbird populations from climate change stressors. The conservation strategy also recommends monitoring the quality of functional habitat in the RCIS area to adaptively manage land uses and management actions to adapt to changing environmental conditions.

3.8.11 Golden Eagle

The actions and priorities for golden eagle were informed primarily by the ECCC HCP/NCCP and the EACCS.

3.8.11.1 Conservation Goals, Objectives, and Actions

Goal 12. Maintain or increase the population size and distribution of golden eagles in the RCIS area.

Objective 12-1. Protect and monitor all current or historical, but potentially viable, golden eagle nest sites in the RCIS area. Measure progress toward achieving this objective in the number of current and historical, but potentially viable, nest sites protected.

- ***Action GE-1.*** Survey suitable habitat, where access is permitted, to locate nest sites.
- ***Action GE-2.*** Permanently protect, through a conservation easement or other approved real estate instrument, golden eagle nest sites.
- ***Action GE-3.*** Implement an annual monitoring program for golden eagle nests on protected lands to document the presence/absence of nesting pairs and nest productivity, measured in number of young fledged; submit data to the CNDDB and CDFW's golden eagle database.
- ***Action GE-4.*** Protect active nest sites on public lands from human-caused disturbances such as recreation activities, construction activities, etc.

Objective 12-2. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation targets for golden eagle nesting/foraging habitat (440,990 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action GE-5.*** Permanently protect, through a conservation easement or other approved real estate instrument, golden eagle nesting/foraging habitat.

Objective 12-3. Enhance golden eagle habitat in the RCIS area. Measure progress toward achieving this objective in the area of habitat enhanced to benefit golden eagle.

- ***Action GE-6.*** Conduct invasive plant species management for species listed with a High or Moderate Rating on the California Invasive Plant Council's Invasive Plant Inventory in California annual grassland habitat to improve habitat for prey species.
- ***Action GE-7.*** Continue or introduce livestock grazing that will maintain grass heights to encourage ground squirrel colonization as well as facilitate use by lagomorphs, in general.
- ***Action GE-8.*** Create and maintain artificial burrows to encourage colonization of sites where ground squirrel establishment is not feasible or during the interim before ground squirrel colonies naturally establish.

Objective 12-4. Work with public landowners and provide incentives to private landowners to conduct land management practices in a way that will benefit golden eagles. Measure progress toward achieving this objective in the area of habitat managed to benefit golden eagle.

- ***Action GE-9.*** Provide incentives to owners of working lands to develop and implement land management plans to benefit golden eagles.
- ***Action GE-10.*** Encourage land managers to use integrated pest management principles and work with public landowners and provide private landowners with incentives to eliminate or reduce the use of rodenticides and lead bullets to limit the effects of these substances on birds.

Objective 12-5. Work with utility companies to minimize risk of electrocution on power lines. Measure progress toward achieving this objective in the number of power lines undergoing retrofit in areas of habitat managed to benefit the golden eagle.

- ***Action GE-11.*** Provide incentives for public utilities to implement retrofit activities consistent with Avian Line Interaction Committee's suggest practices on poles recognized as being of high risk.

3.8.11.2 Conservation Priorities

- Prioritize permanent protection of unprotected lands within active and potentially viable historically occupied territories with known nesting areas.
- Conduct annual surveys that document presence/absence of nesting pairs and nest productivity (number of young fledged) and submit findings to CNDDB and CDFW's golden eagle database.

3.8.11.3 Opportunities to Adaptation to Climate Change

With a changing climate, habitat distributions will likely shift for many organisms. Models used to project future habitat distributions affected by climate change predict that the probability of golden eagle occurrence in the RCIS area will generally decrease over time (Point Blue Conservation Science 2017) (see Section 3.8.10.3, *Opportunities to Adaptation to Climate Change*, for a description of Point Blue Conservation Science's models). The projected future distribution based on the GFDL CM2.1 climate model projects a decline in the probability of occurrence throughout the RCIS area, whereas the model using the NCAR CCSM3.0 climate model projects a slight decline in the probability of occurrence in the primarily in the eastern portion of the RCIS area.

The overall intent of the conservation strategy for golden eagle is to protect nest sites and maintain or improve foraging habitats. Protecting occurrences and suitable habitat will help to ensure that habitat can be managed to reduce the effects of climate change, if management techniques become available. The conservation strategy for golden eagle and other grassland and open habitats recommends vegetation management techniques such grazing. Grazing, when managed with specific vegetation goals, could help to maintain grasslands or other open habitats, and help to reduce the effects of shifting vegetation communities with a changing climate.

Cattle ranching throughout the central Coastal Ranges can benefit and be beneficial to the golden eagle if grazing is maintained at moderate levels that stimulate growth of herbaceous foods used by primary prey species, including ground squirrels and rabbits (Hunt et al. 1995). In the RCIS area, ground squirrel populations are reported to reach their highest densities in areas of low grass height typical of grazed lands. Cattle ranching also provides eagles a source of carrion from dead cows, stillborn calves, and placentas (Jones & Stokes 2006). Ground squirrels and other fossorial mammals are also important prey. It is uncertain as to how prey abundance will adjust to the shifting climate (Audubon 2014), but implementing actions to maintain prey abundance, such as grazing, could help to buffer golden eagle from the effects of climate change.

3.8.12 Burrowing Owl

3.8.12.1 Conservation Goals, Objectives, and Actions

The actions and priorities for burrowing owl were informed primarily by the ECCC HCP/NCCP the EACCS, and the Santa Clara Valley HCP/NCCP (ICF International 2012).

Goal 13. Maintain or increase the population size and distribution of burrowing owls in the RCIS area.

Objective 13-1. Protect unprotected occurrences of burrowing owl. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action BUOW-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, burrowing owl nests.

Objective 13-2. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for burrowing owl breeding/foraging habitat (225,410 acres) and low-use habitat (41,690 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action BUOW-2.*** Permanently protect, through a conservation easement or other approved real estate instrument, breeding and foraging habitat.

Objective 13-3. Enhance burrowing owl habitat.

- ***Action BUOW-3.*** Continue or introduce livestock grazing that will maintain grass heights to encourage ground squirrel colonization, and will provide suitable vegetation height, composition, and structure for foraging burrowing owls.
- ***Action BUOW-4.*** Conduct invasive plant species management for species listed with a High or Moderate Rating on the California Invasive Plant Council's Invasive Plant Inventory in California annual grassland habitat to improve habitat for ground squirrel and prey species
- ***Action BUOW-5.*** Encourage the use of integrated pest management principles on lands neighboring protected habitats, and cease the use of rodenticides on protected lands, particularly in grasslands, to provide a source for burrow creation (e.g., ground squirrels) and to minimize their effect on nesting birds and their eggs.

Objective 13-4. Work with private landowners to conduct land management practices in a way that will benefit burrowing owls. Measure progress toward achieving this objective in the area of habitat managed.

- ***Action BUOW-6***. Provide incentives to owners of working lands to develop and implement land management plans, including livestock grazing practices (e.g., stocking rates or residual dry matter targets), to benefit burrowing owl.

3.8.12.2 Conservation Priorities

- Prioritize permanent protection and enhancement of known nesting and overwintering locations with a focus on the following areas.
  - Arroyo Mocho and Arroyo Las Positas CPUs north of Pleasanton and Livermore.
  - The Old River CPU from east of Los Vaqueros Reservoir, through the Altamont Hills, south to Corral Hollow Creek.
- Prioritize actions to improve habitat for California ground squirrels near occurrences of burrowing owl where ground squirrels are absent to provide opportunities for expansion of existing occurrences.
- Actions implemented within the Santa Clara Valley HCP/NCCP's extended study area for burrowing owl conservation in the southwest corner of the RCIS area in Fremont and Newark in Alameda County (ICF International 2012) should be coordinated with the Santa Clara Valley Habitat Agency.

3.8.12.3 Opportunities for Adaptation to Climate Change

Gardali et al. (2012) ranked the climate vulnerability of 358 California bird species, as described in Section 3.8.10.3. Burrowing owl was given a score of 21 and was not considered a priority with respect to climate vulnerability (Table 3-7).

Within the RCIS area, suitability of burrowing owl habitat may change with a changing climate. The projected future distribution model using the GFDL CM2.1 climate model projects a slight increase in the probability of occurrence in the western portion of RCIS area and slight decrease in the northeastern portion of the RCIS area, whereas the model using the NCAR CCSM3.0 climate model projects an increase in the probability of occurrence generally throughout the RCIS area (Point Blue

Conservation Science 2017) (see Section 3.8.10.3, for a description of Point Blue Conservation Science's models).

Table 3-7. Climate Vulnerability Scoring for Burrowing Owl as Described in Gardali et al. (2012) [1]

Criteria	Score[2, 3]
Exposure	
Habitat suitability	1 – low; habitat suitability is expected to increase or decrease by 0–10%
Food availability	1 - low; food availability for a taxon would be unchanged or increase
Extreme weather	1 – low; there is no evidence that a taxon would be exposed to more frequent or severe extreme weather events
Sensitivity	
Habitat specialization	3 – high; taxon uses only specific habitat types or elements
Physiological tolerance	1 – low; minimal or no evidence of physiological sensitivity to climatic conditions
Migratory status	2 - moderate; short-distance migrants (movements primarily restricted to the Nearctic zone)
Dispersal ability	1 – low; taxon with high dispersal ability

1 Additional information about species scoring, including the database of scores is located here: http://data.prbo.org/apps/bssc/index.php?page=climate-change-vulnerability

2 Scores range from 1 – 3; generally low, medium, and high

3 Climate vulnerability score = Sum of exposure score X Sum of sensitivity score

By focusing on protection of known nesting locations and expansion of protections and management of foraging habitat surrounding those nesting locations, the conservation strategy aims to provide suitable nesting habitat in locations where this species is known to occur. By expanding protections to new areas, it builds redundancy into the available nesting locations in the region so that if historic nest locations are no longer viable due to the effects from climate change, individual owls can disperse to new locations. The greatest risk from climate change likely comes from the potential for an increase in frequency and intensity of wildfires in the grassland habitats in the Diablo Range. Burrowing owls primarily use these habitats in the winter, when fire risk is low, but an increase in fires could temporarily reduce wintering habitat quality in the years following the fire. Over the long term, fire in grasslands may result in a net benefit in habitat quality by maintaining grasslands and reducing dense thatch.

3.8.13 Swainson's Hawk

3.8.13.1 Conservation Goals, Objectives, and Actions

The actions and priorities for Swainson's hawk were informed primarily by the ECCC HCP/NCCP, the draft Antioch HCP/NCCP, and the *Yolo Habitat Conservation Plan/Natural Community Conservation Plan* (ICF 2018).

Goal 14. Maintain or increase the number of Swainson's hawk nesting pairs in the RCIS area.

Objective 14-1. Protect known Swainson's hawk nest trees in the RCIS area. Measure progress toward achieving this objective in the number of protected nest trees with adjacent compatible uses.

- ***Action SWHA-1.*** Conduct annual surveys of habitat, where access is permitted, to locate nest locations.
- ***Action SWHA-2***. Permanently protect, through a conservation easement or other approved real estate instrument, active and recently active (i.e., within prior five years) nest trees (ICF 2018).

Objective 14-2. Reduce the threat of habitat loss, and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation target for Swainson's hawk nesting habitat (1,700 acres) and conservation targets for natural foraging habitat (24,420 acres) and agricultural foraging habitat (43,900 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action SWHA-3.*** Permanently protect, through a conservation easement or other approved real estate instrument, nesting and foraging habitat with an emphasis on protecting foraging habitat within 10 miles of active nest sites.

Objective 14-3. Enhance Swainson's hawk habitat. Measure progress toward achieving this objective in the area of habitat enhanced to benefit Swainson's hawk.

- ***Action SWHA-4.*** Plant and maintain suitable nest trees such as valley oaks (*Quercus lobata*), cottonwoods (*Populus fremontii*), and willows (*Salix* spp.) within foraging habitat.
- ***Action SWHA-5.*** Continue or introduce livestock grazing to control invasive vegetation and to maintain low-moderate grass heights so that prey is accessible to foraging Swainson's hawk.

Objective 14-4. Work with private landowners to conduct land management practices in a way that will benefit Swainson's hawk. Measure progress toward achieving this objective in the area of habitat managed to benefit Swainson's hawk.

- ***Action SWHA-6.*** Provide incentives to private landowners to voluntarily manage working lands to support Swainson's hawk foraging habitat on agricultural lands (e.g., planting alfalfa, irrigated pasture, and low-height row crops that provide high-quality foraging habitat) and trees for nesting**.**
- ***Action SWHA-7.*** Encourage land managers to use integrated pest management principles and work with public landowners and provide private landowners with incentives to eliminate or reduce the use of rodenticides and lead bullets to limit the effects of these substances on birds.

3.8.13.2 Conservation Priorities

- Prioritize permanent protection of land that has supported an active nest in the past 5 years and is still structurally viable in the Marsh Creek, Middle River-San Joaquin River, Kellogg Creek-Big Break, and Old River CPUs (Figure F-17, Appendix F).
- Prioritize permanent protection foraging habitat or voluntary management of working lands to provide Swainson's hawk foraging habitat within at least 10 miles of active nest sites.

3.8.13.3 Opportunities to Adaptation to Climate Change

Gardali et al. (2012) ranked the climate vulnerability of 358 California bird species (Climate Vulnerability Assessment), as described in Section 3.8.10.3. Swainson's hawk was given a score of 42 and moderate climate priority in the Climate Vulnerability Assessment (Table 3-8) and was therefore considered a priority with respect to climate vulnerability (Gardali et al. 2012). Swainson's hawk is vulnerable to the effects of climate change due to an expected loss of nesting habitat in the Central Valley, loss of foraging habitat to urban development and to conversion to unsuitable agricultural practices, and a potential increase in exposure to extreme weather events because it is a long-distance migrant.

Table 3-8. Climate Vulnerability Scoring for Swainson's Hawk as Described in Gardali et al. (2012)[1]

Criteria	Score[2, 3]
Exposure	
Habitat suitability	3 – high; habitat suitability is expected to decrease by >50%
Food availability	1 - low; food availability for taxon would be unchanged or increase
Extreme weather	2 – moderate; taxon is expected to be exposed to some increase in extreme weather events
Sensitivity	
Habitat specialization	2 – moderate; taxon that tolerates some variability in habitat type or element
Physiological tolerance	1 – low; minimal or no evidence of physiological sensitivity to climatic conditions
Migratory status	3 - high; long-distance migrants (migrates at least to the neotropics)
Dispersal ability	1 – low; taxon with high dispersal ability

1 Additional information about species scoring, including the database of scores is located here: http://data.prbo.org/apps/bssc/index.php?page=climate-change-vulnerability

2 Scores range from 1 – 3; generally low, medium, and high

3 Climate vulnerability score = Sum of exposure score X Sum of sensitivity score

Models used to predict future habitat distributions affected by climate change predict that the probability of Swainson's hawk distribution will generally decline in the northeast portion of the RCIS area, and shift southwest toward Pleasanton (see Section 3.8.10.3, for a description of Point Blue Conservation Science's models).

The overall intent of the conservation strategy for Swainson's hawk is to protect nest sites and maintain or improve foraging habitats. Protecting occurrences and suitable habitat will help to ensure that habitat can be managed to reduce the effects of climate change, if management techniques become available. The conservation strategy for Swainson's hawk and other grassland and open habitats recommends vegetation management techniques such as grazing. Grazing, when adaptively managed, could help to maintain grasslands or other open habitats, and help to reduce the effects of shifting vegetation communities with a changing climate.

Historically, Swainson's hawk occupied large grassland and shrubsteppe habitats in California (Woodbridge 1998); protecting natural habitat will provide Swainson's hawks with foraging habitat in the RCIS area that is not subject to variation as a result of changing agricultural crop patterns. Swainson's hawks have also successfully adapted to certain agricultural landscapes. With a possible decrease in water availability in a changing climate, and a potential decrease in the profitability of some crop types (e.g., alfalfa), agricultural practices and land uses may change. Loss of foraging habitat in the RCIS area would make nesting attempts less successful. The conservation strategy recommends providing incentives to encourage private landowners to plant good forage crops, which could help to offset these effects of climate change.

3.8.14 California Black Rail

Actions and priorities for California black rail were informed by *Baylands Ecosystem Habitat Goals* (Goals Project 1999), *The Baylands and Climate Change: What We Can Do* (Goals Project 2015), and the *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (U.S. Fish and Wildlife Service 2013a).

3.8.14.1 Conservation Goals, Objectives, and Actions

Goal 15. Maintain or increase the California black rail population in the RCIS area.

Objective 15-1. Protect marshes occupied by California black rail. Measure progress toward achieving this objective in the area of occupied habitat protected.

- ***Action CBR-1.*** Survey potentially suitable habitat, where access is permitted, to locate areas not previously known to be occupied by black rail.
- ***Action CBR-2.*** Permanently protect, through a conservation easement or other approved real estate instrument, current and historical occurrences of California black rail.

Objective 15-2. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the habitat needed to meet the conservation targets for black rail (12,910 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action CBR-3***. Permanently protect, through a conservation easement or other approved real estate instrument, California black rail habitat.

Objective 15-3. Enhance California black rail habitat. Measure progress toward achieving this objective in the area of habitat enhanced to benefit California black rail.

- ***Action CBR-4.*** Improve California black rail habitat in the RCIS area through the reduction of invasive plants (e.g., *Spartina alterniflora, Lepidium latifolium*). Collaborate with the California Coastal Conservancy as part of the San Francisco Estuary Invasive Spartina Project.
- ***Action CBR-5.*** Control non-native predators (e.g., feral cats, red fox) in California black rail habitat.

Objective 15-4. Restore and manage habitat for California black rail. Measure progress toward achieving this objective in the area of habitat restored and managed to benefit California black rail.

- ***Action CBR-6.*** Implement actions BAY-1 through BAY-4 and BAY-6 (Section 3.9.3, *Baylands*), and California black rail actions in Appendix H, *Summary of Baylands Conservation Strategies*.
- ***Action CBR-7.*** Create or restore an upland transition zone at the edge of existing and restored tidal marsh habitat to allow for marsh transgression as a result of sea level rise and to provide high tide refuge.

3.8.14.2 Conservation Priorities

- Prioritize permanent protection of marshes occupied by California black rail.
- Prioritize restoration of degraded Bayland habitats suitable to restore habitat for California black rail.
- See Conservation Priorities in Section 3.9.3.2, *Baylands.*

3.8.14.3 Opportunities for Adaptation to Climate Change

Gardali et al. (2012) ranked the climate vulnerability of 358 California bird species, as described in Section 3.8.10.3. California black rail was given a score of 49 (Table 3-9) and high climate priority in the Climate Vulnerability Assessment and was therefore considered a priority with respect to climate vulnerability. California black rail is highly vulnerable to sea level rise, which can flood and eliminate suitable habitat. Adaptations to sea level rise are limited in many areas along the urban fringe of the San Francisco Bay and Delta because urban development has eliminated many areas where tidal marsh habitat could shift. This RCIS emphasizes habitat restoration in areas upland of suitable habitat, where restoration opportunities exist, to provide transitional habitats and areas to accommodate shifting habitat with rising sea levels (Section 3.9.3).

Table 3-9. Climate Vulnerability Scoring for California Black Rail as Described in Gardali et al. (2012)[1]

Criteria	Score[2, 3]
Exposure	
Habitat suitability	3 – high; habitat suitability is expected to decrease by >50%
Food availability	1 - low; food availability for taxon would be unchanged or increase
Extreme weather	3 – high; taxon is very likely to be exposed to major increases in the number and duration of extreme weather events
Sensitivity	
Habitat specialization	3 – high; taxon that use only specific habitat types of elements
Physiological tolerance	1 – low; minimal or no evidence of physiological sensitivity to climatic conditions
Migratory status	1 - low; year-round resident
Dispersal ability	2 – moderate; taxon with an average dispersal ability

[1] Additional information about species scoring, including the database of scores is located here: http://data.prbo.org/apps/bssc/index.php?page=climate-change-vulnerability

[2] Scores range from 1 – 3; generally low, medium, and high

[3] Climate vulnerability score = Sum of exposure score X Sum of sensitivity score

3.8.15 San Joaquin Kit Fox

Actions and priorities for San Joaquin Kit Fox were informed by the ECCC HCP/NCCP, the EACCS, and the *San Joaquin Kit Fox* (Vulpes macrotis mutica) *5-Year Review: Summary and Evaluation* (U.S. Fish and Wildlife Service 2010b), and the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (U.S. Fish and Wildlife Service 1998a).

3.8.15.1 Conservation Goals, Objectives, and Actions

Goal 16. Maintain or increase the population and distribution of San Joaquin kit fox and important regional linkages for the species in the RCIS area.

Objective 16-1. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the denning and movement habitat needed to meet the conservation target for San Joaquin kit fox denning/movement habitat (203,280 acres). Measure progress toward achieving this objective in the area of habitat protected.

- ***Action SJKF-1***. Survey potentially suitable habitat, where access is permitted, to locate occupied habitat.
- ***Action SJKF-2.*** Permanently protect, through a conservation easement or other approved real estate instrument, San Joaquin kit fox denning/movement habitat.

Objective 16-2. Protect regional movement corridors for San Joaquin kit fox. Measure progress toward achieving this objective in the area of corridor habitat protected and number of barriers to movement modified, removed, or otherwise ameliorated.

- ***Action SJKF-3****.* Conduct movement studies of San Joaquin kit fox to identify key areas to protect and improve landscape connectivity.
- ***Action SJKF-4.*** Permanently protect, through a conservation easement or other approved real estate instrument, natural communities and working lands to improve landscape connectivity for San Joaquin kit fox and other focal and non-focal species between large blocks of public lands in and around the Los Vaqueros Watershed and Black Diamond Mines Regional Preserve, including the following areas (see Section 2.2.8.1 and Figure 2-23b for details).
    - Round Valley
    - Briones Valley
    - Deer Valley
    - Horse and Lone Tree Valleys
- ***Action SJKF-5.*** Permanently protect, through a conservation easement or other approved real estate instrument, land north and south of Interstate 580 at key connecting points east of Livermore and through the Altamont Pass.
- ***Action SJKF-6.*** Create new crossings for wildlife at key locations across Interstate 580.

Objective 16-3. Enhance San Joaquin kit fox habitat. Measure progress toward achieving this objective in the area of habitat enhanced to benefit San Joaquin kit fox.

- ***Action SJKF-7****.* Use livestock grazing to control invasive vegetation and reduce dense vegetation growth in grasslands (U.S. Fish and Wildlife Service 2010b).
- ***Action SJKF-8****.* On protected lands, cease the use of rodenticides and emphasize the conservation and expansion of California ground squirrel colonies and other fossorial mammals.
- ***Action SJKF-9.*** Improve upland habitat through the reduction of invasive plant growth and by promoting land management practices that will positively benefit California ground squirrels and other fossorial mammals.

Objective 16-4. Work with public landowners and provide incentives to private landowners to conduct land management practices in a way that will benefit San Joaquin kit fox. Measure progress toward achieving this objective in the area of habitat managed to benefit San Joaquin kit fox.

- ***Action SJKF-10.*** Work with private landowners in areas likely to support San Joaquin kit fox to develop land management strategies conducive to San Joaquin kit fox, including minimal fencing and rodenticide use.

3.8.15.2 Conservation Priorities

- Improve movement barriers to enhance movement potential in the Kellogg Creek–Big Break, Old River, Arroyo Mocho, Arroyo Valle, and Corral Hollow Creek CPUs, including an assessment of roadways and canals that may be barriers to wildlife movement (Jones & Stokes 2006).
- Create new passages (undercrossings or overcrossings) across I-580 between Livermore and the Alameda/San Joaquin County Line and overcrossings at key locations along the California Aqueduct that are large enough to accommodate movement of terrestrial mammals, including San Joaquin kit fox (ICF International 2010).
- Fund wildlife camera studies to determine whether San Joaquin kit fox continues to persist north of Interstate 580.

3.8.15.3 Opportunities for Adaptation to Climate Change

Stewart et al. (2016) found San Joaquin kit fox to be moderately or less vulnerable to climate change by analyzing 27 climate change vulnerability criteria (e.g., natural history, habitat requirements, physiology, interactions with other species). Although up to 74% of current occurrence locations are projected to become climatically unsuitable by 2070-2099, there is an expected increase in suitable habitat within observed dispersal distance across the range by between approximately 13% and 33% (Stewart et al. 2016). San Joaquin kit fox may also benefit from an upslope expansion of habitat into nearby foothills, provided other ecological factors align (e.g., interactions with predators, prey availability).

In the RCIS area, suitable habitat for San Joaquin kit fox is expected to significantly increase under all four climate scenarios analyzed (Stewart et al. 2016). Baseline habitat models in Stewart et al. show habitat in Eastern Contra Costa and Alameda Counties, consistent with the habitat distribution model developed for the RCIS area. Areas of newly suitable habitat will be widely distributed across the eastern and southern parts of the RCIS area, covering more than half of Contra Costa County and approximately one-third of Alameda County. The RCIS area is at the northwest edge of the kit fox's range and is identified as a satellite recovery area (U.S. Fish and Wildlife Service 1998a). The conservation strategy for this species focuses on improving landscape connectivity in the eastern portion of the RCIS area, prioritizing movement across Interstate 580 to facilitate movement between habitats. Improving landscape connectivity would improve access to habitat in the RCIS area if habitat expands and/or improves in the RCIS area with a changing climate.

3.8.16 Mountain Lion

3.8.16.1 Conservation Goals, Objectives, and Actions

Goal 17. Support a sustainable population of mountain lion in the RCIS area by improving habitat connectivity and public awareness.

Objective 17-1. Improve habitat connectivity for mountain lion. Measure progress toward achieving this objective in the area of corridor habitat protected, number of barriers to movement modified, removed, or otherwise ameliorated, and number of crossings constructed.

- ***Action ML-1***. Conduct movement studies of mountain lion to identify key areas to protect and improve landscape connectivity.[15]
- ***Action ML-2.*** Implement actions to improve landscape connectivity for native terrestrial wildlife, as described in Section 3.9.1.
- ***Action ML-3.*** Evaluate the feasibility of and construct overpasses or underpasses to allow for connectivity over major roads and freeways at otherwise recognized key connection points for terrestrial connectivity.

Objective 17-2. Reduce human-mountain lion conflicts that negatively impact landowners and mountain lions. Measure progress toward achieving this objective in the number of outreach actions (e.g., number of outreach programs implemented, or landowners contacted) or reduced instances of livestock depredation.

- ***Action ML-4.*** Work with private landowners to discourage harming mountain lion, including livestock practices that facilitate negative mountain lion-livestock interactions.
- ***Action ML-5.*** Conduct public outreach to reduce human-mountain lion encounters, particularly in urban areas adjacent to the wildland interface.

