San Joaquin Valley Regional Conservation Investment Strategy

January 2025

Public Draft

San Joaquin Valley

Regional Conservation Investment Strategy

RCIS Proponent:

Reclamation District 2092

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Photo Credit: River Partners

1.1 Introduction

In the heart of California lies the San Joaquin Valley, a region renowned for its agricultural importance, the San Joaquin River and its tributaries have shaped a landscape with productive soils, sustaining a legacy of farming that continues today. Yet beneath this productive surface, the Valley harbors remnants of its natural heritage—diverse plant communities and wildlife that survive on undeveloped and protected lands. These natural areas face growing threats from groundwater overdraft, climate change, increased flood risks, intensifying drought, and the decline of landscape diversity and connectivity. Amidst these challenges, political and economic shifts are creating opportunities to transform the region. By taking actions such as incorporating wildlife friendly agricultural land-use practices, setting back levees, and restoring and reconnecting native habitats, the ecological integrity of the San Joaquin Valley may be revitalized. The San Joaquin Valley Regional Conservation Investment Strategy provides a strategic conservation vision to guide these critical actions, fostering a resurgence in species and habitat recovery across the region.

The San Joaquin Valley Regional Conservation Investment Strategy (RCIS)[1] is a conservation vision to help guide these beneficial actions to improve region-wide species and habitat recovery efforts. The San Joaquin Valley RCIS is a conservation planning tool sponsored by Reclamation District 2092[2] to promote the conservation of species, habitats, and other natural resources in the San Joaquin Valley. An RCIS is a voluntary, non-binding, non-regulatory conservation assessment that facilitates conservation outcomes through:

- Providing a regional plan for focal conservation elements through strategic, scientifically grounded actions and investments. Conservation elements include sensitive species and habitats, habitat connectivity, and hydrogeomorphic processes.
- Establishing conservation and enhancement goals, objectives, actions, and priorities. Implemented conservation element actions can impact a broad suite of species and habitats beyond those specifically identified this San Joaquin Valley RCIS (See Chapter 4, Conservation Strategy).
- Describing and promoting methods of conservation investment that will contribute to species and habitat conservation, including but not limited to:
    - Land acquisition and protection.
    - Habitat and ecological function creation, restoration, and enhancement.
    - Habitat corridor and transition zone establishment and enhancement.
- Complementing and consistent with existing natural community conservation plans, habitat conservation plans, federal and state recovery plans, and other approved conservation plans that overlap with the RCIS area (the geographic area encompassed by an RCIS).
- Enabling the development of mitigation credit agreements (MCAs) with the California Department of Fish and Wildlife (CDFW). Project proponents could use MCAs to fulfill

[1] Development of an RCIS was enabled by the passage of Assembly Bill 2087 in 2016 and the RCIS Program (California Department of Fish and Wildlife [CDFW] 2023a) administered by the California Department of Fish and Wildlife (CDFW).

[2] Reclamation District 2092 is the special district responsible for leading the middle San Joaquin River Regional Flood Management Plan. The Mid San Joaquin River region extends from the Merced-San Joaquin River confluence to the Stanislaus-San Joaquin River confluence.

resource agency mitigation requirements for projects in advance of project impacts.

The San Joaquin Valley RCIS is not a regulatory document. It does not create or modify regulatory requirements, regulate land use, establish land use designations, or affect or preempt the land use authority of a public agency to implement infrastructure and urban development in local general plans. Nothing in this RCIS is intended to, nor shall it be interpreted to, conflict with controlling federal, state, or local law, including California Fish and Game Code (FGC) Sections 1850–1861, or any guidelines adopted by CDFW pursuant to FGC Section 1858. This RCIS complies with all applicable laws and does not preempt the authority of the state or of local agencies to implement infrastructure and urban development in local general plans. The RCIS is not a mitigation plan, but it may be used to find mitigation opportunities and enable MCAs (see Chapter 5) to make compliance with existing mitigation requirements easier.

The approval or existence of this RCIS does not:

- Modify in any way the standards for issuance of incidental take permits, consistency determinations, take authorizations, lake or streambed alteration agreements, or any other permits or authorizations;
- Modify in any way the standards under CEQA, or in any way limit a lead agency's or responsible agency's discretion in determining whether a proposed project may or may not result in significant environmental effects or in any way establish a presumption of whether a proposed project may or may not result in significant environmental effects or whether a proposed project's impacts would be mitigated;
- Prohibit or authorize any project or project impacts;
- 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;
- 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;
- Alter or affect, or create additional requirements for, the general plan of the cities and counties that overlap the RCIS area;
- Constitute any of the following, for the purposes of CEQA: (1) a plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect; (2) a local policy or ordinance protecting biological resources; or (3) an adopted local, regional, or state Habitat Conservation Plans (HCPs).

The RCIS presents a vision for conservation in the San Joaquin Valley and includes quantitative conservation targets. These conservation targets are voluntary and non-binding; the targets are not regulatory requirements or standards and are not regulatory compliance success criteria. Public and private entities (such as land trusts, regulatory agencies, nonprofit organizations, and landowners) can use this RCIS to better understand regional context and needs, as well as overlapping priorities as they relate to conservation planning. See Table 1-1 below for detailed uses of this RCIS.

Conditions of RCIS development and CDFW approval include that (CDFW 2023a):[3]

[3] The RCIS Program Guidelines (CDFW 2023a) includes a glossary of standard terms used in the program. Key terms may be defined in the San Joaquin Valley RCIS. See the guidelines document for additional definitions.

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

If approved by CDFW, an RCIS may be valid for up to 10 years. CDFW may extend the duration of an approved or amended RCIS for an additional 10 years provided the RCIS is updated to include new scientific information and the RCIS continues to meet the RCIS Program's requirements (CDFW 2023a).

An iterative process was used to develop this RCIS in coordination with a project team, steering committee, and interested parties (see Appendix A, Public Outreach). This process identified regionally important species, habitats, and ecological processes and developed conservation strategies to inform future investment. This document provides a snapshot of conditions at the time of writing and may be amended by the RCIS sponsor in the future.

1.1.1 RCIS Document Structure

The San Joaquin Valley RCIS has five chapters and supporting appendices.

Chapter 1 outlines the document's purpose and need, proposing agencies, and development process and outreach. It also provides an introduction on how to best use and access information in the RCIS document.

Chapter 2 provides a summary of the existing conditions in the region. This review of the region's natural and built environments includes community demographics, habitats, infrastructure, land use and existing conservation. The chapter also describes existing conservation and restoration planning in the region as well as pressures and stressors faced by species and habitats.

Chapter 3 describes the process for selecting the focal species, other conservation elements, and non-focal species and natural resources for inclusion in the RCIS. It also includes a description of each focal conservation element's ecological requirements, threats, climate change vulnerability, and associated non-focal conservation elements.

Chapter 4 presents the conservation strategy, which has priorities, goals and the associated objectives and actions for each focal conservation element. It also recommends actions and locations prioritized for the benefit of conservation elements.

Chapter 5 describes implementation, advance mitigation, adaptive management and monitoring, and processes for extending and amending the RCIS.

Appendices provide further documentation on project support, outreach and engagement efforts, and technical data. Technical appendices include review of other planning documents, vegetation community crosswalk, and non-focal species information.

Table 1-1. How to Use the San Joaquin Valley RCIS, by Objective

Objective	Potential RCIS Users	How to Use the RCIS	Relevant RCIS Section(s)
Strategically acquire property or conservation easements for conservation purposes from willing sellers	▪ Land trusts ▪ Entities seeking mitigation ▪ Organizations wishing to restore habitat	▪ Review figures to see locations with overlapping habitat values ▪ Review conservation strategies for regional land acquisition priorities	▪ Section 2.3: Natural Communities, Biodiversity, and Connectivity ▪ Section 2.6: Land Conservation ▪ Chapter 4: Conservation Strategy
Improve effectiveness of restoration and enhancement actions	▪ Land managers ▪ Project proponents ▪ Entities seeking mitigation	▪ Review climate resilience actions and incorporate them into project designs ▪ Review and understand existing conditions and restoration planning efforts already underway in the region ▪ Align restoration project design elements with conservation element goals and objectives ▪ Ensure project alignment with other regional plans by reviewing the regional planning overview	▪ Chapter 2: Regional Conditions ▪ Section 2.4: Major Infrastructure ▪ Section 2.7: Existing Conservation Plans, Studies, Policies, and Compliance ▪ Chapter 4: Conservation Strategy ▪ Appendix D: Consistency Review
Avoid or minimize impacts on areas with high conservation value	▪ Regulatory agencies ▪ Project proponents ▪ Entities seeking mitigation	▪ Review figures and data portal for locations with overlapping habitat values to assess potential impacts ▪ Review conservation strategies that identify high-value areas for conservation	▪ Section 2.3: Natural Communities, Biodiversity, and Connectivity ▪ Section 2.6: Land Conservation ▪ Chapter 4: Conservation Strategy

Objective	Potential RCIS Users	How to Use the RCIS	Relevant RCIS Section(s)
Obtain funding for restoration, enhancement, stewardship, or acquisition projects	▪ Landowners, including land trusts, governments, non-profits, private owners, and other organizations acquiring land or water for conservation	▪ Demonstrate the alignment of proposed projects with RCIS actions ▪ Include priority actions and locations in funding requests	▪ Chapter 4: Conservation Strategy
Support education and outreach efforts	▪ Nonprofit organizations ▪ Entities with an educational mission	▪ Review regional conditions information such as demographics, infrastructure, and habitats to understand communities and how they relate to the RCIS area ▪ Use conservation element profiles to provide education in appropriate languages on species and habitat needs and threats in the region	▪ Chapter 2: Regional Conditions ▪ Chapter 3: Conservation Elements ▪ Chapter 4: Conservation Strategy
Obtain regulatory permits for projects and mitigation plans	▪ Regulatory agencies ▪ Project proponents	▪ Review existing and proposed infrastructure ▪ Review maps to identify areas of potential habitat for avoidance or restoration ▪ Implement actions identified in the RCIS conservation strategy	▪ Section 2.4: Major Infrastructure ▪ Section 2.3: Natural Communities, Biodiversity, and Connectivity ▪ Section 2.6: Land Conservation ▪ Chapter 3: Conservation Elements Chapter 4: Conservation Strategy
Design more resilient, sustainable, and beneficial projects	▪ Regulatory agencies ▪ Project proponents	▪ Review climate resilience strategies and actions and incorporate them into project designs	▪ Chapter 4: Conservation Strategy

Objective	Potential RCIS Users	How to Use the RCIS	Relevant RCIS Section(s)
Develop or update general plans, master plans, or other planning documents	▪ Government agencies ▪ Regional collaboratives	▪ Review priority actions and location, and conservation strategies that identify high-value areas for conservation ▪ Incorporate actions addressing policy, such as zoning changes in high-value conservation areas, into new planning documents	▪ Chapter 4: Conservation Strategy

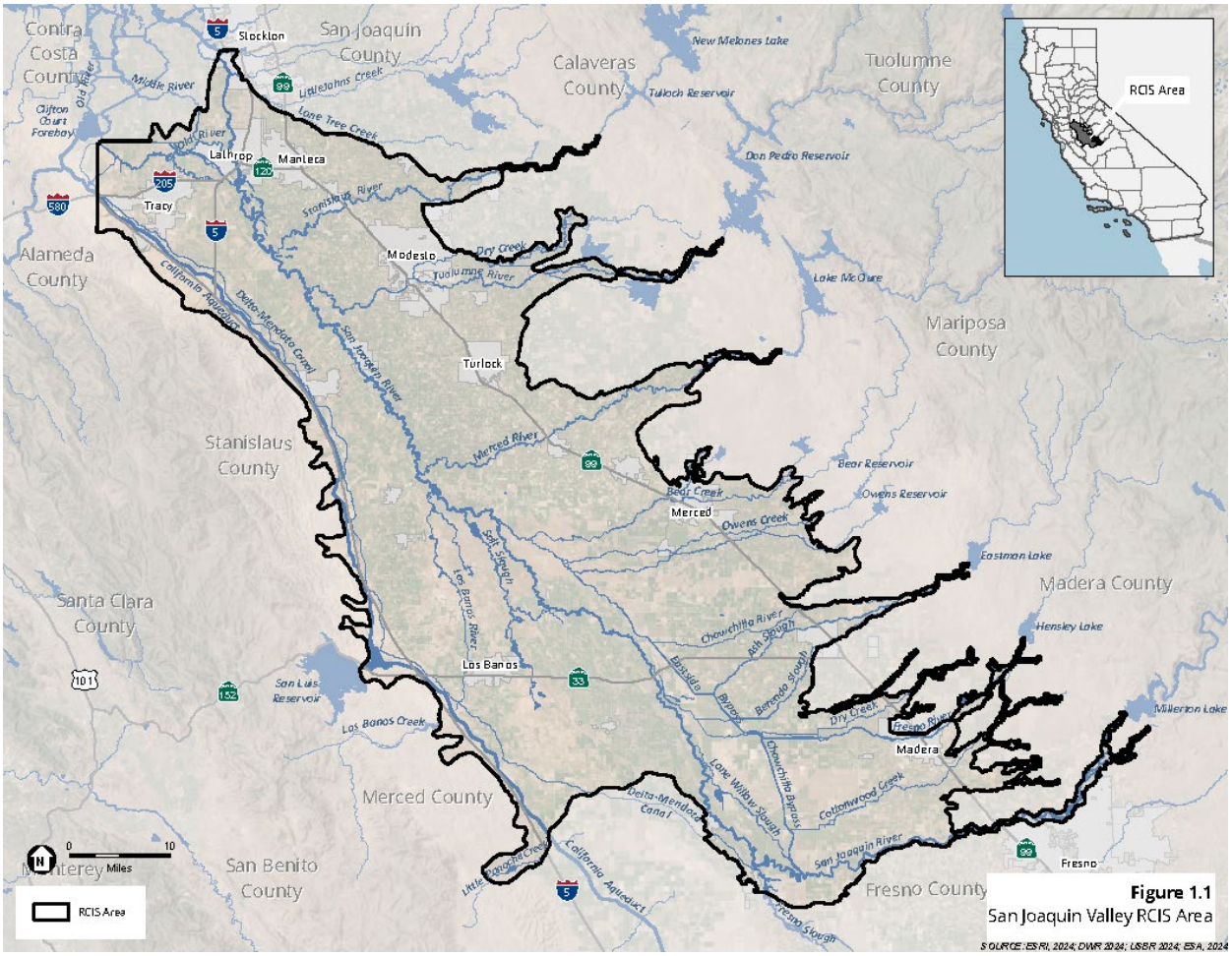
1.1.2 San Joaquin Valley Overview and RCIS Geographic Extent

The San Joaquin Valley RCIS area extends into San Joaquin, Stanislaus, Merced, and Madera counties, plus small portions of Tuolumne and Fresno counties (Figure 1-1).

The San Joaquin Valley RCIS area was delineated to include the streams, floodplains, alluvial fans, and terraces associated with the San Joaquin River system between Friant Dam and the Sacramento-San Joaquin Delta (Delta). The San Joaquin River is 330 miles long and drains an area of 15,558 square miles. The RCIS area coincides with US Environmental Protection Agency (USEPA) Level IV Ecoregions 7m, 7n, 7o, and part of 7p The RCIS area coincides with US Department of Agriculture (USDA) Level III Ecoregions 5, 6, and 7. Adjacent areas outside the RCIS area boundary include the regions characterized by the Delta ecosystems to the north, high-density vernal pool complexes to the east, Tulare Basin to the southeast, and the Central Coast Range to the west.

The San Joaquin Valley RCIS complements and builds on the existing conservation plans in the region, including the Central Valley Flood Protection Plan and its supporting Conservation Strategy (California Department of Water Resources [CDWR], 2016), which focuses on establishing an integrated landscape that supports wildlife habitat, flood safety and high-quality agricultural land, while supporting sustainable water resource management. In aligning the planning area with these priorities, the San Joaquin Valley RCIS can drive progress toward numerous state and regional goals through the inclusion of actions that align with regulatory and non-regulatory drivers in the region (see Chapter 2 for more details on drivers).

Figure 1-1. San Joaquin Valley RCIS Area



1.1.3 RCIS Conservation Purpose and Need

Guiding legislation (FGC, Section 1852[b]) states:

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

The San Joaquin Valley RCIS area is a highly altered landscape. The region is largely characterized by agricultural land use with urban centers and rural communities interspersed, though managed habitat areas are dominated by herbaceous wetlands. It has been impacted by groundwater overdraft, climate change, increased flood risk, intensifying drought, water pollution, disrupted natural hydrology and sediment supply pathways, invasive species and pathogens, and the loss of landscape heterogeneity and habitat connectivity. The San Joaquin Valley is home to approximately 4.3 million people of diverse cultural backgrounds (Public Policy Institute of California, 2023). Landscape planning that addresses the region's pressures and stressors must be done at a holistic level to be inclusive of the region's diverse communities and land use needs.

Informed by a range of climate change projections, the conservation actions described in this San Joaquin Valley RCIS aim to contribute to increased resilience of the Valley's habitats, water infrastructure, and neighboring communities from climate change impacts such as flooding, drought, and other extreme weather events. Future restoration, habitat connectivity, and infrastructure resiliency projects will benefit from a holistic regional plan that outlines conservation investments, some in the form of advance mitigation, which can be implemented to reconnect, improve, and build landscape reliance of riparian habitat (e.g., habitat with an clear divide between aquatic and land vegetation) and wetland habitat (e.g., aquatic habitat dominated by vegetation).

The San Joaquin Valley RCIS has been developed to integrate the best available scientific data, existing conservation plans and priorities, and anticipated mitigation needs to enhance resiliency and buffer the region against projected climate change impacts. The conservation actions and habitat enhancement actions (Chapter 4) advance the conservation of the focal conservation elements identified in Chapter 3. The RCIS also serves to provide nonbinding, voluntary guidance for the identification of wildlife and habitat conservation priorities (such as the establishment and improvement of habitat connectivity).

1.1.4 RCIS Development Process

The public and interested parties, including community-based and non-governmental organizations and federal, state, and local agencies provided input in the development of the San Joaquin Valley RCIS. Reclamation District 2092 and its partners developed the San Joaquin Valley RCIS to promote regional habitat conservation planning. The San Joaquin Valley RCIS project team included River Partners staff, representing the RCIS Sponsor Reclamation District 2092, and consultants from Environmental Science Associates (ESA), Environmental Incentives, and HT Harvey. Funding for the development of the San Joaquin Valley RCIS was provided by the California Wildlife Conservation Board.

Diverse input from interested parties is a key component in developing any regional planning effort with community buy-in. Participation varies based on the goal of public input (see Table 1-2). The goal of each public engagement event during the development process is detailed in Table 1-3. The RCIS planning team notified and engaged a broad array of interested parties, including local public agencies with land use authority, during the development of the RCIS. Additionally, public notice was issued to announce RCIS development, and a public meeting was held in accordance with FGC requirements.

Table 1-2. Public Participation Spectrum

	Inform	Consult	Involve	Empower
Goal	To provide the public with balanced and objective information to assist them in understanding the problems, alternatives, and/or solutions.	To obtain public feedback on analysis, alternatives, and/or decisions.	To work directly with the public throughout the process to ensure that public issues and concerns are consistently understood and considered.	To place final decision-making in the hands of the public.
Promise	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns, and provide feedback on how public input influenced the decision.	We will collaborate with you to ensure that your concerns and issues are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will implement what you decide.
Example Materials	Fact sheets Website	Public comment Public meetings	Workshops Polling	Delegated decisions

Note: This table is adapted from the International Association for Public Participation.

Information about the San Joaquin Valley RCIS and updates about its development and implementation can be accessed on the public website, www.sjvrcis.org.

1.1.4.1 RCIS Steering Committee

The RCIS Steering Committee shaped the development and future implementation of the RCIS. The Steering Committee met regularly starting in May 2023 and consisted of an inclusive and diverse set of members who lent their expertise on the San Joaquin Valley and specific conservation issues. The RCIS Steering Committee led the public outreach and involvement process to ensure that FGC public meeting requirements were met and to engage potential users of the RCIS throughout the development process (Table 1-3). The Steering Committee also fostered buy-in from key groups to ensure that the RCIS reflects local perspectives, and therefore will lead to better conservation outcomes.

The San Joaquin Valley RCIS Steering Committee was made up of members affiliated with the following organizations:

- San Joaquin Council of Governments
- San Joaquin River Restoration Program
- California State Parks
- California Department of Transportation (Caltrans)
- ValleyEco
- Self-Help Enterprises
- University of California, Davis
- Sustainable Conservation
- Central California Irrigation District
- Madera County

- U.S. Fish and Wildlife Service
- San Joaquin Area Flood Control Agency
- California Department of Water Resources
- California Department of Fish and Wildlife
- Environmental Defense Fund
- Restore the Delta
- Grassland Water District
- San Joaquin River Conservancy
- Turlock Irrigation District
- San Luis and Delta-Mendota Water Authority
- Bay Institute

1.1.4.2 Public Outreach

Public outreach and involvement were an important part of the process in developing the San Joaquin Valley RCIS. FGC Section 1854(c)(5) requires that, at least 60 days before submitting a final RCIS to CDFW for its review and approval, the RCIS proponent (in this case, Reclamation District 2092) shall notify the board of supervisors and the city councils in each county within the RCIS area and provide the board of supervisors and the city councils an opportunity to submit written comments for at least 30 days. On X, Reclamation District 2092 notified county boards of supervisors and city councils and invited the boards of supervisors and city councils to submit written comments on the San Joaquin Valley RCIS. Reclamation District 2092 also notified 53 contacts associated with Tribes and Tribal organizations with land or service area overlapping the RCIS area. See Appendix A for a full list of notified entities. This notice was combined with the notice of availability of the draft San Joaquin Valley RCIS for public review. The public was invited to provide written comments on the draft San Joaquin Valley RCIS to Reclamation District 2092 or CDFW.

FGC Section 1854(c)(3)(B) requires that, in a draft RCIS submitted to CDFW for approval, the public agency shall include responses to written public comments submitted to the RCIS proponent before and during the public comment period. This final San Joaquin Valley RCIS includes responses to public comments from Reclamation District 2092 (Appendix A).

1.1.4.3 Notice of Intent

On March 13, 2024, a Notice of Intent was posted with the six counties within or overlapping with the RCIS area: San Joaquin, Stanislaus, Merced, Madera, Fresno, and Tuolumne counties. The notice was also sent to the California Governor's Office of Planning and Research (State Clearinghouse), CDFW, and major cities and Tribes with jurisdictions within or overlapping with the RCIS area. See Appendix A for a full list of notified entities.

1.1.4.4 Public Meeting

A public meeting was held in person in Merced, California, within the boundaries of the RCIS area, on April 24, 2024, from 5:30-7:30 p.m. There was also a virtual meeting option. Notice of the public meeting was published on March 21, 2024, more than 30 days in advance of the meeting, to CDFW's RCIS notification list and the RCIS's outreach list, which includes all local public agencies with land use authority and contacts from Tribes and Tribal organizations with land or service areas overlapping the RCIS area. The public meeting notice included a request

to submit translation requests in advance. Verbal, chat, and written comments received during the public meeting are summarized in Appendix A.

Table 1-3. Interested Party Involvement and Public Outreach

Date	Engagement Action	Public Participation Spectrum[1]	Objective/Topics
March 30, 2023	Steering Committee soft launch	Collaborate	Introduce the San Joaquin Valley RCIS to potential steering committee members.
May 24, 2023	Steering Committee meeting	Collaborate	Gather input on the RCIS boundary, focal species and conservation elements selection process, and data sources.
August 8, 2023	Steering Committee meeting	Collaborate	Identify major regional drivers affecting conservation action implementation to incorporate into the Regional Conditions.
December 15, 2023	Public website published	Inform	Establish website as a public communication tool for the RCIS.
March 13, 2024	Public Notice of Intent to Draft an RCIS	Inform	Inform the public about the RCIS development and how to learn more and provide input.
March 21, 2024	Notice of Public meeting	Inform	Inform the public about the April 24 public meeting and how to participate.
April 24, 2024	Steering Committee meeting	Collaborate	Identify priorities for the Conservation Strategy.
April 24, 2024	Public meeting	Consult	Review RCIS progress to date and provide an opportunity for input.
September 8, 2024	Steering Committee meeting	Collaborate	Discuss Steering Committee feedback on the Administrative Draft RCIS.

1 See Table 1-2 for how various parties could participate in RCIS development.

2 Regional Conditions

This section provides context for the San Joaquin Valley RCIS by summarizing the RCIS area's history, including historical ecology, settlement, and development, through to the present day. Current land uses, habitat conditions, policy initiatives, and pressures on the landscape provide the foundation for the selection of goals, objectives, and actions that will lead to species, habitat, and ecosystem function conservation and recovery.