3.8.16.2 Conservation Priorities

- Permanently protect, through a conservation easement or other approved real estate instrument, lands that are connected to those already protected to improve habitat connectivity across the following areas.
    - The east Diablo Range between Los Vaqueros Reservoir, through the Altamont Hills, to Corral Hollow Creek, with an emphasis on key connections across Interstate 580 in the Kellogg Creek–Big Break, Old River, and Arroyo Las Positas CPUs.
    - Mount Diablo to Los Vaqueros Reservoir in the Marsh Creek and Kellogg Creek–Big Break CPU.
    - Briones Regional Park and the Berkeley Hills in the Walnut Creek–Frontal Suisun Bay Estuaries, CPU.
    - Between Chabot Regional Park and Garin Regional Park, across Interstate 580 in the Walnut Creek–Frontal Suisun Bay Estuaries and Arroyo de la Laguna CPUs.

[15] CDFW encourages conservation practitioners and researchers to consult the habitat selection model developed by Dellinger et al. (2019) and with CDFW before designing mountain lion movement studies (California Department of Fish and Wildlife, pers. comm.).

- Between Pleasanton Ridge and the Upper Alameda Creek Watershed, across Interstate 680 in the Arroyo Las Positas, Arroyo Mocho, and Arroyo Valle CPUs.

- Permanently protect, through a conservation easement or other approved real estate instrument, land on both sides of major roadways and other infrastructure in locations where movement could occur (i.e., typically at road undercrossings, including culverts).

3.8.16.3 Opportunities for Adaptation to Climate Change

There is limited research available on the climate change vulnerability of mountain lion, though there is much research on other highly mobile mammal species (e.g., Stewart et al. 2016). Because mountain lions are highly mobile, they have the ability to move into suitable habitat and away from stressors during some life stages, in permeable landscapes (e.g., those that are relatively undeveloped). This adaptability makes them less vulnerable to climate change if the landscape is permeable to their movement. They also occupy all land cover types in the RCIS area, so even if vegetation types shift under climate scenarios, habitat in the RCIS area may remain suitable. The conservation strategy for this species focuses on improving landscape connectivity in the RCIS area, prioritizing movement across Interstate 580 to facilitate movement between habitats and expanding and connecting large blocks of habitat. Improving landscape connectivity would improve access to habitat in the RCIS area if habitat expands and/or improves in the RCIS area with a changing climate.

3.8.17 Focal Plants with Habitat Distribution Models

Habitat models were created for 13 of the focal plant species in the RCIS area: pallid manzanita, brittlescale, big tarplant, fragrant fritillary, round-leaved filaree, Mount Diablo fairy lantern, Congdon's tarplant, Presidio clarkia, recurved larkspur, San Joaquin spearscale, Brewer's western flax, Mason's lilaeopsis, and most beautiful jewelflower (hereafter referred to collectively as modeled focal plant species). These species have existing data and/or numerous occurrences in the RCIS area, or relatively well defined habitats (e.g., restricted to serpentine grasslands, coastal wetlands, etc.) which allowed for the creation of habitat distribution models (Section 2.2.6.2 and Appendix F). Because habitat distribution models were created for these species, the conservation strategy for the modeled focal plant species focuses on protection and enhancement of existing occurrences, restoration of habitat and occurrences (Section 3.7.4, *Transplanting Plants to Create New Populations*), and protection of suitable habitat to potentially protect and enhance unrecorded occurrences or create opportunities to translocate occurrences.

Actions to enhance existing occurrences includes management actions to control invasive plants and vegetation through grazing or targeted, localized removal if a species does not tolerate grazing (e.g., hand-pulling, mowing), and protecting occurrences from overgrazing by livestock, and herbivory from native and non-native wildlife, if needed. A habitat enhancement action, for example, could include grazing vernal pool grasslands to control vegetation in vernal pools to improve habitat for brittlescale. Because there is relatively little information available on best habitat management practices for many of the focal plant species, as well as current conditions of the occurrence and habitat supporting the occurrences, conditions of occurrences should be assessed before adjusting on-going management actions (if any) or implementing new management actions. On-going and new management actions should be implemented carefully, within an adaptive management and monitoring framework to inform and adjust management actions based on monitoring results (Section 3.11).

This RCIS includes restoration as a tool to rehabilitate habitats and plant occurrences. Restoration is the manipulation of a site with the goal of returning species, habitat, and ecological and ecosystem functions to a site that historically supported such species, habitat, and functions, but which no longer supports them due to the loss of one or more required ecological factors or as a result of past disturbance. Depending on the condition of the occurrence and habitat, restoration actions may include clearing debris (e.g., trash), controlling public access, revegetation, soil stabilization, and watering vegetation and focal plants to facilitate establishment.

The RCIS includes transplantation as a tool to introduce and create an occurrence to an area where the species or subspecies hasn't occurred in the past by planting seeds, seedlings, or cuttings to new locations that support required habitat conditions (e.g., soil type, moisture, shade, associated vegetation, etc.) of the species or subspecies being transplanted. Transplantation of rare plants is rarely successful (Howald 1996), and should only be done after developing a thorough plan in coordination with botanists with expertise on the species or subspecies (or closely related taxa) to be transplanted, and with CDFW and USFWS, particularly if the plant is state or federally listed, or considered rare by the California Native Plant Society. See Section 3.7.4 for details about the use of transplantation.

Table 3-10 includes the East Bay RCIS goal for the number of occurrences of modeled focal plant species to protect and enhance in the RCIS area. These species-specific protection goals are identified in the *Occurrence Protection and Enhancement Targets* column in Table 3-10. See Section 3.3.1.3, *Assigning Modeled Habitat Protection Targets*, for an explanation of how protection and enhancement targets were determined.

Occurrences on currently protected land may not be adequately managed for the benefit of focal plant species. The actions in this RCIS can be used to improve habitat for focal plant species on protected lands. Land managers in the RCIS area may use this RCIS as a guide to identify habitat enhancement actions for focal species, and in some cases landowners may establish mitigation credit agreements (MCAs) with CDFW to enhance habitat for currently protected focal plant species and non-focal plant species.

Broadly applicable conservation goals, objectives, and actions are provided below for focal plant species, as most focal plant species would benefit from similar types of actions such as controlling invasive vegetation and restoring habitat. Following the goals, objectives, and actions are species-specific priority conservation actions.

Habitat models were not created for six of the focal plant species in the RCIS area: Loma Prieta hoita, palmate-bracted bird's beak, Livermore tarplant, Contra Costa goldfields, rock sanicle, and showy madia. The conservation strategy for those species are discussed in Section 3.8.18.

Table 3-10. Conservation Targets for Occurrences of Focal Plant Species with Habitat Models

Modeled Focal Plant Species	Total Number of Occurrences in the RCIS Area	Occurrence Protection and Enhancement Targets
Pallid manzanita	8	7
Brittlescale	18	14
Big tarplant	33	30
Fragrant fritillary	8	6
Round-leaved filaree	89	67
Mount Diablo fairy lantern	52	47
Congdon's tarplant	35	26
Presidio clarkia	1	1
Recurved larkspur	4	3
San Joaquin spearscale	59	53
Brewer's western flax	22	20
Mason's lilaeopsis	69	62
Most beautiful jewelflower	20	15

3.8.17.1 Conservation Goals, Objectives, and Actions

Goal 18. Maintain or increase populations of modeled focal plant species.

Objective 18-1. Protect the number of occurrences identified in the *Occurrence Protection and Enhancement Targets* column in Table 3-10 for each modeled focal plant species. Measure progress toward achieving this objective in the number of viable or restorable occurrences protected.

- ***Action FPw-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, unprotected occurrences.

Objective 18-2. Reduce the threat of habitat loss and increase opportunities for beneficial habitat management by protecting the primary habitat in the *Conservation Gap* column in Table 3-4 for the modeled focal plant species, needed to meet the conservation targets. Measure progress toward achieving this objective in the area of habitat protected.

- ***Action FPw-2*****.** Permanently protect, through a conservation easement or other approved real estate instrument, primary habitat for focal plant species.

Objective 18-3. Enhance habitat for the focal plant species. Measure progress toward achieving this objective in the area of habitat enhanced to benefit each modeled focal plant species.

- ***Action FPw-3*****.** Enhance occurrences, as warranted by site-specific conditions.
- ***Action FPw-4.*** Continue or introduce livestock grazing in a variety of regimes with the appropriate timing and intensity for the modeled focal plant species, where appropriate.
- ***Action FPw-5.*** Conduct targeted studies to evaluate the response of focal plant species to various management actions, including grazing regimes.

- ***Action FPw-6.*** Remove and manage invasive vegetation with a High, Moderate, or Limited Rating listed in the California Invasive Plant Council's Invasive Plant Inventory in occupied and suitable habitat through hand pulling, mowing, or mechanical removal.
- ***Action FPw-7***. Conduct prescribed burns in suitable habitat for the annual focal plant species and pallid manzanita, where feasible. For the annual focal plant species, prescribed burns reduce the amount of invasive competitor species, and fire stimulates pallid manzanita seed germination. Use targeted studies to inform location and frequency of prescribed burns that will benefit modeled focal plant species. In suitable habitat where prescribed burns are not feasible, conduct alternative vegetation treatments.
- ***Action FPw-8***. Protect occurrences on public lands that can be impacted from recreational uses by relocating recreational activities (e.g., rerouting trails), or using fencing or signs to keep people out of sensitive areas.

Objective 18-4. Limit the spread of *Phytophthora* species*,* which cause root rot, in populations of pallid manzanita (U.S. Fish and Wildlife Service 2015) and other native plants (see Section 2.3.5, *Non-native Species and Disease*) and Sudden Oak Death in some oak species. Measure progress toward achieving this objective in the area or number of pallid manzanita or other modeled focal species known to be affected by *Phytophthora.*

- ***Action FPw-9***. Determine appropriate treatments for plants infected by *Phytophthora* spp., based on best available science (U.S. Fish and Wildlife Service 2015).
- ***Action FPw-10***. Treat viable pallid manzanita stands infected by *Phytophthora* spp. and monitor treatment effects (U.S. Fish and Wildlife Service 2015).
- ***Action FPw-11.*** Develop and implement a *Phytophthora* spread avoidance plan from management activities and for roads and trails for use by public and private landowners, as described in the Pallid Manzanita Recovery Plan (U.S. Fish and Wildlife Service 2015).
- ***Action FPw-12***. Develop and implement a public outreach program where *Phytophthora* is known to be present, such as signage and pamphlets at trailheads, as described in the Pallid Manzanita Recovery Plan (U.S. Fish and Wildlife Service 2015).
- ***Action FPw-13.*** Implement the best available best management practices to reduce the spread of *Phytophthora* spp., particularly when implementing restoration and habitat enhancement actions.[16]

Objective 18-5. Survey habitat to identify unrecorded occurrences of modeled focal plant species. Measure progress toward achieving this objective in the area surveyed.

- ***Action FPw-13****.* Survey suitable habitat, where access is permitted, to locate undocumented occurrences of focal plant species, with an emphasis on surveying habitat patches adjacent or nearby to known occurrences.
- ***Action FPw-14.*** Permanently protect, through a conservation easement or other approved real estate instrument, newly discovered occurrences of focal plant species and suitable habitat adjacent to known populations.

[16] Best management practices to minimize *Phytophthora* contamination in restoration projects are available here: http://www.suddenoakdeath.org/wp-content/uploads/2016/04/Restoration_guidance_FINAL-111716.pdf

Objective 18-6. Restore occurrences and habitat of modeled focal plant species. Measure progress toward achieving this objective in the number and area of restored occurrences.

- ***Action FPw-16.*** Develop restoration plans and actions based on site-specific conditions using the best available science on the species and habitats being restored.
- ***Action FPw-17.*** Restore occupied habitat and suitable but unoccupied habitat using methods described in the transplantation plan.
- ***Action FPw-18.*** Monitor and adaptively manage restoration sites.

Objective 18-7. Create occurrences of modeled focal plant species. Transplantation plans and actions, including those below, must be informed by the best available science on the species being transplanted and methods for transplantation. Measure progress toward achieving this objective in the number and area of created occurrences.

- ***Action FPw-19.*** Develop a thorough transplantation plan in coordination with botanists with expertise on the species or subspecies (or closely related taxa) to be transplanted, and with CDFW and USFWS, particularly if the plant is state or federally listed, or considered rare by the California Native Plant Society, before transplantation of plant material. The transplantation plan should include a monitoring and adaptive management plan.
- ***Action FPw-20****.* Identify source population(s) of plant material to transplant.
- ***Action FP w-21****.* Store and maintain seeds from natural occurrences in the RCIS area at botanic gardens that are part of the Center for Plant Conservation network.
- ***Action FPw-22***. Identify receptor sites for transplantation. Receptor sites of rare plants should be far enough from existing populations, as measured by the potential for genetic exchange among individuals through pollen or propagule (e.g., seed, fruit) dispersal. Receptor sites should be carefully selected on the basis of physical, biological, and logistical considerations (Fiedler 1991, Fiedler and Laven 1996).
- ***Action FPw-23.*** Prepare source location and the receptor site to ensure that plants are removed and planted in a manner that provides them with the best chance of reestablishment.
- ***Action FPw-24.*** Translocate plant material using methods described in the transplantation plan.
- ***Action FPw-25.*** Monitor and adaptively manage translocations.

3.8.17.2 Species-Specific Conservation Priorities

Pallid Manzanita

The actions and priorities for pallid manzanita were informed by the *Recovery Plan for* Arctostaphylos pallida *(pallid manzanita)* (U.S. Fish and Wildlife Service 2015).

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any newly discovered occurrences of pallid manzanita on unprotected land. Prioritize protection of pallid manzanita in the following locations (Figure F-20, Appendix F).
  - San Lorenzo Creek- Frontal San Francisco Bay Estuaries CPU.
  - San Pablo Creek- Frontal San Pablo Bay Estuaries CPU.

- Corte Madera Creek- Frontal San Francisco Bay Estuaries CPU.

- Enhance known occurrences of pallid manzanita in the RCIS area in the following locations.
  - Walnut Creek- Frontal Suisun Bay Estuaries CPU.
  - San Lorenzo Creek- Frontal San Francisco Bay Estuaries CPU.
  - San Pablo Creek- Frontal San Pablo Bay Estuaries CPU.
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the San Pablo Creek- Frontal San Pablo Bay Estuaries CPU.
- Survey for undocumented occurrences of pallid manzanita in the East Bay Hills in suitable habitat near San Pablo Reservoir and Briones Reservoir, where access is permitted.
- Prioritize actions to limit the spread of *Phytophthora cinnamomi* to achieve Objective 18-4. Pallid manzanita is susceptible to disease caused by *Phytophthora* species*. P. cinnamomi* has killed pallid manzanita plants in two locations in the RCIS area (U.S. Fish and Wildlife Service 2015). *Phytophthora* species can be spread by water runoff and soil erosion, as well as by humans and vehicles. This disease is likely to spread throughout pallid manzanita stands as long as conditions are suitable. Phosphite treatment can increase a plant's natural defense mechanisms to *P. cinnamomi* (U.S. Fish and Wildlife Service 2015).
- Conduct prescribed burns in suitable habitat for pallid manzanita, where feasible.
- Manage competing vegetation that alters the shade regime to stimulate seed germination in stands where numbers of pallid manzanita are declining, or sites no longer occupied by pallid manzanita.
- Develop and implement vegetation and regeneration management plans in coordination with USFWS, EBRPD, and species experts.
- Expand existing pallid manzanita stands.
- Establish new pallid manzanita stands.

Brittlescale

Actions and priorities for brittlescale are informed by the ECCC HCP/NCCP.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any newly discovered occurrences of brittlescale on unprotected land. Prioritize protection of brittlescale in the following locations (Figure F-21, Appendix F).
  - Kellogg Creek–Big Break CPU
  - Marsh Creek CPU
  - Old River CPU
  - Arroyo Las Positas CPU
- Enhance occurrences of brittlescale on protected land in the RCIS area.
  - Kellogg Creek- Big Creek CPU
  - Old River CPU

  - Arroyo Las Positas CPU
  - Agua Caliente Creek–Frontal San Francisco Bay Estuaries CPU
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the Old River CPU.
- Survey for undocumented occurrences on suitable habitat (Jones & Stokes 2006), where access is permitted, in the Marsh Creek, Old River, and Corral Hollow Creek CPUs, as well as in the Los Vaqueros Reservoir property in Kellogg Creek–Big Break and Old River CPUs.
- Develop and implement monitoring and adaptive management plans for brittlescale. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of brittlescale, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).

Big Tarplant

Actions and priorities for big tarplant are informed by the ECCC HCP/NCCP and the EACCS.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any newly discovered occurrences of big tarplant on unprotected land. Protect occurrences of big tarplant in the following CPUs (Figure F-22, Appendix F).
  - Old River CPU
  - Arroyo Las Positas CPU
  - Corral Hollow Creek CPU
- Enhance known occurrences of big tarplant on protected land in the RCIS area in the following locations.
  - Middle River–San Joaquin River
  - Marsh Creek CPU
  - Kellogg Creek–Big Break CPU
  - Corral Hollow Creek CPU
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the Corral Hollow Creek CPU.
- Survey for undocumented occurrences of big tarplant on suitable habitat (Jones & Stokes 2006), where access is permitted, in the Kellogg Creek-Big Break, Corral Hollow Creek, Old River, and Marsh Creek CPUs.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).

- Establish an incentive program for private landowners to allow for botanical surveys on their property and to ensure the management of habitats with focal plant populations to suppress non-native invasive vegetation and promote regeneration and recruitment of native species while supporting the natural processes typically found in the communities that support the focal plant species (ICF International 2010).
- Identify source populations for potential banking of seeds for use in future reintroduction of focal plant species into suitable habitat (ICF International 2010).
- Continue or introduce livestock grazing in a variety of grazing regimes with the appropriate timing and intensity for native plant species in grassland and scrub habitats (Bartolome et al. 2006). Conduct mowing in selected areas to reduce plant height and biomass cover where use of livestock is impractical (ICF International 2010).
- Obtain permits for and conduct prescribed burns. Use targeted studies to inform location and frequency (ICF International 2010).
- Develop and implement monitoring and adaptive management plans for brittlescale. Plans should include strategies to minimize site-specific threats and identify new threats.
- Identify locations in the study area where shrub- or tree-dominated plant communities are encroaching on grassland communities (including alkali meadow and scald, California annual grassland, and non-serpentine bunchgrass grassland) and, if appropriate, work to reduce the encroachment through mechanical removal (ICF International 2010).

Fragrant Fritillary

Actions and priorities for fragrant fritillary are informed by the Recovery Plan for Serpentine Soil Species of the Bay Area (U.S. Fish and Wildlife Service 1998b) and the Santa Clara Valley Habitat Plan (ICF International 2012).

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrence) and any new occurrences of fragrant fritillary on unprotected land. Protect occurrences of fragrant fritillary in the following locations (Figure F-23, Appendix F). Protection should secure a 500-foot buffer around each occurrence to reduce threats (e.g., impacts from recreation) and allow expansion of populations (U.S. Fish and Wildlife Service 1998b).
    - Walnut Creek–Frontal Suisun Bay Estuaries CPU
    - San Lorenzo Creek–Frontal San Francisco Estuaries CPU
- Little precise information about the ecology of this species exists, including details of its life history stages, population dynamics, microhabitat requirements (e.g., edaphic factors), demography, and pollination biology to inform management actions. As such, it is not clear whether grazing benefits or adversely affects fragrant fritillary. Conduct targeted studies to evaluate the response of modeled focal plant species to various management actions, including grazing regimes.
- Additional target studies that may determine factors that support occurrence expansion such as specific seed germination requirements and successful transplantation requirements to create or augment new occurrences shall also be conducted (ICF International 2012).

- Enhance known occurrences of fragrant fritillary on protected land in the RCIS area in the following locations, based on information from targeted studies.
  - Lake Chabot Regional Park in the San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPU.
  - Walnut Creek-Frontal Suisun Bay Estuaries CPU.
- Survey for undocumented occurrences of fragrant fritillary on suitable habitat, where access is permitted, in Lake Chabot Regional Park, Anthony Chabot Regional Park, and Berkeley-Oakland Hills (East Bay Hills).
- Develop and implement monitoring and adaptive management plans for fragrant fritillary. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of fragrant fritillary, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).

Round-Leaved Filaree

Actions and priorities for round-leaved filaree are informed by the ECCC HCP/NCCP.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrence) and any new occurrences of round-leaved filaree on unprotected land. Protect occurrences of round-leaved filaree in the following locations (Figure F-24, Appendix F).
  - Arroyo Las Positas CPU
  - Corral Hollow Creek CPU
  - Marsh Creek CPU
  - Middle River–San Joaquin River CPU
  - Mount Diablo Creek–Frontal Suisun Bay Estuaries CPU
- Enhance occurrences of round-leaved filaree on protected land in the RCIS area in the following locations.
  - Contra Costa Water District's Los Vaqueros Reservoir in the Kellogg Creek–Big Break CPU
  - Marsh Creek CPU
  - Middle River–San Joaquin River CPU
  - Kellogg Creek–Big Break CPU
- Survey for undocumented occurrences of round-leaved filaree on suitable habitat (Jones & Stokes 2006), where access is permitted, in the Arroyo Mocho, Corral Hollow Creek, Old River, and Marsh Creek CPUs, as well as on the Contra Costa Water District's Los Vaqueros Reservoir in Kellogg Creek-Big Break CPU.

- Develop and implement monitoring and adaptive management plans for round-leaved filaree. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of round-leaved filaree, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).

Mount Diablo Fairy Lantern

Actions and priorities for Mount Diablo fairy lantern are informed by the ECCC HCP/NCCP.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrence) and any new occurrences of Mount Diablo fairy on unprotected land. Protect occurrences of Mount Diablo fairy lantern in the following locations (Figure F-25, Appendix F).
    - Marsh Creek CPU
    - Mount Diablo Creek–Frontal Suisun Bay Estuaries CPU
    - Walnut Creek–Frontal Suisun Bay Estuaries CPU
    - San Pablo Creek–Frontal San Pablo Bay Estuaries CPU
- Enhance occurrences of Mount Diablo fairy lantern on protected land in the RCIS area in the following locations.
    - Marsh Creek CPU
    - Mount Diablo Creek–Frontal Suisun Bay Estuaries CPU
    - Walnut Creek–Frontal Suisun Bay Estuaries CPUs
    - San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPU
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the Marsh Creek CPU.
- Survey for undocumented occurrences of Mount Diablo fairy lantern on suitable habitat (Jones & Stokes 2006), where access is permitted, in the Marsh Creek and San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPUs.
- Develop and implement monitoring and adaptive management plans for Mount Diablo fairy lantern. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of Mount Diablo fairy lantern, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).

Congdon's Tarplant

Actions and priorities for Congdon's tarplant are informed by the EACCS.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrence) and any new occurrences of Congdon's tarplant on unprotected land. Protect occurrences of Congdon's tarplant in the following locations (Figure F-26, Appendix F).
    - Arroyo Mocho CPU
    - Arroyo de la Laguna CPU
    - Arroyo Las Positas CPU
    - Walnut Creek–Frontal Suisun Bay Estuaries CPU
    - Suisun Bay CPU
    - Mount Diablo Creek–Frontal Suisun Bay Estuaries CPU
    - San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPU
- Enhance occurrences of Congdon's tarplant on protected land in the RCIS area in the following locations.
    - Don Edwards National Wildlife Refuge in San Francisco Bay CPU
    - Near Suisun Bay in the Walnut Creek–Frontal Suisun Bay Estuaries CPU
    - Alameda Creek CPU
    - Agua Caliente Creek–Frontal San Francisco Bay Estuaries CPU
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection in the Arroyo Mocho and Arroyo de la Laguna CPUs.
- Survey for undocumented occurrences of Congdon's tarplant on suitable habitat, where access is permitted, in modeled habitat in the Arroyo Mocho, Arroyo de la Laguna, Arroyo Las Positas, Old River, Marsh Creek, Kellogg Creek-Big Break, Walnut Creek–Frontal Suisun Bay Estuaries, San Francisco Bay, and Agua Caliente Creek–Frontal San Francisco Bay Estuaries CPUs.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).
- Establish an incentive program for private landowners to allow for botanical surveys on their property and to guarantee the management (e.g., through written assurances such as management plans with long-term endowments, deed restrictions) of habitats with focal plant populations to suppress non-native invasive vegetation and promote regeneration and recruitment of native species while supporting the natural processes typically found in the communities that support the focal plant species (ICF International 2010).
- Identify source populations for potential banking of seeds for use in future reintroduction of focal plant species into suitable habitat (ICF International 2010).
- Continue or introduce livestock grazing in a variety of grazing regimes with the appropriate timing and intensity for native plant species in grassland and scrub habitats (Bartolome et al.

2006). Conduct mowing in selected areas to reduce plant height and biomass cover where use of livestock is impractical (ICF International 2010).

- Conduct prescribed burns. Use targeted studies to inform location and frequency (ICF International 2010).
- Identify locations in the study area where shrub- or tree-dominated plant communities are encroaching on grassland communities (including alkali meadow and scald, California annual grassland, and non-serpentine bunchgrass grassland) and, if appropriate, work to reduce the encroachment through mechanical removal (ICF International 2010).

Presidio Clarkia

Actions and priorities for Presidio clarkia are informed by the Recovery Plan for Serpentine Soil Species of the Bay Area (U.S. Fish and Wildlife Service 1998b).

- Conduct surveys to determine the status of the three Biodiversity Information Serving Our Nation (BISON) occurrences in the RCIS area.
- Prioritize permanent protection and enhancement of known occurrences and any new occurrences of Presidio clarkia in the San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPU on unprotected land (Figure F-28, Appendix F). Protection should secure a 500-foot buffer around each occurrence to reduce threats (e.g., impacts from recreation) and allow expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop and implement monitoring and adaptive management plans for Presidio clarkia. Plans should include strategies to minimize site-specific threats (e.g., roadside maintenance, foot traffic, mowing) and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of Presidio clarkia, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).
- Enhance the occurrences, if determined to be extant, of Presidio clarkia in the following locations.
  - San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPU
  - Walnut Creek–Frontal Suisun Bay Estuaries CPU
- Survey for undocumented occurrences on suitable habitat, where access is permitted, in the San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPU.

Recurved Larkspur

Actions and priorities for recurved larkspur are informed by the ECCC HCP/NCCP and the EACCS.

- Conduct surveys to determine the status of the three, general location CNDDB occurrences[17] in the Old River CPU (Figure F-30, Appendix F) (Jones & Stokes 2006).
- Prioritize permanent protection and enhancement of the one known occurrence (i.e., precise CNDDB occurrence) and any new occurrences of recurved larkspur in the Old River CPU on unprotected land. Prioritize the protection of the three unprotected occurrences in the Old River CPU only if they are determined to be extant.
- Survey for undocumented occurrences on suitable habitat, where access is permitted, in the Old River, Kellogg Creek-Big Break, and Marsh Creek CPUs.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).
- Establish an incentive program for private landowners to allow for botanical surveys on their property and to guarantee the management (e.g., through written assurances such as management plans with long-term endowments, deed restrictions) of habitats with focal plant populations to suppress non-native invasive vegetation and promote regeneration and recruitment of native species while supporting the natural processes typically found in the communities that support the focal plant species (ICF International 2010).
- Identify source populations for potential banking of seeds for use in future reintroduction of focal plant species into suitable habitat (ICF International 2010).
- Continue or introduce livestock grazing in a variety of grazing regimes with the appropriate timing and intensity for native plant species in grassland and scrub habitats (Bartolome et al. 2006). Conduct mowing in selected areas to reduce plant height and biomass cover where use of livestock is impractical (ICF International 2010).
- Conduct prescribed burns. Use targeted studies to inform location and frequency (ICF International 2010).
- Identify locations in the study area where shrub- or tree-dominated plant communities are encroaching on grassland communities (including alkali meadow and scald, California annual grassland, and non-serpentine bunchgrass grassland) and, if appropriate, work to reduce the encroachment through mechanical removal (ICF International 2010).

San Joaquin Spearscale

Actions and priorities for San Joaquin spearscale are informed by the Recovery Plan for Upland Species of the San Joaquin Valley, California (U.S. Fish and Wildlife Service 1998a), the EACCS, and the ECCC HCP/NCCP.

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[17] Data reported to the CNDDB are done so with varied precision. Some occurrences are well documented with explicit locations (e.g., GPS coordinates), while other are reported with more general location information. General occurrences have been documented in very general terms and include non-specific records (such as the boundary of a park where an occurrence is known to occur) or records with an accuracy of 0.1, 0.2, 0.4, 0.6, 0.8, or 1.0 mile. See Section 2.2.6.2 for more information.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise occurrences) and any new occurrences of San Joaquin spearscale on unprotected land. Prioritize protection of occurrences in the following locations (Figure F-31, Appendix F).
  - Arroyo de la Laguna CPU
  - Arroyo Mocho CPU
  - Arroyo Las Positas CPU
  - Marsh Creek CPU
  - Kellogg Creek-Big Break CPU
  - Old River CPU
  - Suisun Bay CPU
- Enhance occurrences of San Joaquin spearscale on protected land in the RCIS area in the following locations.
  - On the Contra Costa Water District's Los Vaqueros Water District property in Kellogg Creek–Big Break CPU
  - Marsh Creek CPU
  - Old River CPU
  - Agua Caliente Creek-Frontal San Francisco Bay Estuaries CPU
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the Old River and Kellogg Creek-Big Break CPUs.
- Surveys for undocumented occurrences in suitable habitat (Jones & Stokes 2006), where access is permitted, in the Old River, Kellogg Creek-Big Break, and Marsh Creek CPUs.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).
- Establish an incentive program for private landowners to allow for botanical surveys on their property and to guarantee the management (e.g., through written assurances such as management plans with long-term endowments, deed restrictions) of habitats with focal plant populations to suppress non-native invasive vegetation and promote regeneration and recruitment of native species while supporting the natural processes typically found in the communities that support the focal plant species (ICF International 2010).
- Identify source populations for potential banking of seeds for use in future reintroduction of focal plant species into suitable habitat (ICF International 2010).
- Continue or introduce livestock grazing in a variety of grazing regimes with the appropriate timing and intensity for native plant species in grassland and scrub habitats (Bartolome et al. 2006). Conduct mowing in selected areas to reduce plant height and biomass cover where use of livestock is impractical (ICF International 2010).
- Conduct prescribed burns. Use targeted studies to inform location and frequency (ICF International 2010).

- Identify locations in the study area where shrub- or tree-dominated plant communities are encroaching on grassland communities (including alkali meadow and scald, California annual grassland, and non-serpentine bunchgrass grassland) and, if appropriate, work to reduce the encroachment through mechanical removal (ICF International 2010).

Brewer's Western Flax

Actions and priorities for Brewer's western flax are informed by the ECCC HCP/NCCP.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any new occurrences of Brewer's western flax on unprotected land. Prioritize protection of occurrences in the following locations (Figure F-32, Appendix F).
    - Mount Diablo Creek-Frontal Suisun Bay Estuaries CPU
    - Kellogg Creek-Big Break CPU
    - Marsh Creek CPU
    - Corral Hollow Creek CPU
- Enhance occurrences of Brewer's western flax on protected land in the RCIS area in the following locations.
    - Mount Diablo in Mount Diablo Creek–Frontal Suisun Bay Estuaries CPU
    - Marsh Creek CPU
    - Contra Costa Water District's Los Vaqueros Reservoir in Kellogg Creek–Big Break CPU
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the Marsh Creek CPU.
- Survey for undocumented occurrences in suitable habitat (Jones & Stokes 2006), where access is permitted, in Marsh Creek, Corral Hollow, Agua Caliente Creek-Frontal San Francisco Bay Estuaries, Alameda Creek, Kellogg Creek-Big Break, Walnut Creek-Frontal Suisun Bay Estuaries, and Mount Diablo Creek-Frontal Suisun Bay Estuaries CPUs.
- Develop and implement monitoring and adaptive management plans for Brewer's western flax. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of Brewer's western flax, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).

Mason's Lilaeopsis

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any new occurrences of Mason's lilaeopsis on unprotected land, nearly all of which occur immediately adjacent the northeastern boundary of the RCIS area. Prioritize protection and enhancement in the following locations (Figure F-35, Appendix F).

  - Old River CPU
  - Kellogg Creek-Big Break CPU
  - Middle River–San Joaquin River CPU
  - Mount Diablo Creek–Frontal Suisun Bay Estuaries CPU
  - Suisun Bay CPU

- Enhance occurrences of Mason's lilaeopsis on protected land in the RCIS area in the same CPUs as listed in the previous bullet point.
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the Suisun Bay and Mount Diablo Creek- Frontal Suisun Bay Estuaries CPUs.
- Survey for undocumented occurrences in suitable habitat, where access is permitted, in Kellogg Creek–Big Break, Middle River–San Joaquin River, Mount Diablo Creek–Frontal Suisun Bay Estuaries, and Suisun Bay CPUs.
- Develop and implement monitoring and adaptive management plans for Mason's lilaeopsis. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of Mason's lilaeopsis, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).

Most Beautiful Jewelflower

Actions and priorities for most beautiful jewelflower are informed by the Recovery Plan for Serpentine Soil Species of the Bay Area (U.S. Fish and Wildlife Service 1998b) and the Santa Clara Valley Habitat Plan (ICF International 2012).

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any new occurrences of most beautiful jewelflower on unprotected land in the following locations (Figure F-38, Appendix F). Protection should secure a 500-foot buffer around each occurrence to reduce threats (e.g., impacts from recreation) and allow expansion of populations (U.S. Fish and Wildlife Service 1998b).
  - Alameda Creek CPU
  - San Lorenzo Creek–Frontal San Francisco Bay Estuaries CPU
- Enhance occurrences of most beautiful jewelflower on protected land in the RCIS area in the following locations.
  - Alameda Creek CPU
  - Walnut Creek–Frontal Suisun Bay Estuaries CPU

  - Mount Diablo Creek–Frontal Suisun Bay Estuaries CPU
  - Arroyo Hondo CPU
- Survey for undocumented occurrences in suitable habitat near known occurrences, where access is permitted, in the Alameda Creek, Walnut Creek–Frontal Suisun Bay Estuaries, Mount Diablo Creek–Frontal Suisun Bay Estuaries, Arroyo Valle, and Arroyo Hondo CPUs.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, and seed dispersal (ICF International 2012).
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and surveys in the Marsh Creek CPU.
- Develop and implement monitoring and adaptive management plans for most beautiful jewelflower. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of most beautiful jewelflower, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).
- Establish an incentive program for private landowners to allow for botanical surveys on their property and to ensure the management of habitats with focal plant populations to suppress non-native invasive vegetation and promote regeneration and recruitment of native species while supporting the natural processes typically found in the communities that support the focal plant species (ICF International 2010).
- Identify source populations for potential banking of seeds for use in future reintroduction of focal plant species into suitable habitat (ICF International 2010).
- Continue or introduce livestock grazing in a variety of grazing regimes with the appropriate timing and intensity for native plant species in grassland and scrub habitats (Bartolome et al. 2006). Conduct mowing in selected areas to reduce plant height and biomass cover where use of livestock is impractical (ICF International 2010).
- Conduct prescribed burns. Use targeted studies to inform location and frequency (ICF International 2010).
- Identify locations in the study area where shrub- or tree-dominated plant communities are encroaching on grassland communities (including alkali meadow and scald, California annual grassland, and non-serpentine bunchgrass grassland) and, if appropriate, work to reduce the encroachment through mechanical removal (ICF International 2010).

3.8.17.3 Opportunities for Adaptation to Climate Change

Like all organisms, plants need to be able to move away from stress caused by climate change into areas that are either still suitable or newly suitable under changed climate conditions. In general, the predicted consequence of climate change will result in shifts of suitable habitat to higher elevations and latitudes (Jump and Penuelas 2005), including small elevational changes in and above tidal zones (Grewell et al. 2013). If climate change causes current habitat to become unsuitable, populations will have to either 1) complete likely multi-generational movement to suitable habitat, 2) face genetic change in place to cope with the new conditions, or 3) go extinct. If the climate changes more rapidly than either #1 or #2, then extinction will be inevitable (Thomas et al. 2004). Under climatic changes, temperature and water availability are the two variables most often documented as influencing either genetic change or physical movement (summarized in Jump and Penuelas 2005).

How individual species or populations are affected by changed conditions under a different climate is largely influenced by their phenotypic plasticity and their ability to move. Phenotypic plasticity can accommodate short-term changes and potentially lead to long-term genetic change, but if changes are drastic, the ability of plasticity to accommodate the change will reach its limit and dispersal will be necessary (Murren et al. 2015). The ability to move is influenced by dispersal methods (e.g., can dispersal occur fast enough to outpace threats) and barriers, either natural barriers (e.g., ecotones, change in soil type) or human-made barriers (e.g., developed landscapes). This conservation strategy facilitates adaptation to climate change by recommending actions that facilitate dispersal across the landscape, and assisted migration (e.g., creating new occurrences).

Anacker et al. (2013) conducted a climate vulnerably assessment of 156 plant species in California. The analysis included the following RCIS focal plant species with habitat models: brittlescale, fragrant fritillary, Mount Diablo fairy lantern, Congdon's tarplant, recurved larkspur, San Joaquin spearscale, Brewer's western flax, and most beautiful jewelflower. All of these species were identified as being moderately or highly vulnerable to climate change, expect for Congdon's tarplant, which is not considered to be vulnerable to climate change. They determined that these species are vulnerable to climate change from a variety of factors including anthropogenic barriers, sensitivity to temperature and precipitation, hydrology, or moisture regime, and restriction to uncommon geologic features. Some of the focal plant species with habitat distribution models are restricted to specific soil types (e.g., serpentine or alkali) which have a limited distribution in the RCIS area. Similarly, some of these species grow in wetlands and require specific moisture regimes, and even those that do not require consistent annual precipitation in the spring for growth and reproduction. Some of these species are adaptable to disturbance and often can thrive when the period of disturbance is limited and temporary. However, substantial disturbances (e.g., development, mining, recreational activities, improper grazing timing) can lead to population declines (U.S. Fish and Wildlife Service 1998b) and loss of habitat. In addition, large expanses of surrounding intensive urban development leave this species with little ability to shift its range in response to climate change.

The conservation strategy includes actions to protect occupied and unoccupied focal plant species habitat, discover unknown occurrences, and enhance suitable habitat throughout the RCIS area. In this way, the RCIS will protect both extant populations and suitable habitat to help facilitate shifts in distributions to more favorable areas in response to climate change. Further, the focus of this RCIS' conservation strategy on invasive plant management, an issue that could be exacerbated by climate change (e.g., new conditions could favor pest plants more than native plants), grazing, and

Phytophthora control, will help to maintain the suitability of existing habitat. Collecting and storing of seeds will ensure that seeds are available to translocate to new habitats if climate change makes current habitats unsuitable. Where barriers limit dispersal from current locations, translocation (i.e., assisted migration) methods may be used to ensure the persistence of focal plant species.

3.8.18 Focal Plants without Habitat Distribution Models

Habitat models were not created for six of the focal plant species in the RCIS area: palmate-bracted bird's beak, Livermore tarplant, Loma Prieta hoita, Contra Costa goldfields, rock sanicle, and showy madia. These species have few occurrences in the RCIS area and very specific habitat requirements that were not feasible to model within the scope of this RCIS; therefore, habitat distribution models would greatly overestimate their habitat in the RCIS area and not provide a useful guide for actions and priorities. Because habitat distribution models were not created, the conservation strategy for these plant species focuses on protection of occurrences (Table 3-11) and locating and enhancing and restoring suitable habitat. The approach for identifying the number of occurrences to protect and enhance is that same as described under Section 3.8.17.

Table 3-11. Conservation Targets for Occurrences of Focal Plant Species without Habitat Models

Focal Plant Species without Models	Total Number of Occurrences in the RCIS Area	Occurrence Protection and Enhancement Targets
Palmate-bracted bird's beak	1	1
Livermore tarplant	4	4
Loma Prieta hoita	3	3
Contra Costa goldfields	4	4
Showy madia	2	2
Rock sanicle	4	4

3.8.18.1 Conservation Goals, Objectives, and Actions

Goal 19. Protect existing populations, locate new populations, and maintain and improve habitat for palmate-bracted bird's beak, Livermore tarplant, Loma Prieta hoita, Contra Costa goldfields, showy madia and rock sanicle.

Objective 19-1. Protect the number of occurrences identified in the *Occurrence Protection and Enhancement Targets* column in Table 3-11, as well as any newly discovered occurrences. Measure progress toward achieving this objective in the number of viable or restorable occurrences protected.

- ***Action FPwo-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, unprotected occurrences.
- ***Action FPwo-2***. Permanently protect, through a conservation easement or other approved real estate instrument, potentially suitable habitat.

Objective 19-2. Locate undocumented occurrences of palmate-bracted bird's beak, Livermore tarplant, Contra Costa goldfields, showy madia, and rock sanicle. Measure progress toward achieving this objective in the area of potentially suitable habitat surveyed and the number of newly discovered occurrences.

- ***Action FPwo-3***. Survey for undocumented occurrences and suitable habitat in RCIS area.

Implement actions FPw-3 through FPw-9 and FPw-11 through FPw-25, as appropriate, for palmate-bracted bird's beak, Livermore tarplant, Loma Prieta hoita, Contra Costa goldfields, showy madia and rock sanicle.

3.8.18.2 Species-Specific Conservation Priorities

Palmate-Bracted Bird's Beak

Actions and priorities for palmate-bracted bird's beak are informed by the Recovery Plan for Upland Species of the San Joaquin Valley, California (U.S. Fish and Wildlife Service 1998a) and the EACCS.

- Prioritize permanent protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any new occurrences of palmate-bracted bird's beak on unprotected land in the following locations (Figure F-27, Appendix F) (U.S. Fish and Wildlife Service 1998a).
    - Arroyo Las Positas CPU
    - Kellogg Creek–Big Break CPU
- Protect and/or enhance 90% or more of the plants and occupied habitat (owned by the City of Livermore, Federal Communication Commission, or private landowners] of the Springtown Alkali Sink (U.S. Fish and Wildlife Service 2009b).
- Collaborate with the City of Livermore, Springtown Alkali Sink Working Group, Federal Communications Commission, and private landowners to protect and manage the occurrence of palmate-bracted bird's beak on their property, including appropriate seasonal grazing and invasive plant removal practices (e.g., stinkwort (*Dittrichia graveolens*), perennial pepperweed (*Lepidium latifolium*), and Italian ryegrass (*Festuca perennis*).
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the Arroyo Las Positas CPU.
- Fence and prohibit recreation on all occupied palmate-bracted bird's beak habitat.
- Conduct annual monitoring of extant palmate-bracted bird's beak occurrences, and survey suitable habitat for new occurrences in the Arroyo Las Positas and Kellogg Creek-Big Break CPUs.
- Survey for undocumented occurrences in potentially suitable habitat near known occurrences, where access is permitted.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).
- Establish an incentive program for private landowners to allow for botanical surveys on their property and to ensure the management of habitats with focal plant populations to suppress non-native invasive vegetation and promote regeneration and recruitment of native species

while supporting the natural processes typically found in the communities that support the focal plant species (ICF International 2010).

- Identify source populations for potential banking of seeds for use in future reintroduction of focal plant species into suitable habitat (ICF International 2010).
- Continue or introduce livestock grazing in a variety of grazing regimes with the appropriate timing and intensity for native plant species in grassland and scrub habitats. Conduct mowing in selected areas to reduce plant height and biomass cover where use of livestock is impractical (ICF International 2010).
- Identify locations in the study area where shrub- or tree-dominated plant communities are encroaching on grassland communities (including alkali meadow and scald, California annual grassland, and non-serpentine bunchgrass grassland) and, if appropriate, work to reduce the encroachment through mechanical removal (ICF International 2010).

Livermore Tarplant

Actions and priorities for Livermore tarplant are informed by the EACCS (ICF International 2010).

All occurrences of Livermore tarplant are located in Arroyo Las Positas CPU (Figure F-29, Appendix F). The following actions are priorities for Livermore tarplant.

- Prioritize permanent protection and enhancement of occurrences of Livermore tarplant.
- Collaborate with the City of Livermore and the Springtown Alkali Sink Working Group to protect and manage occurrences of Livermore tarplant, including appropriate seasonal grazing and invasive plant removal practices (e.g., stinkwort, perennial pepperweed, and Italian ryegrass).
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement.
- Fence the entire Springtown Livermore tarplant population to prohibit access and reduce the heavy use by pedestrians and bicycle riders. Once fenced, enhance and restore this area. Consider seeding or planting Livermore tarplant, if appropriate.
- Conduct annual monitoring of the four occurrences of Livermore tarplant and survey suitable habitat for new occurrences in Arroyo Las Positas CPU.

Loma Prieta Hoita

Actions and priorities for Loma Prieta hoita are informed by the Recovery Plan for Serpentine Soil Species of the Bay Area (U.S. Fish and Wildlife Service 1998b) and the Santa Clara Valley Habitat Plan (ICF International 2012).

- Prioritize permanent protection and enhancement of the one known occurrences (i.e., precise occurrences) and any newly discovered occurrences of Loma Prieta hoita in the San Pablo Creek–Frontal San Pablo Bay Estuaries CPU on unprotected land (Figure F-33, Appendix F). Protection should secure a 500-foot buffer around each occurrence to reduce threats (e.g., impacts from recreation) and allow expansion of populations (U.S. Fish and Wildlife Service 1998b).

- Prioritize the permanent protection of unprotected general location occurrences if they are determined to be extant in the following locations.
    - San Lorenzo Creek–Frontal San Pablo Bay Estuaries CPU
    - Arroyo Mocho CPU
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2012).
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and surveys in the Marsh Creek CPU.
- Develop and implement monitoring and adaptive management plans Loma Prieta hoita. Plans should include strategies to minimize site-specific threats and identify new threats (U.S. Fish and Wildlife Service 1998b).
- Remove non-native species and establish buffer zones to control reinvasion and to facilitate expansion of populations (U.S. Fish and Wildlife Service 1998b).
- Develop a public outreach program to inform the public about the ecology and life history of Loma Prieta hoita, and the threats and conservation actions being implemented for this species (U.S. Fish and Wildlife Service 1998b).

Contra Costa Goldfields

All occurrences of Contra Costa goldfields are located in the San Lorenzo Creek–Frontal San Francisco Bay Estuaries, San Pablo Creek–Frontal San Pablo Bay Estuaries, and along the border of the San Francisco Bay and Aqua Caliente Creek-Frontal San Francisco Bay Estuaries CPUs (Figure F-34, Appendix F). The following actions are priorities for the four known occurrences of Contra Costa goldfields.

- Prioritize permanent protection and enhancement of all legally designated under ESA critical habitat for Contra Costa goldfields in the San Pablo Creek-Frontal San Pablo Bay Estuaries, Old River, Aqua Caliente Creek-Frontal San Francisco Bay Estuaries, and Kellogg Creek-Big Break CPUs.
- Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize areas for protection and enhancement in the San Francisco Bay CPU.
- Collaborate with the Muir Heritage Land Trust to manage the population of Contra Costa goldfields in Contra Costa County. Specific actions may include cattle grazing and targeted management of stinkwort and pepperweed (U.S. Fish and Wildlife Service 2013b).
- Collaborate with the Don Edwards National Wildlife Refuge to manage populations of Contra Costa goldfields on the refuge. Specific actions may include cattle grazing and targeted management of Italian ryegrass and prickly lettuce (*Lactuca serriola*) (U.S. Fish and Wildlife Service 2013b).
- Conduct floristic surveys over multiple years, where access is permitted, to determine the status of the Contra Costa goldfields occurrence near Russel City in Alameda County. Survey nearby suitable habitat in the San Lorenzo Creek–Frontal San Francisco Bay Estuaries and San

Francisco Bay CPUs. In addition, conduct these surveys in critical habitat in the Kellogg Creek-Big Break and Old River CPUs.

- Coordinate with the USFWS to conduct enhancement activities in critical habitat, such as invasive plant species removal and vernal pool restoration or creation.

Showy Madia

The two known occurrences of showy madia in the RCIS area are historical, with a general location provided in the CNDDB (California Department of Fish and Wildlife, Natural Diversity Database 2016) within the Marsh Creek CPU and on the border of the Middle River–San Joaquin River and Mount Diablo Creek–Frontal Suisun Bay Estuaries CPUs (Figure F-36, Appendix F). Little information is available about the conservation needs of this species; as such, the following priority actions focus on locating and protecting occurrences, and if found, assessing habitat conditions, factors limiting occurrence expansion, and threats to occurrences.

- Surveys should be conducted to identify showy madia occurrences. Utilize the Botanical Priority Protection Guidebook (Bartosh et al. 2010) to prioritize survey areas within following areas.
    - Marsh Creek CPU
    - Middle River-San Joaquin River CPU
- Prioritize permanent protection of newly discovered (or rediscovered) showy madia occurrences.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).
- Implement management actions based on the results of target studies.

Rock Sanicle

All occurrences of rock sanicle are located in the Marsh Creek, Mount Diablo Creek-Frontal Suisun Bay Estuaries, and Walnut Creek-Frontal Suisun Bay Estuaries CPUs (Figure F-37, Appendix F). Little information is available about the conservation needs of this species; as such, the following priority actions focus on the protection of occurrences, assessment of habitat conditions, factors limiting occurrence expansion, and threats to occurrences.

- Prioritize permanent protection and enhancement of all known occurrences of rock sanicle in the Marsh Creek, Mount Diablo Creek–Frontal Suisun Bay Estuaries, and Walnut Creek–Frontal Suisun Bay Estuaries CPUs.
- Target studies to determine factors that limit occurrence expansion including biotic factors relating to microsite needs, germination, pollination, seed dispersal, and threats (ICF International 2010).
- Implement management actions based on the results of target studies.

3.8.18.3 Opportunities for Adaptation to Climate Change

As described above under Section 3.8.17, changes to the annual precipitation and temperature patterns in the RCIS area will likely modify current habitat conditions (e.g. wet areas drying) in areas occupied and or potentially suitable for the focal plant species, and change the extent and distribution of that habitat. As the climate changes, the focal plant species will need to shift away from these areas to more suitable habitat that meets their life history needs, unless they are able to adapt to these new conditions. If this habitat is unavailable in the RCIS area or if these changes occur before these focal plant species can migrate or adapt, they face possible extirpation. Anacker et al. (2013) conducted a climate vulnerably assessment of 156 plant species in California, however none of the focal plant species without habitat distribution models were included in the analysis. It is expected that most, if not all, of these species are moderately or highly vulnerable to climate change because they face many of the same threats as those species included in the analysis. Factors that influence vulnerability, including sensitivity to changes in temperature, precipitation, hydrology, and moisture regime and reliance on uncommon geological features, and dependence on specific disturbance regimes, would affect these species. For example, Contra Costa goldfields is reliant on vernal pools and other seasonally inundated wetlands. Increased temperatures and changes in precipitation (i.e. drought) could cause some or all of this habitat to remain dry during the spring growing season. Additionally, all of these species rely on specific soil types and/or geologic features that have limited distributions in the RCIS area. Available habitat for these focal plant species will be significantly reduced if large portion of these areas are altered as the climate changed.

The RCIS provides a conservation strategy for the focal plant species without habitat models to ensure their long-term survival. The conservation strategy includes actions to acquire occupied and unoccupied focal species habitat, locate unknown occurrences, and enhance suitable habitat throughout the RCIS area. In this way, the RCIS will protect both extant populations and suitable habitat in order to ensure that the focal plant species can shift their distribution into more favorable areas in response to climate change. Further, the focus of this RCIS' conservation strategy on invasive plant management, an issue that could be exacerbated by climate change (e.g., new conditions could favor pest plants more than native plants), grazing, and *Phytophthora* control, will help to maintain the suitability of existing habitat. Creation and management of new habitat will increase the amount of available habitat. Where barriers limit dispersal from current locations, translocation (i.e., assisted migration) methods may be used to ensure the persistence of these focal plant species with habitat distribution models.

3.9 Conservation Strategy for Other Conservation Elements

3.9.1 Habitat Connectivity and Landscape Linkages

The conservation strategies for wildlife focal species includes species-specific actions to improve connectivity between habitats and across landscapes. If implemented, those actions could benefit multiple species with that move within and between habitats at different spatial scales. For example, actions implemented to improve habitat connectivity for San Joaquin kit fox (Section 3.8.15, *San Joaquin Kit Fox*) and mountain lion (Section 3.8.16, *Mountain Lion*) across major barriers such as Interstate 580 could benefit a range of taxa that use habitats on both sides of the highway, including California red-legged frog, California tiger salamander, bobcat, ground squirrels, and other mammals. Similarly, actions implemented to remove or modify barriers to passage that prevent access of Central California Coast steelhead to spawning and rearing habitat could improve movement between habitats for other aquatic species such as foothill yellow-legged frog.

The section builds upon focal species actions to improve connectivity by recommending landscape-level actions to connect large habitat blocks, as well as localized actions that can be applied more broadly than the focal species actions.

3.9.1.1 Conservation Goals, Objectives, and Actions

Goal 20. Increase connectivity for native wildlife species across the landscape by protecting and/or improving the condition of natural and semi-natural lands to maintain or restore ecological permeability.

Objective 20-1. Protect multiple, alternative pathways for movement within important habitat linkages for the focal species, non-focal species, and other native species in the RCIS area. Measure progress toward achieving this objective in the area of identified Critical Linkages protected and the amount of natural communities and working lands protected in and around the Los Vaqueros Watershed and Black Diamond Mines Regional Preserve.