2.1 San Joaquin Valley RCIS Area Boundary

The San Joaquin Valley RCIS area boundary was established based on landscape features, including the streams, floodplains, alluvial fans, and terraces associated with the San Joaquin River system between Friant Dam and the Sacramento-San Joaquin Delta (Delta) (U.S. Geological Survey [USGS], 2016). The planning area coincides with USEPA Level IV Ecoregions 7m, 7n, 7o, and a portion of 7p that is north of the San Joaquin River (Figure 2-1). These areas all include nearly level floodplain and basin floors, or very gently to gently sloping floodplains and alluvial fans, as well as having similar soil regimes and land cover (USGS 2016). Adjacent areas excluded from the RCIS area boundary include the regions characterized by the Delta ecosystems to the north, high-density vernal pool complexes to the east, Tulare Basin to the southeast, and the Central Coast Range to the west.

Figure 2-1. RCIS Area Boundary Selection

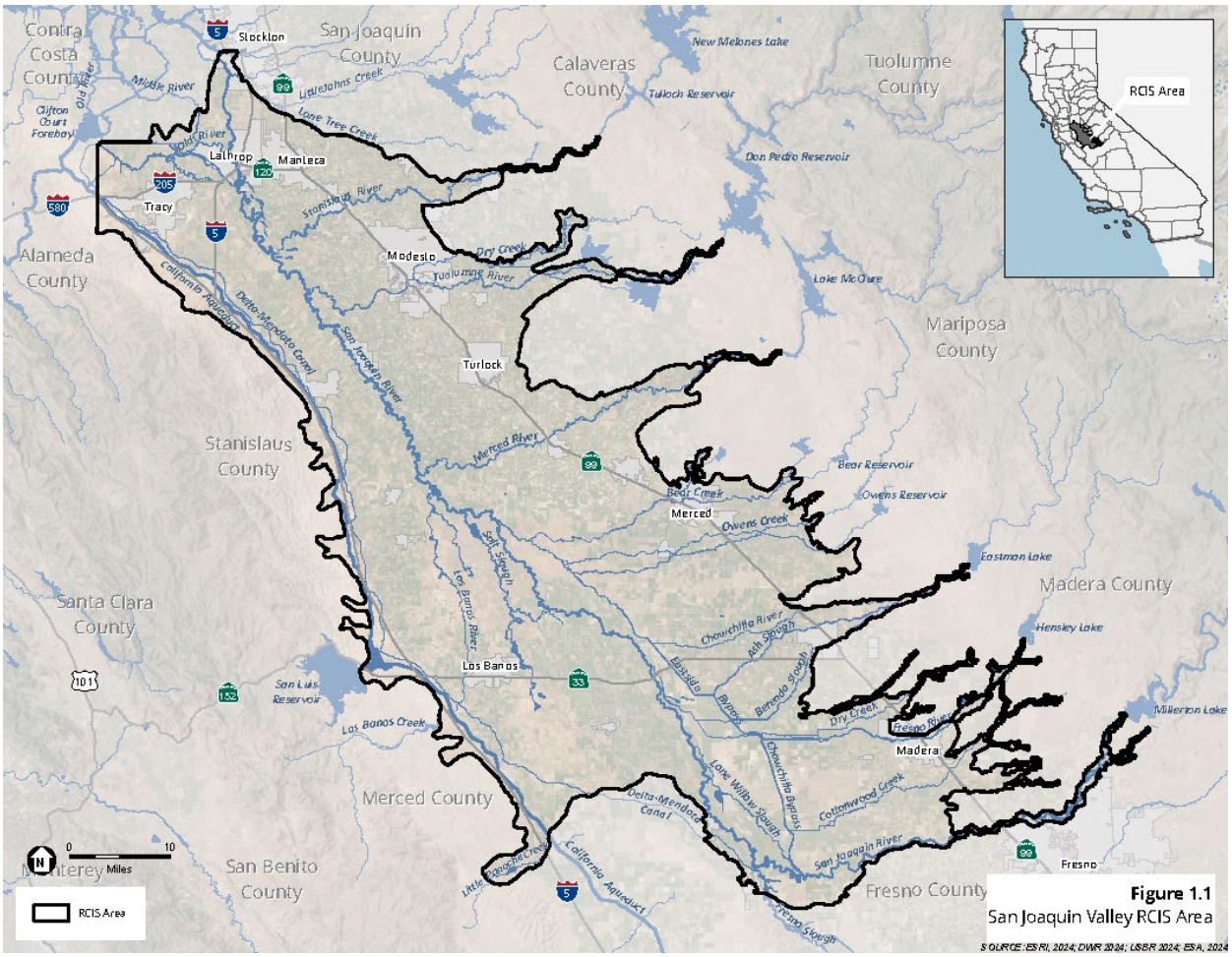


Figure 1.1
San Joaquin Valley RCIS Area

SOURCE: ESRI, 2024; DWR 2024; USBR 2024; ESA, 2024

2.2 Regional Conditions Overview

As part of the Great Central Valley of California, the San Joaquin River Basin is a gently sloping valley between the foothills of the Sierra Nevada and the Inner Coast Ranges that drains into the Delta, the largest estuary on the West Coast. The San Joaquin River itself is 330 miles long and drains an area of approximately 15,550 square miles (SWRCB, 2016). The landscape has been heavily modified and consists primarily of agricultural lands interspersed with urban centers and rural communities. A limited number of natural vegetation communities have not been modified and are intact, while managed habitats occupy a portion of the region; some of these areas are protected in state and federal reserves and habitat easements. The San Joaquin River Basin (together with the Tulare Basin) is home to approximately 4.3 million people of diverse cultural backgrounds (Public Policy Institute of California [PPIC], 2022).

Picture: San Joaquin River in Merced, California

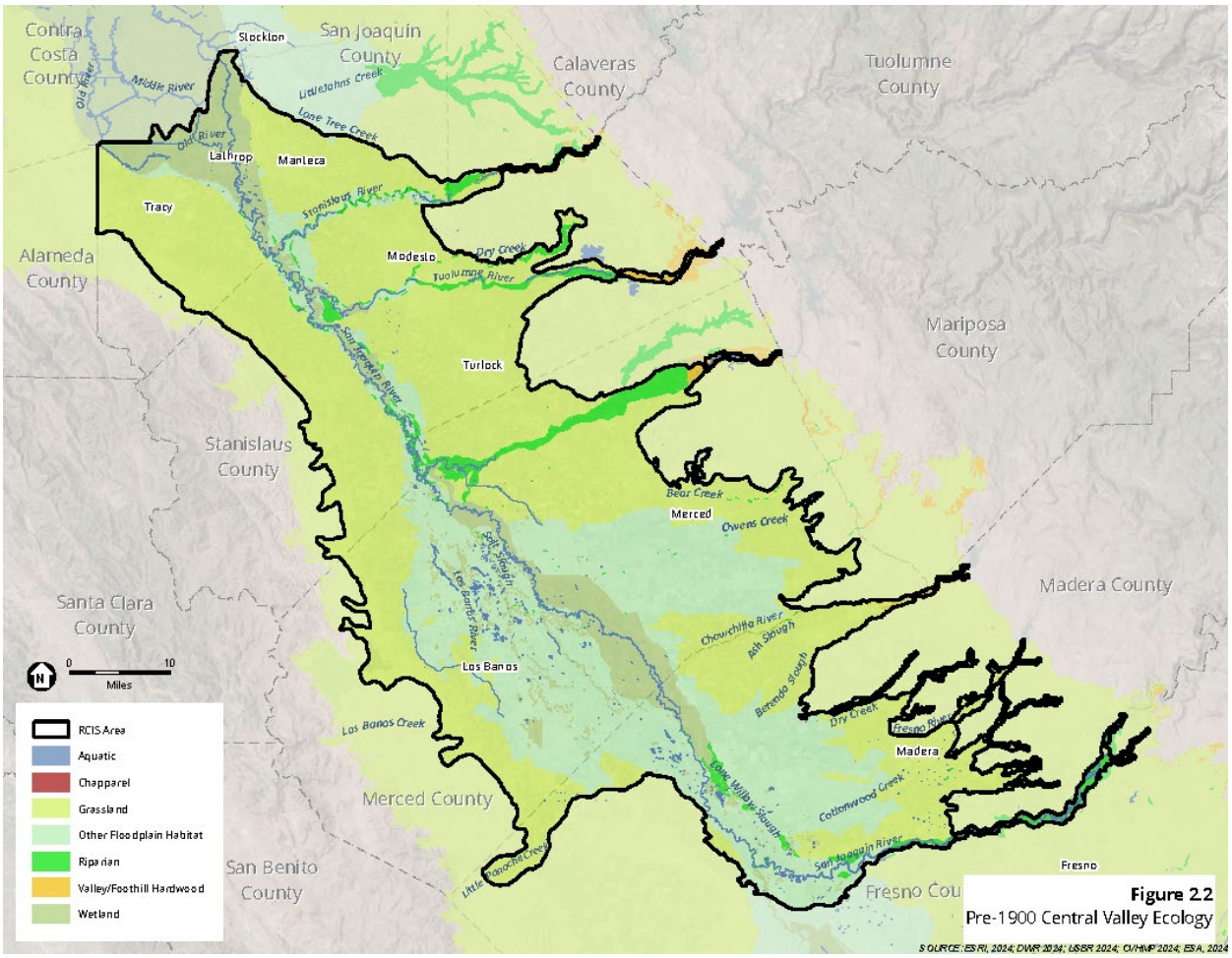
2.3 Landscape History

2.3.1 Pre-historic Landscape

Prior to European settlement, the San Joaquin Valley's natural landscape comprised a mosaic of desert scrub, freshwater wetlands habitat, riparian corridors, grasslands, and shrublands (Kelly et al., 2006; California State University, Chico, 2003; see Figure 2-2). Tule elk and pronghorn antelope grazed grasslands, which consisted of diverse assemblages of annual and perennial grasses and forbs, including seasonal wetlands (e.g., vernal pools) with numerous endemic species (Wallace, 2004; Whipple et al., 2012).

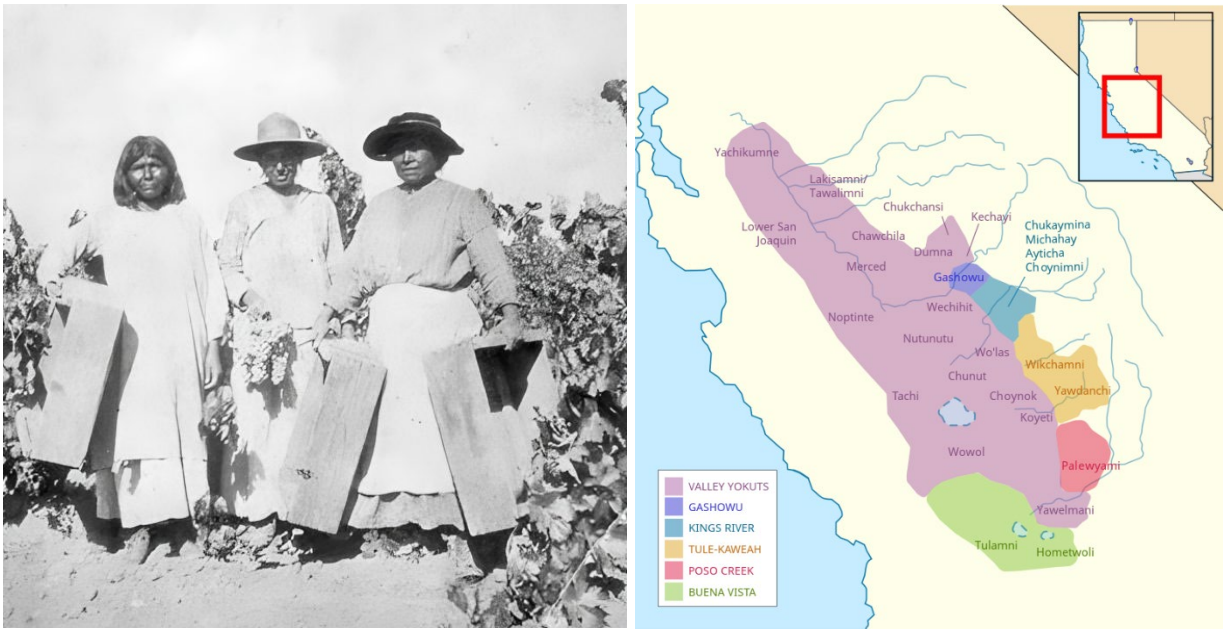
Much of the region's ecology stems from its hydrogeologic history and alluvial substrates. Historically, the floodplains along San Joaquin Valley rivers were regularly inundated for extended periods of time during large seasonal floods. These floodwaters peaked during spring snowmelt and slowly receded, leaving behind moist soils that supported highly productive seasonal wetlands and riparian shrublands and forests (Central Valley Joint Venture [CVJV], 2020). Major tributaries to the San Joaquin River flowed freely without obstruction and supported large populations of anadromous fish, which migrated between the valley's rivers and the Pacific Ocean.

Figure 2-2. Pre-1900 Central Valley Ecology



2.3.2 Indigenous History

The RCIS area is culturally and geographically affiliated with various Yokuts groups, with some of the upper reaches of the watersheds affiliated with various Miwok groups (Gorelick, 2020). Yokuts and Miwok have been divided into numerous cultural-geographical groups, each regional group having their own Tribal organizations within (Gorelick, 2020). The Yokuts and Miwok typically lived in permanent villages, with the latter also utilizing semi-temporary camps for summer resource procurement (Gorelick, 2020). Yokuts and Miwok groups relied on the natural landscape to fish, hunt, and gather food, using waterways to conduct these activities as well as a means of travel throughout the region (Gorelick, 2020). Neither group is thought to have practiced intensive agricultural activities, though evidence exists for horticultural activities and landscape and resource management activities, including intentional burning (Anderson, 2005; Gorelick, 2020). The federal and state governments recognize several Yokuts and Miwok groups active in the region as California Native American Tribes. These groups are living communities who actively participate in preserving their Tribal culture and resources.



Pictures: North Fork Rancheria residents, selection from historical map

2.3.3 Colonial Era to Present-Day

2.3.3.1 European Settlement

European settlement in the San Joaquin Valley brought persecution, disease, and displacement to its native peoples. California's first contact with colonial Europeans was in the 1700s. The Spanish established missions and other settlements along the coast and made missionary expeditions into the RCIS area. Beginning in the 1820s, cattle grazing took place in the San Joaquin Valley on ranchos granted by the Mexican government. It is likely that at this time, the extensive displacement of native plants from the San Joaquin Valley's grasslands by Eurasian grasses and forbs began (Bartolome et al., 2007). Also around this time—and for the next two hundred years—hunting from European explorers reduced and eliminated populations of native ungulate grazers, such as tule elk (Wallace, 2004).

In 1849, following the discovery of gold in the Sierra Nevada, the state's landscapes changed dramatically. The gold rush brought hydraulic mining, which eroded and altered the landscape. Hydraulic mining flushed sediment down rivers, clogging them downstream and increasing flooding in the valley by raising channel beds above their natural state (CDWR, 2016). In response to increased flood events and challenges, levees and other flood management facilities were established. Such facilities isolated large areas of floodplain from flood flows, to facilitate agricultural and urban development, which led to a loss of marsh and floodplain habitat (CDWR, 2012).

The California Gold Rush also brought mass migration of people and increased development of the region with railways, growth of towns and cities, and expansion of agriculture (Norwich University Online, 2017). This generated a large influx of cattle and sheep into the Central Valley. The Los Banos region, for example, was the winter base of flocks of sheep that in summer grazed the mountains of the Sierra Nevada (Minnich, 2008). In the following decades, dry-land farming became widespread, and irrigated agriculture began to spread via the development of canals, rerouting of streams, and, increasingly, alterations to the valley's natural topography.

With demand for water resources increasing, the California legislature adopted Britain's Common Law of riparian water rights in 1850 (Stene, 2015). The law gave landowners bordering streams or bodies of water rights to that water; those whose land did not border had no rights to the water, which restricted access of many landowners to California's water (Stene, 2015). However, the California courts also recognized the common-law practice of appropriative water rights, which began in mining communities (Water Education Foundation [WEF], 2023). After posting a notice of claim, water could be diverted from one point for use at a separate point, often through canals. In 1914, the State Legislature officially recognized the state's hybrid system of riparian and appropriative water rights (WEF, 2023). Demand for water also led to the development of water storage and allocation facilities.

Picture: Miners in 1852, during the California gold rush

2.3.3.2 Agricultural Expansion

Agriculture has intensified, diversified, and proliferated within California since the period of European settlement. The San Joaquin Valley's agricultural development has been consistent with the general trends seen in the Central Valley as a whole. Production has shifted from field crops toward intensive fruit and nut cultivation (Olmstead & Rhode, 2017). The lower value field crops provided habitat for species, while the high value perennial crops provide little habitat value to flora and fauna. Agriculture continues to evolve and respond to market pressures, technological innovations, and biological constraints to the present-day.

The legacy of past agricultural practices continues to affect natural resources in the region. For example, soils on the western side of the San Joaquin Basin are derived from marine sediments that are high in salts and trace elements (CVJV, 2020). Post-harvest irrigation was formerly used to leach these substances from the upper soil, and return flows were used as a wetland water source. Selenium concentrations in this tailwater proved damaging to a wide range of birds and presents a management challenge for the region today (CVJV, 2020).

2.3.3.3 Hydrology Alteration

2.3.3.3.1 Rivers and Watersheds

Beginning in the mid-1800s, large-scale gold extraction techniques, flood control projects, and land reclamation projects for agriculture and urban development led to the conversion of most riverine lands and wetlands to other uses. As settlement in the San Joaquin Valley increased, the need to control annual flooding led to the construction of dams, straightening of channels, and armoring of streambanks (Table 2-1).

Table 2-1. Major Water Diversions Impacting San Joaquin River Hydrology, 1849–2010

Year Completed	Water Diversion Infrastructure
1871	Mendota Dam (Weir)
1872	Miller and Lux Canal along west side of San Joaquin Valley
1912	Goodwin Dam on Stanislaus River[1]
1919	Newer Mendota Dam on San Joaquin River with a movable section to allow navigation
1919	Exchequer Dam and Power Plant (created Lake McClure)[1]
1923	O'Shaugnessy Dam on Tuolumne River (created Hetch Hetchy Reservoir)[1]
1923	Don Pedro Dam on Tuolumne River (created Don Pedro Reservoir)[1]
1924	Melones Dam on Stanislaus River[1]
1929	Pardee Dam on Mokelumne River (created Pardee Reservoir)[1]
1940	Water diversions started in Contra Costa Canal[1]
1949	Friant Dam on San Joaquin River (created Millerton Lake)[1]
1951	Delta Cross Channel,[1] Delta-Mendota Canal, and Tracy (Jones) Pumping Plant[1]
1958	Tulloch Dam on Stanislaus River (created Tulloch Reservoir)[1]
1963	Camanche Dam on Mokelumne River (created Camanche Reservoir)[1]
1964	New Hogan Dam on Calaveras River (created New Hogan Reservoir)[1]
1959–1966	Lower San Joaquin River Flood Control System, including bypass system, above Merced River
1967	San Luis Canal and Dam (created San Luis Reservoir)
1967	New Exchequer Dam on Merced River[1]
1967	State Water Project Delta (Banks) Pumping Plant and California Aqueduct
1970	New Don Pedro Dam on Tuolumne River[1]
1978	New Melones Dam on Stanislaus River[1]
1998	Los Vaqueros Dam on Kellogg Creek (created Los Vaqueros Reservoir)[1]

Source: Reclamation, 1997; Singer and James, 2008

[1] Reflects an area outside the RCIS area.

The demand for agricultural production incentivized allocation of water supplies for irrigation. Major modifications to the hydrology within the RCIS area include the construction of diversion facilities, such as Friant Dam, for irrigation and flood management; construction of flood control levees and channelization of waterways; encroachment of agriculture and urban development into the floodplain; and aggregate mining in the upper reaches of the San Joaquin River and its tributaries (CDWR, 2012).

The development of dams, diversions, canals, and levees for agricultural and urban development have dramatically changed the hydrology of the Central Valley, significantly reducing the quality and extent of riverine, and riparian and wetland habitats (See Chapter 2, Natural Communities),. Late nineteenth and early twentieth century diversion dams for agriculture disrupted salmon migration and significantly reduced late summer and fall flows (Cain et al., 2003). On the west side of the San Joaquin River, overbank flows continued to inundate tens of thousands of acres of seasonal wetlands (the "Grasslands") that continued to support vast numbers of migratory waterfowl and shorebirds (Garone, 2011).

Friant Dam and the massive diversion capacity of the Friant-Kern and Madera canals significantly altered the valley's riverine and floodplain ecosystems. The reduced flows of the mainstem San Joaquin River left large stretches of the river dry during summer and fall months starting in the late 1940s, which extirpated salmon from the southern part of the Central Valley. Friant Dam and its associated diversions, combined with upstream hydropower reservoirs, significantly reduced the size and frequency of winter and spring floods, which reduced downstream riverine and wetland habitats. Overbank flows no longer seasonally inundated surrounding grassland habitats.

Near full control of the floods on the San Joaquin's three major tributaries—the Merced, Tuolumne, and Stanislaus—did not occur until the late 1960s and 1970s when smaller dams, built on each of these rivers, were replaced by major flood control reservoirs. These diversions drastically reduced the flow rates in these riverine systems (Cain et al., 2003). Smaller tributaries experienced even greater alterations. The Fresno River, for example, was dammed to reduce flooding and divert irrigation water, and portions of its natural channel were replaced with manufactured channels.

The largely successful efforts to control floods on the San Joaquin River and its major and minor tributaries allowed agriculture to encroach further onto the once vast historic floodplain wetlands of the San Joaquin Valley. Habitat losses have continued with the trend toward perennial crops like nuts and vineyards. The substantial degradation of riverine and riparian habitats has continued for decades after construction of the flood control and water supply system because the natural processes that sustained ecosystems were permanently altered. The dams blocked the downstream movement of gravel that replenished gravel beds. Together with levees and diversions, dams dramatically reduced the extent and frequency of the previously routine, widespread, and gradually receding spring floods. The spring floods would recontour channels and floodplains which allowed for willows and cottonwoods to establish in new locations. Since the impairment of these processes, riverine and riparian habitats have been simplifying and changing in their species composition, incrementally shifting from shrubs and forests dominated by willows and cottonwoods to forests and woodlands dominated by species whose life cycle is not dependent on gradually receding floodwaters, such as valley oak and elderberry (Mount, 1995; Jones & Stokes, 1998; Vaghti & Greco, 2007).

2.3.3.3.2 Groundwater Basins

Groundwater occurs in aquifers throughout the San Joaquin Basin and is important for sustaining healthy ecosystems. It is also a major part of the region's water supply. Pumping groundwater to irrigate crops exacerbated the loss of habitat already resulting from surface water control infrastructure; in much of the valley, pumping lowered groundwater below the reach of the tree roots and caused the land to subside (Hundley, 2001).

There are several groundwater subbasins within the RCIS area (see Section 2.4.1 Present-Day Landscape: Hydrology, for more details). Many aquifers in the basin contain a thick layer of clay, called Corcoran clay, which is susceptible to compaction when groundwater is pumped. As a result, several large parts of the RCIS area have experienced noticeable sinking of land, called land subsidence, that has further altered how water flows on the surface. The Central Valley is more dependent on groundwater than the rest of the state. For example, 90% of Central Valley residents rely on groundwater for part or all their drinking water.