- ***Action HC-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, habitat for focal species, non-focal species and other native species within the East Bay Hills–Diablo Range and Mount Diablo-Diablo Range Critical Linkages (Penrod et al. 2013; Figure 2-23b) to maintain and enhance connectivity between large habitat blocks, as well as fill in gaps of unprotected areas within large habitat blocks.

Objective 20-2. Enhance wildlife permeability across Interstate 580/205, Interstate 680, and State Route 24 in the RCIS area by improving or creating multiple, alternative pathways for movement across highways and other transportation facilities. Measure progress toward achieving this objective in the number of barriers to movement modified, removed, or otherwise ameliorated.

- ***Action HC-2.*** Identify known or potential road crossings with suitable habitat on both sides of the roadway for focal species, non-focal species, or other native species.
- ***Action HC-3.*** Remove or modify barriers to increase permeability to wildlife, and where possible, install or repair crossings to increase permeability within the RCIS area for the focal species, non-focal species, or other native species.
- ***Actions HC-4***. Provide funding for long-term management of crossings (e.g., through endowments).
- ***Action HC-5.*** Conduct public outreach to inform landowners and land managers of the benefits of wildlife corridors and what can be done to improve permeability for wildlife.
- ***Action HC-6.*** Protect or enhance crossings and vegetation on either side of the crossing to maintain permeability.

3.9.1.2 Conservation Priorities

- Prioritize wildlife corridor improvements in the East Bay Hills–Diablo Range and Mount Diablo-Diablo Range Critical Linkages (Penrod et al. 2012) where they intersect Interstate 580, Interstate 680, and State Route 24, as shown on Figure 2-23b, with an emphasis on preserving corridors between large habitat blocks and filling in gaps of unprotected areas within large habitat blocks included under *Conservation Priorities* under Section 3.8.15 and Section 3.8.16

- Prioritize wildlife crossing improvements at the Alameda Creek undercrossing of Interstate 680 in the Arroyo de la Laguna CPU (K. Boxer, pers. comm.).

3.9.2 Working Landscapes

3.9.2.1 Conservation Goals, Objectives, and Actions

Goal 21. Retain economically viable working lands for the benefit of focal species, non-focal species, and other native species, and agricultural uses in the RCIS area.

Objective 21-1. Work with agriculture producers and the ranching community to manage croplands, ranchlands, and salt ponds in ways that both maintain economically viable operations (including infrastructure necessary to support well managed working lands operations) and benefit wildlife use and connectivity in the RCIS area. Measure progress toward achieving this objective in the area of working lands that have a written plan or agreement to manage working lands to benefit wildlife use and connectivity.

- ***Action WL-1.*** Work with agencies (e.g., Resource Conservation Districts, Natural Resource Conservation Service, CDFW, and USFWS) to establish programs (e.g., Safe Harbor Agreements) that conserve and enhance habitat for wildlife, native plants, and other conservation elements while protecting working lands from conversion to more intensive land uses (e.g., urban development, orchards and vineyards) not compatible with sustaining focal species and other conservation elements.
- ***Action WL-2-*** Encourage landowners and managers to use integrated pest management principles and incentivize public and private landowners to cease or reduce the use of rodenticides and limit the use of pesticides and herbicides, particularly near focal species occurrences.
- ***Action WL-3.*** Provide information to agriculture producers and the ranching community regarding wildlife-friendly practices such as hedgerows, integrated pest management, stock ponds with wildlife-friendly design features, wildlife-friendly fencing, vegetation conditions that benefit wildlife, and management to promote small mammal-compatible compatible farm and ranch practices.
- ***Action WL-4.*** Offer financial or regulatory incentives (e.g., Safe Harbor Agreements) to private landowners to maintain and enhance habitat for focal species.
- ***Action WL-5.*** Introduce livestock grazing to reduce vegetation cover that currently excludes ground squirrels and encourage ground squirrel colonization.
- ***Action WL-6.*** Work with public and private landowners to incorporate focal species habitat into existing operations.

3.9.2.2 Conservation Priorities

Prioritize the *Working Landscape* actions on prime farmland and ranchland with landowners willing to implement them in the following locations. (Figure 2-24).

- Prime farmland south of Livermore.
- Prime farmland east of Brentwood south into Alameda County.
- All grazing lands (rangelands) in the RCIS area.
    - San Pablo Creek-Frontal San Pablo Bay Estuaries CPU
    - San Lorenzo Creek-Frontal San Francisco Bay Estuaries CPU
    - Walnut Creek-Frontal Suisun Bay Estuaries CPU
    - Arroyo de la Laguna CPU
    - Alameda Creek CPU
    - Arroyo Hondo CPU
    - Mount Diablo Creek-Frontal Suisun Bay Estuaries CPU
    - Arroyo Mocho CPU
    - Arroyo Valle CPU
    - Middle River-San Joaquin River CPU
        - Marsh Creek CPU
    - Arroyo Las Positas CPU
    - Corral Hollow Creek CPU
    - Kellogg Creek-Big Break CPU
    - Old River CPU

3.9.3 Baylands

3.9.3.1 Conservation Goals, Objectives, and Actions

Goal 22. Maintain and restore functional baylands land cover types (e.g., deep bay, shallow bay, tidal vegetation etc.) and the subtidal zone to protect habitat for native species and provide ecosystem services (e.g., natural flood protection).

Objective 22-1*.* Protect and manage subtidal and intertidal communities to benefit rare, threatened, and endangered species and protect as broad a coastal zone as possible allow space for subtidal and intertidal communities to shift inland as sea-level rises, and to buffer more inland areas (including developed areas) from sea-level rise, consistent with the conservation plans summarized in

Appendix H.[18] Measure progress toward achieving this objective in the area of protected and managed subtidal and intertidal communities.

- ***Action BAY-1.*** Permanently protect, through a conservation easement or other approved real estate instrument, existing, historic, and restorable tidal marsh habitat in the RCIS area to promote the long-term conservation of these habitats.
- ***Action BAY-2.*** Enhance, restore and create subtidal and intertidal habitats in the RCIS area, working with private and public landowners (e.g., Don Edwards National Wildlife Refuge).
- ***Action BAY-*3-** Enhance, restore, and/or create transitional zones along the Bay that support focal species and other baylands species.
- ***Action BAY-4.*** Conduct studies to investigate key data gaps (e.g., population viability analysis or predation impacts) for rare, threatened, and endangered species, and species of concern that occur in the baylands in the RCIS area.
- ***Action BAY-5.*** Enhance and protect suitable nesting habitat (e.g., barren or sparsely vegetated areas protected from predators) for western snowy plover, terns, and other shorebirds.
- ***Action BAY-6.*** Provide more and wider buffers around tidal marshes and improve management to reduce human intrusion and predators into sensitive areas, using best current methods (e.g., seasonal habitat fencing, predator removal programs, or protecting nests with cages).
- ***Action BAY-7.*** Develop education and recreation plans in protected areas, where appropriate, to improve awareness, appreciation, and enjoyment of Bayland ecosystems while reducing the effects of recreation on baylands' species and habitat, such as siting trails away from sensitive resources, implementing an educational program, or installing managed visitor facilities.

3.9.3.2 Conservation Priorities

- Prioritize actions for the species addressed in the Recovery Plan for Tidal Marsh Ecosystem of Northern and Central California (U.S. Fish and Wildlife Service 2013a).
- Because unique land cover types, including intertidal habitats and the subtidal zone in the baylands, cover only a small part of the RCIS area (2% or less), they should be prioritized anywhere they occur.
- Evaluate, and if feasible, implement restoration projects that integrate upland, subtidal and intertidal habitats. Locations to consider for restoration project include, but are not limited to, the following (California State Coastal Conservancy and Ocean Protection Council, National Marine Fisheries Service and Restoration Center, San Francisco Bay Conservation and Development Commission, and San Francisco Estuary Partnership 2010, National Marine Fisheries Service 2014, Goals Project 2015).
    - Breuner Marsh and Point Molate – connect to Point San Pablo eelgrass bed.

[18] Because of the extensive conservation planning in the baylands, this RCIS refers to the existing conservation plans to guide voluntary conservation actions, habitat enhancements, and the development of mitigation credit agreements (MCA) for the natural communities, focal species, and non-focal species in the baylands. It is the intent of this RCIS that by identifying and summarizing the conservation needs of species and their habitats that rely on the baylands, credits may be created through an MCA to offset future impacts to these species.

- Eastshore State Park and Giant Marsh – wetland restoration integrated with oyster and eelgrass restoration and creek daylighting.
- Dutch Slough.
- Eden Landing - restore large areas of managed ponds to tidal marsh connected to the Alameda Creek Flood Control Channel, Old Alameda Creek and Mount Eden Landing.
- Richmond Point - remove creosote pilings.
- Control invasive *spartina* to minimize its spread to newly restored marshes.

- Prioritize partnerships and collaborative efforts to prioritize and implement potential projects that could be funded by San Francisco Bay Restoration Authority through Measure AA funds[19] (San Francisco Bay Restoration Authority 2017).

3.9.4 Bat Habitat

3.9.4.1 Conservation Goals, Objectives, and Actions

Goal 23. Protect or avoid impacting bat roost sites and enhance habitat for bats in the RCIS area.

Objective 23-1. Protect bat maternity roosts and hibernacula (hibernation sites) and adjacent foraging habitats in the RCIS area. Measure progress toward achieving this objective in the number of maternity roosts and hibernacula protected.

- ***Action BATS-1***. Survey potential roost sites to locate bat maternity roost and hibernacula in the RCIS area.
- ***Action BATS-2***. Permanently protect, through a conservation easement or other approved real estate instrument, land with bat maternity roosts and hibernacula, with a focus on protecting roost sites for a diversity of bat species.
- ***Action BATS-3.*** Where possible, fence or otherwise limit access to locations the support active bat maternity roosts and/or hibernacula.
- ***Action BATS-4*.** Acquire natural habitats that provide foraging habitat in close proximity to roosts.

Objective 23-2. Preserve, create, restore, and enhance habitat for bats in the RCIS area. Measure progress toward achieving this objective in the number of maternity roosts and hibernacula created, restored, and enhanced.

- ***Action BATS-4.*** Create and maintain bat houses to encourage use of habitats such as riparian corridors, along waterways, and at ecotones between woodlands and open habitats such as grasslands.
- ***Action BATS-5.*** Retain trees with cavities that provide roost sites for bats.
- ***Action BATS-6.*** Use gates to stabilize abandoned mine and cave that could support bat roosts and hibernacula.

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[19] For information on projects that could be potentially funded by the San Francisco Bay Restoration Authority, see http://sfbayrestore.org/sf-bay-restoration-authority-project-list.php

- ***Action BATS-7***. Retrofit or create stock ponds, with pooled water accessible to bats, which drink water on-the-wing, consistent with best available design standards to improve accessibility and safety for bats and other wildlife while improving water quality for livestock (e.g., Taylor and Tuttle 2012).
- ***Action BATS-8.*** Coordinate with local agencies and landowners to incorporate habitat for bats into enhancement or restoration projects in the RCIS area.

3.9.4.2 Conservation Priorities

- Locate and permanently protect bat roost sites and adjacent foraging habitat.

3.9.5 Unique Land Cover Types

Unique land cover types are locally rare (i.e., within the RCIS area) land cover types that support native vegetation and one or more focal plant or wildlife species. See Section 2.2.8.5, *Unique Land Cover Types*, for a description of how unique land cover types were defined for this RCIS. See Section 2.2.5.5, *Natural Communities and Land Cover Types in the RCIS Area*, for descriptions of unique land cover types.

The following land cover types are identified as unique for this RCIS.

- Serpentine grassland
- Alkali grassland
- Northern coastal scrub/Diablan sage scrub
- Serpentine chaparral
- Cismontane juniper woodland
- Valley oak woodland
- Montane hardwood
- Serpentine hardwood
- Redwood forest
- Serpentine conifer
- Coulter pine forest
- Knobcone pine forest
- Ponderosa pine woodland
- Sargent cypress woodland
- Mixed riparian forest and scrub
- Serpentine riparian
- Sycamore alluvial woodland
- Alkali wetland

- Perennial freshwater marsh
- Seep/Spring (non-serpentine)
- Seep/Spring (serpentine)
- Seasonal wetland
- Pond
- Tidal vegetation
- Tidal bay flat

3.9.5.1 Conservation Goals, Objectives, and Actions

Goal 24. Protect and enhance unique land cover types in the RCIS area.

Objective 24-1. Protect, enhance, and restore unique land cover types in amounts needed to meet the conservation targets in Table 3-3. Measure progress toward achieving this objective in the area of unique land cover types protected.

- ***Action ULCT-1***. Permanently protect, through a conservation easement or other approved real estate instrument, unique land cover types.
- ***Action ULCT-2***. Restore unique land cover types using the guidelines for prioritizing sites for restoration (Section 3.7.2, *Guidelines for Prioritizing Sites for Restoration*) and guiding principles for habitat restoration (Section 3.7.3, *Guiding Principles for Habitat Restoration and Management*) to inform restoration site selection and restoration actions. Use site-specific conditions and to inform restoration methods and techniques.

Objective 24-2. Work with land managers to incorporate management practices that benefit unique land cover types on public and private lands. Measure progress toward achieving this objective in the area managed to benefit unique land cover types.

- ***Action ULCT-3****.* Develop written/visual materials that describe the ideal condition for each unique land cover type that could be used by policy makers, landowners, and land managers alike to strive for an improved vegetative condition for unique land cover types in the RCIS area.
- ***Action ULCT-4.*** Offer financial and regulatory incentives (e.g., Safe Harbor Agreements) to private landowners to maintain and enhance unique land cover types that provide habitat for focal species.

3.9.5.2 Conservation Priorities

- Prioritize permanent protection and restoration of land cover types with the greatest conservation gap, percentagewise (i.e., land cover types with the lowest percent of the conservation target currently protected). For example, prioritize protection of serpentine chaparral because only 9% of the conservation target is currently protected (Table 3-3).

3.9.6 Important Soil Types

3.9.6.1 Conservation Goals, Objectives, and Actions

Goal 25. Retain serpentine soils, alkali soils, sandy soils and clay lenses (i.e., important soils), and the native species supported by those soils in the RCIS area.

Objective 25-1. Protect serpentine and alkali land cover types in amounts needed to meet the conservation targets in Table 3-3 in the RCIS area. Measure progress toward achieving this objective in the area of serpentine and alkali land cover types protected.

- ***Action ST-1***. Permanently protect, through a conservation easement or other approved real estate instrument, serpentine and alkali land cover types.

Objective 25-2. Protect sandy soils and clay lenses in the RCIS area. Measure progress toward achieving this objective in the area of sandy soils and clay lenses protected.

- ***Action ST-2***. Permanently protect, through a conservation easement or other approved real estate instrument, sandy soils and clay lenses.

Objective 25-3. Reduce the edge effects of development on important soil types in the RCIS area. Measure progress toward achieving this objective in the area of land that buffers important soil types on protected lands.

- **Action ST-3***.* Protect large blocks of areas on a range of environmental gradients that contain important soils types that have a low edge-to-interior ratio.

3.9.6.2 Conservation Priorities

- Prioritize the protection of unprotected serpentine soils with 30% or more serpentine components and adjacent to protected areas, as shown on Figure 2-11.
- Prioritize the protection of unprotected alkali soils that support extant occurrences of the focal species (e.g., San Joaquin spearscale).
- Prioritize the protection of unprotected sandy soils that support known occurrences of Northern California legless lizard.
- Prioritize the protection of unprotected clay lenses that support known occurrences of the focal species (e.g., round-leaved filaree).

3.10 Consistency with Approved Conservation Strategies and Recovery Plans

California Fish and Game Code 1852(c)(11) states that an RCIS shall have “an explanation of whether and to what extent the strategy is consistent with any previously approved strategy or amended strategy, state or federal recovery plan, or other state or federal approved conservation strategy that overlaps with the strategy area.” This section explains how this RCIS is consistent with these types of plans and strategies that overlap the RCIS area.

The RCIS area overlaps with the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan and four other approved HCPs (Section 1.5.1, *Existing Habitat Conservation Plans and Natural Community Conservation Plans*). Additionally, 16 federally approved recovery plans address species or resources in the RCIS area. Each of those plans are addressed below.

3.10.1 Consistency with Habitat Conservation Plans and Natural Community Conservation Plans

3.10.1.1 East Contra Costa County HCP/NCCP

The ECCC HCP/NCCP is by far the largest and most comprehensive HCP and the only approved NCCP in the RCIS area (Figure 1-2). (The Antioch HCP/NCCP is in development and is being drafted to be consistent with the ECCC HCP/NCCP.) This RCIS has conservation goals and objectives similar to the biological goals and objectives of the ECCC HCP/NCCP. In the ECCC HCP/NCCP, biological goals and objectives are stated at the natural community level and identify which covered species are expected to benefit from the conservation objectives and associated conservation measures, while this RCIS provides goals and objectives for focal species, habitat connectivity and landscape linkages, working landscapes, baylands, bats, unique land cover types, and important soil types.

See Section 3.6 for a description of how this RCIS, including the conservation goals, objectives, actions, and priorities complement, is consistent with, the ECCC HCP/NCCP.

The pressures and stressors that affect the ECCC HCP/NCCP area are also relevant to the entire RCIS area, and therefore, similar conservation and habitat enhancement actions, restoration actions, and conservation priorities are recommended for both inside and outside of the ECCC HCP/NCCP area. Having similar, consistent actions aimed at enhancing and restoring habitats will facilitate collaborative partnerships with the Habitat Conservancy, so that entities using the RCIS to partner with the Habitat Conservancy will be guided by the same suites of actions that the Habitat Conservancy will implement.

Comparison of Focal Species Conservation Strategies

Following is a summary about how the RCIS objectives and actions are consistent and compatible with the ECCC HCP/NCCP’s biological objectives and actions for habitat enhancement and restoration objectives for focal species that are also ECCC HCP/NCCP covered species.

Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp

These species use similar vernal pool and alkali wetland habitats and are sparsely distributed throughout the RCIS area. This RCIS and the ECCCHCP/NCCP include similar conservation objectives and actions to protect and improve habitat for these vernal pool branchiopods, as follows.

- Protect vernal pool branchiopod occurrences and vernal pool and alkali wetland habitats and complexes.
- Maintain or improve habitats using grazing, prescribed burning, and minor recontouring of basins to improve hydrologic conditions.

- Develop management plans to improve habitat conditions.
- Restore vernal pool and alkali wetlands.

Northern California Legless Lizard

This RCIS and the ECCC HCP/NCCP include similar conservation objectives and actions to protect and improve habitat for northern California legless lizard, as follows.

- Protect occurrences of legless lizard and its habitat.
- Maintain or improve habitat for legless lizard, including avoiding and minimizing impacts to legless lizard and its habitat and managing vegetation using grazing and other methods.
- Control invasive plant species in habitats with sandy or loose, loamy soil to maintain sparse vegetation cover.

Alameda Whipsnake

This RCIS and the ECCC HCP/NCCP include similar conservation objectives and actions to protect and improve habitat for northern Alameda whipsnake, as follows.

- Protect occurrences of Alameda whipsnake and its habitat.
- Maintain or improve habitat for Alameda whipsnake by managing invasive species.
- Maintain or improve habitat for Alameda whipsnake by implementing management actions to improve habitat for Alameda whipsnake prey.

Giant Garter Snake

This RCIS and the ECCC HCP/NCCP include similar conservation objectives and actions to protect and improve habitat for northern giant garter snake, as follows.

- Protect habitat occupied by giant garter snake.
- Protect movement corridors for giant garter snake.
- Maintain or improve giant garter snake habitat by providing suitable amounts of water during the snake's active season.
- Provide and manage upland habitats and basking sites.
- Provide and manage emergent vegetation in canals for escape cover and foraging habitat.
- Restore giant garter snake habitat.

California Tiger Salamander and California Red-legged Frog

California tiger salamander and California red-legged frog use similar upland and aquatic habitats in the RCIS area. This RCIS and the ECCC HCP/NCCP include similar conservation objectives and actions to improve upland and aquatic habitat for California tiger salamander and California red-legged frog, as follows.

- Protect wetlands and ponds through land acquisitions/protection.
- Maintain or improve conditions in upland habitat by managing vegetation with grazing and other methods.

- Manage invasive, non-native wildlife that depredate and compete with California tiger salamander and California red-legged frog.
- Increase populations of ground squirrels and burrow habitat (for California tiger salamander).
- Manage ponds and wetlands to provide suitable amounts of vegetative cover.
- Restore and create habitat for California tiger salamander and California red-legged frog.
- Maintain native emergent vegetation where appropriate.
- Improve hydrologic conditions (e.g., hydroperiod, water quality, flows) of aquatic habitat.

Foothill Yellow-legged Frog

This RCIS and the ECCC HCP/NCCP include conservation objectives and actions to improve habitat for foothill yellow-legged frog, as follows.

- Protect species occurrences and habitat.
- Manage and restore riparian habitat.
- Manage invasive, non-native wildlife.
- Improve hydrologic conditions of aquatic habitat during key periods of the species' lifecycle.
- Increase the amount of suitable cobblestone substrate to provide breeding habitat.

Tricolored Blackbird

This RCIS and the ECCC HCP/NCCP include conservation objectives and actions to improve nesting and foraging habitat for tricolored blackbird, as follows.

- Protect wetland and pond habitat.
- Enhance and restore aquatic nesting habitat for tricolored blackbird.
- Manage vegetation and enhance pond and wetland habitat.
- Enhance foraging and breeding habitat by managing invasive vegetation.

Golden Eagle, Burrowing Owl, Swainson's Hawk

This RCIS and the ECCC HCP/NCCP include conservation objectives and actions to improve habitat for golden eagle, burrowing owl, Swainson's hawk as follows.

- Protect occurrences, including active or recently active nest trees and nest sites for each species
- Protect grassland habitats.
- Increase populations of ground squirrels and burrow habitat, which provide prey for golden eagle and Swainson's hawk, and burrows for burrowing owl.
- Enhance habitat by managing vegetation with grazing and other methods.
- Enhance habitat by discouraging the use of rodenticides on protected lands.
- Enhance burrowing owl habitat by creating artificial burrows to encourage use by burrowing owls.

San Joaquin Kit Fox

This RCIS and the ECCC HCP/NCCP include conservation objectives and actions to improve habitat for San Joaquin kit fox, as follows.

- Protect grassland habitat.
- Protect or enhance important movement routes for San Joaquin kit fox.
- Enhance habitat by managing grassland vegetation with grazing, invasive species and other methods.
- Enhance San Joaquin kit fox habitat by prohibiting the use of rodenticides on protected lands.
- Increase populations of ground squirrels and burrow habitat

Brittlescale, San Joaquin Spearscale, Mount Diablo Fairy Lantern, Recurved Larkspur, Round-leaved Filaree, Brewer's Western Flax, Showy Madia

This RCIS and the ECCC HCP/NCCP include conservation objectives and actions to improve habitat for brittlescale, San Joaquin spearscale, Mount Diablo fairy lantern, recurved larkspur, round-leaved filaree, Brewer's western flax and showy madia, as follows.

- Protect populations of covered plant species through land acquisition.
- Enhance occupied and potentially suitable habitat.
- Manage invasive vegetation.

3.10.1.2 Santa Clara Valley HCP/NCCP

The *Santa Clara Valley Habitat Plan* (Habitat Plan) (ICF International 2012), an HCP/NCCP, is a large, regional conservation plan primarily in Santa Clara County. The Habitat Plan includes an extended study area for burrowing owl conservation in the southwest corner of the RCIS area in Fremont and Newark in Alameda County. Because conservation opportunities for burrowing owl were limited in the Santa Clara County permit area, the Habitat Plan proponents extended the study area into Alameda County as a means to increase local populations. The allowable activities covered by the Habitat Plan in the expanded study area are limited only to conservation actions for burrowing owl.

This RCIS's conservation goals, objectives, and actions are consistent with, and complementary to, the Habitat Plan's biological goals, objectives, and conservation actions for burrowing owl. This RCIS has conservation goals and objectives for burrowing owl similar to the biological goals and objectives of the Habitat Plan, as the Habitat Plan was used to inform development of this RCIS's burrowing owl conservation strategy. This RCIS and the Habitat Plan include conservation objectives and actions to improve habitat for burrowing owl, as follows.

- Enhance burrowing owl habitat by managing vegetation with grazing and other methods.
- Enhance burrowing owl habitat by prohibiting the use of rodenticides on protected lands.
- Enhance burrowing owl habitat by creating artificial burrows to encourage use by burrowing owls.

3.10.1.3 PG&E Bay Area Operations and Maintenance HCP

The *PG&E Bay Area O&M Habitat Conservation Plan* (PG&E O&M HCP; ICF 2017) addresses impacts from day-to-day operation and maintenance activities as well as large maintenance projects that require extensive planning and coordination. The purpose of the Bay Area O&M HCP is to enable PG&E to continue to conduct covered activities in the Bay Area while avoiding and minimizing impacts on covered species and mitigating for impacts on covered species' habitats. The geographic scope of PG&E's O&M HCP study area includes the nine California counties that surround San Francisco Bay: Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco (Plan Area). The Plan Area (where all activities covered under the HCP occur) consists of PG&E gas and electric transmission and distribution facilities, plus right of ways (ROWs), the lands owned by PG&E and/or subject to PG&E easements to maintain these facilities, private access routes associated with PG&E's routine maintenance, a buffer around the ROWs, and mitigation areas acquired to mitigate for impacts resulting from covered activities. Plan Area encompasses approximately 402,440 acres and both the RCIS and the PG&E O&M HCP cover Contra Costa and Alameda Counties. Within the Plan Area, approximately 128,735 acres are in natural land-cover types, many of which support endangered or threatened species' habitat.

PG&E received incidental take authorization through the PG&E O&M HCP for 33 routine O&M activities, minor new construction, and Community Pipeline Safety Initiative activities for its electric and gas transmission and distribution systems affecting 18 covered wildlife and 13 plant species. Of the covered species, 11 are RCIS focal species: vernal pool fairy shrimp, vernal pool tadpole shrimp, longhorn fairy shrimp, callippe silverspot butterfly, California tiger salamander (Central California distinct population segment), California red-legged frog, Alameda whipsnake, San Joaquin kit fox, pallid manzanita, Brewer's dwarf flax, and Contra Costa goldfields.

The PG&E O&M HCP's conservation strategy is guided by the following five key principles.

- The avoidance and minimization of impacts is ensured by a thorough review of covered activities via environmental impact review, planning, and screening.
- Avoiding impacts on habitat (i.e., implementing AMMs and BMPs) is preferable to mitigating or preserving habitat offsite.
- Preserving lands for covered species with high-quality habitat or of high conservation value helps to build on other local and regional conservation efforts.
- Preserving large, contiguous areas of habitat is preferable to preserving a larger number of small areas.
- Habitat mitigation lands will be protected and managed in perpetuity.