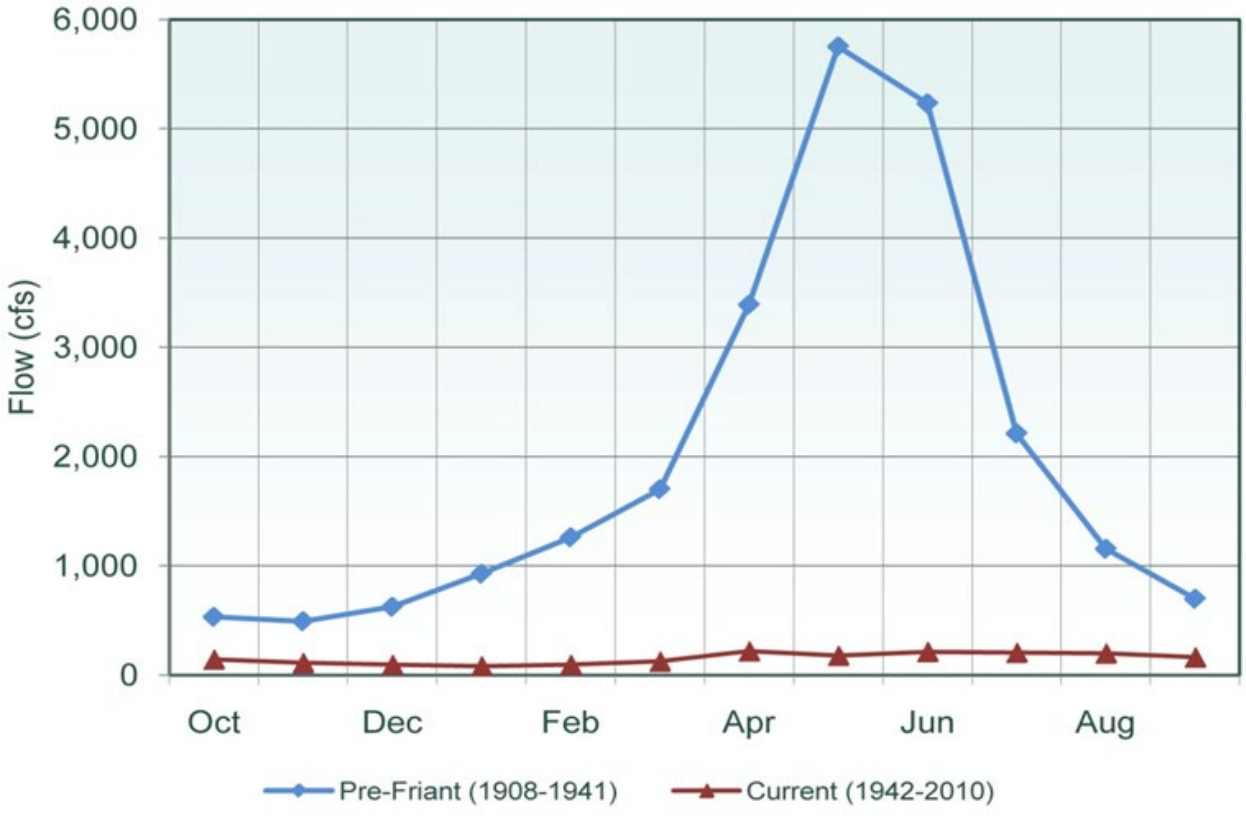
Picture: Delta-Mendota Canal and California Aqueduct near Los Banos, California. Photo by Ken James, California Department of Water Resources.

2.4 Present-Day Landscape

2.4.1 Hydrology

As discussed above, dams, diversions, and levees have dramatically changed the natural hydrology of the rivers, streams, and creeks within the RCIS area. Today, the west side of the RCIS area is supplied with surface water imported from the Delta through the Central Valley Project; on the east side, flows on every major river within the basin are regulated by dams and diversion facilities (see Section 2.4.3.3.1, Existing Infrastructure). The consequences of this regulation are illustrated by Figure 2-3 which shows a graph of median monthly discharge of the San Joaquin River before and after construction of Friant Dam (CDWR, 2012). The primary natural sources of surface water to the basin are the San Joaquin River and its three principal tributaries—the Merced, Tuolumne, and Stanislaus rivers—that drain the western slope of the Sierra Nevada (Figure 2-4). Each of these rivers drains large areas of high-elevation watersheds that typically supply snowmelt runoff during the late spring and early summer months. Historically, peak flows occurred in May and June, and flooding occurred in most years along all the major rivers (CDWR, 2012). The U.S. Federal Emergency Management Agency (FEMA) has mapped flood risk zones throughout the RCIS area (Figure 2-5).

Figure 2-3. Monthly Median Flows in the San Joaquin River below Friant Dam



Note. Graph is based on USGS Gage 11251000 data.
Source: CDWR, 2012

Figure 2-4. Surface Hydrology within the RCIS Area

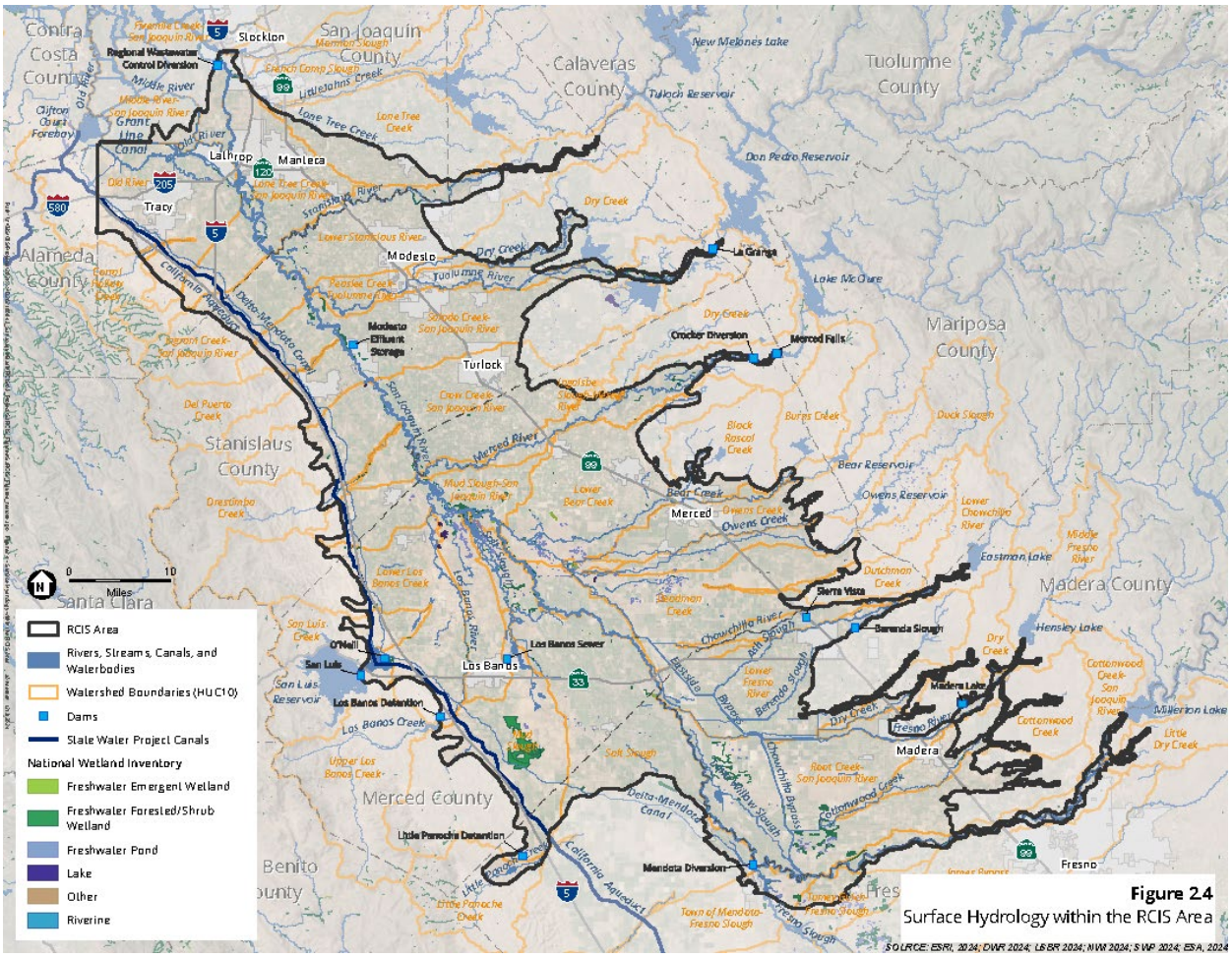
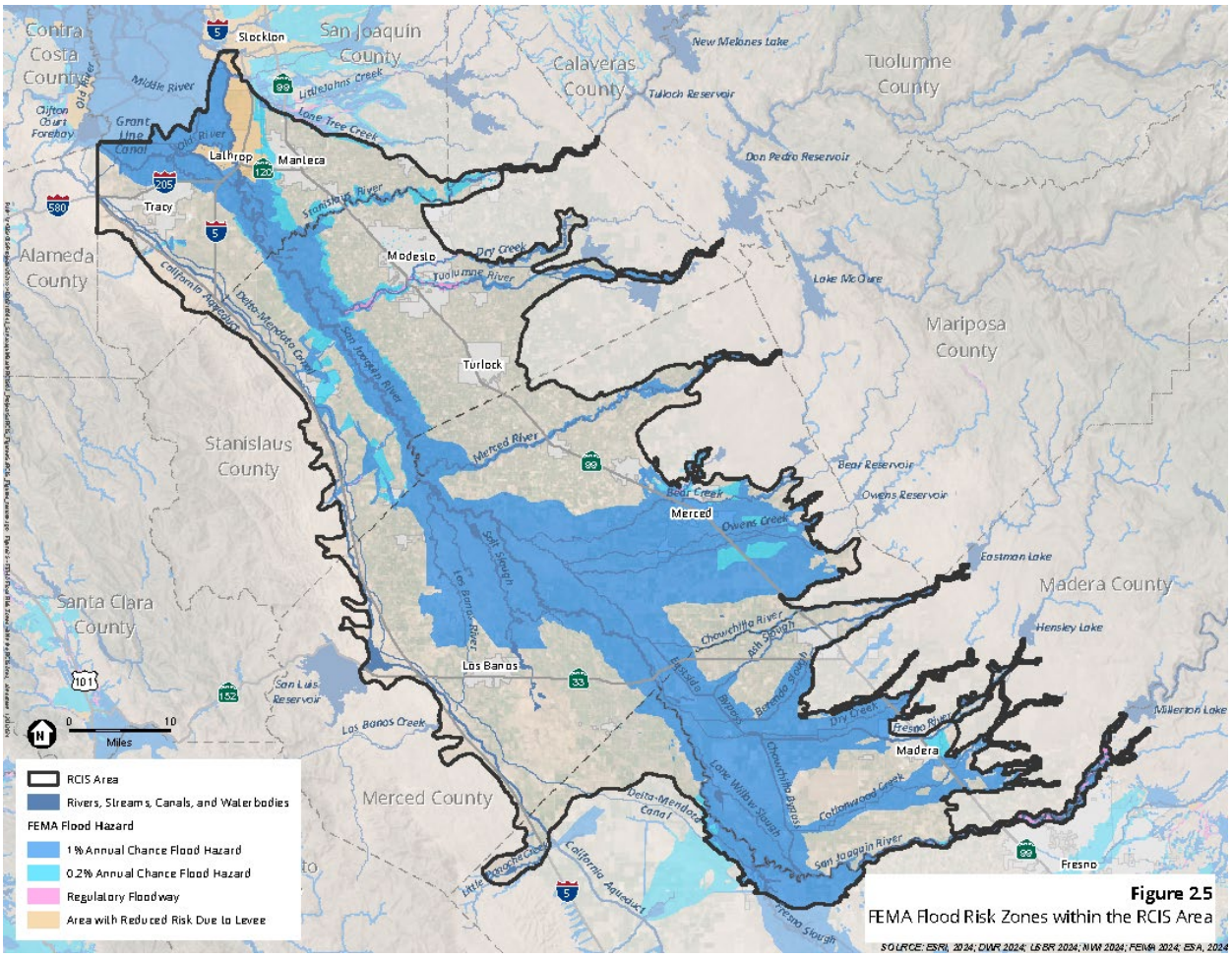


Figure 2.4
Surface Hydrology within the RCIS Area

SOURCE: ESRI, 2024; DWR 2024; USBR 2024; NWI 2024; SWP 2024; ESA, 2024

Figure 2-5. FEMA Flood Risk Zones within the RCIS Area



2.4.1.1 Rivers and Watersheds

Despite major changes to the region's rivers and streams, they remain particularly important to native biodiversity because of the ecosystem services and habitat values they provide in an otherwise arid environment. Water scarcity and agricultural development have significantly increased the importance of rivers and streams to many native species because they are one of the few places in the RCIS area where native species can find both water and native vegetation. Table 2-2 lists 35 major stream systems present within the RCIS area (which are also shown in Figure 2-4). Many of these streams have been characterized in detail within other plans. For example, the Central Valley Flood Protection Plan (CVFPP) includes descriptions of the streams that contain major dams and other flood control infrastructure (CDWR, 2016, Appendix F). The CVFPP not only details the infrastructure itself but contains useful information about the attributes of the stream systems and their natural processes.

Table 2-2. Major Stream Systems within the RCIS Area

Ash Slough	East Side Bypass	Middle River	Salmon Slough
Bear Creek	French Camp Slough	Mountain House Creek	Salt Slough
Berenda Slough	Fresno River	Mud Slough	San Joaquin River
Bravel Slough	Fresno Slough	Old River	Stanislaus River
Buttonwillow Slough	Little Panoche Creek	Owens Creek	Sugar Cut
Chowchilla River	Lone Tree Creek	Paradise Cut	Tom Paine Slough
Cottonwood Creek	Lone Willow Slough	Red Bridge Slough	Tuolumne River
Deep Slough	Los Banos Creek	Richie Slough	Walthall Slough
Dry Creek	Merced River	Riley Slough	

Note. The stream systems (also shown in Figure 2-2a) represent major hydrologic features digitized from 1:24,000-scale USGS topographic maps. These are not all the hydrologic features found on the USGS topographic maps.

Source: USGS, 2019

Despite the major modifications to hydrology in the RCIS area, watersheds remain a useful unit for describing habitats and ecosystem processes across the region. Because watersheds are nested at different scales, Hydrologic Unit Codes (HUCs) comprise a standardized set of hydrologic boundaries used by regulatory agencies for the purpose of clearly describing project locations in documents such as permit applications (USGS, 2013). HUCs are expressed along with a number e.g., HUC10, that refers to the scale at which the hydrologic boundaries are delineated. Table 2-3 lists the 35 HUC10s present within the RCIS area.

Table 2-3. HUC10s within the RCIS Area

1803000909 – Tumey Gulch-Fresno Slough	1804000204 – Salado Creek-San Joaquin River
1803000910 – Town of Mendota-Fresno Slough	1804000205 – Ingram Creek-San Joaquin River
1804000101 – Little Dry Creek	1804000301 – Corral Hollow Creek
1804000102 – Cottonwood Creek	1804000302 – Lone Tree Creek-San Joaquin River
1804000103 – Cottonwood Creek-San Joaquin River	1804000305 – Five-mile Creek-San Joaquin River
1804000104 – Little Panoche Creek	1804000306 – Old River
1804000107 – Lower Chowchilla River	1804000309 – Middle River-San Joaquin River
1804000108 – Root Creek-San Joaquin River	1804000703 – Middle Fresno River

1804000109 – Dutchman Creek	1804000704 – Dry Creek
1804000112 – San Luis Creek	1804000705 – Lower Fresno River
1804000113 – Mud Slough	1804000807 – Dry Creek
1804000114 – Black Rascal Creek	1804000808 – Ingalsbe Slough-Merced River
1804000116 – Deadman Creek	1804000913 – Dry Creek
1804000118 – Lower Bear Creek	1804000914 – Peaslee Creek-Tuolumne River
1804000119 – Lower Los Banos Creek	1804001007 – Lower Stanislaus River
1804000121 – Mud Slough-San Joaquin River	1804005103 – Lone Tree Creek
1804000120 – Salt Slough	1804005104 – French Camp Slough
1804000202 – Crow Creek-San Joaquin River	

Source: USGS/NRCS, 2013

2.4.1.2 Groundwater Basins

There are nine major groundwater basins in the RCIS area, seven of which are critically over-drafted (CDWR, 2023b). Basins are considered critically overdrafted when “continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts” (CDWR, 2023a). During average hydrologic conditions, groundwater often provides around 40% of the urban and agricultural water supply. This percentage increases during dry years when surface water supplies are limited. For certain areas of the San Joaquin Basin, including rural communities, groundwater may be the only water supply available year-round.

2.4.2 Natural Communities

Natural communities within the RCIS area include aquatic, riparian, grassland, shrubland, and woodland community types (Figure 2-6). As discussed previously, the landscape has undergone large-scale land use changes that have diminished the current extent of these natural community types within the RCIS area. Based on vegetation mapping used in this RCIS, the remaining natural communities comprise about 20% of the RCIS area (Table 2-4), yet support the majority of the region’s biodiversity, providing habitat for a range of common and special-status species. The California Landscape Conservation Cooperative (CLCC) Central Valley Landscape Conservation Project provides a summary of the natural communities in the region, along with an assessment of their projected climate vulnerability in the Central Valley (CLCC, 2018).

The RCIS uses a detailed geographic information system (GIS)-based map of land cover types to spatially characterize the distribution of existing natural communities and habitat within the RCIS area. The majority of the data sources (CDFW 2011, 2014, 2018, 2019, 2022) were created under the auspices of the Vegetation Classification and Mapping Program (VegCAMP) in compliance with the Survey of California Vegetation Classification and Mapping Standards (SCV). Existing Vegetation (EVeg) from the U.S. Forest Service (USFS, 2019) were used for locations where VegCAMP data were not available. To create a consistent classification system across the complete RCIS study area, all datasets were cross-walked with the California Wildlife Habitat Relationship System (CWHR), then further reclassified using CWHR and other more fine-scale information (e.g., NVCS Alliance) to distinguish the most prevalent and significant natural communities and habitats for the RCIS. Appendix B provides more information on the vegetation data sources and a crosswalk between source vegetation layers and the compilation layer used for this report.

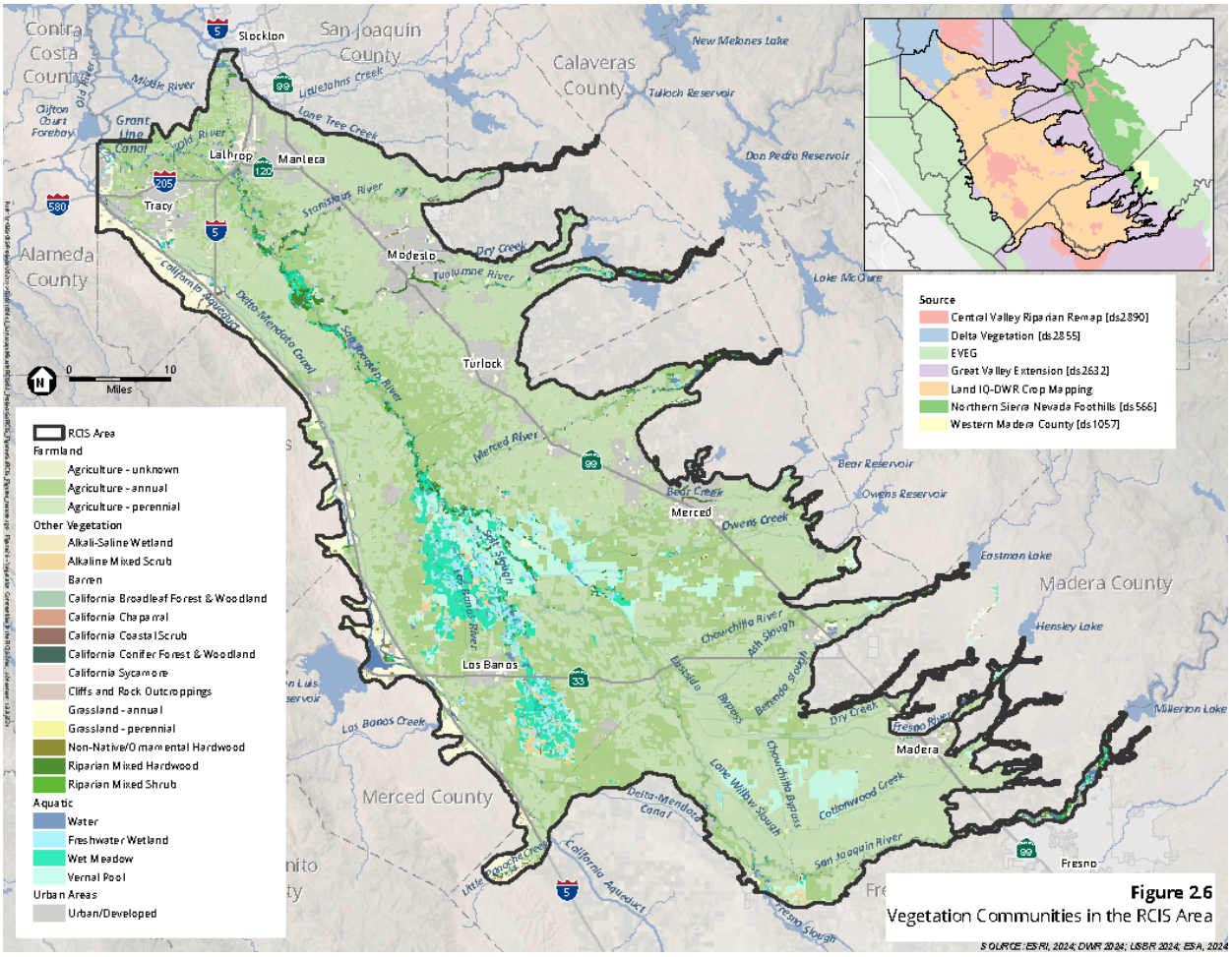
The vegetation community types occurring within the RCIS area are summarized in Table 2-4, which includes the total acres in the RCIS area, the percent of the RCIS area made up of the vegetation community, and the percent protected (as shown in California Protected Areas Database (CPAD), 2023). The vegetation types are categorized as "natural" and "developed" to show the relative prevalence of these types across the entire RCIS area.

Table 2-4. Acreages of Vegetation Communities within the RCIS Area

Vegetation Community Types	Total Acres[1]	% of RCIS Area	Acres Protected[2]	% Protected
Natural Vegetation Community Types	***381,879***	**20.7%**	**72,230**	**19%**
Alkaline Mixed Scrub	7,337	0.4%	868	12%
Alkali-Saline Wetland	2,904	0.2%	1,579	54%
Barren	5,205	0.3%	284	5%
California Broadleaf Forest and Woodland	1,746	0.1%	44	3%
California Chaparral	347	<0.1%	4.71	1%
California Coastal Scrub	854	<0.1%	347.56	41%
California Conifer Forest and Woodland	7	<0.1%	0	0%
California Sycamore	531	<0.1%	64.89	12%
Cliffs and Rock Outcroppings	35	<0.1%	5.99	17%
Freshwater Wetland	12,651	0.7%	3,628	29%
Grasslands – Annual	127,059	6.9%	8,549	7%
Grasslands – Perennial	174	<0.1%	172.75	99%
Non-native/Ornamental Hardwood	2,017	0.1%	102	5%
Riparian Mixed Hardwood	24,652	1.3%	5,128	21%
Riparian Mixed Shrub	3,904	0.2%	554	14%
Vernal Pool	98,449	5.3%	28,856	29%
Water	24,706	1.3%	4,184	17%
Wet Meadow	69,301	3.8%	17,858	26%
Developed Community Types	***1,465,569***	**79.3%**	**149,380**	**10%**
Agriculture – Annual	437,850	23.7%	406	<0.1%
Agriculture – Perennial	695,044	37.6%	75,876	11%
Agriculture – Unknown	153,939	8.3%	72,230	47%
Urban/Developed	178,736	9.7%	868	<0.1%[3]
Total	**1,847,449**	**-**	**221,610**	**12%**

[1] Acres are rounded to nearest whole acre.
[2] Number of acres protected as shown in CPAD (2023).
[3] City parks primarily comprise protected urban areas.

Figure 2-6. Vegetation Communities in the RCIS Area



2.4.2.1 Habitat Connectivity

Plants and animals depend on habitat connectivity, which is the degree to which organisms or natural processes can move unimpeded across habitats. Animals move between different patches of habitat to feed, rest, and reproduce as part of their daily and seasonal activities. Individuals disperse in search of unoccupied habitat, and some embark on long migrations on which their species depend. As fruits and seeds, plants move between patches of habitat adhered to or in the guts of animals and floating on air or water. Additionally, water flowing along rivers and streams not only moves plants and animals downstream and onto floodplains, but also moves nutrients and sediments and reshapes channels and floodplains.

Together these movements sustain the diversity and functioning of biological communities. They allow populations to persist through the colonization and recolonization of habitats, and the interchange of individuals and their genes. They also result in habitat patches containing greater numbers and variety of species—thereby having greater resilience.

Therefore, connected habitats support species at different life stages, maintain ecosystem functions, allow species migration, maintain geneflow, and increase resiliency to climate change. Natural ecosystem processes, a mosaic of habitats, and large, intact landscape blocks are essential elements of habitat connectivity. Whereas fish passage barriers, such as dams,

and barriers to the movement of terrestrial animals such as linear infrastructure (e.g., roads and canals) and converted landscapes (e.g., for urban or agricultural use) reduce or eliminate connectivity.

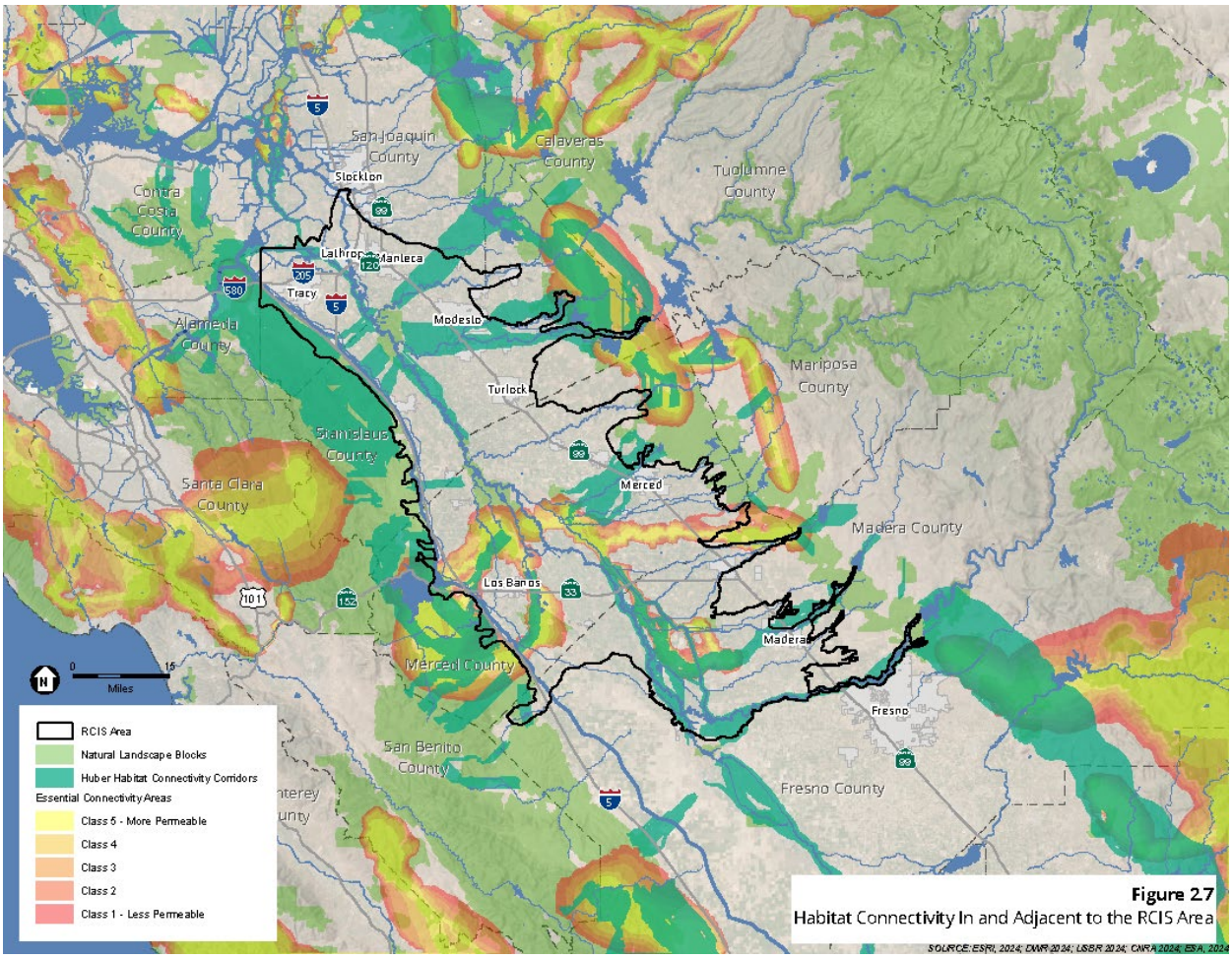
In the San Joaquin River Basin, species movement has been dramatically reduced over time. The terrestrial landscape has become one of agriculture and development permeated by roads and canals; with the exception of the Grassland Ecological Area, refuges and other protected areas of habitat that remain are fragmented and isolated. Meanwhile, the construction of dams, levees, and other water infrastructure has reduced the connectivity of waterways. The degradation of nearshore and inundated floodplain habitats has further impeded aquatic species movement, and animals are sometimes directly pulled into unscreened water diversions.

Habitat connectivity is facilitated in the San Joaquin River Basin through landscape-level connections between habitats within the RCIS planning area and with the neighboring coastal and Sierran bioregions. Habitat connectivity is not just important to species in the planning area, but it is also essential for species moving across the bioregion from the coast to the Sierra on annual migrations or through decadal population dispersal. These corridors include east-west and north-south connections. Migratory birds use linkages between habitat areas for travel, feeding, and resting. Aquatic to upland connectivity can be provided by elevational gradients such as across natural habitats on floodplains and levees that provide opportunities for wildlife movement during high water and flood events. Rivers and riparian corridors provide linear connections from upper watersheds to the Delta. In addition to providing for the movement of animals and plant dispersal, these corridors include waterways that transport sediment and nutrients from upstream sources and groundwater sources that can affect surface flows and the movement of nutrients, salts, and chemicals.

Statewide, scientists have been working to map habitat connectivity and understand which regional habitat linkages are most important to reconnect habitat connectivity in California. These efforts include the Missing Linkages Project (Penrod et al., 2001), the California Essential Habitat Connectivity Project (Spencer et al., 2010), Critical Linkages: Bay Area and Beyond (Penrod et al., 2013), Central Valley Corridors (Huber et al., 2011), and the California Biodiversity Initiative Roadmap (California Natural Resources Agency [CNRA], 2018). Most recently, connectivity has been integrated into California's 30x30 initiative (CNRA, 2022).

Figure 2-7 shows Essential Connectivity Areas within and adjacent to the RCIS area. The California Essential Habitat Connectivity Project was a statewide assessment to identify large remining blocks of intact, contiguous natural habitat (natural landscape blocks), and modeled linkages (essential connectivity areas) between them to best maintain habitat connectivity across the landscape (Spencer et al., 2010; Hube et al., 2015; CDFW, 2023a). It depicts large, relatively natural habitat blocks that support native biodiversity and areas essential for ecological connectivity between them. Areas mapped by Spencer et al. (2010) also show the landcover permeability of these areas to ecological flow. See additional information about habitat connectivity in Chapter 3.

Figure 2-7. Habitat Connectivity within the RCIS Area



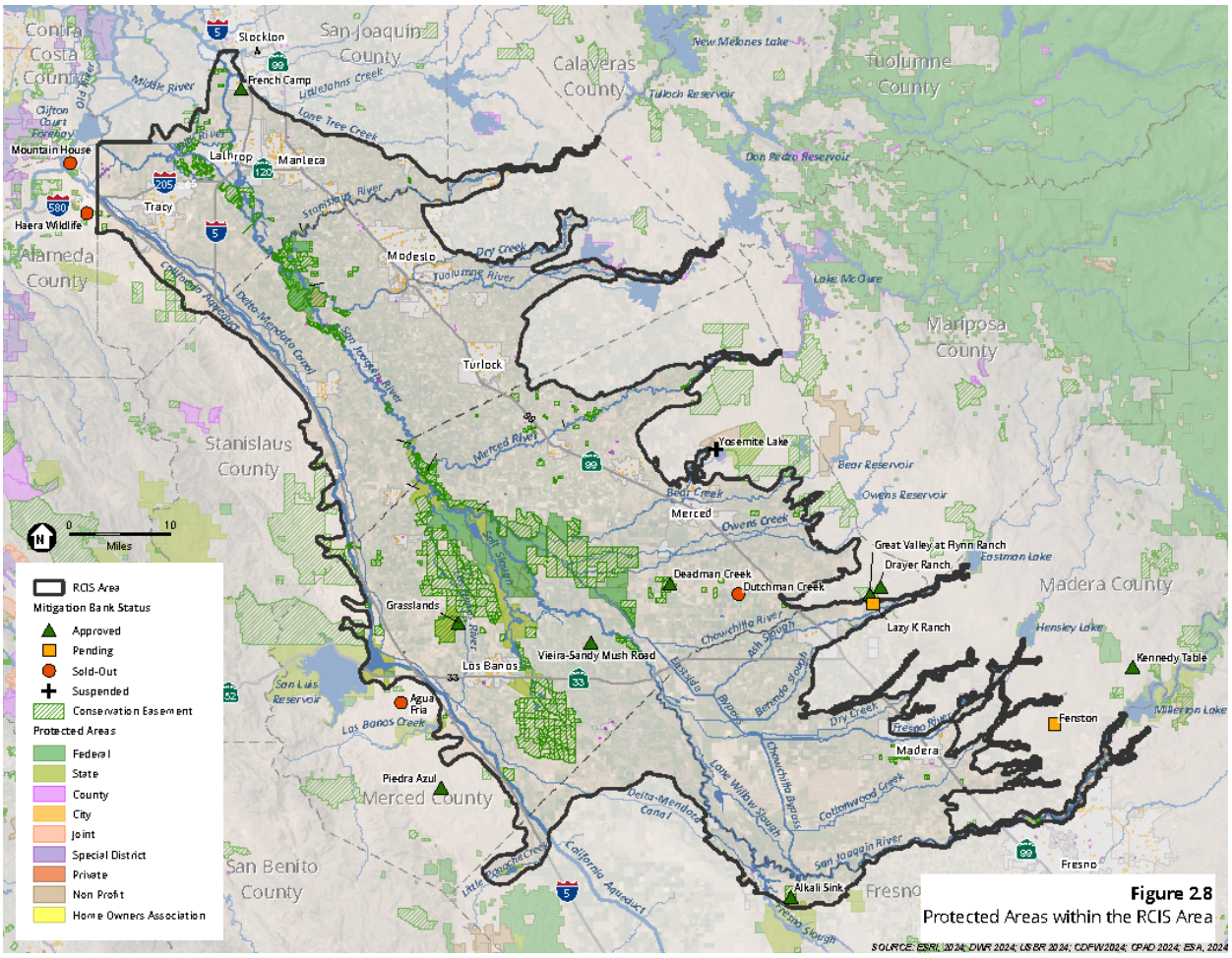
2.4.2.2 Protected Areas

Protecting land in perpetuity reduces the potential for development and helps to retain existing habitats and ecosystem functions, including habitat connectivity. In total, only about 5% of land within the RCIS area is currently protected through public acquisition or conservation easement. This is about 20% of all the natural vegetation communities within the RCIS area (Figure 2-4a), 3% of urban areas, and less than 1% of working and agricultural lands.

These protected areas include several federal wildlife refuges, state wildlife areas, state parks, and private wetlands (CVJV, 2020; see Figure 2-8). Some of the private wetlands are located in the Grassland Resource Conservation District on the western side of the basin**.** Most of the private wetlands have long-term protections under state or federal conservation easements. Private mitigation and conservation banks comprise another category of protected area within the basin.

Protected areas differ in the level of public access. Public access to nature is limited and a challenge in the San Joaquin Valley (CNRA, 2022). Of the 5% of lands in the RCIS area that are protected, 40% have open public access (CPAD, 2023). These areas include both lands managed for conservation and lands primarily managed for other purposes, such as urban parks or water management.

Figure 2-8. Protected Areas within the RCIS Area



2.4.2.2.1 *Publicly Managed Lands*

Publicly managed lands within the RCIS area include properties owned by all levels of government, from local to federal agencies. Public use of areas is limited, due to access barriers such as physical distance and the financial burdens of transportation, entrance fees, maintenance, enforcement, and recreational equipment for both urban and rural communities (CNRA, 2022). Table 2-5 shows the acreages of the largest protected areas (those greater than approximately 300 acres).

Table 2-5. Protected Areas within the RCIS Area

Land Management Authority	Protected Area	Acres
State	Alkali Sink Ecological Reserve	446
State	Ball Ranch	367
Non-profit	Bobcat Flat	414
State	Dos Rios State Park	1,563
Federal	Grasslands Wildlife Management Area[1]	12,351

Land Management Authority	Protected Area	Acres
State	Great Valley Grasslands State Park	2,732
State	Little Panoche Reservoir Wildlife Area	828
State	Los Banos Wildlife Area	6,275
Irrigation District	Madera Lake Park and Recreation Area	528
Federal	Merced National Wildlife Refuge	5,768
State	North Grasslands Wildlife Area	7,354
Federal	San Joaquin National Wildlife Refuge[2]	7,192
State	San Joaquin River Ecological Reserve	981
Federal	San Luis National Wildlife Refuge	18,416
State	San Luis Reservoir State Recreation Area	5,373
Non-profit	Spano River Ranch	380
Non-profit	Sycamore Island	323
Local	Tuolumne River Regional Park	424
Federal	U.S. Bureau of Land Management (unnamed)	583
State	Volta Wildlife Area	3,758
State	West Hilmar Wildlife Area	346

Source: CPAD, 2023
1. Grasslands Wildlife Management Area is approximately 95,000 acres, consisting of both private and public lands under easement. The amount here reflects only state and federal lands not otherwise captured by other names in this table as provided in the CPAD database.
2. Efforts are underway to expand the San Joaquin National Wildlife Refuge.

2.4.2.2.2 Lands Managed by Nonprofit Organizations

Nonprofit organizations such as Friends of the Tuolumne, River Partners, and San Joaquin River Parkway and Conservation Trust manage a number of properties for conservation purposes. Table 2-6 displays properties larger than 100 acres that are managed by nonprofits for conservation.

Table 2-6. Nonprofit-Managed Properties within the RCIS Area

Property	Managing Agency	Acres
Ball Ranch	San Joaquin River Parkway and Conservation Trust	367
Bobcat Flat	Friends of the Tuolumne	414
Dos Rios Ranch	River Partners	1,563
Gibson Property	San Joaquin River Parkway and Conservation Trust	271
Jenson River Ranch	San Joaquin River Parkway and Conservation Trust	188
Ledger Island	San Joaquin River Parkway and Conservation Trust	177
Spano River Ranch	San Joaquin River Parkway and Conservation Trust	380
Sycamore Island	San Joaquin River Parkway and Conservation Trust	323
Van Buren Unit	San Joaquin River Parkway and Conservation Trust	267

Source: CPAD, 2023

2.4.2.2.3 Conservation and Mitigation Banks

Approved conservation and mitigation banks with service areas that overlap the RCIS area are described in Table 2-7 and shown in Figure 2-8. Note, the figure includes banks that are not currently selling mitigation credits as these areas are permanently protected.

Table 2-7. Mitigation and Conservation Banks in the RCIS Area

Bank (County)	Species and/or Resource	Brief Description
Bank Located within RCIS Area		
Alkali Sink Conservation Bank (Fresno)	▪ Swainson's hawk ▪ Vernal pool fairy shrimp (credits are sold out) ▪ Longhorn fairy shrimp ▪ Burrowing owl ▪ San Joaquin kit fox	▪ Approved by CDFW, USFWS ▪ Large preserve adjacent to CDFW's Mendota Wildlife Area and Alkali Sink Ecological Reserve
Deadman Creek Conservation Bank (Merced)	▪ California tiger salamander – central DPS ▪ Vernal pool fairy shrimp ▪ Vernal pool tadpole shrimp ▪ San Joaquin kit fox	▪ Approved by USFWS ▪ Wetlands and annual grassland habitat
Dutchman Creek Conservation Bank (Merced)	▪ California tiger salamander – central DPS ▪ Swainson's hawk ▪ Vernal pool fairy shrimp ▪ Vernal pool tadpole ▪ Conservancy fairy shrimp ▪ Western spadefoot ▪ Burrowing owl ▪ San Joaquin kit fox	▪ Approved by CDFW, USFWS ▪ Vernal pool and grassland habitat ▪ Sits within larger natural lands matrix with other existing conservation banks and easements and USFWS Merced National Wildlife Refuge ▪ All credits sold out
French Camp Conservation Bank (San Joaquin)	▪ Valley elderberry longhorn beetle	▪ Approved by USFWS ▪ Confluence of French Camp Slough and San Joaquin River ▪ Restored primarily as VELB habitat
Grasslands Mitigation Bank (Merced)	▪ Giant garter snake ▪ Seasonal wetlands (credits are sold out)	▪ Approved by CDFW, USFWS, USACE, EPA ▪ Adjacent to other protected lands managed for wildlife and wetlands
Vieira-Sandy Mush Road Conservation Bank (Merced)	▪ California tiger salamander – central DPS ▪ Vernal pool fairy shrimp ▪ Vernal pool tadpole shrimp ▪ San Joaquin kit fox	▪ Approved by USFWS ▪ Vernal terrace habitat

Bank (County)	Species and/or Resource	Brief Description
Banks Located Outside RCIS Area with Service Areas Overlapping RCIS Area		
Agua Fria Conservation Bank (Merced)	▪ Burrowing owl ▪ San Joaquin kit fox	▪ Approved by CDFW, USFWS ▪ All credits sold out
Beach Lake Mitigation Bank (Sacramento)	▪ Seasonal wetland ▪ Riparian ▪ Palustrine emergent marsh	▪ Approved by USACE ▪ Restored wetlands in Stone Lake National Wildlife Refuge ▪ All credits sold out
Big Gun Conservation Bank (Placer)	▪ California red-legged frog	▪ Approved by USFWS ▪ Largest population of California red-legged frog in Sierra Nevada Mountains
Cayetano Creek Mitigation Bank (Alameda)	▪ California red-legged frog ▪ California tiger salamander ▪ Burrowing owl ▪ San Joaquin kit fox ▪ Congdon's tarplant ▪ Riparian woodland ▪ Seasonal wetland	▪ Approved by CDFW, USFWS, USACE ▪ Wetland creation
Cosumnes Floodplain Mitigation Bank (Sacramento, San Joaquin)	▪ Riparian ▪ Freshwater marsh complex (floodplain mosaic wetlands) ▪ Shaded riverine aquatic	▪ Approved by CDFW, USACE, USFWS, NMFS, EPA ▪ Floodplain habitat at confluence of Cosumnes and Mokelumne rivers ▪ All credits sold out
Drayer Ranch Conservation Bank (Merced)	▪ California tiger salamander ▪ San Joaquin kit fox ▪ Vernal pool fairy shrimp ▪ Vernal pool tadpole shrimp ▪ San Joaquin Orcutt grass ▪ Greene's tuctoria ▪ Succulent owl's clover	▪ Approved by USFWS ▪ Vernal pool habitat
Elsie Gridley Mitigation Bank (Solano)	▪ Wetlands ▪ Vernal pool fairy shrimp ▪ Conservancy fairy shrimp ▪ California tiger salamander ▪ Swainson's hawk foraging habitat ▪ Burrowing owl overwintering and foraging habitat	▪ Approved by CDFW, USFWS, and USACE ▪ Grassland and riparian preserve ▪ Only Swainson's hawk and burrowing owl credits are available
Fitzgerald Ranch Conservation Bank (San Joaquin)	▪ California tiger salamander ▪ Vernal pool fairy shrimp	▪ Approved by USFWS ▪ Vernal pool and upland habitat ▪ All credits sold out

Bank (County)	Species and/or Resource	Brief Description
Fremont Landing Conservation Bank (Yolo)	▪ Riparian forest ▪ Shaded riverine aquatic ▪ Central Valley Chinook salmon ▪ Steelhead ▪ Green sturgeon	▪ Approved by NMFS ▪ Confluence of Sacramento and Feather rivers
Great Valley Conservation Bank (Merced)	▪ California tiger salamander ▪ Vernal pool fairy shrimp ▪ Vernal pool tadpole shrimp ▪ San Joaquin kit fox	▪ Approved by USFWS ▪ Restored Flynn Ranch with vernal pool wetlands and grasslands
Haera Wildlife Conservation Bank (Alameda)	▪ Burrowing owl ▪ San Joaquin kit fox	▪ Approved by CDFW, USFWS ▪ Annual grassland habitat east of Altamont Pass ▪ All credits sold out
Kennedy Table Conservation Bank (Madera)	▪ Vernal pool fairy shrimp ▪ Succulent owl's clover	▪ Approved by USFWS, USACE ▪ Vernal pool habitat
Kreyenhagen Hills Conservation Bank (Fresno)	▪ San Joaquin kit fox	▪ Approved by USFWS ▪ Former Slievenamon Ranch
Liberty Island Conservation Bank (Yolo)	▪ Chinook salmon ▪ Central Valley steelhead ▪ Delta smelt ▪ Longfin smelt ▪ Tule marsh shaded riverine aquatic	▪ Approved by CDFW, NMFS, USFWS ▪ Lower end of Yolo Bypass
Mountain House Conservation Bank (Alameda)	▪ California tiger salamander ▪ California red-legged frog ▪ Burrowing owl ▪ Swainson's hawk breeding ▪ San Joaquin kit fox ▪ Vernal pool fairy shrimp	▪ Approved by CDFW, USFWS ▪ Only burrowing owl credits remaining
Nicolaus Ranch VELB Conservation Bank (Sacramento)	▪ Valley elderberry longhorn beetle	▪ Approved by USFWS ▪ All credits sold out
Noonan Ranch Conservation Bank (Solano)	▪ California tiger salamander ▪ Contra Costa goldfields ▪ Vernal pool fairy shrimp	▪ Approved by USFWS ▪ Vernal pool habitats

Bank (County)	Species and/or Resource	Brief Description
North Delta Fish Conservation Bank (Yolo)	▪ Sacramento River winter-run Chinook salmon ▪ Central Valley spring-run Chinook salmon ▪ Central Valley fall- and later fall-run Chinook salmon ▪ Central Valley steelhead ▪ Delta smelt ▪ Longfin smelt ▪ Green sturgeon ▪ Riparian shaded riverine aquatic ▪ Tule marsh shaded riverine aquatic	▪ Approved by CDFW, NMFS, USFWS ▪ Located on Liberty Island in Yolo Bypass adjacent to Liberty Island Conservation Bank
Ohlone Preserve Conservation Bank (Alameda)	▪ Alameda whipsnake ▪ California tiger salamander ▪ California red-legged frog	▪ Approved by CDFW, USFWS ▪ All credits sold out
Oursan Ridge Conservation Bank (Contra Costa)	▪ Alameda whipsnake ▪ California red-legged frog	▪ Approved by CDFW, USFWS ▪ Pristine watershed lands
Piedra Azul Conservation Bank (Merced)	▪ California red-legged frog ▪ California tiger salamander ▪ Burrowing owl foraging ▪ Swainson's hawk foraging ▪ San Joaquin kit fox	▪ Approved by CDFW, USFWS ▪ Surrounded by land unlikely to be developed or converted for crop production
Pleasanton Ridge Conservation Bank (Alameda)	▪ Alameda whipsnake ▪ California tiger salamander ▪ California red-legged frog	▪ Approved by CDFW, USFWS ▪ Adjacent to Pleasanton Ridge Regional Park
Sand Creek Conservation Bank (Tulare)	▪ California tiger salamander ▪ Vernal pool fairy shrimp (credits are sold out) ▪ San Joaquin kit fox	▪ Approved by CDFW, USFWS ▪ Vernal pool and upland annual grassland habitats

Source: CDFW, 2023b; USACE, 2023

2.4.2.2.4 Habitat Conservation Plans and Natural Community Conservation Plans

A Habitat Conservation Plan (HCP) is a federal planning document that authorizes limited and unintentional take of species listed under the federal Endangered Species Act (and other sensitive species), when it occurs incidental to otherwise lawful activities (USFWS, 2024). HCPs describe the anticipated effects of the proposed taking, how those impacts will be minimized or mitigated, and how the HCP is to be funded. There is a similar state planning document, a Natural Community Conservation Plan (NCCP); however, no NCCPs overlap the RCIS area. The RCIS Program requires coordination and consistency with HCPs and NCCPs in the RCIS area.

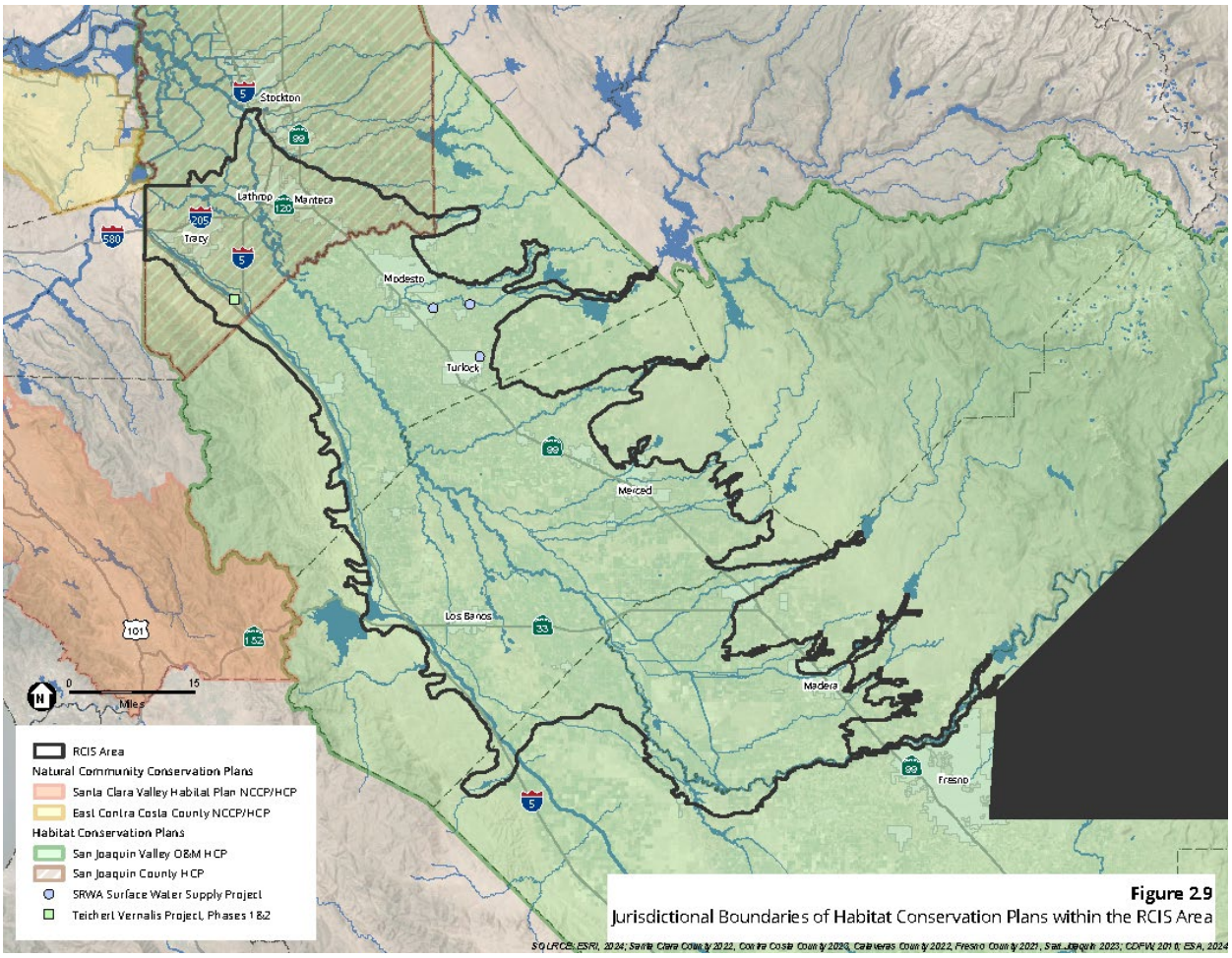
The San Joaquin County Multi-Species Habitat Conservation and Open Space Plan is the only regional HCP within the RCIS area, and it has been approved to accommodate economic development. The plan covers 97 species within the county boundary and overlaps with the RCIS area north of the Stanislaus River. Additionally, there are four additional project- or organization-specific HCPs. These HCPs typically cover a smaller geographic area and set of species, and they are usually prepared to address the incidental take needs of specific projects or facilities. The HCPs are listed in Table 2-8 and displayed in Figure 2-9. Appendix D describes how this RCIS is consistent with the HCPs.