The conservation strategies for this RCIS and the PG&E O&M HCP are consistent and compatible, as they both include conservation measures aimed at increasing populations of the 11 species listed above. This RCIS and the PG&E O&M HCP aim to 1) protect known occurrences; 2) protect potentially suitable habitat that potentially; and 3) includes management actions to improve protected habitats to increase population levels across the study area/RCIS area.

The PG&E O&M HCP aims to protect high-quality natural lands, especially those already supporting multiple covered species. Lands that do not require intensive management to maintain existing habitat quality, and those that provide opportunities for habitat enhancement will also receive high priority for acquisition as mitigation lands, similar to this RCIS. When mitigation for impacts to critical habitat is necessary, lands currently designated or proposed for designation as critical habitat, and which have the appropriate primary constituent elements, will be used. This RCIS recommends voluntary conservation priorities, including areas located within designated critical habitat of overlapping focal species. Because the PG&E O&M HCP doesn't identify specific locations for mitigation actions, and because the RCIS program is voluntary, there is no conflict between this RCIS and the PG&E O&M HCP.

3.10.1.4 Warmington Homes Assumption of The Bluffs Low Effect HCP

The *Warmington Homes Assumption of The Bluffs low-effect HCP* received incidental take coverage in 1999 for a permit term of 2 years. The permit area was 32.3 acres of California annual grassland. The HCP covered the San Joaquin kit fox and California tiger salamander, which are focal species in this RCIS. This RCIS is consistent with, and complements, the Warmington Homes Assumption of The Bluffs low-effect HCP by including actions for Section 3.8.4 *California Tiger Salamander* and Section 3.8.15.

3.10.1.5 East Bay Municipal Utility District HCP

The *East Bay Municipal Utility District Habitat Conservation Plan* (EBMUD HCP) addresses covered activities on watershed lands to meet its various obligations as a public entity to provide water service to its customers in the East Bay. The purpose of the EBMUD HCP is to enable EBMUD to continue to conduct covered activities within the plan area while avoiding and minimizing impacts on covered species and mitigating for impacts on covered species' habitats. The HCP covers land, which is primarily managed for protection of water quality in numerous reservoirs operated by EBMUD, in the Mt. Diablo Range, east of the cities of Berkeley, Oakland and San Leandro in Alameda County.

The EBMUD HCP was permitted in 2008 for a permit term of 30 years. EBMUD received take coverage within the 28,000-acre permit area for six covered species including the Central Valley steelhead, California red-legged frog, Alameda whipsnake, and pallid manzanita, which are also focal species in this RCIS. The EBMUD HCP's conservation strategy is guided by the following general biological goals.

- Maintain covered species habitats currently on EBMUD watershed lands within natural weather-driven variability.
- Protect the water quality by managing the watershed for high biodiversity.

This RCIS and the EBMUD HCP aim to 1) maintain and improve California red-legged frog, Alameda whipsnake, and pallid manzanita occurrences and habitat and 2) include management actions to improve protected habitats to increase population levels of and habitat quality across the plan area/RCIS area.

3.10.2 Approved Recovery Plans

California Fish and Game Code 1852(c)(11) states that an RCIS shall have "an explanation of whether and to what extent the strategy is consistent with any previously approved strategy or amended strategy, state or federal recovery plan, or other state or federal approved conservation strategy that overlaps with the strategy area."

There are 16 approved recovery plans that overlap the RCIS area. The purpose of recovery plans is to provide a framework for the conservation and survival of the listed species that focuses and prioritizes threat abatement and restoration actions necessary to recover, and eventually delist, a species. This section briefly summarizes those recovery plans and explains how this RCIS is consistent with these plans that overlap the RCIS area.

3.10.2.1 Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon

The USFWS approved the *Recovery Plan for Vernal Pool Ecosystems in California and Southern Oregon* (Vernal Pool Recovery Plan) in 2005 (U.S. Fish and Wildlife Service 2005a). The Vernal Pool Recovery Plan addresses 24 plants species, seven invertebrate species, and one animal species that occur exclusively or primarily on vernal pool complexes in California and Southern Oregon. These species are associated with vernal pools in several different landforms, geologic formations and soils types. Four of the species addressed in the Vernal Pool Recovery Plan are included as focal species in this RCIS: longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields. The conservation strategy for these focal species will also benefit the additional species included in the Vernal Pool Recovery Plan that occur in the RCIS area, including the unlisted species of concern.

The overall objective of the recovery plan is to protect self-sustaining populations of vernal pool species by eliminating threats throughout their range (U.S. Fish and Wildlife Service 2005a), which is achieved through the following three interim goals.

- Stabilize and protect populations.
- Conduct research.
- Down-list species to threatened when each species is no longer in danger of extinction.

Similar to this RCIS, the recovery plan presents a habitat-level strategy for recovery and conservation, because all of the listed species and species of concern co-occur in vernal pools. The likelihood of successful recovery for the listed species and species of concern addressed by the recovery plan is increased by protecting entire habitats. This approach facilitates species recovery and conservation but does not negate the need to consider the requirements of each species addressed by the recovery plan.

Recovery and long-term conservation objectives emphasized in the recovery plan include the following.

- Ameliorate or eliminate threats.
- Promote ecosystem processes and functions by protecting and conserving vernal pool complexes.

Actions which the recovery plan states will contribute to achieving these objectives include the following.

- Habitat protection.
- Adaptive habitat management, restoration, creation, and monitoring.
- Surveys for sensitive species.

- Research.
- Participation and outreach.

The conservation goals and objectives for vernal pool branchiopods in this RCIS (Section 3.8.1, *Vernal Pool Branchiopods*) address the core recovery objectives in the Vernal Pool Recovery Plan. The RCIS and recovery plan include actions to protect habitat and occurrences, conduct surveys, enhance degraded vernal pool habitat to improve ecological functions and process, restore and create vernal pool complexes where vernal pools historically occurred, but are no longer present, and inoculate unoccupied habitat. Additionally, the focal plant species section (Section 3.8.18) includes consistent objectives and actions (i.e., habitat protection and enhancement and focal species surveys) for Contra Costa goldfields modeled habitat (e.g., vernal pool and seasonal wetlands).

The recovery plan delineates core areas to identify locations that should be the initial focus for implementation of protection measures. There is one core area in Contra Costa County and one that spans Alameda and Contra Costa County: The Rodeo Creek Core Area and the Altamont Hills Core Area, respectively. There is also critical habitat designated for Contra Costa goldfields which is equivalent to the Rodeo Creek Core Area but covers only a portion of the Altamont Hills Core Area. Preservation and enhancement of core areas is important to maintain and possibly expand the distribution of the vernal pool species range wide. The RCIS maps very little of either core area as vernal pool habitat, except in the City of Livermore. Due to this, the RCIS prioritizes the protection, enhancement, and restoration of Contra Costa goldfields critical habitat, rather than the land cover type.

3.10.2.2 Recovery Plan for the ESU of Sacramento River Winter-Run Chinook Salmon, Central Valley Spring-Run Chinook Salmon, and DPS of Central Valley Steelhead

In 2014, NMFS released the *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 the Central Valley Steelhead* (Chinook and Steelhead Recovery Plan) (National Marine Fisheries Service 2014). The Sacramento River winter-run Chinook salmon evolutionarily significant unit (ESU) and the distinct population segment (DPS) of Central Valley steelhead addressed by the Chinook and Steelhead Recovery Plan are also East Bay RCIS focal species. The Chinook and Steelhead Recovery Plan addresses the conditions in the Sacramento-San Joaquin Delta that will increase survival for species emigrating into the Sacramento and San Joaquin Rivers.

The overarching goal of the Chinook and Steelhead Recovery Plan is the removal of the Sacramento River winter-run Chinook salmon ESU and Central Valley steelhead DPS from the Federal List of Endangered and Threatened Wildlife. According to NMFS (2014), recovery and long-term sustainability of an endangered or threatened species requires the following.

- Adequate reproduction for replacement of losses due to natural mortality factors (including disease and stochastic events).
- Sufficient genetic robustness to avoid inbreeding depression and allow adaptation.
- Sufficient habitat (type, amount, and quality) for long-term population maintenance.

- Elimination or control of threats (this may also include having adequate regulatory mechanisms in place).

The Chinook and Steelhead Recovery Plan organizes biological objectives and criteria for achieving those objectives at the population, diversity group,[20] and ESU/DPS levels. The Chinook and Steelhead Recovery Plan also identifies critical recovery actions for the Central Valley, as well as watershed- and site-specific recovery actions. Watershed-specific recovery actions address threats in each of the rivers or creeks that currently support spawning populations of the Sacramento River winter-run Chinook salmon ESU and the Central Valley steelhead DPS. Site-specific recovery actions address threats to these species occurring within a migration corridor (e.g., San Francisco Bay or the Delta).

The recovery actions are organized according to geographic region. Four regions overlap the RCIS area: Throughout California, the Pacific Ocean, the San Francisco, San Pablo, and Suisun Bay, and the Delta.

The goals, objectives, conservation actions, and priorities for this East Bay RCIS were informed by the recovery actions described in the recovery plan. As such, this RCIS is consistent and compatible with the Chinook and Steelhead Recovery Plan. Sacramento River winter-run Chinook salmon ESU and Central Valley steelhead DPS use the Delta and San Francisco Bay in the RCIS area for migration and rearing. The Chinook and Steelhead Recovery Plan includes detailed recovery actions presented in a series of tables for each geographic region. Recovery actions addressed by this RCIS include the following general types of recovery actions.

- Acquire habitat to minimize potential impacts from urbanization.
- Restore and enhance, aquatic, riparian and floodplain ecosystems to provide a diversity of migration and rearing habitat types.
- Minimize the effects of non-native predators of salmonids and steelhead.

Implementing the RCIS conservation strategy to benefit Sacramento River winter-run Chinook salmon ESU and Central Valley steelhead DPS species will therefore contribute to the recovery plan's objectives.

3.10.2.3 Coastal Multispecies Final Recovery Plan: California Coastal Chinook Salmon ESU, Northern California Steelhead DPS, and Central California Coast Steelhead DPS

The National Marine Fisheries Service approved the *Coastal Multispecies Recovery Plan for California Coastal Chinook Salmon, Northern California Steelhead, and Central California Coast Steelhead* (Chinook and Steelhead Coastal Recovery Plan) (National Marine Fisheries Service 2016). Central California Coast steelhead is the only species of the three addressed in this recovery plan that occurs in the RCIS area (Figure F-6, Appendix F). The Chinook and Steelhead Coastal Recovery Plan addresses the Central California Coast distinct population segment (DPS), including five steelhead diversity strata,[21] one of which occurs in the RCIS area (the Interior San Francisco Bay diversity

[20] The recovery plan (National Marine Fisheries Service 2014) identifies population groups, or salmonid ecoregions, as diversity groups.

[21] Diversity Strata are geographically distinct areas with similar environmental conditions (National Marine Fisheries Service 2016).

stratum), covering the entire RCIS area, including Pinole Creek, Wildcat Creek, San Pablo Creek, Codornices Creek, San Leandro Creek, San Lorenzo Creek, and Alameda Creek.

The goal of the Chinook and Steelhead Coastal Recovery Plan is to remove the Central California Coast steelhead DPS from the federal list of endangered and threatened wildlife due to its recovery. The recovery plan objectives are to achieve the following.

- Reduce the present or threatened destruction, modification, or curtailment of habitat or range.
- Ameliorate utilization of Central California Coastal steelhead DPS for commercial, recreational, scientific, or educational purposes.
- Abate disease and predation.
- Establish the adequacy of existing regulatory mechanisms for protecting Central California Coastal steelhead DPS now and into the future (i.e., post-delisting).
- Address other natural or manmade factors affecting the continued existence of Central California Coastal steelhead DPS.
- Ensure Central California Coastal steelhead DPS is at a low risk of extinction based on abundance, growth rate, spatial recovery, and diversity.

The Chinook and Steelhead Coastal Recovery Plan provides detailed recovery actions for Central California Coast steelhead at the DPS level, for each diversity stratum, and each watershed within diversity stratum. Actions at all levels addressing targeted habitat attribute (e.g., floodplain, estuary, riparian, etc.) or threats for the diversity strata that occur in the RCIS area are listed in Table 3-12.

Actions described in the recovery plan are prioritized as the following.

- Priority 1. An action that must be taken to prevent extinction or to identify those actions necessary to prevent extinction.
- Priority 2. An action that must be taken to prevent a significant decline in population numbers, habitat quality, or other significant negative impacts short of extinction.
- Priority 3. All other actions necessary to provide for full recovery of the species.

The goals, objectives, actions, and priorities for this East Bay RCIS were informed by the actions described in the Chinook and Steelhead Coastal Recovery Plan for the diversity strata that occur in the RCIS area. As such, this RCIS is consistent and compatible with the Chinook and Steelhead Coastal Recovery Plan. Implementation of this RCIS's actions and habitat enhancements for Central California Coast Steelhead (Section 3.8.3), and the baylands (Section 3.9.3) will therefore contribute to the Chinook and Steelhead Coastal Recovery Plan's goal to recover the Central California Coast steelhead DPS and objectives by the following.

- Reducing the present or threatened destruction, modification, or curtailment of habitat or range.
- Addressing other natural or manmade factors affecting the continued existence of Central California Coast steelhead DPS.

Table 3-12 identifies this RCIS' actions that address the targeted attributes or threats identified in the Chinook and Steelhead Coastal Recovery Plan for the RCIS area.

Table 3-12. East Bay RCIS Actions that Address the Targeted Attributes and Threats Identified in the Coastal Multispecies Recovery Plan

Targeted Attribute or Threat from the Coastal Multispecies Recovery Plan Identified in the RCIS Area	East Bay RCIS Actions that Address Targeted Attribute or Threats Identified in the Coastal Multispecies Recovery Plan
Estuaries	BAY1-4, SS-9-11
Floodplain connectivity	SS-4
Hydrology	SS-5, SS-6
Passage	SS-7, SS-8
Habitat complexity	SS-1, SS-3-6, SS-9-11
Riparian	SS-4, ULCT-2
Sediment	SS-5, SS-6, SS-7, SS-9-11
Water quality	SS-3, SS-4, SS-6, SS-9, SS-10
Viability	SS-1-11
Channel modification	SS-3, SS-4, SS-7, SS-8
Disease/predation/competition	SS-3, SS-4, SS-9-11
Fishing/collecting	N/A
Hatcheries	N/A
Livestock	WL-1-6
Mining	N/A
Recreation	N/A
Residential/commercial development	SS-1-6
Roads/railroads	SS-8
Severe weather patterns	N/A
Water diversions/impoundments	SS-6

3.10.2.4 Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California

The USFWS approved the *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (Tidal Marsh Recovery Plan) (U.S. Fish and Wildlife Service 2013a). The Tidal Marsh Recovery Plan focuses on five endangered species: two endangered animals, California clapper rail (*Rallus longirostris obsoletus*) and salt marsh harvest mouse (*Reithrodontomys raviventris*), and three endangered plants, Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*), soft bird's beak (*Chloropyron molle* ssp. *molle*), and California sea-blite (*Suaeda californica*). In addition, the Tidal Marsh Recovery Plan addresses 11 species or subspecies of concern. These include the salt marsh wandering shrew (*Sorex vagrans halicoetes*), Suisun shrew (*S. ornatus sinuosus*), San Pablo vole (*Microtus californicus sanpabloensis*), California black rail (*Laterallus jamaicensis coturniculus*), three song sparrow subspecies of the San Francisco Bay Estuary (Alameda song sparrow [*Melospiza melodia ssp. pusillula*], Suisun song sparrow [*M.m. maxillaris*], and San Pablo song sparrow [*M.m. samuelis*]), saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*), old man tiger beetle (*Cicindela senilis senilis*), delta tule pea (*Lathyrus jepsonii* ssp. *jepsonii*), and Pacific cordgrass (*Spartina foliosa*). Recovery goals and objectives were only set for listed species, with the assumption that species of concern would also benefit from completion of those goals and objectives, since they occur in the same habitat types and locations.

The Tidal Marsh Recovery Plan describes five recovery units: Suisun Bay Area, San Pablo Bay, Central/South San Francisco Bay, Central Coast, and Morro Bay. The East Bay RCIS falls within the Central/South San Francisco Bay Recovery Unit, which supports all of the endangered and species or subspecies of concern, expect for Suisun thistle, which is found only in Suisun Marsh in Solano County.

Species that occur in the saltmarsh habitats in the RCIS area were excluded as focal species in this RCIS (expect for California black rail) because there are many planning efforts underway that address these species. Instead of including tidal marsh species as focal species in this RCIS, and creating new conservation goals, objectives, actions, and priorities, the RCIS includes a conservation strategy for the baylands. The goal of the baylands conservation strategy is to maintain and restore a functional ecosystem for the species therein through habitat protection, enhancement, and restoration. In addition, Appendix H of the RCIS consolidates information from the existing plans and strategies for the baylands, including the Tidal Marsh Recovery Plan. Appendix H is organized by species, to provide a species-specific guide for existing conservation strategies. This appendix is meant to serve as a guide for implementing conservation and habitat enhancement actions in the baylands in the RCIS area.

Achieving the baylands conservation strategy is consistent with, and will contribute to achieving, the Tidal Marsh Recovery Plan objectives to do the following.

- 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.

This RCIS also includes an action that recommends conducting studies to investigate key data gaps for species that occur in the baylands in the RCIS area. This action is consistent with the Tidal Marsh Recovery Plan's ecosystem-level recovery strategy to conduct range-wide species status surveys for listed species and species of concern, and to conduct research necessary for the recovery of listed species and the long-term conservation of species of concern (U.S. Fish and Wildlife Service 2013a).

3.10.2.5 Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area

U. S. Fish and Wildlife Service approved the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (Serpentine Soils Recovery Plan) in 1998 (U.S. Fish and Wildlife Service 1998b). The recovery plan features 28 species of plants and animals that occur exclusively or primarily on serpentine soils and serpentine grasslands in the San Francisco Bay Area, including three that are RCIS focal species (fragrant fritillary, Presidio clarkia, and most beautiful jewelflower). These species occur in dry, nutrient-poor, serpentine soil grasslands of the greater San Francisco Bay Area and the adjacent foothills and valleys, including the serpentine grasslands of the RCIS area (Figure 2-15).

The overall objective of the Serpentine Soils Recovery Plan is to delist federally listed covered species and ensure the long-term conservation of covered species of concern. Interim goals include stabilizing and protecting populations, conducting research necessary to refine classification and recovery criteria, and reclassifying to threatened species currently listed as endangered.

The Serpentine Soils Recovery Plan presents a community-level strategy for recovery and conservation, because all of the listed species and species of concern co-occur in the same natural community. The likelihood of successful recovery for the listed species addressed by the Serpentine Soils Recovery Plan is increased by protecting entire communities, and by doing so, conservation of species of concern also addressed by the Serpentine Soils Recovery Plan is possible. The community-level approach facilitates species recovery and conservation but does not negate the need to consider the requirements of each species addressed by the recovery plan.

Recovery and long-term conservation tasks emphasized in the Serpentine Soils Recovery Plan are the following.

- Habitat protection
- Habitat management and restoration, including removal of invasive non-native species
- Surveying and monitoring
- Ex-situ conservation, such as artificial rearing and seed banking
- Research
- Public participation, outreach, and education

The Serpentine Soils Recovery Plan identifies high priority protection areas of two general types: 1) areas currently occupied by, or providing potential habitat for several species covered in the plan, and 2) areas that are currently occupied by, or providing potential habitat for, only a single species covered in the plan.

The goals, objectives, actions, and priorities for Focal Plant Species with Habitat Distribution Models (Section 3.8.18), Unique Land Cover Types (Section 3.9.5), and Important Soil Types (Section 3.9.6) for this East Bay RCIS were informed by the six elements listed above that compose the recovery plan's community-level recovery and conservation strategy, as outlined below. As such, this RCIS is consistent and compatible with the Serpentine Soils Recovery Plan.

Habitat protection. This RCIS prioritizes the protection of occupied habitat for focal plant species, including fragrant fritillary, Presidio clarkia, and most beautiful jewelflower Furthermore, this RCIS includes goals and objectives to protect unique land cover types, such as serpentine grasslands, and serpentine soil.

Habitat management and restoration, including removal of invasive non-native species. The East Bay RCIS identifies objectives and actions for fragrant fritillary, Presidio clarkia, and most beautiful jewelflower to enhance habitat, such as the removal of invasive species or prescribed burns. Furthermore, this RCIS includes objectives and actions to enhance serpentine grasslands and habitats on serpentine soils in the RCIS area to benefit other species that rely on serpentine habitats.

Surveying and monitoring. This RCIS includes actions to conduct surveys to locate new occurrences of fragrant fritillary, Presidio clarkia, and most beautiful jewelflower. This RCIS also includes a monitoring and adaptive management strategy (Section 3.11, *Monitoring and Adaptive*

Management Strategy) that can be used to develop monitoring and adaptive management plans for serpentine grasslands managed by entities or individuals interested in managing habitat to benefit serpentine species, and for use in MCAs.

Ex-situ conservation, such as artificial rearing and seed banking. This RCIS includes actions for fragrant fritillary, Presidio clarkia, and most beautiful jewelflower to bank seeds for future use in reintroduction and to restore and establish occurrences of these species.

Research. This RCIS includes actions that recommend conducting research to inform management of fragrant fritillary, Presidio clarkia, and most beautiful jewelflower.

Public participation, outreach, and education. The conservation strategy for unique land cover types (Section 3.9.5), which includes serpentine grasslands, identifies the need for outreach with private and public land managers in the RCIS area. This includes actions to develop a management guide for the unique land cover types and offering incentives for land managers to retain and enhance habitat for the focal species (including those that occur in serpentine grasslands/serpentine soils).

3.10.2.6 Recovery Plan for the Central California Distinct Population Segment of California Tiger Salamander

The U. S. Fish and Wildlife Service approved the *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander* (California Tiger Salamander Recovery Plan) in 2017 (U.S. Fish and Wildlife Service 2017a). The goal of the California Tiger Salamander Recovery Plan is to reduce the threats to the Central California tiger salamander to ensure its long-term viability in the wild and allow for its removal from the list of threatened and endangered species. The California Tiger Salamander Recovery Plan classified the range of the Central California tiger salamander into four recovery units. These recovery units are not regulatory in nature; the boundaries of the recovery units do not identify individual properties that require protection, but they are described solely to facilitate recovery and management decisions. The recovery units are the Central Valley Recovery Unit, the Southern San Joaquin Valley Recovery Unit, the Bay Area Recovery Unit, and the Central Coast Range Recovery Unit. The Bay Area Recovery Unit overlaps with the RCIS area.

The California Tiger Salamander Recovery Plan's strategy to recover the Distinct Population Segment (DPS) of Central California tiger salamander focuses on alleviating the threat of habitat loss and fragmentation to increase population resiliency (ensure each population is sufficiently large to withstand stochastic events), redundancy (ensure a sufficient number of populations to provide a margin of safety for the species to withstand catastrophic events), and representation (conserve the breadth of the genetic makeup of the species to conserve its adaptive capabilities) (U.S. Fish and Wildlife Service 2017a). The California Tiger Salamander Recovery Plan includes the following objectives.

- Secure self-sustaining populations of Central California tiger salamander throughout the full range of the DPS, ensuring conservation of native genetic variability and diverse habitat types (e.g., across elevation and precipitation gradients).
- Ameliorate or eliminate the threats that caused the species to be listed, and any future threats.
- Restore and conserve a healthy ecosystem supportive of Central California tiger salamander populations.

Several recovery actions are identified in the Implementation Schedule for the Central California Tiger Salamander, starting on page III-14 of the California Tiger Salamander Recovery Plan. Those actions are grouped into the following seven categories.

- Maintain current distribution of species.
- Maintain genetic structure across the species range.
- Reduce road mortality.
- Reduce the risk of introduction of diseases (e.g., ranaviruses, chytrid fungi, or other pathogens) within preserves.
- Reduce levels of non-native predator species within preserves.
- Develop and implement adaptive management and monitoring plans for protected habitat counted toward recovery.
- Monitor trends to gain a better understanding of population health, trends in habitat loss, and other information that will help to guide conservation planning for the Central California tiger salamander.

The conservation goals and objectives listed for California tiger salamander in the RCIS (Section 3.8.4) address all of the high-level recovery actions in the California Tiger Salamander Recovery Plan, listed above. Objective 5-1 adapts the preserve recovery goals for management units overlapping the RCIS area for use in this RCIS. Specifically, the objective is to protect at least nine preserves, each at least 3,398 acres in size, containing at least four breeding ponds in areas not dominated by hybrid or non-native tiger salamanders, within a matrix of upland habitat (e.g., upland habitat within typical movement distance [1.3 miles] of breeding ponds), distributed across the California tiger salamander management units overlapping the RCIS area identified in the California Tiger Salamander Recovery Plan.

The California Tiger Salamander Recovery Plan has much more detailed actions than the RCIS, but the actions are generally consistent. Certainly, the primary objectives to protect existing habitat across the range and reduce threats from non-native species are centerpieces of both the RCIS and California Tiger Salamander Recovery Plan. The RCIS conservation strategy for California tiger salamander has actions to protect habitat, improve breeding habitat and upland habit through a variety of management techniques, restore degraded habitat and/or create California tiger salamander habitat.

The RCIS, which also includes a conservation strategy for *Habitat Connectivity and Landscape Linkages* (3.8.1), includes Action HC-2 to identify road crossings for the focal species and remove barriers and/or install or repair crossings, which is consistent with the California Tiger Salamander Recovery Plan's goal of reducing road morality. The RCIS also includes Objective 5-5 and Actions CTS-15 and 16 to assess and manage ponds to provide habitat that favors native California tiger salamanders over California tiger salamander – barred tiger salamander hybrids, which is consistent with California Tiger Salamander Recovery Plan's goal to maintain genetic structure across the species range. As such, this RCIS is consistent and compatible with the California Tiger Salamander Recovery Plan.

3.10.2.7 Recovery Plan for the California Red-legged Frog

The U.S. Fish and Wildlife Service approved *The Recovery Plan for the California Red-legged Frog* (California Red-legged Frog Recovery Plan) in 2002 (U.S. Fish and Wildlife Service 2002a). The goal of the California Red-legged Frog Recovery Plan is to recover the species, with specific objectives related to the number and distribution of the species across its range. There are eight recovery units identified in the California Red-legged Frog Recovery Plan. One of those units (South and East San Francisco Bay) overlaps the RCIS area. Within those recovery units, there is one Core Recovery Area (East San Francisco Bay). This Core Recovery Area is currently occupied and considered to have a source population (i.e., a population that produces excess individuals that may be able to disperse to other areas and populations).