Table 2-8. Habitat Conservation Plans within the RCIS Area

Project	Species Covered	Boundary
Regional HCPs		
San Joaquin County Multi-Species Habitat Conservation and Open Space Plan	▪ 97 plant, fish, and wildlife species	San Joaquin County
Project and Organization HCPs		
City of Waterford (expired)	▪ Valley elderberry longhorn beetle	City of Waterford
Pacific Gas and Electric (PG&E) San Joaquin Valley Operations and Maintenance Habitat Conservation Plan	▪ 23 wildlife and 42 plant species	Portions of San Joaquin, Tuolumne, Mariposa, Madera, Fresno, Tulare, Kern, Stanislaus, Merced, and King counties
Stanislaus Regional Water Authority (SRWA) Surface Water Supply Project (completed)	▪ Valley elderberry longhorn beetle	29 acres along Tuolumne River in Stanislaus County
Teichert Vernalis Project Phases I & II	▪ California red-legged frog ▪ San Joaquin kit fox	300 acres near Tracy, CA

Source: City of Waterford, 1995; Horizon Water and Environment, 2020; Jones & Stokes, 2006; SJCG, 2000

Figure 2-9. Jurisdictional Boundaries of Habitat Conservation Plans within the RCIS Area



2.4.3 Developed Land Uses

2.4.3.1 Agriculture

Since the early 1980s, the extent of irrigated farmland within the San Joaquin Valley has remained relatively stable, but the crop mix has changed over time (Hanak et al., 2017, 2019). Water-intensive perennial crops typically generate more revenue per unit of applied water (Medellín-Azuara et al., 2015). Almonds alone represent over a quarter of the total irrigated acreage in the San Joaquin Valley; other perennial crop types, including pistachios, grapes, citrus, and other subtropical crops have an important presence in this region. The potential for high economic return has fueled the expansion in planting perennial crops, which have expanded from 21% of total acreage in the 1980s to 61% in 2018 (Escriva-Bou et al., 2023). Because perennial crops require substantial capital investment and often survive for decades, they cannot be easily fallowed during drought years without incurring financial losses for the agricultural operator (Mall and Herman, 2019). Therefore, this trend in planting permanent crops may increase the need for stable water supplies to irrigate crops where the land cannot be easily fallowed (Faunt et al., 2016). The persistence of perennial crops during recent drought years suggests that revenue is the driving factor for crop choices in the region and that additional costs of groundwater pumping during drought have not historically influenced crop choices (Mall and Herman, 2019).

The California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP) currently conducts Important Farmland mapping efforts within the state of California (California Department of Conservation [CDOC], 2023a) (Table 2-9, Figure 2-10). The FMMP maps are updated every two years using aerial photographs, public review, and field reconnaissance (CDOC, 2023a). There are four categories of agricultural land in the RCIS area that are considered Important Farmland types. These categories represent land that may be actively farmed economically for the foreseeable future absent conversion to a non-agricultural use (CDOC, 2023b). The following list provides a description of the Important Farmland types:

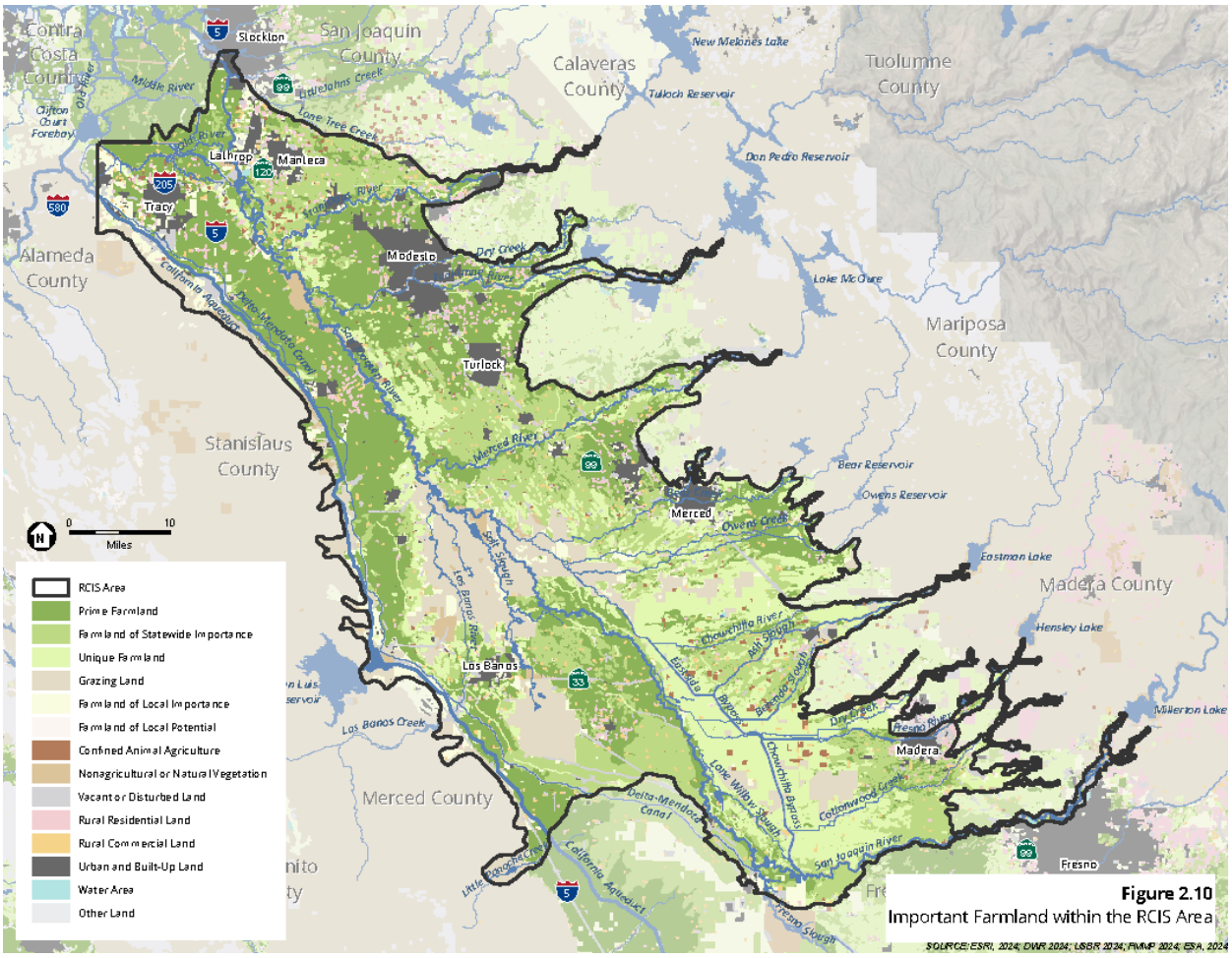
- **Prime Farmland** – Land that has the best combination of physical and chemical features able to sustain long-term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields.
- **Farmland of Statewide Importance** – Land similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture.
- **Unique Farmland** – Land of lesser quality soil used to produce the state's leading agricultural cash crops. This land is usually irrigated but may include non-irrigated orchards or vineyards as found in some climatic zones in California.
- **Farmland of Local Importance** – Land that is of importance to the local agricultural economy, as defined by each county's local advisory committee and adopted by its board of supervisors.

Table 2-9. Acres of Farmland Categories in the RCIS Area

Farmland Categories	Acres in the RCIS Area
Important Farmland Types	
Prime Farmland	687,971
Farmland of Statewide Importance	605,039
Unique Farmland	216,942
Farmland of Local Importance	80,559
Not Included in Important Farmland Types	
Grazing Land	256,207
Semi-Agricultural and Rural Commercial Land	12,722
Confined Animal Agriculture	24,280

Source: CDOC, 2023a

Figure 2-10. Important Farmland within the RCIS Area



2.4.3.2 Land Use Authorities

As part of the RCIS Program Guidelines (CDFW, 2023a), an RCIS must be developed in coordination with cities and counties with land use authority (see Chapter 1 regarding outreach). Cities and counties develop General Plans and Master Plans that serve as the blueprint for development within their jurisdiction. These plans are an important framework for how and where conservation actions can be implemented, and they should be considered during project development.

Counties with land use authority within the RCIS area include:

- San Joaquin
- Stanislaus
- Merced
- Fresno
- Madera
- Tuolumne (minimal overlap)

Incorporated cities with land use authority that are located partially or completely within the RCIS area are listed in Table 2-10 (see also Figure 1-1). Development is projected to continue to expand into the already limited RCIS area's natural communities (CNRA, 2022; see Figure 2-6).

Table 2-10. Cities within the RCIS Area

Atwater	Fresno	Madera	Oakdale	Turlock
Ceres	Gustine	Manteca	Patterson	Waterford
Chowchilla	Hughson	Mendota	Ripon	
Dos Palos	Lathrop	Merced	Riverbank	
Escalon	Livingston	Modesto	Stockton	
Firebaugh	Los Banos	Newman	Tracy	

2.4.3.3 Existing and Planned Infrastructure

This RCIS considers the existing and future development of infrastructure planned in the next 10 years to help inform the RCIS conservation strategies. Table 2-11 summarizes how the RCIS considered major infrastructure. Examples include selecting focal species based on anticipated infrastructure impacts—including strategies to help reduce barriers created by infrastructure—and considering impacts of infrastructure modifications necessary to respond to a changing climate. Infrastructure and other planning agencies may use this RCIS to inform the siting and planning of projects to reduce conflicts with natural resources and to identify conservation or habitat enhancement actions that could be used as mitigation to offset impacts from infrastructure projects or operations and maintenance.

Table 2-11. Rationale for Consideration of Major Infrastructure within the RCIS Area

Infrastructure Type	Rationale for Consideration	How the RCIS Considers	Sources for Additional Information
Transportation ▪ Roadway, rail ▪ Projects aim to address growing population and traffic needs, repair and maintain old infrastructure, and add utility to existing transportation facilities and routes.	▪ Infrastructure projects could result in impacts to focal species and other conservation elements. RCIS strategies can be integrated into project scopes to avoid, minimize, or compensate for impacts, benefit ecosystems, and serve as project mitigation.	▪ Focal species and other conservation element selection considers anticipated impacts and mitigation needs. ▪ Strategies consider opportunities for removing barriers and restoration of hydrological processes and connectivity currently impacted by linear roadway and rail features.	*State* ▪ Caltrans State Highway Operation and Protection Program (SHOPP) 10 Year Book (Ten Year Book) and Statewide Advance Mitigation Needs Assessment (SAMNA) ▪ District 6 ▪ District 10 ▪ California State Rail Plan ▪ California High Speed Rail Authority *County* ▪ Fresno Council of Governments Regional Transportation Plan (RTP)/Sustainable Communities Strategy (SCS) ▪ Madera County RTP/SCS ▪ Merced County RTP/SCS ▪ San Joaquin County RTP/SCS ▪ Stanislaus County RTC/SCS

Infrastructure Type	Rationale for Consideration	How the RCIS Considers	Sources for Additional Information
Flood Management Infrastructure ▪ Projects aim to replace and repair aging infrastructure; manage water for beneficial uses, such as habitat; and address flooding in consideration of climate change.	▪ Projects could impact focal species and other conservation elements. ▪ Flood control (e.g., levees) and water diversions affect hydrology and the opportunities for restoration and other conservation action. ▪ Facilities and infrastructure susceptible to flooding may need to alter operations or facilities to adapt. These changes could impact focal species and habitats in the RCIS area or result in mitigation needs.	▪ Future conditions planning considers how climate change will affect current hydrological processes and timing of peaks in flows. ▪ Strategies include actions to breach and restore hydrologic and habitat connectivity, build structures to cross water infrastructure, and provide upland ecotone transition habitat to maintain flood protections where necessary.	*Federal* ▪ Lower San Joaquin River Feasibility Study ▪ San Joaquin River Restoration Program *State* ▪ Central Valley Flood Protection Plan ▪ State Plan of Flood Control

Infrastructure Type	Rationale for Consideration	How the RCIS Considers	Sources for Additional Information
Water Supply ▪ Projects aim to increase or maintain existing water supply or decrease water use and extraction from surface and groundwater sources.	▪ Water supply facilities and infrastructure may need to alter operations or facilities to adapt to changing physical or regulatory conditions. These changes could impact focal species and habitats in the RCIS area or result in mitigation needs. ▪ Land repurposing projects and associated infrastructure may create restoration opportunities.	▪ Selection of focal species and other conservation elements considers anticipated impacts and mitigation needs. ▪ Strategies include actions to address changes in water supply.	*Federal* ▪ Bureau of Reclamation *State* ▪ California Water Commission ▪ Department of Water Resources California Aqueduct Subsidence Program ▪ Department of Water Resources Sustainable Groundwater Management Office ▪ Sustainable Groundwater Management & Recharge (arcgis.com) *Regional* ▪ Chowchilla Subbasin Groundwater Sustainability Plan ▪ Delta-Mendota Subbasin Groundwater Sustainability Plan ▪ Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan ▪ Madera Subbasin Groundwater Sustainability Plan ▪ Merced Subbasin Groundwater Sustainability Plan ▪ Modesto Subbasin Groundwater Sustainability Plan ▪ Root Creek Water District Groundwater Sustainability Plan
Energy Generation/ Transmission Lines	▪ Energy generation and transmission projects could result in impacts to focal species and other conservation elements.	▪ RCIS considers how existing energy generation and transmission corridors can affect movement and migration of focal species.	*State* ▪ California Public Utility Commission GIS data *Regional (Utility)* ▪ Pacific Gas & Electric (PG&E) Operations and Maintenance Habitat Conservation Plan

2.4.3.3.1 Existing Infrastructure

Flood Management

Flood management infrastructure in the RCIS area includes reservoirs, wasteways, a bypass system on the San Joaquin River, and levees along portions of the San Joaquin River and its tributaries (Figure 2-4; Figure 2-11; Figure 2-12, Figure 2-13). Many of these facilities were federally authorized projects (e.g., “project” levees); although state or local agencies are primarily responsible for operations and maintenance.

Major reservoirs just upstream of the RCIS area include New Melones (Stanislaus River), Don Pedro (Tuolumne River), Lake McClure (Merced River), and Millerton Lake (San Joaquin River). The largest reservoirs on major rivers (Table 2-1) are New Melones (2.4 million acre-feet), New Don Pedro (2.03 million acre-feet), New Exchequer (1.03 million acre-feet), and Millerton Reservoir (0.52 million acre-feet). The extent of the 500-year floodplain for dozens of miles downstream of each of these major reservoirs is limited by low bluffs obviating the need for an organized system of levees (CDWR, 2010). All major cities and most infrastructure are constructed on higher land outside of the floodplain, but private levees and berms protecting riverside agricultural lands from inundation are common (CDWR, 2010).

These reservoirs are operated in accordance with flood control rules established by the U.S. Army Corps of Engineers, and, in some cases, provide hydroelectric power (CDWR, 2016). In general, rules governing flood control require that a proportion of storage space in the reservoirs is reserved for capturing flood flow peaks and releasing them gradually in consideration of downstream channel capacity (CDWR, 2016). This space is drained as quickly as feasible to maintain storage capacity for the next flood flow peak (CDWR, 2016).

Levee and related flood control infrastructure varies across the region. The Central Valley Flood Protection Plan divides the planning area into three Regional Plan areas—the Upper San Joaquin, the Middle San Joaquin, and the Lower San Joaquin—for the purpose of describing and planning the flood control infrastructure and needs of the San Joaquin Valley.

Figure 2-11. Existing Infrastructure

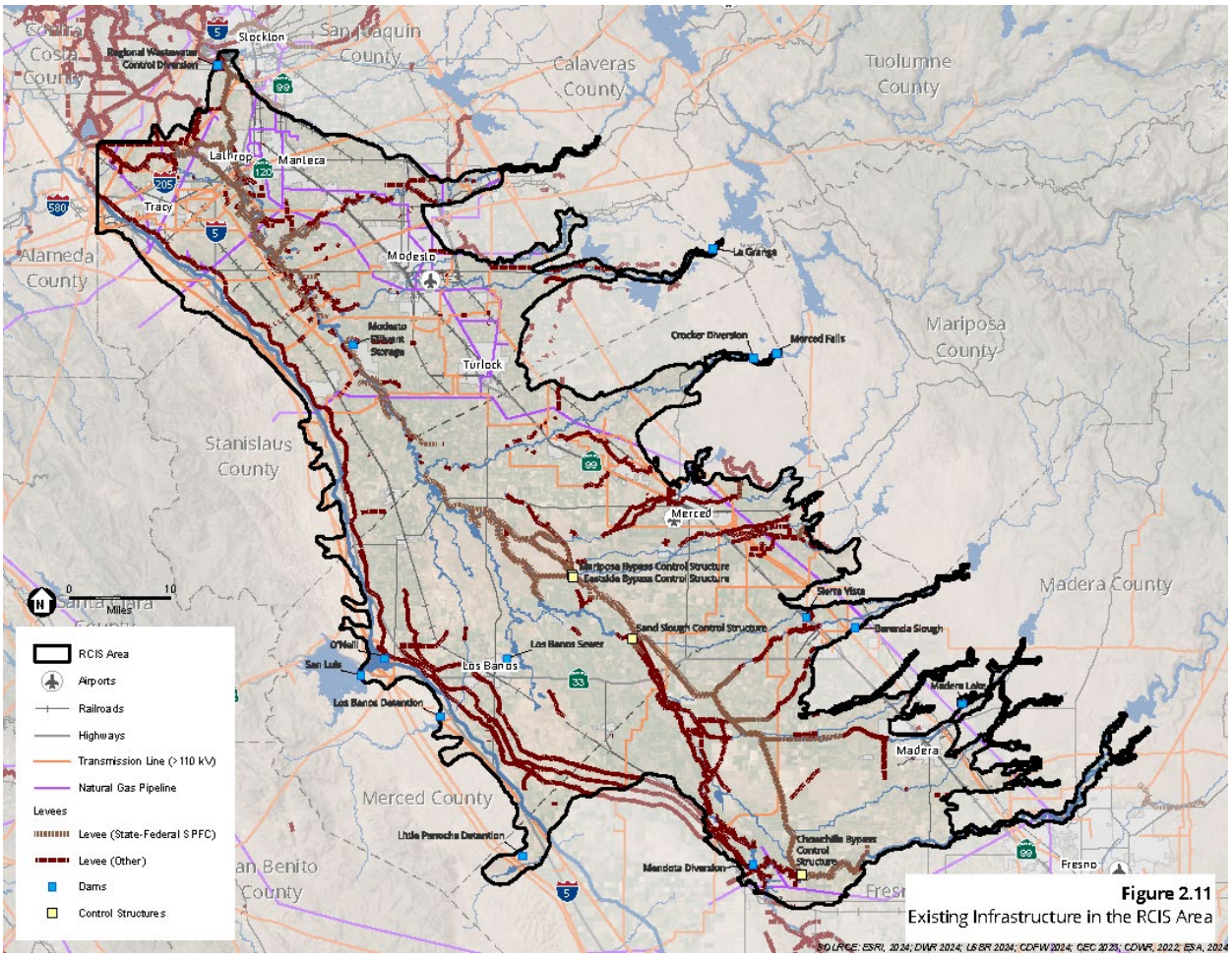
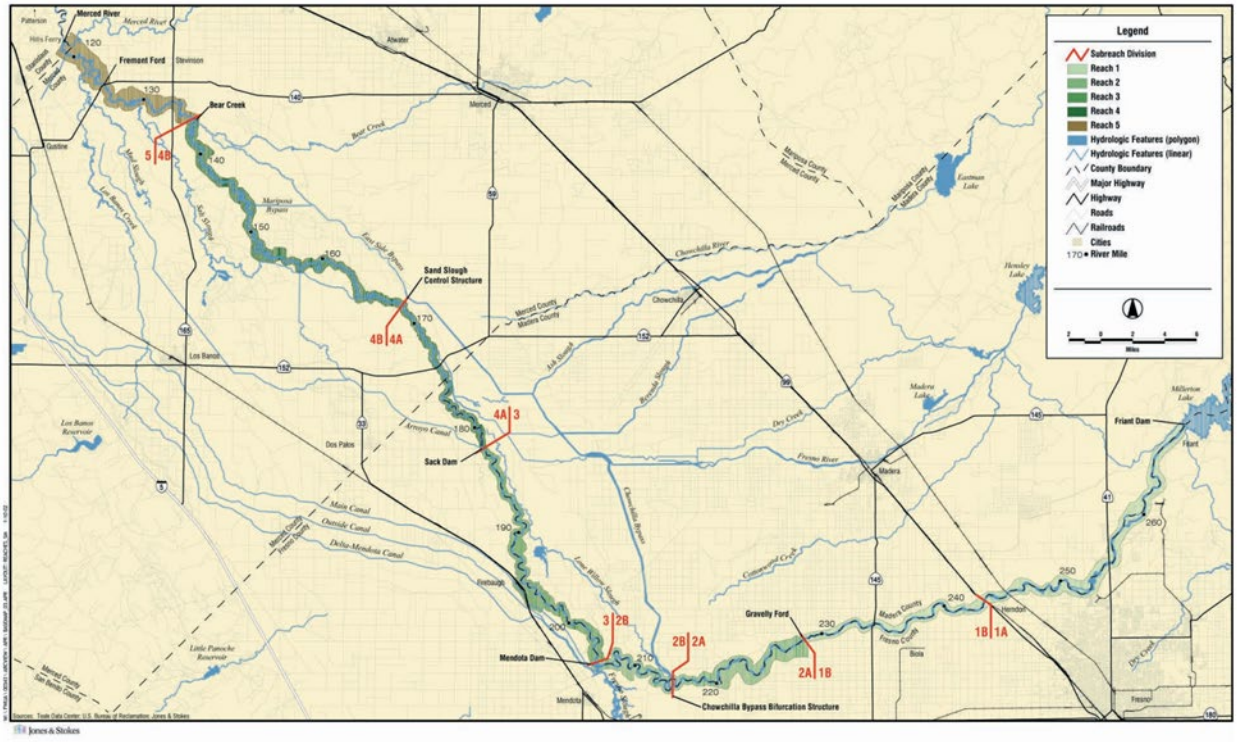
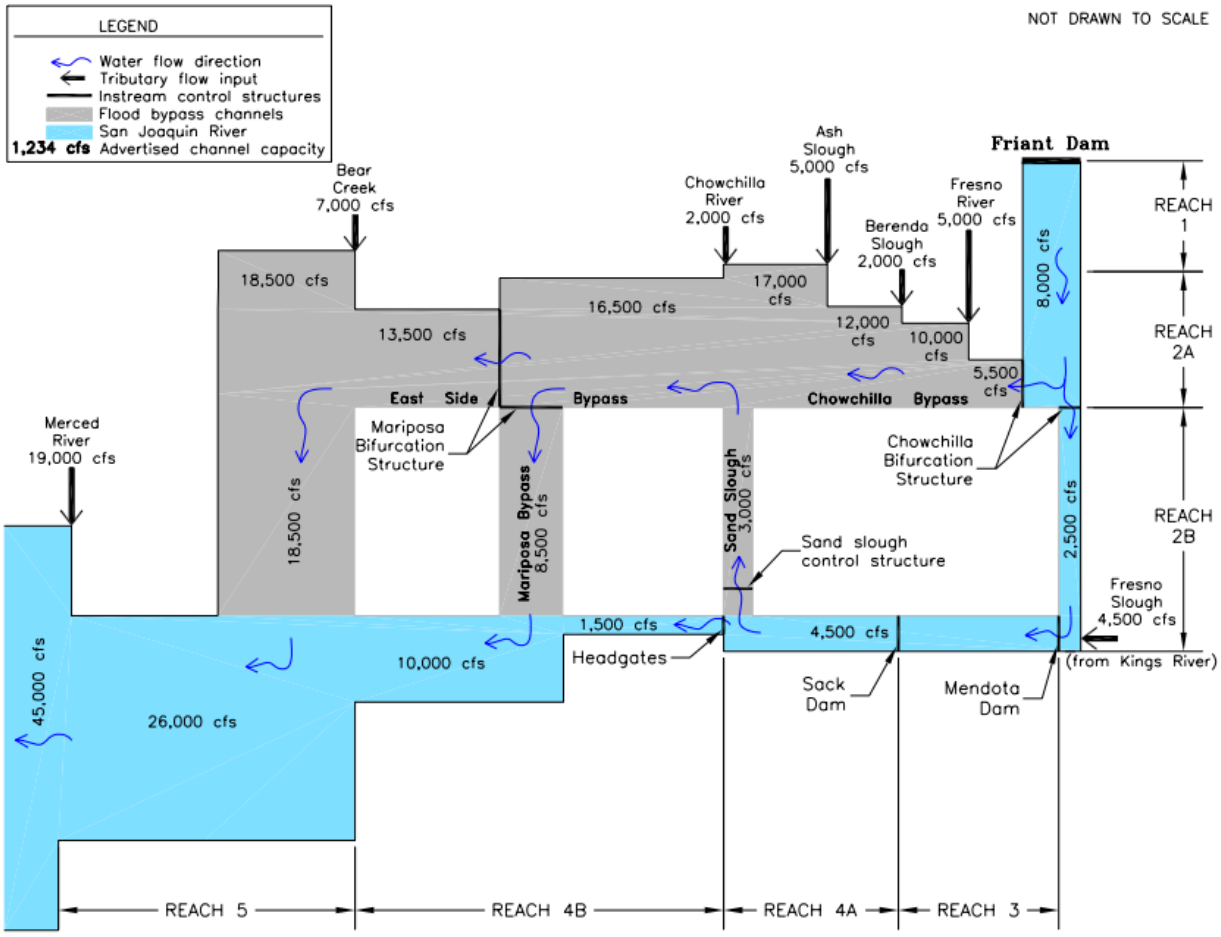


Figure 2-12. San Joaquin River Restoration Plan Area Showing Reaches and Major Infrastructure



Source: San Joaquin River Restoration Study Background Report (McBain et al., 2002)

Figure 2-13. San Joaquin River Restoration Plan Area Schematic of Structures and Flood Routing



Source: San Joaquin River Restoration Study Background Report (McBain et al., 2002)

Upper San Joaquin Flood Management Planning Area

The Upper San Joaquin Flood Management Planning Area includes an extensive levee and flood bypass upstream of the confluence of the San Joaquin River with the Merced River (CDWR, 2010; Figure 2-12; Figure 2-13). This planning region also includes scattered levees and modified channels along smaller streams in Merced County including Bear, Owens, and Mariposa creeks, which still frequently cause widespread flooding.

An extensive levee and bypass system was built by the state after the construction of Friant Dam to protect a large area of bottomlands between Gravelly Ford (on the San Joaquin River, west of Madera) and the Merced River from flooding (CDWR, 2010). Upstream of Gravelly Ford the San Joaquin River floodplain is confined by natural bluffs above the river bottom. These bluffs end near Gravelly Ford, and under natural conditions, floodwaters downstream of Gravelly Ford would spread out across the San Joaquin Valley.

Today, the levee and bypass system prevent inundation of the valley bottom upstream of the Merced River in all but the most extreme years (CDWR, 2010). Fragile, sandy levees confine San Joaquin River flood flows from Gravelly Ford to the Chowchilla Bifurcation Structure, a system of gates that diverts most of the river's flood waters into a bypass system that routes the flood flows along the eastern edge of the valley bottom (CDWR, 2010).

From the Chowchilla Bifurcation Structure, the bypass structure routes flood water north through a 1,000-foot-wide trapezoidal channel bounded by levees known as the Chowchilla Canal Bypass, which also collects and conveys flood waters from a series of local creeks including the Chowchilla and Fresno rivers that historically flooded lower elevations of the San Joaquin Valley (CDWR, 2010). The Chowchilla River bypass conveys the combined flood flows of the San Joaquin, Chowchilla, and Fresno rivers into the Eastside Bypass, which is a narrow 1,500-foot-wide engineered floodway, bounded by levees. Eventually, another system of gates—known as the Mariposa Slough Bifurcation Structure—diverts the first 8,500 cubic feet of floodwater into the 4-mile-long Mariposa Bypass, which discharges into the natural channel of the San Joaquin River (CDWR, 2010). Any remaining flood water continues in the Eastside Bypass, between the San Luis National Wildlife Refuge and Merced National Wildlife Refuge, for another 35 miles until it joins the main channel of the San Joaquin River upstream of the State Route (SR) 165 bridge (CDWR, 2010).

Downstream of the Mariposa Bypass, both the natural channel of the San Joaquin River and the Eastside Bypass are confined by levees that were designed to prevent floodwaters from inundating natural areas within the San Luis National Wildlife Refuge, the Merced National Wildlife Refuge, and state wildlife areas and other easement lands within the Grassland Ecological Area; these levees are not sufficient to protect developed or cultivated lands. Large areas within the refuges and wildlife areas of the Grassland Ecological Area were acquired and are managed for waterfowl, with water management infrastructure helping to protect wetlands that could be harmed by uncontrolled flooding.

Middle San Joaquin Flood Management Planning Area

The Middle San Joaquin Regional Flood Management Planning Area extends along the San Joaquin River from the Merced River confluence north to the Stanislaus River confluence. The levee system along the middle San Joaquin River is discontinuous (CDWR, 2016) and includes short stretches of project levees on the lower Merced, Tuolumne, and Stanislaus rivers,

including the lowermost 10 miles of the Stanislaus River where project levees are nearly continuous (CDWR, 2016).

The Central Valley Flood Protection Plan identifies the middle San Joaquin River as an area with good opportunities for floodplain restoration and reconnection, because large parts of the levee system in this region are not needed to protect homes, lives, or critical infrastructure. In this area, River Partners' restoration efforts at Dos Rios Ranch and the neighboring San Joaquin River National Wildlife Refuge have restored over 3,000 acres of floodplain habitat—demonstrating what restoration efforts can accomplish.

Lower San Joaquin Flood Management Planning Area

The Lower San Joaquin Flood Management Planning Area begins on the San Joaquin River downstream of the San Joaquin River confluence with the Stanislaus River and into the Sacramento-San Joaquin River where it is confined by federal project levees along both sides of the river channel (CDWR, 2016). Upstream of Highway Interstate (I)-5, these levees mostly protect agricultural lands, but downstream of I-5 they protect tens of thousands of people that live in the communities of Lathrop, Manteca, and Stockton. Upgrading these levees and expanding the Paradise Cut Bypass are a priority of the CVFPP.

Water Conveyance

Two major water projects, the federal Central Valley Project (CVP) and the State Water Project (SWP), deliver large amounts of water from the Delta (Delta Stewardship Council, 2013). The CVP delivers water from the Delta via pumping to lift the water into the Delta-Mendota Canal for delivery of water to CVP contractors within the San Joaquin Valley. Water from the SWP is pumped and conveyed southward through the San Joaquin Valley via the California Aqueduct. CVP and SWP water is stored in the San Luis Reservoir, located just outside the RCIS area.

There are several regional irrigation and water districts within the RCIS area (Table 2-12). These districts maintain systems of canals, pipelines, wells, and pumps for surface and groundwater conveyance.

Table 2-12. Regional Irrigation and Water Districts in the RCIS Area

District	Surface Water Source	Main Use
Grassland Water District	Central Valley Project	Managed Wetlands
Madera Irrigation District	Big Creek and North Fork of Willow Creek (senior water rights[4])	City of Madera and surrounding areas
Merced Irrigation District	Merced River	Agriculture
Modesto Irrigation District	Tuolumne River	Irrigation Drinking water (City of Modesto) Electrical service (New Don Pedro Dam)
Oakdale Irrigation District	Stanislaus River (senior water rights)	City of Oakdale
San Joaquin River Exchange	Central Valley Project	Irrigation

[4] Water rights claimed before 1914 when the state began regulating water ownership and use.

District	Surface Water Source	Main Use
Contractors Water Authority	San Joaquin River	Irrigation
South San Joaquin Irrigation District	Stanislaus River (senior water rights)	Irrigation

Source: California Department of Water Resources

Transportation

Figure 2-11 shows the location of major transportation infrastructure within the RCIS area, including interstate highways, state routes, railways, and airports. Regional transportation planning agencies coordinate transportation planning. Plans applicable to the RCIS area include those for Madera County (Madera County Transportation Commission, 2022), Merced County (Merced County Association of Governments, 2022), Stanislaus Council of Government (StanCOG) (StanCOG, 2022), and San Joaquin Council of Governments (SJCG) (SJCG, 2022). These documents identify existing transportation networks and resources within their respective counties as well as planned maintenance and transportation improvement elements.

Highways

I-5 and SR 99 are the two primary north-south transportation arteries. These highways are vital for the movement of goods, as they carry truck traffic at volumes much higher than the statewide average for the highway system. East-west transportation arteries include SR 120, SR 132, SR 140, and SR 152. An extensive network of county roads connects to the state highways. I-205 and I-580 serve as the gateway connections between the San Joaquin Valley and the San Francisco Bay Area and are critical to interregional travel and commerce. Caltrans owns and maintains the State Highway System. The metropolitan planning organizations, regional transportation planning agencies, and other public agencies identified above own and maintain the connecting road infrastructure.

Rail

The rail network within the RCIS area is owned by private freight railroad companies. BNSF Railway (BNSF) and Union Pacific Railroad (Union Pacific) own most of the route-miles (Caltrans, 2023a). BNSF is North America's largest rail carrier while Union Pacific is California's largest railroad in terms of volume, employees, and mileage (Caltrans, 2023a). BNSF and Union Pacific operate freight rail and allow for passenger rail operations on their tracks through different funding arrangements. Caltrans funds intercity passenger routes throughout the state with Amtrak operating these intercity passenger rail services. The route known as the San Joaquins is one of these Caltrans-supported routes within the RCIS area, which connects the San Francisco Bay Area and Sacramento through the San Joaquin Valley to Bakersfield; it is the sixth busiest Amtrak route in the nation.

High-speed Rail

In 2008, California voters approved Proposition 1A for a down payment to build a high-speed rail system to carry passengers between San Francisco and Los Angeles. Construction is already underway on the first 119-mile section in the Central Valley, which is meant to serve as a test track for high-speed trains in the state (California High Speed Rail Authority [CHSRA], 2021, 2023a; see Figure 2-14). In June 2022, the Governor and the State Legislature agreed to provide the remaining funds from the voter-approved Proposition A1A to advance an initial electrified high-speed rail line in Central Valley between Merced and Bakersfield (CHSRA, 2023a). In April 2022, the Authority approved the Final Environmental Impact Report and

Environmental Impact Statement for the rail-line section from San Jose to Merced (via Gilroy) (CHSRA, 2023a).

Figure 2-14. California High Speed Rail Proposed Statewide System Map

Source: CHSRA 2021

Energy

Electrical

Pacific Gas & Electric (PG&E) provides and maintains an electrical transmission and distribution system within the Central Valley. The distribution system includes primary and secondary distribution lines delivering electricity and distribution transformers that reduce voltage from distribution to utilization levels (Jones & Stokes, 2006).

Gas

PG&E manages hundreds of miles of natural gas pipeline within the San Joaquin Basin area and thousands of distribution pipelines which are buried several feet underground (Jones & Stokes, 2006). The natural gas system includes transmission pipelines, compressor stations, regulator stations, and distribution pipelines (Jones & Stokes, 2006).

2.4.3.3.2 Planned Infrastructure

This section describes foreseeable development of major infrastructure within the RCIS area, including those related to flood management, transportation, utility transmission facilities, and water conveyance and treatment projects (Table 2-13).

Flood Management

Lower San Joaquin River Project

The Lower San Joaquin River Project will provide flood protection for the city of Stockton. There is significant risk to public health, safety, and property in the project area associated with flooding, with major flood events having occurred in 1955, 1958, and 1997 (U.S. Army Corps of Engineers & San Joaquin Area Flood Control Agency, 2018). The project will include 23 miles of levee improvements and two flow closure structures, one at Fourteen Mile Slough and the other at Smith Canal (U.S. Army Corps of Engineers, 2018). The levee improvements include cutoff walls, deep soil mixing (seismic), a new levee, levee geometry improvements, and erosion protection (U.S. Army Corps of Engineers, 2018).

Mossdale Tract Urban Flood Risk Reduction Project

The Mossdale Tract Urban Flood Risk Project seeks to provide 200-year flood protection for the Mossdale Tract Area (San Joaquin River Area Flood Control Agency, 2023). The project consists of fix-in-place levee improvements and an extension of an existing dryland levee in Manteca.

Paradise Cut Expansion and South Delta Restoration Project

The CVFPP and the Delta Stewardship Council's Delta Plan has identified prioritizing expanding Paradise Cut, a high flow bypass for the San Joaquin River. Expanding Paradise Cut would direct flood water away from urbanizing reaches of the San Joaquin River and into the less developed primary zone of the Delta along Old River and Grant Line Canal. The San Joaquin Area Flood Control Agency is currently leading a planning effort to expand the bypass with funding assistance from the Department of Water Resources.

Black Rascal Creek Flood Control Project

Black Rascal Creek upstream of the city of Merced will provide 100-year level of protection for the community of Franklin-Beachwood and 200-year level of protection for the city of Merced (CDWR, 2022). The project will involve construction of a detention basin with spillway, channel medications, and an outlet structure. The project is expected to reduce flooding, contribute to groundwater recharge, and reduce sedimentation downstream.

Transportation

Roads and Highways

The San Joaquin Council of Governments (SJCOG) is the planning, financing, and coordinating agency for the San Joaquin region, including the RCIS area, overseeing transportation.

Transportation maintenance and improvement projects are also planned along major interstates and state route highways within the RCIS area. More details regarding these individual transportation improvement projects are available in Caltrans 10 Year Book and on the Caltrans websites for District 6 (Caltrans, 2023b) and District 10 (Caltrans, 2023c). District 6 includes Fresno, Madera, and Mariposa counties; District 10 includes Calaveras, Mariposa, Merced, San Joaquin, Stanislaus, and Tuolumne counties.

Rail

The San Joaquin Joint Powers Authority is planning an expansion to the Altamont Corridor Express which connects San Joaquin County, the Tri-Valley region (Dublin, Livermore, Pleasanton), and Silicon Valley with passenger train service between Stockton and San Jose (Stanislaus Council of Governments, 2022). The Altamont Corridor Express Expansion project will extend service to Manteca, Modesto, Ceres, Turlock, and Merced.

The Valley Rail Project will improve passenger rail service between the San Joaquin Valley and the Sacramento region using the San Joaquins (Amtrak) and the Altamont Corridor Express service (Stanislaus Council of Governments, 2022). The Ceres expansion of the Valley Rail project will make track improvements on the existing Union Pacific Railroad freight corridor that runs just east of I-5 to accommodate passenger service. New stations will also be constructed along with the Altamont Corridor Express and San Joaquins routes. Along the Altamont Corridor Express route, new stations will be constructed in the cities of Ceres, Modesto, Ripon, Manteca, and North Lathrop (Stanislaus Council of Governments, 2022).

High-speed Passenger Rail

The High-Speed Rail Authority approved the alignment for Phase 1 of the project, which extends from Fresno to Merced and west across the Valley to the Bay Area with stations in the San Joaquin Valley in Fresno, Madera, and Merced (CHSRA, 2023a; Figure 2-14). From Fresno to Madera, the alignment is being constructed to the east of SR 99, but north of Madera it will cross SR 99. The alignment runs west across the valley, through the Grassland Ecological Area to Volta and then after crossing Interstate I-5 and the California Aqueduct, it will enter a new tunnel under the Inner Coast Range. A branch from the east-west portion of the alignment will extend north to Merced. It crosses the San Joaquin River at SR 99 at the Fresno/Madera County lines and again north of the river's junction with the Fresno River. The alignment bisects the Grassland Ecological Area. The alignment for Phase 1 will be built on embankments or elevated structures (viaducts). Except along elevated structures, the alignment is fenced with undercrossings for movement of water and wildlife (CHSRA, 2023a).

Energy

Electrical

PG&E is undertaking an initiative to underground 10,000 miles of powerlines in high fire risk areas to reduce wildfire risk and safeguard its utility grid against other types of weather extremes (PG&E, 2023). PG&E is also dedicating more resources to vegetation management to keep trees and other vegetation at appropriate distances from powerlines (PG&E, 2023).

Solar Power Generation

Solar development in the San Joaquin Valley is expected to continue to expand in part due to SB 100 (2018), which requires 100% of electricity sold to California customers to be derived from zero-carbon or renewable resources by 2045. Existing solar generation will need to triple the existing amount to meet that target of roughly 150,000 acres (PPIC, 2022). Solar developments are already being constructed in Fresno and Merced counties (PPIC, 2022).

Table 2-13. Planned Infrastructure Projects in the RCIS Area

Project Type	Planned Projects/ Improvements	Location	Description and Relevance
Flood	Lower San Joaquin River Project	Stockton region	The overall project purpose is to reduce flood risk for Stockton residents by improving 23 miles of levee. The levee improvements include cutoff walls, deep soil mixing (seismic), a new levee, levee geometry improvements, and erosion protection. Construction is currently scheduled to begin in 2024 and continue to 2037.
Flood	Mossdale Tract Urban Flood Risk Project	Manteca	The project consists of fix-in-place levee improvements and an extension of an existing dryland levee in Manteca.
Flood	Paradise Cut Expansion	San Joaquin County	Expanding Paradise Cut would direct flood water away from urbanizing reaches of the San Joaquin River and into the less developed primary zone (DSC, 2013) of the Delta along Old River and Grant Line Canal.
Flood	Black Rascal Creek Flood Control	Merced County	The project would construct a detention basin with spillway, channel medications, and an outlet structure to provide flood protection, groundwater recharge, and reduce sediment downstream
Transportation (rail)	Altamont Corridor Express Expansion	Throughout the RCIS area	This planned expansion will enhance commuter and intercity rail service through service expansion, station enhancement, and track improvements. It will extend service to the cities of Manteca, Modesto, Ceres, Turlock, and Merced. The effort will extend the Altamont Corridor Express from its current terminus in Lathrop to Ceres (Phase I) and Merced (Phase II).
Transportation (rail)	High-Speed Rail Project	Throughout the RCIS area	Construction is currently underway to establish a high-speed rail line within the Central Valley. Current construction is focused on a 119-mile segment which spans Madera, Fresno, Kings, Tulare, and Kern counties. Testing of the initial electrical high-speed rail line is planned to commence in 2028.
Transportation (rail)	Valley Rail Project	Throughout the RCIS area	This project involves implementing track improvements on the existing Union Pacific Railroad Sacramento Submission freight corridor so it can be used for passenger service. New rail stations will be constructed, including ones in Ceres, Modesto, Ripon, Manteca, and North Lathrop.
Transportation (road)	State Highway System, Maintenance and Improvements	Throughout the RCIS area	Caltrans District 10 and 6 have State Highway System state highway system repair and improvement projects planned for the interstate and state route systems within the Central Valley, including those within the RCIS area. The roadway improvements include actions such as culvert repair, roundabout installation, and bridge replacement.

Project Type	Planned Projects/ Improvements	Location	Description and Relevance
Transportation (road)	Local and regional roads	Throughout the RCIS area	Metropolitan Planning Organizations, Regional Transportation Planning Agencies, and other public agencies that implement transportation improvements have regional and local road improvements planned within the RCIS area. The roadway improvements include actions such as new roads as well as road widening, addition of bicycle lanes, and other capacity increasing projects.
Water	San Joaquin River Restoration Program	Throughout the RCIS area	The overall program seeks to ensure self-sustaining populations of salmonids downstream of Friant Dam. This program involves both restoration and water management elements. The restoration component involves major changes to existing infrastructure and modifications to the bypass system.
Water supply	Dry Creek Flood Mitigation Direct Recharge Project	Stanislaus County	The project involves the delivery of approximately 5,400 acre-feet of surface water from Dry Creek through a limited number of new or existing points of diversions off Dry Creek and subsequent conveyance through new or existing private irrigation conveyance infrastructure for direct recharge during the non-growing season.
Water supply	Merced-Chowchilla Intertie	Merced County	The Merced-Chowchilla Intertie project would provide benefits to the subbasin by allowing the purchase of excess water supply from Merced during years in which excess supplies are available. The project would consist of building a pipeline connection and negotiating short- and long-term transfer arrangements.
Water supply	Planada Groundwater Recharge Basin Pilot Project	Planada area (Merced County)	This three-year pilot project will construct a groundwater recharge basin in the Planada area.
Water supply	Storm Drain Cross Connection Removal Project	City of Modesto	This multi-benefit and multi-component project captures, treats, and infiltrates stormwater within the City of Modesto. The project uses low-impact development techniques including bio-retention planters, infiltration trenches, and underground retention basins under city parks to recharge the groundwater aquifer.
Water supply	Tuolumne River Flood Mitigation and Direct Recharge Project	Modesto Subbasin	The Tuolumne River Flood Mitigation and Direct Recharge Project is intended to be a cooperative long-term project between Modesto Irrigation District and landowners. It involves the delivery of approximately 20,000 acre-feet of surface water from the Tuolumne River in wet and above-normal water years through a limited number of new points of diversions off existing irrigation conveyance infrastructure and subsequent conveyance through newly constructed private irrigation conveyance infrastructure for storage and direct recharge during the non-growing season.

Project Type	Planned Projects/ Improvements	Location	Description and Relevance
Water supply	DWR California Aqueduct Subsidence program	Statewide near CA aqueduct	One of several programs underway to help improve resiliency of water management systems within California and prepare for future needs by implementing targeted projects.

Sources: U.S. Army Corps of Engineers & San Joaquin Area Flood Control Agency, 2018; Stanislaus Council of Governments, 2022; CHSRA, 2023a; CDWR, 2024

2.4.4 Major Programs and Policies

Local, state, and federal agencies have instituted programs and policies to address economic and ecological problems caused by past development or address problems anticipated as the climate changes. If fully implemented, these programs could significantly change hydrology, land use, and ecosystem function in the Central Valley. For example, the San Joaquin River Settlement Act and the Sustainable Groundwater Management Act could significantly increase long-term surface flows and groundwater levels, respectively. The primary regulatory and non-regulatory drivers (plans, initiatives, programs, and regulations) that affect natural resource management, including water management, within the RCIS area are listed in Table 2-14 and Table 2-15.

Where these drivers have specific strategies (goals, objectives, or actions) for species and habitat recovery, these strategies will be integrated into this RCIS Conservation Strategy in Chapter 4. Other drivers listed below influence the actions that private citizens, local communities, or the state may take to benefit residents, such as improved water quality, flood protection, recreation, and economy. The RCIS aims to identify mutually beneficial actions that can service both societal and conservation goals when compatible. The RCIS integrates conservation and habitat enhancement actions into multi-benefit projects.

Because there are many complex drivers affecting land use and conservation in the region, this document cannot summarize all of them; instead, Table 2-15 provides links to additional sources of information on drivers. Some major programs and policies that are driving regional change are described in more detail below or cited within relevant sections of this document.

2.4.4.1 Central Valley Project Improvement Act Program

To mitigate the impacts of constructing and operating the Central Valley Project, the Central Valley Project Improvement Act (CVPIA) was enacted in 1992. The CVPIA established water supply goals for 19 wildlife habitat areas in the Central Valley, including many within the Grassland Ecological Area in the RCIS boundary. The CVPIA also sets fish restoration goals and other habitat objectives.

2.4.4.2 San Joaquin River Restoration Program

To implement the San Joaquin River Restoration Settlement Act, the San Joaquin River Restoration Program (SJRRP) was created in 2009. The SJRRP is a collaborative, multi-agency effort to restore flows in the San Joaquin River from Friant Dam to the confluence of the Merced River (San Joaquin River Restoration, 2018). The SJRRP has two primary goals, restore a self-sustaining population of spring-run Chinook salmon and reduce or avoid negative impacts to water supply for Friant Division long-term contractors (SJRRP, 2018).