Table 3-13 details the conservation needs in the East San Francisco Bay Core Area in the California Red-legged Frog Recovery Plan. The table also lists the objectives and actions in the RCIS that will help to address those needs. If needs are not addressed by the RCIS goals and objectives the reason is given.

Table 3-13. California Red-legged Frog Recovery Plan Conservation Needs and the RCIS Goals and Objectives

Conservation Need Identified in for the East San Francisco Bay Core Area	RCIS Objectives and Actions that Support Conservation Need
Protect existing populations	Objectives 7-1, 7-2, 7-3, 7-4
Control non-native predators	Action CRLF-5
Study effects of grazing in riparian corridors, ponds, and uplands	This conservation need is not explicitly addressed in this RCIS; however, Actions CRLF-7 and CRFL-9 are intended to address impacts from grazing.
Reduce impacts associated with livestock grazing	Action CRLF-4, CRLF-7
Protect habitat connectivity	Objectives 7-1, 7-2, 7-3, 7-4, 20-1, 20-2
Minimize effects of recreation and off-road vehicle use	The RCIS has no authority to implement park and open space policy.
Avoid and reduce impacts of urbanization	The RCIS has no authority to dictate local land use policies, though Objectives 7-1, 7-2, 7-3, 7-4 focus on the protection, enhancement, and restoration of habitat. Those areas would be protected from future urbanization.
Protect habitat buffers from nearby urbanization	The RCIS has no authority to dictate local land use policies, though Objectives 7-1, 7-2, 7-3, 7-4 focus on the protection, enhancement, and restoration of habitat. Those areas would be protected from future urbanization. Also, the overall guidance of the conservation strategy to expand and connect existing habitats and to connect protected areas will help to buffer protected habitat from nearby urbanization.

3.10.2.8 Recovery Plan for the Giant Garter Snake

In 2017, the U.S. Fish and Wildlife Service approved the *Recovery Plan for Giant Garter Snake* (Giant Garter Snake Recovery Plan) (U.S. Fish and Wildlife Service 2017c). The strategy to recover the giant garter snake focuses on protecting existing occupied habitat and identifying and protecting areas for habitat restoration, enhancement, and creation including areas that provide connectivity between populations. An essential part of the strategy is to ensure water is available in aquatic habitat during the summer active season.

USFWS defined nine recovery units that correspond directly to the nine geographically and genetically distinct populations, to aid in recovery planning: Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin, Delta Basin, Cosumnes-Mokelumne Basin, San Joaquin Basin, and Tulare Basin. One of the recovery units (Delta Basin) overlaps with the RCIS area.

The goal of the Giant Garter Snake Recovery Plan is to reduce the threats to the giant garter snake to ensure its long-term viability in the wild and allow for its removal from the list of threatened and endangered species. The Giant Garter Snake Recovery Plan lists the following three objectives to achieve this goal.

- Protect existing populations and establish (and protect) self-sustaining populations of the giant garter snake throughout the full ecological, geographical, and genetic range of the species.
- Restore and conserve healthy Central Valley wetland ecosystems that function to support the giant garter snake.
- Reduce or eliminate threats that cause the species to be listed, and any foreseeable future threats.

The goal, objectives, actions, and priorities for giant garter snake in this RCIS (Section 3.8.9, *Giant Garter Snake*) were informed by, and are consistent with, the recovery actions described in the Giant Garter Snake Recovery Plan. This RCIS includes the following conservation goals, objectives, actions and priorities to benefit giant garter snake.

- Protect large interconnected blocks of giant garter snake habitat.
- Conduct surveys in habitat and targeted studies to identify corridors.
- Enhance and restore aquatic and upland habitat.
- Improve water quality and ensure summer water is available.
- Provide incentives to encourage private landowners to appropriately manage habitat for giant garter snake.
- Provide incentives to private landowners to maintain water in canals and ditches during the snake's active season in times of drought
- Monitor giant garter snake populations.

Implementing the RCIS conservation strategy to benefit giant garter snake will therefore contribute toward achieving the Giant Garter Snake Recovery Plan's objectives.

3.10.2.9 Recovery Plan for Tidewater Goby

In 2005, the U.S. Fish and Wildlife Service approved the *Recovery Plan for Tidewater Goby* (Tidewater Goby Recovery Plan) (U.S. Fish and Wildlife Service 2005b). The goal of the Tidewater Goby Recovery Plan is to conserve and recover the tidewater goby (*Eucyclogobius newberryi*) by managing threats and perpetuating viable metapopulations within each recovery unit while maintaining morphological and genetic adaptations to local and environmental conditions (U.S. Fish and Wildlife Service 2005b). Although tidewater goby is not a focal species in this RCIS, implementing the baylands conservation strategy (Section 3.9.3) and the steelhead and salmon conservation strategy (Section 3.8.3) will benefit tidewater goby and its habitat and will therefore contribute toward achieving the Tidewater Goby Recovery Plan's goals and objectives.

The USFWS defined six recovery units that are based on regional clades (i.e., a population or populations that have evolved from a common ancestor) with morphological differences. Where data are lacking, recovery units are based on geomorphology. The recovery units are further divided into 26 sub-units. The Tidewater Goby Recovery Plan also identified 29 potential introduction and reintroduction sites. The six recovery units are defined as the North Coast Unit, Greater Bay Unit, Central Coast Unit, Conception Unit, LA/Ventura Unit, and the South Coast Unit. The RCIS area falls within the Greater Bay Unit and Sub-Unit GB4, which includes Marin, Alameda, Contra Costa, San Francisco, and San Mateo Counties. Within Sub-Unit GB4, the Tidewater Goby Recovery Plan calls out the following available tidewater goby habitat: Strawberry Creek and Lake Merritt in Alameda County.

The Tidewater Goby Recovery Plan's strategy to recover the tidewater goby is to do the following.

- Preserve the diversity of tidewater goby habitats throughout its range.
- Preserve the natural processes of recolonization and population exchange that enable population recovery following catastrophic events.
- Preserve the genetic diversity of tidewater goby.

The baylands conservation strategy is intended to protect habitat and manage tidal and subtidal communities to benefit all native (i.e., unlisted), rare, threatened, and endangered species that occur therein, through habitat acquisition, enhancement, restoration and creation. The baylands conservation strategy also includes an action to conduct research on key data gaps, which is consistent with the goal to conduct studies on specific topics related to tidewater goby listed in the recovery plan.

Goal 4, Objective 4.1, and Actions SS-9 – SS-11 recommend restoring and enhancing estuaries, tidal wetlands, and associated ecosystems to improve rearing and migration habitat for winter-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead in the bays, estuary, and Delta within the RCIS area. Implementing these actions will also improve habitat for tidewater goby. As such, this RCIS is consistent and compatible with the Tidewater Goby Recovery Plan.

3.10.2.10 Recovery Plan for Large-flowered Fiddleneck

In 1998, the U.S. Fish and Wildlife Service approved the *Recovery Plan for Large-flowered Fiddleneck* (Large-flowered Fiddleneck Recovery Plan) (U.S. Fish and Wildlife Service 1997). Large-flowered fiddleneck (*Amsinckia grandiflora*) is not a focal species but will be benefit from the conservation strategy, particularly for the focal plant species. The recovery strategy for large-flowered fiddleneck has two overarching goals: 1) increase the size of existing populations and establish new ones in the historic range for this species 2) restore the ecological conditions of native perennial bunchgrass communities at population sites.

The Large-flowered Fiddleneck Recovery Plan identifies three geographic regions: 1) north of Mt. Diablo, 2) south of Mt. Diablo and north of Highway 580, and 3) south of Highway 580, where six management areas (two in each region) will be established. The recovery strategy focuses on the management and restoration of occupied native grassland habitat through invasive species management, livestock grazing, prescribing burning with the intent to re-establish a functional community that approximately the natural community in which large-flowered fiddleneck evolved.

Many of the focal plant species included in this RCIS occur in grassland habitat, such as big tarplant or Congdon's tarplant, and face the same threats as large-flowered fiddleneck. The conservation strategy for the focal plant species seeks to protect and enhance grassland habitat through land acquisition, invasive plant species management, prescribed burning and livestock grazing, which is consistent with the goals and actions in the Large-flowered Fiddleneck Recovery Plan. In addition, the working lands conservation strategy and some of the focal species conservation strategies, such as golden eagle, will contribute to large-flowered fiddleneck habitat enhancement. As such, this RCIS is consistent and compatible with the Large-flowered Fiddleneck Recovery Plan.

3.10.2.11 Recovery Plan for Pallid Manzanita

In 2015, the U.S. Fish and Wildlife Service approved the *Recovery Plan for Pallid Manzanita* (U.S. Fish and Wildlife Service 2015). In many ways, the Recovery Plan for Pallid Manzanita serves as a management plan, with the ultimate goal of identifying specific actions that will reduce the threats to the species, ensure its long term viability, and allow for its removal from the federal list of endangered and threatened species. The primary management goal of the Recovery Plan for Pallid Manzanita is to maximize seed production and ensure the soil seed bank is adequate to replace a stand in the event of fire.

The Recovery Plan for Pallid Manzanita includes the following recovery objectives:

- Minimize the spread of *Phytophthora cinnamomi*.
- Treat stands infected with *Phytophthora cinnamomi*.
- Manage native and non-native vegetation that shade *Arctostaphylos pallida*.
- Expand existing stands.
- Establish additional stands.
- Ensure stands are protected from incompatible uses and incompatible wildfire fuels reduction activities.

The goal, objectives, actions, and priorities for the focal plants without habitat distribution models in this RCIS (Section 3.8.17) were informed by and are consistent and compatible with the recovery actions described in the Recovery Plan for Pallid Manzanita. This RCIS includes conservation goals, objectives, actions and priorities to (Section 3.8.17.1, *Conservation Goals, Objectives, and Actions*):

- Acquire parcels with unprotected occurrences and suitable habitat and enhance habitat with known occurrences on protected land.

- Conduct surveys to identify additional occurrences.
- Enhance habitat through focused management, including invasive vegetation removal and prescribed burning.
- Conduct targeted studies to determine the species management and micro-habitat needs and pilot projects to determine suitable propagation and planting techniques.
- Address the issue of *Phytophthora* through research, treatment, avoidance and mitigation techniques, and public outreach and education.

The RCIS conservation strategy addresses all of the objectives from the Recovery Plan for Pallid Manzanita in the conservation strategy for pallid manzanita (Section 3.8.17.2, *Species-Specific Conservation Priorities*) by including actions to protect of occurrences and habitat and manage habitat. The RCIS also prioritizes an action to limit the spread of *Phytophthora* species to achieve Objective 18-4, as pallid manzanita is susceptible to disease caused by *Phytophthora* species. Implementing the RCIS conservation strategy to benefit pallid manzanita will therefore contribute toward achieving the Recovery Plan for Pallid Manzanita's objectives. As such, this RCIS is consistent and compatible with the Recovery Plan for Pallid Manzanita.

3.10.2.12 Recovery Plan for Western Snowy Plover Pacific Coast Population

In 2007, the U.S. Fish and Wildlife Service approved the *Recovery Plan for Western Snowy Plover Pacific Coast Population* (Western Snowy Plover Recovery Plan) (U.S. Fish and Wildlife Service 2007). The goal of the Western Snowy Plover Recovery Plan is to ensure the long-term viability of the Pacific coast western snowy plover (*Charadrius nivosus nivosus*) population so that may be removed from the federal endangered and threatened species list. Western snowy plover is treated as a non-focal species by this RCIS and will be benefit from the baylands conservation strategy. The Western Snowy Plover Recovery Plan has the following three objectives.

- Increase population numbers distributed across the range of the Pacific coast population of the western snowy plover.
- Conduct intensive ongoing management for the species and its habitat and develop mechanisms to ensure management in perpetuity.
- Monitor western snowy plover populations and threats to determine success of recovery actions and refine management actions.

The Western Snowy Plover Recovery Plan has been divided into six recovery units that encompass all the known breeding and wintering sites for the Pacific coast populations of western snowy plover. The six recovery units are Washington and Oregon, Del Norte to Mendocino Counties, California, San Francisco Bay, California, Sonoma to Monterey Counties, California, San Luis Obispo to Ventura Counties, California, and Los Angeles to San Diego Counties, California. The RCIS area overlaps with the San Francisco Bay, California recovery unit and includes 12 breeding and wintering sub-units: Alameda Naval Air Station (CA-27), Alameda South Shore (CA-28), Oakland Airport (CA-30), Oliver Salt Ponds, north of Highway 92 (CA-31), Oliver Salt Ponds, south of Highway 92 (CA-32), Baumberg Salt Ponds (CA-33), Turk Island Salt Ponds (CA-34), Coyote Hills Salt ponds (CA-35), Dumbarton Salt Ponds (CA-36), Plummer Creek Salt Ponds (CA-37), Mowry Salt Ponds (CA-38), and the Warm Springs Salt Ponds (CA-39). There are no sub-units identified in

Contra Costa County. The Western Snowy Plover Recovery Plan identifies distinct population goals for each recovery unit; the San Francisco Bay, California recovery unit subpopulation goal is 500 breeding adults, which includes sub-units outside of the RCIS area.

Implementing the actions to achieve the goal and objectives of the Bayland conservation strategy (Section 3.9.3) will benefit western snowy plover. The goal and objectives of the baylands conservation strategy is to maintain and restore functional baylands land cover types (deep bay, shallow bay, tidal vegetation etc.) to protect habitat for native species and provide ecosystem services (e.g., natural flood protection). The conservation strategy objective specifically seeks to conserve habitat for listed species, which includes the Pacific coast population of the western snowy plover. The baylands conservation strategy includes an action to conduct research on the key data gaps for both focal and non-focal species which will contribute to the third WSP Recovery Plan objective. Appendix H consolidates information from the existing plans and strategies for the baylands and including strategies to benefit western snowy plover. The intent of Appendix H is to provide a species-specific guide for the existing conservation strategies; as such, this RCIS is consistent and compatible with the Western Snowy Plover Recovery Plan.

3.10.2.13 Recovery Plan for California Least Tern

In 1985, the U.S. Fish and Wildlife Service approved the *Revised California Least Tern Recovery Plan* (California Least Tern Recovery Plan) (U.S. Fish and Wildlife Service 1985). California least tern (*Sterna antillarum browni*) is not a focal species but occurs in the RCIS area and will be benefit from the baylands conservation strategy. The primary goal of the California Least Tern Recovery Plan is to restore and subsequently maintain the breeding population of California least terns at a secure level so that delisting can be considered. Breeding locations identified in the California Least Tern Recovery Plan include the Alameda Naval Air Station, Oakland Airport, and Alvarado Salt Ponds in Alameda County. No breeding locations are identified in Contra Costa County. The California Least Tern Recovery Plan states that for this to be achieved, the California breeding population must be a least 1,200 pairs distributed among 20 secure coastal management areas. To do this the California Least Tern Recovery Plan requires the following.

- Sufficient habitat to support at least one viable tern colony (defined as consisting of a minimum of 20 breeding pairs with a 5-year mean reproductive rate of at least 1.0 young fledged per year per breeding pair) at each of the 20 coastal management areas (including San Francisco, Mission Bay and Diego Bay, which should have 4, 6, and 6 secure colonies respectively), that are managed to conserve California least terns.
- Land ownership and management objectives are such that future habitat management for the benefit of least terns at those locations can be assured.

  The recovery plan includes the following objectives for California least tern.
- Preserve and manage nesting habitat.
- Protect and managed non-nesting habitat.
- Monitor least tern populations to determine status, distributed and progress of management during the breeding season.
- Conduct research on California least tern to provide additional necessary information for tern management.

- Utilize existing laws and regulations protecting California least tern and its habitat.
- Develop and implement a conservation education program.

Implementing the actions to achieve the goal and objectives of the Bayland conservation strategy (Section 3.9.3) will benefit California least tern. The goal of the baylands conservation strategy is to maintain and restore functional baylands land cover types (deep bay, shallow bay, tidal vegetation etc.) to protect habitat for native species and provide ecosystem services (e.g., natural flood protection). All three of the California least tern breeding locations in the RCIS area identified in the California Least Tern Recovery Plan are already managed to benefit the species. Implementing the actions in the baylands conservation strategy will compliment these ongoing management actions. The conservation strategy objective specifically seeks to conserve habitat for listed species, which includes the California least tern. Appendix H of this RCIS consolidates information from the existing plans and strategies for the baylands and includes California least tern. The intent of Appendix H is to provide a species-specific guide for the existing conservation strategies. As such, this RCIS is consistent and compatible with the California Least Tern Recovery Plan.

3.10.2.14 Recovery Plan for Upland Species of the San Joaquin Valley

In 1998, the U.S. Fish and Wildlife Service approved the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (San Joaquin Valley Recovery Plan) (U.S. Fish and Wildlife Service 1998a). The San Joaquin Valley Recovery Plan covers approximately 17,570 square miles across the San Joaquin Valley, Carrizo and Elkhorn Plains, and parts of the Cuyama, Salinas, and Sacramento, and other valleys. San Joaquin Valley Recovery Plan covers only a small portion of eastern Contra Costa and Alameda counties. The San Joaquin Valley Recovery Plan addresses 34 species of the San Joaquin Valley. The majority of the 34 species occur in arid grassland scrublands of the San Joaquin Valley and the adjacent foothills and valleys. Of the 34, only palmate-bracted bird’s beak and San Joaquin kit fox are focal species in this RCIS.

The San Joaquin Valley Recovery Plan includes site-specific protect requirements to meet the delisting criteria for the federally listed species addressed in the plan. For palmate-bracted bird’s beak, the San Joaquin Valley Recovery Plan states that 90 percent of the plants and occupied habitat in the Springtown Alkali Sink in Alameda County must be protected. For San Joaquin kit fox, one satellite population must be present in the northern range and Valley edges, defined as Alameda, Contra Costa, San Joaquin and Stanislaus counties.

The goal of the San Joaquin Valley Recovery Plan is to delist the federally listed species addressed in the plan and achieve long term conservation of the candidate of species of concern addressed in the plan. The San Joaquin Valley Recovery Plan includes interim goals to stabilize and protect populations and to conduct research necessary to refine reclassification and recovery criteria and subsequently reclassify those listed species that are endangered to threatened. The San Joaquin Valley Recovery Plan uses an ecosystem-level strategy to establish a network of reserves and conservation areas that represent all natural communities in the San Joaquin upland system. The San Joaquin Valley Recovery Plan includes the following objectives applicable to the RCIS area.

- Develop and implement a regional cooperative program and participation plan.
- Protect and secure existing populations.
- Determine distributions and population statuses of species addressed in the plan.

- Conduct research and monitoring.
- Maintain and establish linkages in existing natural lands and between islands of habitat on the Central Valley floor and natural lands around the fringe of the Central Valley.
- Adaptively manage protected areas.
- If necessary, reintroduce species to appropriate habitat within their historic range.

The goal, objectives, actions, and priorities for palmate-bracted bird's beak (Section 3.8.18) were informed by, and are consistent with, the recovery actions described in the San Joaquin Valley Recovery Plan. This RCIS includes the following actions and consistent with the San Joaquin Valley Recovery Plan.

- Acquire parcels with occurrences and suitable habitat and enhance habitat with known occurrences on protected land.
- Conduct surveys to identify additional occurrences.
- Enhance habitat through focused management, including invasive vegetation removal and prescribed burning.
- Conduct targeted studies to determine the species management and micro-habitat needs and pilot projects to determine suitable propagation and planting techniques.
- Address the issue of *Phytophthora* through research, treatment, avoidance and mitigation techniques, and public outreach and education.

The goal, objectives, actions, and priorities for San Joaquin kit fox (Section 3.8.15) were also informed by, and are consistent with, the recovery actions described in the San Joaquin Valley Recovery Plan. This RCIS includes the following actions and consistent with the San Joaquin Valley Recovery Plan.

- Acquire unprotected parcels with modeled habitat.
- Protect regional movement corridors.
- Create wildlife crossings across Interstate 580.
- Enhance San Joaquin kit fox habitat through grazing, working with private landowners, and targeted studies.

The RCIS also includes a conservation strategy for landscape connectivity (Section 3.9.1), which includes objectives to protect habitat linkages and enhance permeability across major highways for the focal species in the RCIS area.

The RCIS conservation strategy addresses all of the objectives from the SJV Recovery Plan for palmate-bracted bird's beak and San Joaquin kit fox through land acquisition and land protection, surveys/research, habitat enhancement, including public outreach, and protection/creation of movement corridors for San Joaquin kit fox. Implementing the RCIS conservation strategy to benefit palmate-bracted bird's beak and San Joaquin kit fox will therefore contribute toward achieving the San Joaquin Valley Recovery Plan's goal of delisting both of these species.

3.10.2.15 Revised Recovery Plan for Three Endangered Species Endemic to Antioch Dunes, California

In 1984, the U.S. Fish and Wildlife Service approved the *Revised Recovery Plan for Three Endangered Species Endemic to Antioch Dunes* (Antioch Dunes Recovery Plan) (U.S. Fish and Wildlife Service 1984). The Antioch Dunes Recovery Plan includes the following three species which occur in the RCIS area: Lange's metalmark butterfly (*Apodemia mormo* langei), Antioch Dunes evening-primrose (*Oenothera deltoides* ssp. *Howellii*) and *Erysimum capitatum* var. *angustatum*), none of which are focal species in this RCIS. The Antioch Dunes covers an area of roughly 70 acres adjacent to the San Joaquin River east of the City of Antioch, in Contra Costa County, in the RCIS area. This Antioch Dunes Recovery Plan includes natural populations on the Antioch Dunes as well as two introduced populations on Brannan and Brown's Island, which are outside of the RCIS area.

There are three primary goals in the Antioch Dunes Recovery Plan include the following

- Prevent further loss of Lange's metalmark butterfly, Contra Costa wallflower, and Antioch Dunes evening-primrose.
- Protect introduced populations and their habitats.
- Determine the number of populations which are necessary to reclassify each species to threatened and to delist.

The goals are supported by the following three objectives.

- Protect Antioch Dunes ecosystem and essential habitat for Lange's metalmark butterfly, Contra Costa wallflower, and Antioch Dunes evening-primrose.
- Restore Antioch Dunes ecosystem and increase numbers and improve habitat for Lange's metalmark butterfly, Contra Costa wallflower, and Antioch Dunes evening-primrose.
- Initiate an information and education program.

In 1980, the 55-acre Antioch Dunes National Wildlife Refuge (Antioch Dunes NWR) was established to protect the Antioch Dunes and Lange's metalmark butterfly, Contra Costa wallflower, and Antioch Dunes evening-primrose. Contra Costa wallflower and Antioch Dunes evening primrose are found on and immediately adjacent to the Antioch Dunes NWR and Lange's metalmark butterfly is found only on the Antioch Dunes NWR (U.S. Fish and Wildlife Service 2008). This RCIS does not include a conservation strategy for the Antioch Dunes because the majority of this area is already a federally protected and managed to benefit these listed species. The conservation strategy for unique land cover types (Section 3.9.5) and important soil types (Section 3.9.6), seeks to protect and manage sensitive habitats and soils in the RCIS area. Implementing the RCIS conservation strategy for unique land cover types and important soil types will therefore contribute toward achieving the Antioch Dunes Recovery Plan objectives, if implemented on habitats outside of the Antioch Dunes NWR. As such, this RCIS is consistent and compatible with the Antioch Dunes Recovery Plan.

3.10.2.16 Recovery Plan for the Sacramento-San Joaquin Native Fishes

In 1996, the U.S. Fish and Wildlife Service approved the *Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes* (Delta Native Fishes Recovery Plan) (U.S. Fish and Wildlife Service 1996). The Natives Fishes Recovery Plan includes the Sacramento, San Joaquin and Mokelumne Rivers, and their confluence in the Sacramento-San Joaquin Delta (Delta). The RCIS area overlaps the Native

Fishes Recovery Plan where it includes the Delta in Eastern Contra Costa County. The Delta Native Fishes Recovery Plan includes eight fish species native to the Sacramento-San Joaquin Delta: delta smelt (*Hypomesus transpacificus*), Sacramento splittail (*Pogonichthys macrolepidotus*), longfin smelt (*Spirinchus thaleichthys*), green sturgeon (*Acipenser medirostris*), spring-run, late fall-run, and San Joaquin fall-run Chinook salmon (*Oncorhynchus tshawytscha*), and Sacramento perch. Although none of these species are focal species in this RCIS, implementing the baylands conservation strategy (Section 3.9.3), the steelhead and salmon conservation strategy (Section 3.8.3), and unique land cover types conservation strategy (Section 3.9.5) will benefit the species addressed by Delta Native Fishes Recovery Plan and their habitats, and will therefore contribute toward achieving the recovery plan's goals and objectives.

The goal of the Delta Native Fishes Recovery Plan is to remove delta smelt from the federal list of endangered and threatened species and restore the historical population dynamic and distribution patterns of Sacramento splittail, longfin smelt, green surgeon, spring-run, late fall-run and San Joaquin fall-run Chinook salmon. The Delta Native Fishes Recovery Plan also includes a goal to investigate the possibility of restoring Sacramento perch to the Delta ecosystem. The following objectives are included in support of these goals.

- Enhance/restore aquatic and wetland habitat.
- Reduce the effect of harvest (over-utilization).
- Reduce the effects of introduced aquatic species (predation or disease).
- Change and improve enforcement of regulatory mechanisms.
- Conduct monitoring and research to increase understanding of the basic biology and management requirements.
- Assess effects of Delta native fishes recovery management actions.
- Increase public awareness to determine the need to federally list them as endangered or threatened species.

The baylands conservation strategy is intended to protect habitat and manage tidal and subtidal communities to benefit all native (i.e., unlisted), rare, threatened, and endangered species that occur therein, through habitat acquisition, enhancement, and restoration. The baylands conservation strategy also includes an action to conduct research on key data gaps, which is consistent with the goal to conduct studies on specific topics related to the Delta Native Fishes Recovery Plan.

Goal 4, Objective 4.1, and Actions SS-9 – SS-11 recommend restoring and enhancing estuaries, tidal wetlands, and associated ecosystems to improve rearing and migration habitat for winter-run Chinook salmon, Central Valley steelhead, and Central California Coast steelhead in the bays, estuary, and Delta within the RCIS area. Implementing these actions will also improve habitat for tidewater goby. As such, this RCIS is consistent and compatible with the Delta Native Fishes Recovery Plan.

3.11 Monitoring and Adaptive Management Strategy

According to the Program Guidelines, in order for an individual or entity to develop an MCA under this East Bay RCIS, this RCIS must include a monitoring and adaptive management strategy. The monitoring and adaptive management plan included in an MCA will be consistent with the MCA adaptive management and monitoring plan template (California Department of Fish and Wildlife 2018a). Requirements and processes for creating an MCA, including a monitoring and adaptive management plan, will be provided in CDFW's MCA Guidelines. This section is intended to provide an overview of monitoring and adaptive management and describes the framework that can be used to inform the monitoring and adaptive management plans used in an MCA in the RCIS area.