2.4.4.3 Sustainable Groundwater Management Act

Groundwater management for the San Joaquin Basin has been substantially affected by the 2014 passage of the Sustainable Groundwater Management Act (SGMA) (CDWR, 2023a). SGMA established a path for sustainable management of groundwater through the formation of locally organized groundwater sustainability agencies and locally developed groundwater sustainability plans (CDWR, 2023a).

With regulatory support and program oversight by the California Department of Water Resources, SGMA requires local agencies to form groundwater sustainability agencies for the high- and medium-priority basins (CDWR, 2023b). Groundwater sustainability agencies develop and implement groundwater sustainability plans to avoid undesirable results and mitigate overdraft within 20 years (CDWR, 2023b).

To balance groundwater supply and demand, the implementation of SGMA necessitates the coordinated management of landscapes to minimize economic, social, and environmental impacts from the transition of agricultural lands to less water-intensive land uses.

2.4.4.4 Multibenefit Land Repurposing Program (MLRP)

The Multibenefit Land Repurposing Program (MLRP), led by the California Department of Conservation (DOC), was established to increase regional capacity to repurpose irrigated agricultural land, thereby reducing reliance on groundwater while providing community health, economic wellbeing, water supply, habitat, renewable energy, and climate benefits (DOC, 2023c). Funded by the Public Resources Trailer Bill in 2021 and (AB 211) in 2022, the program provides block grants of up to $10 million to regional- or basin-scale organizations to develop and implement land repurposing programs. Additionally, the program included a set-aside for funding to tribes, and the program prioritizes the achievement of disadvantaged community benefits when implementing this program (DOC, 2022). Of the eligible entities located within the RCIS area, the County of Madera, East Turlock and Merced Subbasin Groundwater Sustainability Agency have received MLRP block grant funding for land repurposing.

Table 2-14. Regulatory (Required) Drivers for Land Use in the RCIS Area

Species Recovery, Conservation, and Restoration	Flood and Surface Water Management	Drinking Water and Water Quality/Groundwater Management	Community
▪ Central Valley Project Improvement Act ▪ Habitat Conservation Plans/Natural Community Conservation Plans ▪ National Wildlife Refuge Comprehensive Conservation Plans ▪ San Joaquin River Settlement Act ▪ USFWS/NMFS Species Recovery Plans	▪ Central Valley Flood Protection Act	▪ California Water Plan (Water Code Section 10005(a)) ▪ California Water Rights Act (Human Right to Water) ▪ Central Valley Salinity Alternatives for Long-Term Sustainability (CV SALTS) and Nitrate Control Program ▪ Dairy General Order ▪ Sustainable Groundwater Management Act (SGMA)/Groundwater Sustainability Plans ▪ Regional Water Management Planning Act	▪ California Natural Resource Agency Tribal Communication Policy ▪ County and City General Plans

Table 2-15. Non-Regulatory (Voluntary, Visionary) Drivers for Land Use in the RCIS area

Species Recovery, Conservation, and Restoration	Flood and Surface Water Management	Drinking Water and Water Quality/Groundwater Management	Community
▪ 30x30 Initiative ▪ California Biodiversity Initiative ▪ California Essential Habitat Connectivity Project ▪ Central Valley Flood Protection Plan Conservation Strategy ▪ Central Valley Joint Venture 2020 Implementation Plan ▪ Central Valley Landscape Conservation Project ▪ Central Valley Project Improvement Act Near-term Restoration Strategy ▪ Central Valley wildlife corridor analysis (Huber et al, 2015) ▪ EcoRestore ▪ Healthy Rivers and Landscape Program	▪ (Governor's) 2020 Water Resilience Portfolio ▪ Central Valley Flood Protection Plan ▪ Flood-Managed Aquifer Recharge (MAR) ▪ Regional Flood Management Plans ▪ Safeguarding California Plan 2018	▪ Integrated Regional Water Management Plans ▪ Landflex ▪ Multibenefit Land Repurposing Program (MLRP) ▪ SAFER Drinking Water Program ▪ San Joaquin Collaborative Action Plan (CAP) ▪ Wastewater management plans ▪ Water Blueprint for the San Joaquin Valley ▪ Water Quality Control Plans – Bay Delta Plan, Basin Plan	▪ California's 4th Climate Change Assessment ▪ California Department of Food and Agriculture AgVision for the Next Decade ▪ California's Integrated Energy Policy ▪ Regional Transportation Plans ▪ San Joaquin Parkway Masterplan ▪ San Joaquin Regional Blueprint ▪ Statement of Administration Policy Native

Species Recovery, Conservation, and Restoration	Flood and Surface Water Management	Drinking Water and Water Quality/Groundwater Management	Community
▪ Invasive species removal plans ▪ San Joaquin River Restoration Program ▪ State Wildlife Action Plan			American Ancestral Lands ▪ Sustainable Agricultural Lands Conservation (SALC) Program

2.5 Pressures and Stressors

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

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

Identifying projected non-climate and climate pressures and stressors in the RCIS area helps to guide the prioritization of conservation strategies to be implemented. Natural communities and species habitat are primarily affected by pressures and stressors through one of three mechanisms: loss, fragmentation, and degradation. Species can experience direct mortality, health decline, stress, or lower fecundity (reproductive success) because of changed ecological conditions, such as increased noise or light levels. As species and habitats are lost and degraded, overall resilience and genetic diversity decline.

2.5.1 Primary Pressures in RCIS Area

The State Wildlife Action Plan for the CDFW-designated Central Valley and Sierra Nevada Province, species-specific USFWS and National Marine Fisheries Service recovery plans, and a range of RCIS area subregional assessments helped identify the most significant regional pressures and sub-pressures with their resulting stressors affecting focal and non-focal species and natural resources (Table 2-16). Climate change is already affecting plants, wildlife, and habitats throughout California and is the primary stressor assessed in this RCIS because of the severity of its projected future stressors. Climate change stressors are also likely to exacerbate other regional pressures in the area. Climate vulnerability assessments for focal conservation elements are provided in Chapter 3 and for non-focal conservation elements in Appendix E. Each of the key regional pressures and resulting stressors are briefly described in Table 2-16 and then noted throughout the conservation strategy (Chapter 4) where applicable to proposed actions and conservation elements.

Table 2-16. Regional Pressures and Stressors in the RCIS Area

Pressure ***Sub-pressure***	**Stressor**
Climate Change	▪ Increases in day and night temperature extremes, average annual temperature, and evapotranspiration ▪ Altered hydrology and flow through increases in drought frequency and severity and more frequent extreme storms ▪ Changes in precipitation patterns ▪ Increases in wildfire frequency and severity ▪ Changes in surface water and groundwater levels ▪ Changes in the salinity and chemistry of groundwater, surface water, and soils ▪ Changes in spatial distribution, phenology, compositions, and habitats of natural communities and species
Land Conversion and Development	▪ Loss of areal extent of natural communities and species habitat ▪ Fragmentation and reduced connectivity of natural communities and species habitat ▪ Reduction in ecosystem function and complexity ▪ Lowering of groundwater levels ▪ Increases in invasive species and disease ▪ Increases in barriers to migration/movement ▪ Increases in hydrologic constrictions (e.g., linear infrastructure) that affect water circulation and flow ▪ Increases in incompatible land uses ▪ Increases in human-wildlife interactions and direct physical harm and disturbances ▪ Disruption of natural fire regimes ▪ Changes to food webs and predator/prey dynamics ▪ Conversion of land for agricultural purposes (see sub-pressure)
Agriculture and Livestock/Ranching	▪ Increases in pesticide and herbicide use, which can impact water quality, habitats, and individual species ▪ Increases in groundwater overdraft through intensification of agriculture or crop selection ▪ Increases in surface water diversion impacts to aquatic and riparian habitats ▪ Increases in human-wildlife interactions and direct physical harm and disturbance ▪ Disruption of natural clay hardpan and soil substrates by discing and cultivation
Water Pollutants and Discharges	▪ Changes in water quality from suspended sediment ▪ Increases in salinity from agricultural discharges ▪ Increases in chemical pollution, nutrients, and/or algae blooms ▪ Changes in pH and/or dissolved oxygen concentrations ▪ Increases in ecotoxicity for species and concentration of pollutants in the food web (e.g., polychlorinated biphenyls)

Pressure *Sub-pressure*	Stressor
Disrupted Natural Hydrology and Sediment Supply Pathways	▪ Disconnected floodplains ▪ Altered flow and flooding regimes ▪ Increases in erosion ▪ Changes to sediment supply
Invasive Species and Pathogens	▪ Changes to natural community composition and food web dynamics ▪ Displacement of native species ▪ Predation on native species by introduced species ▪ Increases in competition for land and resources ▪ Increases in disease susceptibility

2.5.1.1 Climate Change

Climate change encompasses a variety of changes in weather patterns, including changes in temperature, precipitation amounts and frequency, and the frequency of extreme-weather events, including droughts and floods. Climate change is already affecting plants, wildlife, and habitats throughout California, and its projected effects may continue to intensify (CDFW, 2015). The descriptions of focal species and other conservation elements in Chapter 3 detail vulnerabilities to climate change. Climate change projections for the RCIS area, specific climate change impacts, and potential for climate resilience are discussed below.

To simulate the response of increasing greenhouse gas concentrations, global circulation models representing the potential climate conditions (e.g., dry, wet) are used (IPCC, 2022). Representative concentration pathways (RCPs) have been established to reflect the impacts of the range of human actions on future climate conditions (IPCC, 2022). Because these scenarios were revised in the recent Sixth Assessment Report in 2022, most climate adaptation planning guidance and published climate vulnerability assessments still use scenarios (RCPs) from the Fifth Assessment Report (AR5).

Scenarios RCP4.5 and RCP8.5 from AR5 are the most used in climate adaptation planning. RCP8.5 is referred to as a business-as-usual scenario and represents escalating economic growth, with greenhouse gas concentrations exceeding 900 parts per million by the end of the century. This RCIS will report regional and species or habitat climate change vulnerability results using the RCP8.5 scenario, as that is the trajectory the globe is currently on.

Summaries of projected changes in temperature and hydroclimate metrics based on high emission conditions in counties included in the RCIS area are shown in Table 2-17, Table 2-18, and Table 2-19. Note that only portions of Fresno and Madera counties are included in the RCIS area, but their overall projected climatic changes are likely to be similar throughout the county.

Table 2-17. Annual Average Maximum Temperature at High Emission Scenario (RCP8.5)

County	Historical (1961-1990)	Mid-century (2035-2064)	End-century (2070-2099)
San Joaquin	73.9	78.8	82.0
Stanislaus	73.6	78.3	81.8
Merced	74.7	79.6	83.2
Madera	68.3	73.5	77.2
Fresno	67.3	72.4	76.0
Average	**71.8**	**76.5**	**80.0**

Source: Cal-Adapt, 2018

Table 2-18. Extreme Heat Days with Daily Maximum Temperature Above 101.6 °F at High Emission Scenario (RCP8.5)

County	Historical (1961-1990)	Mid-century (2035-2064)	End-century (2070-2099)
San Joaquin	4	23	45
Stanislaus	4	24	47
Merced	4	29	56
Madera	4	33	64
Fresno	4	34	63
Average	**4**	**28.6**	**55**

Source: Cal-Adapt, 2018

Table 2-19. Average Percentage Change between Current Conditions (2006-2035) and End-Century (2070-2099)

Hydroclimate Metric	End-century (2070-2099)
Total annual snowpack	-85%
Frequency of swings between very wet and very dry years	+124%
Frequency of very wet years	+57%
Frequency of very dry years	+10%

Source: Fernandez-Bou et al., 2021

Scenarios of changing precipitation patterns (including increased risk of drought) coupled with increased temperatures may alter river flows and wetlands in ways that affect migration patterns and suitability for fish and migrating waterfowl. Conversely, scenarios of more frequent and intense storms could result in increased episodic erosion and sedimentation and flood habitats. Climate change projections developed by the CDWR predict that peak flood reservoir spills from Friant Dam for the 50-year flood event may increase by five to 10-fold over the next half century (CDWR, 2022), which would cause widespread damage to the Upper San Joaquin flood control system.

Increased frequency and severity of droughts and temperature extremes may impact the availability of surface water in terrestrial habitats and exacerbate already critical salinity issues. This will further reduce the suitability of remaining habitat areas which could lead to population collapses and increased risk of extinction for some species (Fernandez-Bou et al., 2021). Low productivity in plants may result in food scarcity for a wide range of herbivores and animals at higher trophic levels, as well as reduce agricultural production (Fernandez-Bou et al., 2021).

Future land use changes in the RCIS area are anticipated to significantly reduce the acreage of agricultural land due to multiple factors. With climate change driving warmer temperatures, agricultural water users will face higher water demands for crops and rangeland owing to increased evapotranspiration. Simultaneously, the region is expected to experience a reduction in long-term surface water availability, exacerbated by the shift from snow to rain precipitation due to climate change effects. The provisions required to achieve water use balance by SGMA will likely lead to substantial reductions in agricultural water demand, potentially resulting in large-scale fallowing of marginal cropland. By 2040, average annual water supplies could decline by 20% due to the transitions required by SGMA, but also exacerbated by climate change (Escriva-Bou et al., 2023).

2.5.1.2 Land Conversion and Development

The most disruptive cause of habitat loss, fragmentation, and degradation throughout the Central Valley is conversion of natural habitats to agricultural farmland, as well as recent exponential urban growth (CDFW, 2015; USGS, 2017). This intensive growth has been made possible using irrigation water, delivered through an extensive network of canals and reservoirs (USGS, 2017). The majority of the historical mosaic of desert scrub, wetlands, riparian lands, grasslands, and shrublands, as well as floodplains, seasonal wetlands, and riparian shrublands and forests have been converted to agriculture and urban development through human activities (CDFW, 2015; see Section 2.3.1, *Pre-historic Landscape,* for further details). Natural communities experience stressors from these human-related uses, which can degrade ecosystem health and viability (CDFW, 2015). Fragmentation of habitat into small remnants from land conversion, agriculture, and linear infrastructure (e.g., transportation infrastructure, canals, power lines) threatens the population persistence of wildlife and plant species through impediment or prevention of movement and migration, preponderance of invasive species, increased predation and competition, and altered food web dynamics (CDFW, 2015).

2.5.1.2.1 Agriculture and Livestock/Ranching

Nearly 17 million acres—or 70%—of the RCIS area is planted with annual or perennial crops or is used for raising livestock in feedlots or ranching. The transition from planting annual crops to planting perennial crops (e.g., orchards, vineyards) has impacted biodiversity and habitat quality and quantity. Field crops allow for connectivity between habitat areas and provide food and agricultural wetlands in the winter, while orchards and vineyards have limited habitat value.

Conflicts can arise between natural habitat areas and agricultural land. Farmers may be concerned that habitat lands could harm nearby agricultural lands such as through export of weeds, diseases, and pests. Additionally, prolonged flooding of managed wetland areas may cause seepage onto neighboring farmland and consequently damage crops. Farmland operations can also affect nearby habitat areas, such as through overspray of chemicals and from agricultural drainage discharge, which often contains pesticides and herbicides that could negatively affect native fish, plants, and wildlife occupying the habitat preserve areas. Restoration areas could also be subject to excess noise associated with active agricultural operations. Although agriculture can have adverse effects on ecosystems, agricultural practices have the ability to be compatible with species use and can provide important habitat.

Given the current dominance of agriculture in the San Joaquin Basin, large-scale fallowing required by SGMA will bring about a profound shift in land use patterns. However, this transformation could also present an opportunity for the expansion of clean energy projects, particularly solar power generation. The region's vast open spaces and favorable climate conditions make it an ideal location for solar farms. As the demand for clean energy continues to grow, it is plausible that former farmlands may be repurposed to accommodate renewable energy infrastructure. Nevertheless, the expansion of solar energy projects in the San Joaquin basin is currently hindered by inadequate electrical transmission line capacity and availability of local energy storage options, such as batteries. Creating buffers between solar projects and migratory bird areas is also an important consideration in this region.

2.5.1.3 Water Pollutants and Discharges

Many of the native species of the San Joaquin Basin have evolved to live in this floodplain-dependent ecosystem and require specific water quality conditions. Water quality is impacted by the concentration of dissolved oxygen, chemicals, suspended particles, metals, nutrients, and pH. Salinity concentrations are one of the largest water quality concerns. Salinity is influenced by the accumulation of anions such as carbonates, chlorides, and sulfates, and cations such as potassium, magnesium, calcium, and sodium (SJRRP, 2002). Salinity impacts on fish species in the Central Valley has been documented for decades, while impacts to invertebrates, ecological community structure, and taxa richness has been the subject of research (SJRRP, 2002). Salinity levels in soils and groundwater could limit the recruitment of riparian vegetation, as well as impact the economic productivity of agricultural lands.

Selenium is also a water quality concern for fish, birds, and other wildlife, particularly in the western portion of the RCIS area. Selenium is naturally occurring there, but when concentrated and discharged in drainage water it can bioaccumulate in wildlife, causing negative health and reproductive impacts. There are longstanding efforts to reduce and mitigate selenium pollution including the Kesterson Mitigation Plan and the Grassland Bypass Project.

2.5.1.4 Disrupted Natural Hydrology and Sediment Supply Pathways

As discussed in Section 2.3.3, *Hydrology Alteration*, the river systems and groundwater basins in the RCIS area have been heavily impacted by increased urban and agricultural uses and flood control and water conveyance infrastructure. The stability and conveyance capacity of vast flood control and irrigation systems in the RCIS area are threatened by land subsidence, insufficient funds to maintain the levees, and climate change (CLCC, 2018; Fernandez-Bou et al., 2021). Large-scale land subsidence has increased the gradients in certain locations and reduced it in others: this has resulted in severe erosion where the gradient is over steepened and sedimentation downstream where the gradient is insufficient to convey sediment loads.

CDWR's Central Valley Flood Protection Plan describes the threat of subsidence to the flood control system's long-term stability (CDWR, 2016).

2.5.1.5 Invasive Species and Pathogens

Invasive plant and animal species are a substantial pressure in the RCIS area (CDWR, 2016). Invasive plants and animals may prey on or directly compete with native species for habitat or resources. In the Central Valley, CDWR describes effects of invasive species management as part of the Central Valley Flood Protection Plan (CDWR, 2016). Priority species include giant reed (*Arundo donax*), red sesbania (*Sesbania punicea*), saltcedar (*Tamarix spp.*), and Himalayan blackberry (*Rubus armeniacus*) (CDWR, 2016). Water hyacinth and other floating aquatic weeds impede water deliveries for habitat management. These and other species degrade habitat for endangered species, alter hydrology and sedimentation rates, and reduce flood control capacity (CDWR, 2016). Non-native animal species affecting the RCIS area include striped bass (*Morone saxatilis*) and other non-native predatory fish, bullfrogs (*Lithobates catesbeianus*), turtles, nutria (*Myocastor coypus*), and mammalian predators such as feral cats (*Felis catus*). Pathogens and disease may also impact species, which can be exacerbated by climate change effects, such as rising temperatures, or poor water quality.

3 Conservation Elements

Photo Credit: Lee Eastman, U.S. Fish and Wildlife Service

This chapter provides an overview of the conservation elements analyzed in this RCIS and how they were selected. The descriptions of the selection criteria and species evaluated are included in Appendix C.

3.1 Selection Process

The RCIS Program Guidelines describe requirements for selecting the focal species and other conservation elements for the RCIS (CDFW, 2023a). Per the guidelines, "the focal species list shall consist of a range of species with conservation needs within the RCIS area and should include federal and state-listed species, wide-ranging species, climate-vulnerable species, and representative species from major taxonomic groups…CDFW recommends that the focal species list include listed species that are most representative of the important natural community types in the RCIS area and ecosystem processes that are characteristic of the conservation needs in the RCIS area." Additionally, "an RCIS shall include other conservation elements needing conservation within the RCIS area, and those whose inclusion would help to achieve a comprehensive, cohesive, and connected regional conservation outcome" (CDFW, 2023a).

Conservation Element: *A species, natural resource, or ecological process that is identified and analyzed in an RCIS that will benefit from actions listed in the RCIS. Conservation elements include focal species and other conservation elements.*

Focal Species: *Sensitive species identified and analyzed within an RCIS that will benefit from conservation actions and/or habitat enhancement actions set forth in the RCIS.*

A preliminary list of potential focal species and other conservation elements was developed by conducting record searches and reviewing data from the following sources:

- California Natural Diversity Database (CDFW, 2023b)
- California Native Plant Society Rare Plant Inventory (CNPS, 2023a)
- United States Fish and Wildlife Service Information for Planning and Consulting (IPaC) Tool (USFWS, 2023)
- California Wildlife Habitat Relationships (CDFW, 2014)
- Central Valley Landscape Conservation Project (CLCC, 2018)
- Central Valley Flood Protection Plan Conservation Strategy (CDWR, 2016, 2022)
- Central Valley Joint Venture Implementation Plan (CVJV, 2020)
- California State Wildlife Action Plan Species of Greatest Conservation Need (CDFW, 2015)
- California's list of Fully Protected Species (CDFW, 2023c)
- San Joaquin County Multi-Species Conservation Plan (SJCOG, 2000)
- PG&E San Joaquin Valley Operation & Maintenance Habitat Conservation Plan (Jones & Stokes, 2006)
- Species Recovery Plans (see Appendix D)

Species, natural communities, and ecosystem processes were included in the preliminary list if they were:

- Listed as special-status or rare.
- Umbrella or keystone species.
- Endemic or unique to the RCIS area.
- Vulnerable to climate change.
- Far-ranging across large landscape blocks.
- Essential to or require habitat connectivity.
- Habitat limited.
- Locally declining.
- Providing ecosystem and community benefits.
- Representative of the diversity of species taxonomic groups and ecosystem functions present in the San Joaquin Valley.

This preliminary list of over 150 potential focal and non-focal conservation elements was refined with input from the project's steering committee, expert biologists, and the consulted literature noted above.[5] To determine whether a conservation element would be included from the preliminary list in the plan's final list, additional criteria were considered. These included:

- Presence within the RCIS area, including number of documented occurrences (where known) and range extent.
- Designation as a special-status species, including status as a State Wildlife Action Plan Species of Conservation Need (CDFW, 2015).
- Existence of near-term mitigation needs for impacts from development projects to the species.
- Climate change vulnerability and other threats.
- Opportunities for restoration and recovery.
- Suitability as a representative or indicator species.
- Adequacy of available scientific information.

Species and other conservation elements were excluded from the final list if:

- They did not occupy a sufficient area within the RCIS to warrant a regional strategy.

[5] The CVFPP Conservation Strategy Appendix G describes a rigorous methodology that was used to assess and select the target species for that plan (CDWR, 2022). This analysis was considered in identifying focal and non-focal species for this RCIS.

- There was insufficient data or information available regarding occurrences or life history to develop a strategy.
- Their habitat was already largely protected in areas of occurrence.
- Their range extended largely beyond the RCIS area; therefore, conservation in the RCIS area would have limited impact on the species or habitat as a whole.
- A conservation strategy developed for the conservation element would be too narrowly defined to have regional value.
- A conservation strategy developed for another species or other conservation element would adequately address the conservation needs.

In some cases, species or habitats that were excluded from the final conservation elements list were included as non-focal species or co-benefitted natural resources (described below).

3.2 Conservation Elements: Focal Species and Other Conservation Elements

The resulting list of conservation elements included 11 focal species and 8 other conservation elements. Table 3-1 and Table 3-2 provide a summary of the final conservation elements list, including a brief description of why each element was selected for inclusion in the RCIS. The subsequent sections provide a more detailed description of each conservation element.

Table 3-1. Other Conservation Elements Justification for Selection

Element	Brief Description	Rationale for Inclusion
Hydrogeomorphic Processes	Hydrogeomorphic processes are both the geomorphic and the hydrologic processes involved in water flow across a landscape, typically in a channel such as a stream or river.	The San Joaquin Valley was shaped by its river systems and the RCIS is defined around the San Joaquin River, its tributaries, and floodplains. Hydrologic processes are critical for ecosystem function in the region. An ecosystem process is a required element in the RCIS Program (CDFW, 2023a).
Groundwater Sustainability	Groundwater is water that exists underground in saturated zones beneath the land surface (USGS, 2024). For groundwater to be sustainable, there must be a balance of depletion with recharge.	The Central Valley is heavily dependent on groundwater supply for agriculture, municipal and industrial use, and natural communities. Implementation of SGMA (CDWR, 2023a) creates opportunities for conservation and restoration of groundwater for ecosystem benefit.
Habitat Connectivity	Habitat connectivity is the degree to which organisms or natural processes can move unimpeded across habitats.	Habitat connectivity across the landscape is critical for species population survival and resilience in a changing climate. Habitat connectivity is a required conservation element in the RCIS Program (CDFW, 2023a).
Working Lands	Working lands are farms, orchards, vineyards, and ranches used for agricultural uses (CDFW, 2023a).	The San Joaquin Valley is dominated by agricultural land uses. This presents both challenges and opportunities for restoration and implementation of practices that provide both ecosystem and community benefit. Working Lands must be considered in an RCIS (CDFW, 2023a).