Monitoring and adaptive management plans will only be required for conservation actions or habitat enhancement actions that are implemented under MCAs. A monitoring and adaptive management plan could be developed for any voluntary conservation or habitat enhancement action implemented in the RCIS area (unrelated to an MCA), but it is not required. Such a monitoring and adaptive management plan consistent with the framework described in this section would provide the same benefits as those described for mitigation actions.

The overarching objective of monitoring and adaptive management is to ensure that conservation and habitat enhancement actions are implemented in ways that benefit focal species and other resources credited under the MCA and contribute to the achievement of conservation goals and objectives stated in the RCIS. The level of detail and application of the framework will vary depending on the size and complexity of the MCA site or sites, the resources being monitored, and the nature of the conservation or enhancement actions being executed.

3.11.1 Periods of Monitoring and Adaptive Management

Monitoring and adaptive management can be organized into two periods: interim management period and long-term management period. Key tasks in each phase are described in this section.

3.11.1.1 Interim Management Period

The interim management period is the period from when the MCA site is established to when performance standards have been met and the endowment fund for the MCA has matured (see CDFW's MCA Guidelines for more details). During this period, ecological performance monitoring is conducted to assess the progress and status of resources being enhanced or restored and management activities are being conducted, as necessary. During this time, the long-term endowment fund gains interest and earnings without being expended. If ecological performance standards are not met, remedial actions will be implemented. Monitoring is more intensive and frequent during this period than it is under long-term management, and there may be different or additional management actions required during the interim management period that are not required during the long-term management period.

During the interim management period, management of the site will be guided by an interim management plan (a component of a monitoring and adaptive management plan), which describes the conservation actions or habitat enhancement actions, monitoring, adaptive management, reporting and other activities to be implemented by the MCA sponsor.

3.11.1.2 Long-Term Management Period

The long-term management period begins upon conclusion of the interim management period and continues for the length of the durability agreement which may be in perpetuity for conservation actions, or a shorter period for a habitat enhancement action with appropriate durability that does not involve acquiring land or permanently protecting habitat.

During the long-term management period, management of the site will be guided by a long-term management plan, which will include measures intended to ensure that the MCA site or sites are managed, monitored, and maintained in perpetuity (or a shorter period, as applicable, for a habitat enhancement action with species or habitat-appropriate durability that does not involve acquiring land or permanently protecting habitat), to conserve and protect the resources that support MCA credits, and other natural resources.

As much as possible, the long-term management plan should be a practical guide to management and monitoring actions that will occur on the mitigation site over time, written with the land manager and monitors in mind. The long-term management and monitoring plan should include reasonable management and monitoring tasks and a schedule appropriate for long-term management and monitoring of the species and resources. The anticipated management and monitoring tasks and schedule are to inform the initial calculation of the amount of the endowment. Identified tasks and schedule may be adjusted over time and decisions concerning those adjustments are to be made with consideration for the financial resources available.

Similar to adaptive management actions, the monitoring program can change over time in response to the information collected and the trends observed. This adaptive approach to monitoring ensures that enough data are being collected to determine whether the mitigation site is performing as expected, while also avoiding unnecessary monitoring costs, particularly once the effectiveness of the site has been documented through several years of monitoring.

3.11.2 Adaptive Management

Adaptive management is a decision-making process that adjusts actions as uncertainties become better understood or as conditions change. Documenting actions and monitoring the outcomes of management is the foundation of an adaptive approach, and thoughtful monitoring can both advance scientific understanding and modify management actions iteratively (Williams et al. 2007).

Adaptive management is necessary because of the degree of uncertainty and natural variability associated with ecosystems and their responses to management. It is possible that additional and different actions not described in this East Bay RCIS or an MCA will be identified in the future and proven to be more effective. Results of monitoring may also indicate that some management measures are less effective than anticipated. To address these uncertainties, an adaptive approach will be used to inform management on land subject to MCAs.

The cornerstone of a monitoring and adaptive management program is an approach in which monitoring yields scientifically valid results that inform management decisions. Information collected through monitoring and other experiments is used to manage mitigation lands and help determine progress toward conservation objectives.

- Adaptive management may include the following.
- Evaluate efficacy of monitoring protocols.
- Incorporate best available scientific information into management decisions.
- Review any unexpected or unfavorable results and test hypotheses to achieve desired outcome.

- Adjust management actions and continue to monitor.
- Adjust success criteria and actions, if necessary.

3.11.3 Types of Monitoring

Types of monitoring that may be included in a monitoring plan include but are not limited to the following.

- **Ecological performance monitoring.** This is short term monitoring implemented during the interim management period. Monitoring is conducted to assess progress of restoration or enhancement actions toward achieving incremental performance criteria. The criteria are tied to the incremental availability of credits in a credit release schedule.
- **Conservation easement monitoring and long-term durability instrument monitoring.** This is monitoring implemented by the third party conservation easement holder to monitor the conditions as described in the conservation easement. A similar type of monitoring may be used to track the status of a site used for a habitat enhancement action under a long-term durability instrument.
- **Effectiveness monitoring.** Effectiveness monitoring is often less-intensive and implemented at longer intervals than ecological performance monitoring, during the long-term management period. Effectiveness monitoring is implemented in perpetuity, Effectiveness monitoring is implemented to verify that the site is providing the intended mitigation/offset(s) or conservation values and to inform adaptive management.

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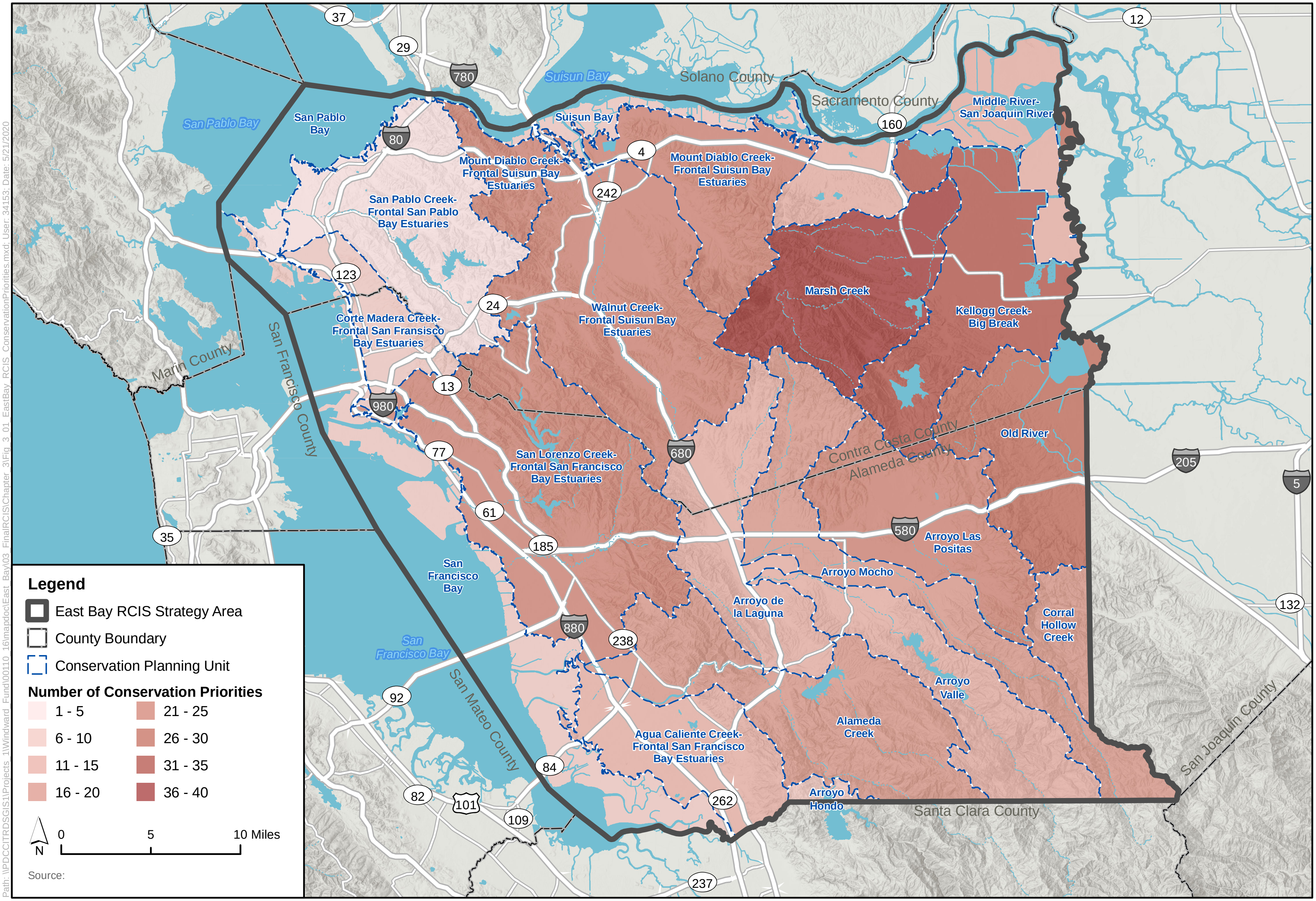

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Figure 3-1
Number of Conservation Priorities within the Conservation Planning Units

Chapter 4
Implementation

After approval by the California Department of Fish and Wildlife (CDFW), the regional conservation investment strategy (RCIS) can inform decisions related to land acquisition, restoration, enhancement, and management actions for focal species and other conservation elements addressed by the RCIS. An RCIS may help to achieve the following.

- Inform how organizations make conservation investments in the RCIS area.
- Inform how state or federal agencies evaluate grant or permit applications for local conservation or research projects.
- Help guide project proponents to site and design proposed compensatory mitigation required pursuant to the following.
    - A California Endangered Species Act permit.
    - A lake or streambed alteration agreement under California Fish and Game Code (CFGC) Section 1600.
    - A California Environmental Quality Act (CEQA) document or other state or federal regulatory permits, such as those required by the Federal Endangered Species Act, Clean Water Act Sections 404 and 401, the State Porter-Cologne Water Quality Control Act, and the California Water Code.
- Support the siting, design, and creation of conservation and mitigation banks.
- Help landowners, public agencies, private entities, or others scope advance mitigation projects that create mitigation credits using a Mitigation Credit Agreement (MCA), which is enabled by an RCIS.
- Guide project proponents to existing conservation and mitigation banks with service areas within the RCIS boundary.
- Guide project proponents to the East Contra Costa County Habitat Conservancy (Habitat Conservancy) for permitting assistance when a proponent's project occurs in the *East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan* (ECCC HCP/NCCP) (Jones & Stokes 2006) permit area.

This chapter describes the RCIS implementation process and provides an overview of MCAs. CDFW will describe the requirements and processes for creating an MCA in their *MCA Guidelines*, which have not been released at the time of submission of the Final Draft East Bay RCIS to CDFW. In this chapter, items that are suggestions—not requirements—are noted as items the RCIS proponent *may* do, as opposed to required elements that proponents *will* do or *shall* do as specified by CFGC Sections 1850-1861 and CDFW's *RCIS Program Guidelines* (Program Guidelines) (California Department of Fish and Wildlife 2018).

Section 4.2, *Required Activities to Create Mitigation Credit Agreements*, describes elements required during RCIS implementation to enable creation of MCAs in the RCIS area. Section 4.3, *Other Potential RCIS Proponent Activities*, describes elements that are not required, but may prove helpful when creating an MCA. Section 4.3 also suggests how local agencies and organizations might support RCIS implementation.

The East Bay RCIS is a non-binding, voluntary conservation strategy. As RCIS proponent, the State of California Coastal Conservancy (Coastal Conservancy) is only responsible for updating the scientific information in this RCIS and evaluating the effectiveness of RCIS conservation actions, habitat enhancement actions, and progress toward achieving RCIS goals and objectives at least once every 10 years (Section 4.2). Entities pursuing MCAs under this RCIS are responsible for funding their involvement in and for developing those MCAs; the Coastal Conservancy bears no financial or other responsibility for developing or monitoring those MCAs.

4.1 Implementation Goals

The purpose of this RCIS is to inform and facilitate conservation actions or habitat enhancement action. These actions include those driven by regulations (primarily via mitigation) and other voluntary actions. This East Bay RCIS was developed to guide investments in conservation, infrastructure, and compensatory mitigation to help ensure conservation actions and habitat enhancement actions occur in an informed and strategic manner to achieve the highest degree of conservation benefit at a regional scale.

4.2 Required Activities for Creating Mitigation Credit Agreements

As a voluntary planning and guidance document, there are no inherent implementation requirements for this RCIS. However, for an RCIS to be used to create MCAs, CFGC Section 1856(b) specifies what must be included in an RCIS, and what must be done after an RCIS is approved by CDFW above and beyond what is required of an RCIS that does not support MCAs. This RCIS is intended to support creation of MCAs, so it includes additional required elements as specified in CFGC Section 1856(b) (quoted below).

> (b) For a conservation action or habitat enhancement action identified in a regional conservation investment strategy to be used to create mitigation credits pursuant to this section, the regional conservation investment strategy shall include, in addition to the requirements of Section 1852, all of the following:
>
> (1) An adaptive management and monitoring strategy for conserved habitat and other conserved natural resources.
>
> (2) A process for updating the scientific information used in the strategy, and for tracking the progress of, and evaluating the effectiveness of, conservation actions and habitat enhancement actions identified in the strategy, in offsetting identified threats to focal species and in achieving the strategy's biological goals and objectives, at least once every 10 years, until all mitigation credits are used.
>
> (3) Identification of a public or private entity that will be responsible for the updates and evaluation required pursuant to paragraph (2).

The Program Guidelines define the RCIS proponent, in this case the Coastal Conservancy, as the public agency or group of public agencies responsible for technical and administrative updates to an

RCIS. The Coastal Conservancy may share, designate, or transfer its RCIS proponent role to another entity or entities at any time, or elect to terminate its role as RCIS proponent.[1]

As the RCIS proponent, the Coastal Conservancy will be responsible for updating this RCIS and tracking the progress and effectiveness of conservation and habitat enhancement actions in achieving RCIS conservation goals and objectives. The Coastal Conservancy will coordinate with the Habitat Conservancy to ensure that updates to this RCIS are consistent and compatible with the ECCC HCP/NCCP. The City of Antioch is also preparing a *Habitat Conservation Plan/Natural Community Conservation Plan* (HCP/NCCP) (ICF in development) following the ECCC HCP/NCCP framework.[2] If the City of Antioch's HCP/NCCP is approved by CDFW and USFWS and adopted by the City of Antioch, the Coastal Conservancy will coordinate with the Antioch HCP/NCCP implementing entity.

This RCIS includes the following elements to facilitate creation of MCAs, as required by CFGC Section 1856(b) and described in the Program Guidelines (Table 1-1).

- An adaptive management and monitoring strategy (Section 3.11, *Monitoring and Adaptive Management Strategy*).
- A process for updating the scientific information at least once every 10 years (Section 4.2.1, *Updating and Extending this RCIS*).
- A process for tracking the progress and effectiveness of conservation and habitat enhancement actions in achieving the goals and objectives, and for offsetting the effects of identified pressures and stressors at least once every 10 years (Section 4.2.2, *Assessing Progress*).
- Identification of an RCIS proponent (see above for description of the Coastal Conservancy agreement to fulfill this role).

The Coastal Conservancy may wish to enlist the support and guidance of additional organizations including those that participated in development of this East Bay RCIS (Chapter 1, *Introduction*) or other organizations that may be able to support implementation of this East Bay RCIS. The role of this larger group is described in Section 4.3.1, *Implementation Support*.

4.2.1 Updating and Extending this Regional Conservation Investment Strategy

According to the Program Guidelines, "an update to an RCIS means updates to the best available scientific information contained in a previously approved RCIS." The Program Guidelines further define a data update as follows.

> A data update is generally the submission of GIS data or minor changes to numbers or text in the document that require less than four hours of CDFW staff time. It does not include updates or amendments to the geographic area, focal species, or other conservation elements. An RCIS proponent may update the scientific information in the RCIS at any time.

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[1] The Coastal Conservancy intends to remain the RCIS proponent and either renew the RCIS or transfer responsibility for renewing the RCIS to another entity at the end of the first 10 years. However, if the Coastal Conservancy is unable to renew the RCIS due to budget or other constraints, and no other entity is willing to take responsibility, the RCIS may expire and no longer be valid.

[2] https://www3.mydocsonline.com/pub/hbancstaff/2018%2001%2030%20Antioch%20HCP%20Progress%20Report%20to%20ECCCHCPAC.pdf

The Coastal Conservancy will contact CDFW to evaluate proposed data updates and incorporate those updates into the RCIS as needed.

Under current state law, CDFW may extend the duration of an approved or amended RCIS for additional periods of up to 10 years. If the Coastal Conservancy or other entities intend to use this RCIS to create additional MCAs pursuant to CFGC Section 1856 after the RCIS approval period ends, the Coastal Conservancy, CDFW,[3] or other entity, with permission from the Coastal Conservancy, shall update the scientific information in this RCIS at least once every 10 years. Once this East Bay RCIS is updated with new scientific information and CDFW finds that the RCIS continues to meet the requirements of CFGC Section 1852, CDFW may extend the duration of this RCIS.

Because this East Bay RCIS is intended to support creation of MCAs, the Coastal Conservancy may, at least once every 10 years, undertake a more substantial update (i.e., not just a data update). This update may include updating and refining, if necessary, the RCIS based on current scientific information that pertains to focal species and other conservation elements addressed in this RCIS, and the goals, objectives, and conservation and habitat enhancement actions pertaining to those elements. The Coastal Conservancy may determine when, within the 10-year approval period, to undertake updates (for example, after 5 years, or toward the end of the 10-year approval period). Updates would then be integrated into the RCIS at the end of the 10-year approval period as part of the RCIS renewal process (or earlier if the Coastal Conservancy decides to update the RCIS earlier).

The Coastal Conservancy may use various data sources to inform the updates, including monitoring results, MCA progress reports (Section 4.2.2), recent scientific literature, technical reports or studies, and guidance from regulatory agencies. The assumptions on which the RCIS conservation strategy was built, particularly related to focal species, other conservation elements, and conservation priorities may be revised, as necessary, based on new data or information. If the results of this review reveal that fundamental aspects of this East Bay RCIS are no longer valid, the Coastal Conservancy may elect to amend this RCIS to address these changes, as outlined in Section 4.5, *Amending the RCIS*.

The Coastal Conservancy or any other entity proposing an update or amendment to the RCIS should consult with the Habitat Conservancy and the Antioch HCP/NCCP implementing entity (if the Antioch HCP/NCCP is approved) to ensure that the update or amendment does not conflict with the ECCC HCP/NCCP or the Antioch HCP/NCCP.

4.2.2 Assessing Progress

In compliance with CFGC Section 1856(b), the Coastal Conservancy will assess the effectiveness of RCIS conservation actions and habitat enhancement actions in achieving the goals and objectives for the focal species and other conservation elements (Chapter 3, *Conservation Strategy*), and offsetting the effects of identified pressures and stressors.

Because an RCIS is meant to be a platform for information that can be used by any entity or agency to inform their conservation or mitigation planning, it is not expected that the Coastal Conservancy will be aware of all actions that occur in relation to this East Bay RCIS. As such, the Coastal

[3] According to the Program Guidelines, "If CDFW determines that an approved RCIS needs to be updated or evaluated more frequently and the RCIS proponent or responsible party declines to do so, MCA sponsors or CDFW may elect to update the RCIS. Any such updates shall become part of the approved RCIS, pending an evaluation by CDFW."

Conservancy is not responsible for tracking data for projects of which it is not aware. However, MCA sponsors with mitigation sites in the RCIS area are required to collect and provide data to the Coastal Conservancy—in addition to CDFW—such that the Coastal Conservancy can meet its tracking obligations as the RCIS proponent (California Department of Fish and Wildlife 2018).

The Coastal Conservancy will use data provided from MCA sponsors to assess the effectiveness of RCIS conservation actions and habitat enhancement actions in achieving the goals and objectives for the focal species and other conservation elements and offsetting the effects of identified pressures and stressors. Other sources of data and information may be used, such as the current versions of the California Protected Areas Database (2019),[4] the California Conservation Easement Database (2019),[5] the Bay Area Protected Areas Database (Bay Area Open Space Council 2017),[6] data from the Conservation Lands Network,[7] and websites maintained by CDFW, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers (USACE)[8] that provide up-to-date information on approved conservation and mitigation banks, among other sources. For example, data from the California Protected Areas Database, California Conservation Easement Database, and Bay Area Protected Areas Database can be used to assess changes in the amounts of focal species' habitat from the amounts of habitat protected at the time this RCIS was developed, as presented in gap analysis Tables 3-3 and 3-4.

4.2.2.1 RCIS Progress Report

As RCIS proponent, the Coastal Conservancy will evaluate the effectiveness of RCIS conservation actions, habitat enhancement actions, and progress toward achieving RCIS goals and objectives at least once every 10 years. The evaluation will be submitted as a report to CDFW at the end of the 10-year approval term. Alternatively, the Coastal Conservancy may report this progress in an updated East Bay RCIS, which would be submitted to CDFW for renewal after the 10-year approval period has ended.

To the extent feasible, the RCIS progress report or updated East Bay RCIS will summarize the following.

- Net change in the amount of focal species' habitat and other conservation elements (e.g., working landscapes and Baylands) protected in the RCIS area. Net change in area should be provided in acres, though for certain ecological features, net change may be provided in other relevant metrics (as specified in the MCA), such as length and width of a restored riparian woodland.

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[4] http://www.calands.org/data

[5] http://www.calands.org/cced

[6] https://www.bayarealands.org/?crb_render_featured_project=yes&crb_popup_index=29

[7] http://www.bayarealands.org/

[8] Up-to-date information on approved conservation and mitigation banks can be found at the following U.S. Fish and Wildlife Service, CDFW, and USACE websites: https://www.fws.gov/sacramento/es/Conservation-Banking/Banks/In-Area/es_conse-bank-in-area.htm

https://www.wildlife.ca.gov/Conservation/Planning/Banking/Approved-Banks

http://www.spn.usace.army.mil/Missions/Regulatory/Mitigation-Banks/Approved-Banks-for-the-San-Francisco-Regulatory-Di/

https://ribits.usace.army.mil/

- Summary of progress made toward achieving the RCIS conservation goals and objectives through implementation of conservation actions and habitat enhancement actions described in Chapter 3.
- Summary of net change in quality of focal species' habitat addressed in the MCAs, using metrics described in the MCA.
- Summary of the pressures and stressors identified in Section 2.3, *Pressures and Stressors on Conservation Elements*, that were offset by implementing RCIS conservation actions and habitat enhancement actions; summary can be provided in tabular form.

To the extent feasible, the RCIS progress report may summarize other conservation and habitat enhancement actions undertaken in the RCIS area not conducted as part of an MCA, if this information is available to the Coastal Conservancy (e.g., conservation of habitat by non-governmental conservation organizations). Regional partners are encouraged to share data and other information about conservation actions and habitat enhancement actions implemented in the RCIS area with the Coastal Conservancy, but the Coastal Conservancy will not be responsible for tracking and reporting data or other information from these entities. The Coastal Conservancy may use this information, in combination with information provided by MCA sponsors, to assess progress toward achieving RCIS conservation goals and objectives.

4.2.2.2 Mitigation Credit Agreement Sponsor Responsibilities

MCA sponsors with mitigation sites in the RCIS area are expected to contribute to tracking the progress and effectiveness of conservation actions and habitat enhancement actions toward achieving RCIS goals and objectives by providing data and relevant information to the Coastal Conservancy. MCA sponsors shall use consistent metrics to assess habitat quality. Metrics will be determined during the MCA development and approval process.

The Coastal Conservancy may request an MCA summary report from each MCA sponsor with mitigation sites in the RCIS area. This information will help assess the effectiveness of RCIS conservation actions and habitat enhancement actions toward achieving goals and objectives for focal species and other conservation elements. Additionally, the Coastal Conservancy or CDFW may provide MCA sponsors with an MCA summary report template to facilitate consistent and adequate reporting by MCA sponsors.

MCA sponsors, upon request of the Coastal Conservancy, may be asked to provide the following information.

- The amount of focal species' habitat and other conservation elements (i.e., working lands and natural communities) protected, enhanced, or restored/created through MCAs at the MCA sponsor's mitigation sites in the RCIS area, and the corresponding East Bay RCIS goal(s) and objective(s) the actions supported.
- The MCA sponsors shall report the amount of land, aquatic features, and habitat for focal species using the same natural community, land cover type, and focal species habitat categories (e.g., breeding habitat, foraging habitat, or upland habitat) as used by this RCIS as described in Chapter 2, *Environmental Setting and the Built Environment* to enable consistent tracking of progress toward achieving RCIS goals and objectives.
- A list of the conservation actions and habitat enhancement actions identified in the MCA and implemented at the MCA sponsor's mitigation sites in the RCIS area.

- A summary of the net change in quality of the target ecological features and ecological functions addressed by conservation or habitat enhancement actions on the MCA sponsor's mitigation sites in the RCIS area, using the metrics identified in the MCA(s).
- A brief summary of the pressures and stressors identified in Section 2.3 that were offset (or partially offset) by implementing conservation and habitat enhancement actions through the MCA.

Measurable objectives in this RCIS include metrics for tracking progress towards achieving the RCIS goals and objectives. The metrics are intended to enable consistent measurement of the net change in habitat area and habitat quality from habitat restoration actions. When implementing conservation actions and habitat enhancement actions that include habitat restoration as part of an MCA, the MCA sponsor shall select, and submit for CDFW's approval, an appropriate metric(s) from the metrics listed below to measure the net change in habitat area and habitat quality.

If the MCA sponsor determines that a metric not listed below is more appropriate for measuring net change in habitat area and habitat quality, the MCA sponsor may make a written request to CDFW to consider approving that alternative metric instead of, or in addition to, one or more metric listed below. CDFW will consider the proposed alternative metric and the RCIS proponent's recommendation, if any, when determining whether to approve the alternative metric.

Once a metric(s) is designated and approved, it must be used for the baseline and subsequent measurements of habitat area and habitat quality. If an approved metric turns out to be faulty or problematic, the MCA sponsor may make a written request to CDFW to consider approving a different metric instead of, or in addition to, the approved metric(s), as set forth above. The determination to approve will be based, in part, on whether that new metric can be compared with the original baseline data in a reasonable way to compare the change in habitat area or habitat quality.

MCA sponsors will report on relevant RCIS metrics for corresponding habitat restoration conservation actions and habitat enhancement actions implemented through an MCA. MCA sponsors may include additional measures and performance standards for assessing habitat quality in an MCA, consistent with the MCA Guidelines and with approval by CDFW.

The following metrics are acceptable in this RCIS for measuring the net change in habitat area and habitat quality resulting from habitat restoration actions.

- Acres.
- Linear feet.
- Percent cover (native vs. non-native 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).
- Vigor index (e.g., health of plant on scale of 1-4).
- Habitat structure (e.g., number of canopy layers, percent cover, snags).

- Distribution of key resources (e.g., number per unit area of nesting trees, ponds, host plants).
- Inundation duration (consecutive days).
- Water depth (feet).
- Stream flow (cubic feet per second).
- Water temperature and chemical composition (e.g., dissolved oxygen).
- Stream substrate composition (e.g., percent cover, gravel size).
- Stream characterization (e.g., pool, riffle, run, length and width).

4.3 Other Potential Regional Conservation Investment Strategy Proponent Activities

Section 4.2 described the requirements for implementation if the RCIS is to be used to create MCAs, as outlined in the CFGC and Program Guidelines. Beyond those requirements, the Coastal Conservancy has the discretion to implement the RCIS in a manner consistent with the vision of their organization and level of funding available at any given time. The following subsections describe some optional items the Coastal Conservancy may consider during implementation.

4.3.1 Implementation Support

The Coastal Conservancy may choose to team with other public agencies or organizations to help guide implementation and updates to this East Bay RCIS, particularly in instances where implementation of this East Bay RCIS would support the missions of these other organizations. These other groups could include representatives from organizations such as the Habitat Conservancy, the Contra Costa Transportation Authority, The Nature Conservancy, the Regional Advance Mitigation Planning Technical Advisory Committee, the Bay Area Open Space Council, the Metropolitan Transportation Commission, and other interested parties.

The following are potential actions supporting organizations may take during teaming; this list is not exhaustive.

- Assess the utility and effectiveness of this East Bay RCIS in guiding project proponents.
- Help resource agencies when matching mitigation needs with regional conservation priorities.
- Publicize this East Bay RCIS and its successful implementation to participating agencies and other entities that may use the strategy to inform conservation actions and habitat enhancement actions in the RCIS area.
- Answer questions from users and potential users of this East Bay RCIS.
- Develop guidance as needed to clarify and refine components of this East Bay RCIS.
- Oversee preparation of the 10-year progress report, or other documents for CDFW as needed, documenting implementation of this East Bay RCIS and MCAs.
- Support the Coastal Conservancy in periodically updating (i.e., at least every 10 years) and extending this RCIS based on significant new information on the focal species and their conservation.

4.3.2 Annual Meeting

The Coastal Conservancy and other supporting agencies and organizations may host an annual meeting to update the public on the progress and challenges with implementation during the previous year. These meetings would present an opportunity to update the public about conservation successes, challenges, and opportunities that have arisen over the previous year. The agenda for the meeting could be determined by the Coastal Conservancy in cooperation with supporting agencies and organizations to ensure that key issues related to implementation are discussed.

4.4 Using this Regional Conservation Investment Strategy to Achieve Conservation Investment and Advance Mitigation

This East Bay RCIS provides a framework for identifying regional conservation priorities and actions for focal species and other conservation elements within the RCIS area. The conservation goals and objectives are designed to be broad-based yet comprehensive in identifying actions necessary to ensure long-term conservation of focal and non-focal species addressed by this RCIS. While centered on focal species, this RCIS also addresses other key conservation elements including habitat connectivity and landscape linkages, working landscapes, baylands, bat habitat, unique land cover types, waters, wetlands, and important soils. As such, the Coastal Conservancy as RCIS proponent anticipates that a combination of conservation investments, MCAs, and compensatory mitigation completed outside of an MCA will be needed to achieve RCIS conservation goals and objectives. The Coastal Conservancy also anticipates that achieving success meeting conservation goals and objectives will require flexibility, creativity, and establishing partnerships in conservation.

4.4.1 Conservation Partners

Agencies and organizations using this RCIS to select conservation investments are encouraged to collaborate with other agencies or organizations operating in the RCIS area if the needs of those agencies or organizations align to support more robust and more effective implementation of one or more conservation priorities. There are many entities involved in conservation in the RCIS area, such as cities, counties, state and federal agencies, resource conservation districts, parks and open space special districts, conservation organizations, land trusts, and watershed groups.

Specific projects with a watershed-based conservation component were identified in the following documents.

- *2006 Bay Area Integrated Regional Water Management Plan* (San Francisco Bay Area Technical Coordinating Committee 2006)
- *2019 San Francisco Bay Area Integrated Regional Water Management Plan Update* (San Francisco Bay Area Integrated Regional Water Management Plan Coordinating Committee 2019)[9]

[9] http://bayareairwmp.org/

- *East Contra Costa County Integrated Regional Water Management Plan Update 2015* (East County Water Management Association 2015)
- *East Contra Costa County Integrated Regional Water Management Plan Update 2019* (East County Water Management Association 2019)[10]

Projects identified in these integrated regional water management plans could use this RCIS to guide project implementation and benefit focal species along with other conservation elements addressed in this RCIS.

The Coastal Conservancy, when and where appropriate, will look for innovative ways to support others taking the lead in making conservation investments and developing MCAs, provided the proposed action is consistent with this East Bay RCIS and would help achieve RCIS goals and objectives.

4.4.2 Mitigation

Assembly Bill 2087 established a new process by which compensatory mitigation credits can be established under an RCIS. Mitigation options existed prior to the adoption of Assembly Bill 2087. These mitigation options are also available for projects that might require compensatory mitigation. These pre-existing mitigation options are briefly described below along with MCAs. More information about how this RCIS can be used to support various state and federal permits that typically require mitigation can be found in Appendix B, *Regulatory Process*.

4.4.2.1 East Contra Costa County HCP/NCCP

The ECCC HCP/NCCP permit area includes 174,018 acres in East Contra Costa County, including areas within unincorporated Contra Costa County and the cities of Brentwood, Clayton, Oakley, and Pittsburg.

The ECCC HCP/NCCP is implemented by the Habitat Conservancy. The Habitat Conservancy is a joint exercise of powers authority formed by the Cities of Brentwood, Clayton, Oakley and Pittsburg and Contra Costa County. The ECCC HCP/NCCP provides a framework for protecting natural resources in eastern Contra Costa County while improving and streamlining the environmental permitting process for impacts to endangered species. The ECCC HCP/NCCP allows Contra Costa County, the Contra Costa County Flood Control and Water Conservation District, the East Bay Regional Park District, and the Cities of Brentwood, Clayton, Oakley, and Pittsburg to control endangered species permitting for activities and projects in the region that they perform or approve. The ECCC HCP/NCCP also provides for comprehensive species, wetlands, and ecosystem conservation and contributes to the recovery of endangered species in northern California. In 2017, USACE issued Regional General Permit 1, which is aligned with the ECCC HCP/NCCP. Projects that do not exceed the impact limits specified in Regional General Permit 1 may also have ECCC HCP/NCCP compliance serve as Clean Water Act Section 404 mitigation.

The ECCC HCP/NCCP permit area is entirely within the RCIS area. Projects within the ECCC HCP/NCCP permit area will be subject to the ECCC HCP/NCCP and will use that plan's species permits for both state and federal listed species. The ECCC HCP/NCCP is designed to streamline permitting, requiring that project proponents pay a fee to the Habitat Conservancy to address

[10] https://www.eccc-irwm.org/

compensatory mitigation needs, eliminating the need to consider further compensatory mitigation for species. Project proponents may also negotiate a combination of fees, land, and other activities to satisfy their mitigation obligation through the ECCC HCP/NCCP.

4.4.2.2 Conservation or Mitigation Banks

CFGC Section 1797.5 defines terms associated with mitigation banking in California (Appendix A, *Glossary*). In summary, a conservation or mitigation bank is privately or publicly owned land that is managed for its natural resource values, with an emphasis on the targeted resource (i.e., species and/or aquatic resources). Mitigation banks typically offer credits for restored or created aquatic resources. Conservation banks may also offer credits for restored resources, but they are more heavily focused on the protection and management of existing occupied habitats for the target species. In exchange for permanently protecting and managing the land—and in the case of mitigation banks, restoring or creating aquatic resources—a bank operator is allowed to sell credits to project proponents who need to satisfy legal requirements for compensating environmental impacts of development projects (California Department of Fish and Wildlife 2016).

A total of 18 conservation banks with available credits are either located in, or have service areas that overlap with, the RCIS area. See Section 2.2.2, *Conservation and Mitigation Banks* for more information about these banks.

4.4.2.3 In-Lieu Fee Programs

Title 33 of the Code of Federal Regulations (CFR) Section 332, *Compensatory Mitigation for Losses of Aquatic Resources* (also known as the Mitigation Rule), identifies in-lieu fee programs as a preferred approach to meeting compensatory mitigation needs for adverse effects on waters of the United States, second to mitigation banks. As defined in the Mitigation Rule, an in-lieu fee program involves the following.

> …the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for DA[11] permits. Similar to a mitigation bank, an in-lieu fee program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the in-lieu program sponsor. However, the rules governing the operation and use of in-lieu fee programs are somewhat different from the rules governing operation and use of mitigation banks. The operation and use of an in-lieu fee program are governed by an in-lieu fee program instrument.

No mitigation lands associated with an in-lieu fee program currently exist in the RCIS area. However, the National Fish and Wildlife Foundation's Sacramento District California In-Lieu Fee Program has a service area that overlaps with the eastern edge of the RCIS area in the geographic area under the jurisdiction of the USACE's Sacramento District.

4.4.2.4 Project-Specific Mitigation

The conservation strategies presented in this RCIS can be used to identify and site conservation actions and habitat enhancement actions that can be used for compensatory mitigation when other means of providing mitigation (e.g., those described above) are not feasible. For example, a project proponent with a project outside of the ECCC HCP/NCCP permit area may use the priority

[11] Department of the Army (DA)

conservation actions in Chapter 3 to identify areas to protect and enhance as compensatory mitigation for take or impacts to a focal species.

4.4.2.5 Mitigation Credit Agreements

An MCA is associated with an RCIS and identifies the type and number of credits a person or entity proposes to create by implementing one or more conservation actions or habitat enhancement actions, as well as the terms and conditions under which those credits may be used. As indicated in CFGC Section 1856(c), credits created through an MCA could be used to fulfill compensatory mitigation requirements pursuant to the California Endangered Species Act, to reduce adverse impacts to fish and wildlife resources from activities authorized pursuant to a Lake or Streambed Alteration Agreement under CFGC Section 1600, or to mitigate significant effects on the environment pursuant to CEQA, and possibly other state or federal regulations. MCAs must be prepared according to the requirements of CFGC Section 1856 and the Program Guidelines.

An MCA helps establish advance mitigation and can provide a number of significant benefits, particularly for agencies or entities with predictable long-term mitigation needs as listed below.

- **Cost effectiveness.** The MCA sponsor can set aside or purchase lands when doing so is most cost effective, knowing those lands will provide useful mitigation values in the future. A mitigation site should be vetted through the appropriate regulatory agency before the site is purchased.
- **Pooled resources for best results.** Mitigation credits can be pooled across large sites or multiple sites, providing economies of scale to deliver mitigation more efficiently across many projects.
- **Predictable future mitigation costs.** Although mitigation credits to satisfy mitigation obligations for a project must be assessed on a case-by-case basis by the regulating authority, an MCA can establish certainty/predictability about future costs for those mitigations.
- **Alignment with regional vision.** An MCA gives CDFW and other resource agencies some assurance that proposed mitigation fits within a larger conservation framework (i.e., an RCIS) and that investments in resource protection, restoration, and enhancement collectively contribute to meeting regional conservation goals and objectives.

Only CDFW may approve an MCA; as the RCIS proponent, the Coastal Conservancy does not have the authority to approve an MCA. Once this East Bay RCIS is approved by CDFW, any public or private entity may prepare, for CDFW approval, an MCA for one or more conservation action or habitat enhancement action that measurably advances East Bay RCIS conservation goals and objectives. A person or entity, including a state or local agency, with mitigation needs may choose to enter into an MCA with CDFW for a single large mitigation site, a single mitigation site with multiple phases, or a suite of mitigation sites.

MCAs will primarily facilitate permitting under the California Endangered Species Act for RCIS focal species that are state listed, and non-focal species whose conservation need is analyzed or otherwise provided for in this RCIS. Credits created through an MCA could be used to "fulfill compensatory mitigation requirements established under any state or federal environmental law, as determined by the applicable local, state, or federal regulatory agency" per Assembly Bill 2087 and CFGC Section 1856(c)), including CEQA, and Lake or Streambed Alteration requirements. This also applies to non-focal species of interest, particularly in the context of CEQA. Conservation actions or habitat enhancement actions aligned with the conservation goals and objectives of this RCIS, and that benefit non-focal species, may also be implemented to create mitigation credits for non-focal species (Section 2.2.7, *Non-Focal Species*, Appendix G, *Non-Focal Species Summaries*). An MCA could also be used to meet federal environmental law and regulation requirements with the approval of applicable federal regulatory agencies. Appendix B outlines how other regulatory agencies and local CEQA lead agencies may use this RCIS to facilitate permitting under their respective authorities.

Mitigation credits can be established by an MCA for any conservation action or habitat enhancement action that contribute to achieving RCIS conservation goals and objectives. Typically, mitigation credits will be established for the following types of conservation actions and habitat enhancement actions.

- Acquiring an interest in land to *permanently protect*[12] that land.
- Restoring habitat that creates new and/or increases existing habitat function for a focal species or non-focal species whose conservation need is analyzed or otherwise provided for in this East Bay RCIS.
- Enhancing habitat conditions or habitat connectivity for the benefit of focal species or non-focal species whose conservation need is analyzed or otherwise provided for in this RCIS.

CFGC Section 1856(f) (quoted below) requires CDFW to publish a notice of availability of any draft MCA for public review for a period of at least 45 days. During this public review period, the public may provide written comments, after which CDFW shall respond to written comments.

> (f) To enter into a mitigation credit agreement with the department, a person or entity shall submit a draft mitigation credit agreement to the department for its review, revision, and approval or disapproval. Within five days of deeming a draft agreement complete, the department shall publish notice of the availability of the draft agreement by filing its notice with the Governor's Office of Planning and Research and the city and county clerks of each county in which the agreement is applicable in part or in whole and shall make the draft agreement available to the public on its Internet Web site, and to any public agency, organization, or individual who has filed a written request to the department for notices regarding agreements, for review and comment for a period of at least 45 days, following which the department shall respond to written comments submitted during the public comment period and may approve the agreement, approve it with revisions, or disapprove it.

See CFGC Section 1856(f) parts 1 through 18 for a description of what an MCA must include.

More information about the MCA development and approval process can be found on the CDFW website.[13]

4.4.2.6 Use of Mitigation Credit Agreements in the ECCC HCP/NCCP Permit Area

This section contains information to guide the following groups.

- MCA sponsors considering creating an MCA within the ECCC HCP/NCCP inventory area or the Antioch HCP/NCCP inventory area (if approved).

[12] The Program Guidelines define permanent protection to mean: recording a conservation easement and providing secure, perpetual funding for management of the land, monitoring, legal enforcement, and defense.
[13] https://www.wildlife.ca.gov/Conservation/Planning/Regional-Conservation

- Proponents of covered activities within the ECCC HCP/NCCP permit area or the Antioch HCP/NCCP permit area (if approved) considering using credits created by an MCA as mitigation for covered activities.

Any project in the urban development area of the ECCC HCP/NCCP permit area subject to a discretionary action by a local land use authority must seek take coverage under the Federal and California Endangered Species Acts through the local land use planning agency in the ECCC HCP/NCCP permit area (i.e., the Cities of Brentwood, Clayton, Oakley, Pittsburg, and Antioch [if the Antioch HCP/NCCP is approved], and Contra Costa County).[14] Similarly, permittees of the ECCC HCP/NCCP (i.e., the Contra Costa County Flood Control and Water Conservation District and East Bay Regional Park District) must comply with the ECCC HCP/NCCP. Projects not subject to local land use authority may receive a species permit though the ECCC HCP/NCCP as a participating special entity.

This RCIS is not an alternative to the ECCC HCP/NCCP; as a voluntary, non-binding conservation strategy, it does not provide permits for compliance with any law or regulation. A project proponent whose project is inside of the ECCC HCP/NCCP permit area may only use mitigation credits created through an MCA if the Habitat Conservancy declines to extend coverage to the project proponent, as specified in CFGC Section 1856(j) (quoted below).

> The creation of mitigation credits pursuant to this section from a conservation action or habitat enhancement action implemented within the plan area of an approved natural community conservation plan shall not duplicate or replace mitigation requirements set forth in the natural community conservation plan and shall require the advance written approval of the plan's implementing entity. Mitigation credits created pursuant to this section may be used for covered activities under an approved natural community conservation plan only in accordance with the requirements of the plan. Individuals and entities eligible for coverage as a participating special entity under an approved natural community conservation plan may use mitigation credits created pursuant to this section only if the plan's implementing entity declines to extend coverage to the covered activity proposed by the eligible individual or entity.

To comply with CFGC Section 1856(j), a person, persons, or entity proposing to CDFW to sponsor an MCA in the ECCC HCP/NCCP inventory area or the City of Antioch's HCP/NCCP (if approved) inventory area must receive advance written approval from the ECCC HCP/NCCP implementing entity (i.e., the Habitat Conservancy) or the City of Antioch HCP/NCCP (if approved) implementing entity. The Habitat Conservancy or City of Antioch HCP/NCCP implementing entity will only approve creation of an MCA within their respective inventory if doing so will not reduce their ability to successfully implement their plans.

Furthermore, to comply with CFGC Section 1856(j), project proponents with activities that occur in the ECCC HCP/NCCP's permit area or the Antioch HCP/NCCP permit area (if approved) that may affect a species covered by the ECCC HCP/NCCP must take action as described below.

Proponents of projects eligible for coverage under the ECC HCP/NCCP must apply for project Endangered Species Act and California Endangered Species Act permits using the ECCC HCP/NCCP permitting process through the Habitat Conservancy, or by using the City of Antioch HCP/NCCP (if approved) permitting process.

[14] http://www.co.contra-costa.ca.us/depart/cd/water/HCP/project-permitting.html

Proponents of projects eligible for coverage as a participating special entity under the ECCC HCP/NCCP or the Antioch HCP/NCCP (if approved) may use mitigation credits created through an MCA for ESA or CESA-related mitigation only if the following criteria are met.

- The Habitat Conservancy or the Antioch HCP/NCCP implementing entity extends coverage to the project proponent as a participating special entity, and the proponent negotiates an alternative fee payment to fulfill mitigation obligations with the Habitat Conservancy or the Antioch HCP/NCCP implementing entity, which includes using or dedicating land or performing restoration through an MCA that meets the standard for a land-in-lieu of fee agreement consistent with the ECCC HCP/NCCP.

  And

- The Habitat Conservancy or Antioch HCP/NCCP implementing entity determines that MCA credits are consistent with the respective HCP/NCCPs and will not reduce the ability of the Habitat Conservancy or the Antioch HCP/NCCP implementing entity to successfully implement their respective plans.

  Or

- The Habitat Conservancy or Antioch HCP/NCCP implementing entity declines to extend coverage to the proposed covered activity.

A project proponent must receive a letter from the Habitat Conservancy or the Antioch HCP/NCCP implementing entity (if approved) before using mitigation credits created through an MCA denying coverage through the HCP/NCCP for activities eligible for permit coverage in the ECCC HCP/NCCP or Antioch HCP/NCCP areas.

For more information about creating an MCA in the ECCC HCP/NCCP inventory area or for requesting coverage for covered activities under the ECCC HCP/NCCP, contact the Habitat Conservancy.[15]

4.5 Amending the Regional Conservation Investment Strategy

The Coastal Conservancy may amend the East Bay RCIS. The Program Guidelines define two types of RCIS amendments: simple and complex. A simple amendment includes small or minor changes to the document that are more than a data update (i.e., the submission of geographic information system [GIS] data or minor changes to numbers or text in the document that require less than 4 hours of CDFW staff time; Section 4.2.1), but that do not result in a substantial change as determined by CDFW. A complex amendment would result in a substantial change to the RCIS, such as changes to the geographic area, focal species, or other conservation elements as determined by CDFW.

The public notice requirements, review and approval process, and timelines for a complex amendment are the same as for developing a new RCIS per the Program Guidelines. A simple amendment does not require public notice.

[15] https://www.contracosta.ca.gov/depart/cd/water/HCP/index.html

A simple or complex amended RCIS can be submitted by either the original RCIS proponent, CDFW, or by a third-party public agency with the express written authorization of the original RCIS proponent. If a third-party public agency wishes to amend an approved RCIS and the original RCIS proponent declines to amend the RCIS or declines to authorize a third-party public agency to do so, the third-party public agency may seek authorization from CDFW to amend the RCIS. CDFW may, in its sole discretion, authorize a third-party public agency to amend an RCIS if it determines that the proposed amendment will provide a substantial conservation benefit and will not unduly prejudice the rights or interests of the original RCIS proponent. CDFW may also, in its sole discretion, amend an RCIS if it determines that an amendment is necessary to conform to new or amended federal, state, or local laws or regulations, or if it determines that the proposed amendment will provide a substantial conservation benefit and will not unduly prejudice the rights or interests of the original RCIS proponent.

Chapter 5
References

5.1 Chapter 1

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5.2 Chapter 2

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Juan Pablo Galván, Land Use Manager, Save Mount Diablo. SMD Comments Draft East Bay Regional Conservation Investment Strategy. May 23, 2019.

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Rebecca Payne	Senior Regulatory and Mitigation Specialist
Simone Berkovitz	Researcher, Project Coordinator
Laura Cooper	Lead Editor
Ariana Marquis	Editor
Anthony Ha	Senior Publications Specialist
James Harmon	Publications Specialist
Jenelle Mountain-Castro	Senior Publications Specialist
Alan Barnard	Graphic Artist

6.2 East Bay RCIS Core Team

East Bay RCIS Core Team members are listed below, in order of last name.

Christa Cassidy*	The Nature Conservancy
Ross Chittenden*	Contra Costa Transportation Agency
Laura Cholodenko	California State Coastal Conservancy
Katherine Dudney*	AECOM
Abby Fateman	East Contra Costa County Habitat Conservancy
Aaron Gabbe	ICF
Kathryn Gaffney*	ICF
Julie Garren	AECOM
Kenneth Kao	Metropolitan Transportation Commission
Hisham Noeimi	Contra Costa Transportation Agency
Liz O'Donoghue	The Nature Conservancy
Carrie Schloss	The Nature Conservancy
Kristin Tremain Davis	AECOM
David Zippin	ICF

(* indicates person left the Core Team during the RCIS development process)

6.3 Resources Law Group

Chris Beale	Lead Attorney; Contributing Author of Appendix B, *Regulatory Processes*

6.4 Reviewers

6.4.1 Core Team and Core Team Member Organizations

The following individuals from Core Team and Core Team member organizations reviewed the East Bay RCIS in whole or in-part.

Laura Cholodenko	California State Coastal Conservancy
Katherine Dudney	AECOM
Abby Fateman	East Contra Costa County Habitat Conservancy
Julie Garren	AECOM

Sasha Gennet	The Nature Conservancy
Kenneth Kao	Metropolitan Transportation Commission
Tammy Lim	AECOM
Katie McLean	AECOM
Liz O’Donoghue	The Nature Conservancy
Ivan Parr	AECOM
Abigail Ramsden	The Nature Conservancy
Carrie Schloss	The Nature Conservancy
Danny Slakey	AECOM
Kristin Tremain Davis	AECOM

6.4.2 East Bay RCIS Stakeholder Group

The East Bay RCIS Stakeholder Group provided feedback and guidance on the East Bay RCIS. The following organizations and agencies were invited to participate in the East Bay RCIS Stakeholder Group. If the organization participated the individual participants are listed.

- Alameda County Resource Conservation District: Leslie Koenig and Katherine Boxer Latipow
- Alameda County Transportation Commission, Carolyn Clevenger and Vivek Bhat
- American Farmland Trust: Kara Heckert and Serena Unger
- Brentwood Agricultural Land Trust: Ron Brown
- Business Industry Association of the Bay Area: Lisa Vorderbrueggen
- California Department of Fish and Wildlife: Shannon Lucas, Ami Olson, and Ron Unger
- California Natural Resources Agency: Brady Moss
- Caltrans, District 4: JoAnn Cullom and Melanie Brent
- Center for Biological Diversity: Lisa Belenky
- Citizens’ Committee to Complete the Refuge: Carin High
- City of Livermore: Andy Ross and Steve Stewart
- City of Pleasanton
- Contra Costa Transportation Authority: Hisham Noeimi and Randy Iwasaki
- Contra Costa County Resource Conservation District: Chris Lim and Elissa Robinson
- County of Alameda: Liz McElligott
- East Bay Leadership Council: Josh Huber
- East Bay Regional Parks District: Sandra Hamlat and Erich Pfeuhler
- East Contra Costa County Habitat Conservancy: Abby Fateman and John Kopchik

- Greenbelt Alliance: Joel Devalcourt
- John Muir Land Trust: Linus Eukel
- Marin Audubon Society: Barbara Salzman
- Ohlone Audubon: Evelyn Cormier
- San Francisco Bay Joint Venture: Arthur Feinstein, Barbara Huning, Beth Huning,
- San Francisco District Army Corps of Engineers: Frankie Malamud-Roam
- Save Mount Diablo: Ted Clement, Seth Adams, and Juan Pablo Galvan
- Sonoma County Land Trust: Wendy Eliot
- State Coastal Conservancy: Laura Cholodenko and Matthew Gerhart
- Stop Waste: Brian Mathews
- Tri-Valley Conservancy: Laura Mercier
- University of California Cooperative: Shelia Barry
- Walnut Creek Watershed Council: Bob Simmons and Lesley Hunt
- Zone 7 Water Agency: Elke Rank

6.4.3 RAMP Technical Advisory Committee

The Bay Area RAMP Technical Advisory Committee (RAMP TAC) was involved in the RCIS planning process. The RAMP TAC provided feedback to the Core Team and consultants drafting the RCIS on technical issues and draft elements of the strategy. The following organizations and agencies participated in the RAMP TAC.

- Alameda County Transportation Commission
- California Department of Fish and Wildlife–Headquarters
- California Department of Fish and Wildlife–Region 3
- California Natural Resources Agency
- Contra Costa Transportation Authority
- Caltrans Headquarters
- Caltrans, District 4
- East Contra Costa County Habitat Conservancy
- Environmental Protection Agency–Region 9
- Metropolitan Transportation Commission
- National Marine Fisheries Service–Central Coast
- San Francisco Bay Conservation and Development Commission
- San Francisco Bay Regional Water Resources Control Board
- Santa Clara County Habitat Conservancy

- Santa Clara Valley Transportation Authority
- Solano Transportation Authority
- State Water Resources Control Board
- Environmental Protection Agency
- U.S. Fish and Wildlife Service