Element	Brief Description	Rationale for Inclusion
Freshwater Wetlands	Freshwater wetlands are areas where fresh surface water or groundwater inundates soils with enough frequency and duration to support plants adapted to saturated soil conditions.	Freshwater wetlands provide important habitat for many species in the Central Valley, notably migrating waterfowl on the Pacific Flyway. Historically, floodplain wetlands were prevalent along the San Joaquin River, but these have been largely lost due to land conversion. Managed wetlands are now the dominant wetland type.
Riparian and Riverine Corridors	Riverine habitats are those within the bed and bank of a stream or river. Riparian habitats occur along river or stream margins and are dominated by water-dependent species.	Riparian and riverine habitats support unique species and provide critical corridors that connect the landscape. Riparian and riverine habitats have been lost and degraded throughout the Central Valley.
Grasslands	Grasslands are dominated by grasses (annual and perennial) and other herbaceous species with less than 10% tree canopy cover (CDFW, 2005c, 2005d; CVJV, 2020).	Most of the historic grasslands, especially native perennials, of the Central Valley have been lost to land conversion. Those that remain provide important habitat for special-status and common plants and animals in the region.
Vernal Pools	Vernal pools are seasonal depressional wetlands typically within grasslands. They are shallowly ponded for variable periods in winter and spring, but dry for summer and fall. Underlying bedrock or claypan soils prevent water from draining (EPA, 2023).	Vernal pools provide habitat for unique and endemic species. Once widespread, vernal pools have also been lost due to land conversion. Those that remain provide habitat for many special-status plants and animals.

Table 3-2. Focal Species Justification for Selection

Common Name ***Scientific Name***	**Species Status**	**Taxonomic Group**	**Rationale for Inclusion**
Salmonids Steelhead – California Central Valley Distinct Population Segment (DPS) *Oncorhynchus mykiss* Chinook salmon – Central Valley spring-run Evolutionarily Significant Unit (ESU) *Oncorhynchus tshawytscha* Chinook salmon – Central Valley fall-run (ESU) *Oncorhynchus tshawytscha*	Depends on species and population: Federally Threatened, State Threatened, and/or Species of Concern (see profile)	Fish	Salmonids (steelhead and Chinook salmon) are special-status species that have lost habitat quality and quantity due to barriers (such as dams),land development, and disrupted hydrogeomorphic processes. The San Joaquin River and its tributaries have historically provided important habitat and are being restored to support these species. Salmonids serve as a keystone species and their recovery benefits other species.
California Tiger Salamander – central California DPS *Ambystoma californiense*	Federally Threatened State Threatened	Amphibian	California tiger salamander has experienced habitat loss and degradation throughout its range. Its use of both aquatic and upland habitats makes it an umbrella species whose conservation benefits other species. There is mitigation demand for the species.
Giant Garter Snake *Thamnophis gigas*	Federally Threatened State Threatened	Reptile	Giant garter snake is impacted by agriculture and water management practices and can benefit from restoration and revised management practices. There is mitigation demand for the species.
Riparian Brush Rabbit *Sylvilagus bachmani riparius*	Federally Endangered State Endangered	Mammal	Riparian brush rabbit is one of the most endangered mammals in the state and endemic to the RCIS area. There are few remaining populations and extensive recovery efforts are underway.
San Joaquin Kit Fox *Vulpes macrotis mutica*	Federally Endangered State Threatened	Mammal	San Joaquin kit fox is a listed species with a core portion of its historic range in the San Joaquin Valley. This species represents large-ranging mammals that need intact and connected landscape blocks for recovery.
Western Red Bat *Lasiurus blossevillii*	State Species of Special Concern Western Bat Working Group High	Mammal	Western red bat is a species of special concern. It is included as a representative bat species as bats, generally, are in decline and considered highly vulnerable to climate change impacts.

Common Name *Scientific Name*	Species Status	Taxonomic Group	Rationale for Inclusion
Swainson's Hawk *Buteo swainsoni*	State Threatened	Bird	Swainson's hawk is a climate vulnerable, special-status species whose habitat has been impacted by development. It is an umbrella species whose conservation supports other species and habitats, such as oak woodlands and riparian habitat. There is mitigation demand for the species.
Tricolored Blackbird *Agelaius tricolor*	State Threatened Species of Special Concern	Bird	Tricolored blackbird is a climate vulnerable, special-status species that has been impacted by land conversion. It has unique habitat needs and can be benefited by water management and agricultural practices. There is mitigation demand for the species.
Monarch butterfly *Danaus plexippus*	Federal Candidate	Invertebrate	Monarch butterfly is a federal candidate species for listing, meaning its mitigation demand may increase in the future. Monarchs have a unique life history that requires long distance migration with interspersed foraging and resting habitat along its route. Their recovery relies on a comprehensive and integrated approach.
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus*	Federally Threatened	Invertebrate	Valley elderberry longhorn beetle is endemic to the Central Valley and naturally rare within its habitat. The protection and enhancement of its habitat benefits other riparian-dependent species.
Delta Button-Celery *Eryngium racemosum*	State Endangered California Rare Plant Rank 1B.1	Plant	Delta button-celery is endemic to California and primarily occurs in the Sacramento-San Joaquin Delta. Flood management projects can be designed to benefit Delta button-celery habitat and other floodplain species.

3.3 Non-Focal Species and Other Co-Benefitted Natural Resources

3.3.1 Non-Focal Species

Non-focal species (or "associated species") are species that are associated with a focal species or other conservation element in an RCIS because of shared ecological needs and requirements (CDFW, 2023a). Non-focal species benefit from the implementation of actions developed for focal species or other conservation elements. Designation as a focal or non-focal species does not indicate conservation priority; rather it is a way to streamline the document structure by reducing redundancy and focusing on those actions that have regional applicability. Appendix E presents a summary of each non-focal species, its ecological needs and climate change vulnerability, justifications for inclusion and association with a focal conservation element, and a crosswalk to beneficial actions in the conservation strategy. Non-focal species

are eligible for creation of MCA credits through implementation of actions with associated focal species or other conservation elements.

3.4 Focal Species and Other Conservation Element Profiles

Focal species and other conservation elements are described in the subsequent profile pages. Each profile includes required information from the RCIS Program Guidelines, as applicable (CDFW, 2023a), such as: regulatory status, current range, known occurrences or extent and potential distribution, ecological requirements, key pressures and stressors, climate vulnerability assessment, and ecosystem services. These profiles serve as a high-level summary and additional sources are provided for more information. This information is used to help support the development of the Conservation Strategy in Chapter 4.

3.4.1 Climate Change Vulnerability Assessments

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

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

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

Conservation element-specific climate change vulnerability assessments are not available for all conservation elements. In these cases, qualitative descriptions of projected impacts are described, or the vulnerability of the habitats the conservation element occurs in are used as proxy for climate change vulnerability.

3.4.2 Spatial Data Sources Used for Conservation Element Maps

To identify range and habitat for focal species, ESA acquired public data on known species occurrences from the California Natural Diversity Database (CNDDB), critical habitat from the National Marine Fisheries Service (NMFS), and species range and predicted habitat suitability data from the California Wildlife Habitat Relationships system for the selected species. Wetlands mapping was obtained from the National Wetlands Inventory (USFWS, 2023).

3.4.3 Conservation Element Profiles

The following profiles on the RCIS conservation elements provide information regarding species and element locations, importance, and factors.

Other Conservation Element

Hydrogeomorphic Processes

Sara Nevis/California Department of Water Resources

REGULATORY STATUS

- None

KEY STRESSORS

- Disconnected floodplains
  - Levees
  - Incised channels
- Altered flow and flooding regimes
- Hydrologic constrictions (e.g., linear infrastructure) that affect water circulation and flow
- Bank revetment

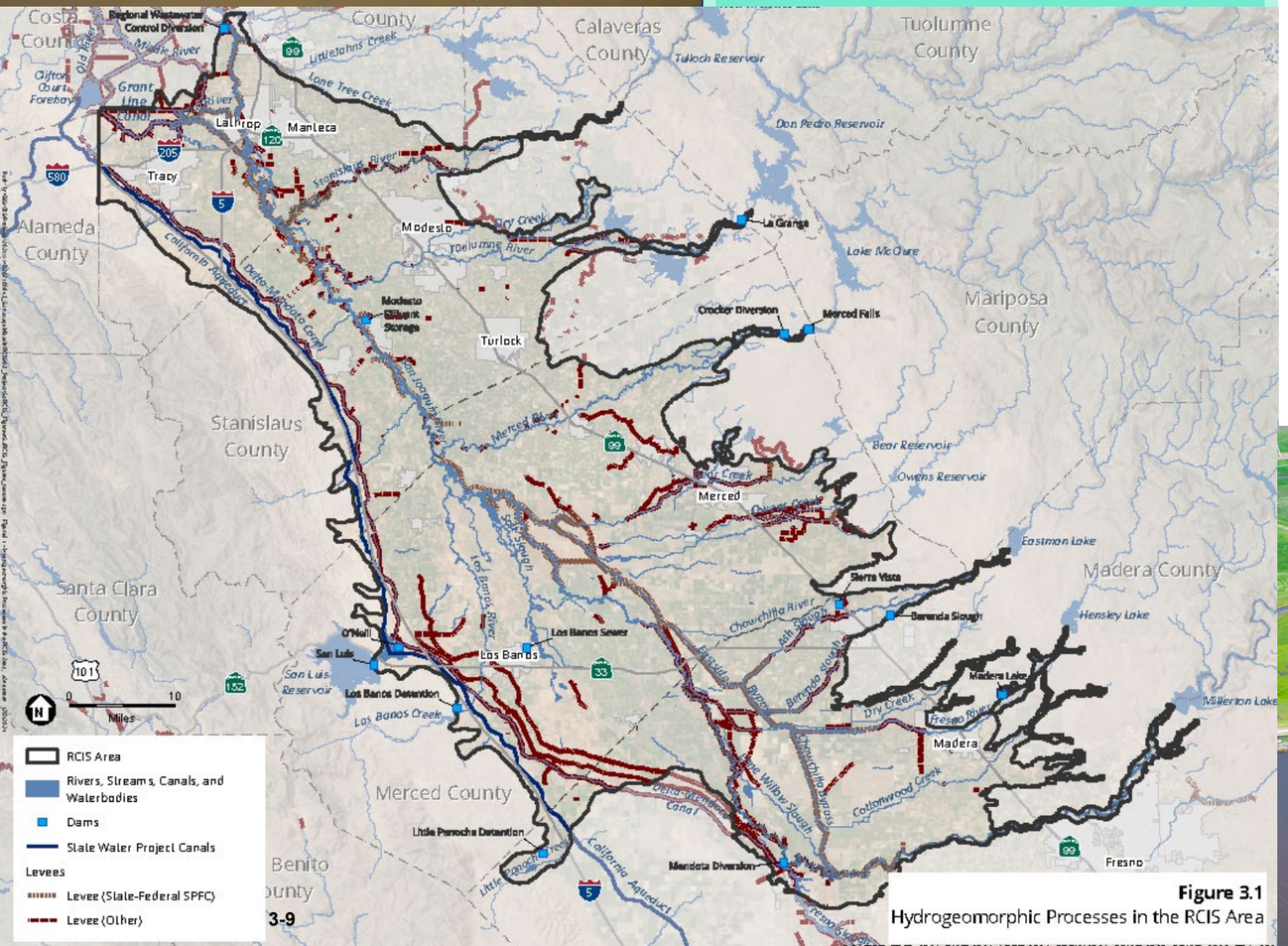


Figure 3.1
Hydrogeomorphic Processes in the RCIS Area

Ecological Requirements

- **RCIS Natural Communities**: Riverine, Riparian Mixed Hardwood, Riparian Mixed Shrub
- **Geomorphic processes** include channel meandering, channel cutoff, new channel formation, bed mobility, and fine and course sediment transport (CDWR, 2016).
  - These processes impact floodplain dynamics (e.g., channel, bank, and floodplain formation) that create and sustain habitats (CDWR, 2016).
- **Hydrological processes** include sediment scouring, erosion and deposition, and prolonged floodplain inundation.
  - Disturbances allow early successional riparian vegetation to establish (CDWR, 2016).
  - Processes result in diverse sediment sizes and irregular banks that provide increased habitat diversity for species (CDWR, 2016).
- Processes have been drastically impacted throughout RCIS area due to installation of major dams upstream of the RCIS area, as well as other flood control infrastructure, such as levees, revetment, and bypasses, leading to disrupted hydrology and sediment pathways.
- **Full account available**: Central Valley Flood Protection Plan Conservation Strategy (CDWR, 2016)

Climate Change Vulnerability

- Hydrogeomorphic processes, such as floodplain dynamics and erosion, are projected to be impacted by climate change. Reduced snowpack in the Sierra Nevada outside the RCIS area will impact streamflow and lead to more rapid snowmelt runoff (CLCC, 2018). This could lead to decreases in mean annual flow during the summer months (CLCC, 2018). Although earlier snowmelt could lead to higher peak flows, the reduced snowpack may eventually lead to lower overall spring flows (CLCC, 2018).
- Coupled with the projected increased intensity and frequency of droughts, water availability will be further reduced by increases in evapotranspiration rates and increase agriculture use (Fernandez-Bou et al., 2021). Projected increases in storm intensity and frequency, as well as changes in timing of snowpack runoff, are likely to pose significant threats to flood control infrastructure throughout the RCIS area (Fernandez-Bou et al., 2021).

California Department of Water Resources

Other Conservation Element

Groundwater Sustainability

Xavier Mascareñas, California Department of Water

REGULATORY STATUS

SGMA established a path for sustainable management of groundwater through the formation of locally organized groundwater sustainability agencies (GSAs) and locally developed groundwater sustainability plans (GSPs) (CDWR, 2023a). GSPs have been submitted for all areas of the RCIS and are in various states of approval, with some plans approved or determined to be inadequate, and others in review. GSAs are required to begin implementing a GSP upon its submittal. Once a GSP is approved, the GSA has 20 years to achieve sustainability within the basin (CDWR, 2023a).

KEY STRESSORS

- Lowering of groundwater levels because of over-drafting
- Altered hydrology and flow through increases in drought frequency and severity, and more frequent extreme storms
- Reduction in ecosystem function and complexity

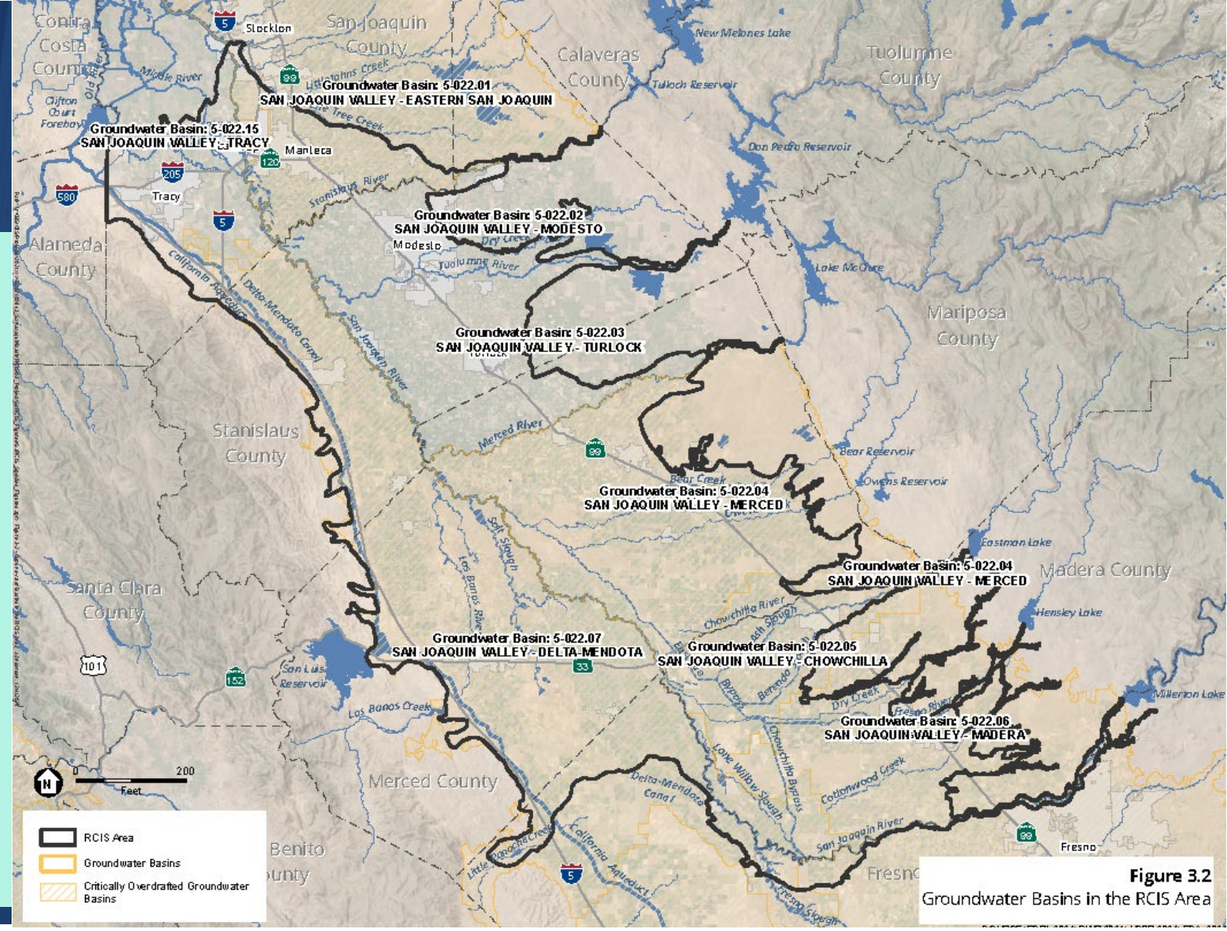


Figure 3.2
Groundwater Basins in the RCIS Area

Ecological Requirements

- **RCIS Natural Communities:** All communities
- Agricultural and urban water users have an increased reliance on groundwater to meet their water needs, resulting in the largest groundwater deficit in the state (Hanak et al., 2019).
- There are nine major groundwater basins in the RCIS area, seven of which are critically over drafted (CDWR, 2023b; see Figure 3-3c).
- The population in northern San Joaquin Valley counties is projected to grow 10–20% between 2020 and 2060, increasing urban water demand (California Department of Finance, 2023).
- Groundwater has been declining in the Central Valley over the past decades. The rate of decline is expected to accelerate with climate change, which could change precipitation patterns and exacerbate the imbalance of water supply and demand (Alam et al., 2019). Over-drafted aquifers are less able to recover from drought (Alam et al., 2021).
- **Full account available:** Water and the Future of the San Joaquin Valley (Hanak et al., 2019)

Climate Change Vulnerability

Groundwater depletion has occurred throughout the RCIS area due to increased water demand and decreased availability of surface water supplies throughout California (CLCC, 2018). Seven of the nine groundwater basins that overlap the RCIS area are critically over drafted, giving them limited ability to respond to increased water needs during periods of drought. Projected reductions in snowpack and precipitation will exacerbate the water supply and demand imbalance, putting additional pressure on groundwater resources (CLCC, 2018). Implementation of SGMA provides opportunities to recharge depleted groundwater basins and increase resilience of a critical water source for the RCIS area.

Other Conservation Element

Habitat Connectivity

Gerald Corsi, iStockPhoto

REGULATORY STATUS

- SB 790

KEY STRESSORS

- There are fish passage barriers throughout the RCIS area. This includes 64 dams, grade control structures, road and utility crossings, and non-structural barriers that create screened, partial, temporal, and total barriers to anadromous fish movement.
- As discussed in Chapter 2, numerous highways, rail networks, and flood and water conveyance infrastructure transect the RCIS area and serve as barriers to habitat connectivity.

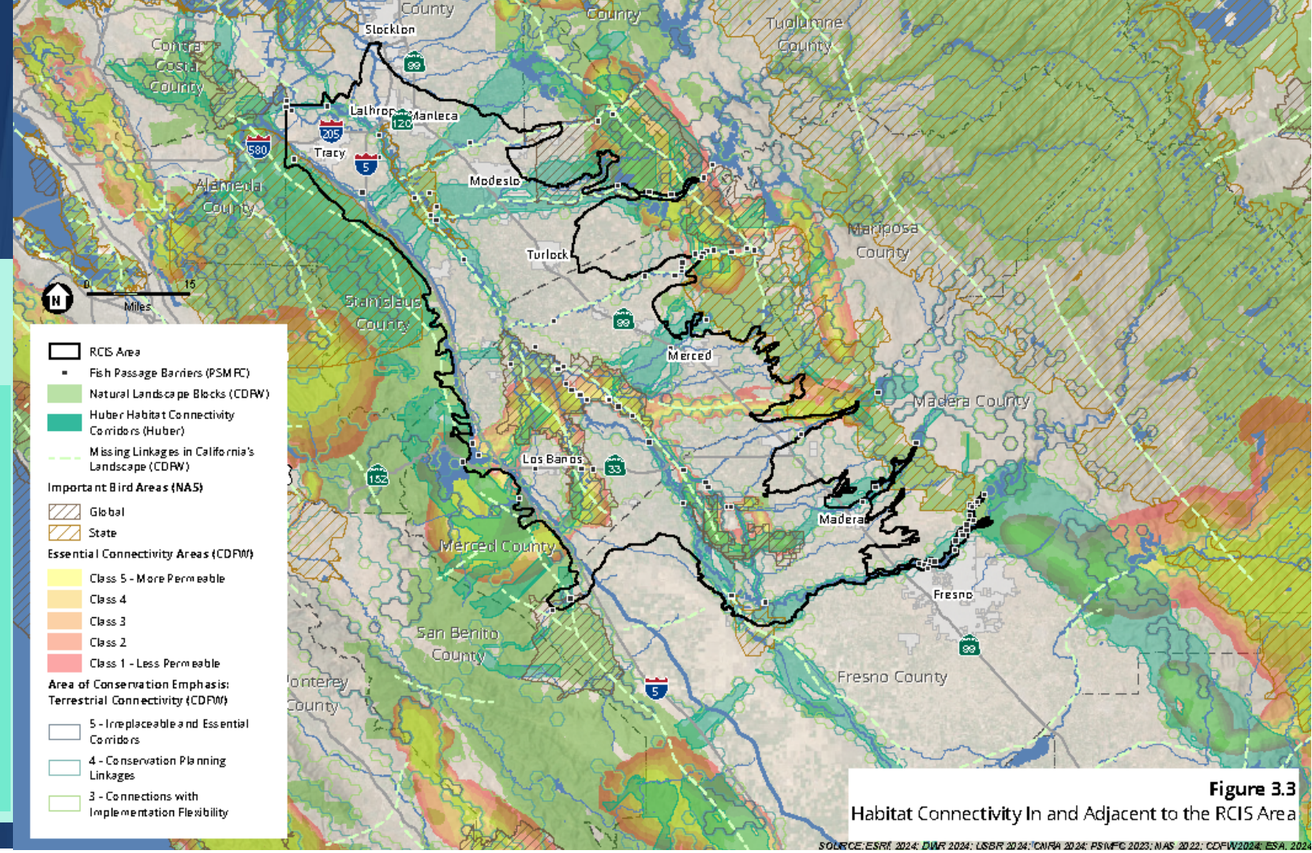


Figure 3.3
Habitat Connectivity In and Adjacent to the RCIS Area

SOURCE: ESRI, 2024; DWR 2024; USBR 2024; CNRA 2024; PSMFC 2023; NAS 2022; CDFW 2024; ESA, 2024

Ecological Requirements

Terrestrial and Aquatic Connectivity

- CDFW Areas of Conservation Emphasis (ACE) identify priority areas of terrestrial connectivity.
- ACE Rank 5 (also referred to as Irreplaceable and Essential Corridors) areas include San Luis National Wildlife Refuge.
- Several corridors transecting the RCIS area from east to west are ACE Rank 4, also referred to as Conservation Planning Linkages. Areas mapped as Rank 3 are Connections with Implementation Flexibility and surround Rank 4 and 5 areas.
  - Huber et al. (2010) mapped several corridors that align with the CDFW ACE Conservation Planning Linkages.
- California Essential Habitat Connectivity (CEHC) dataset identifies 114 natural landscape blocks that function as connectivity corridors and may also provide ecosystem services such as groundwater recharge, runoff retention, flood water retention, and sequestration of harmful air pollutants and carbon (Spencer et al., 2010).
  - Also identifies 29 Essential Connectivity Areas including the San Luis National Wildlife Refuge and the Sandy Mush corridors, as well as riparian corridors such as the San Joaquin River and its major tributaries, which facilitate wildlife movement between natural landscape blocks (Spencer et al., 2010).
- Both terrestrial and aquatic connectivity are critical to metapopulation dynamics, species dispersal, genetic diversity, and climate resilience.

Pacific Flyway

The RCIS area and entire Central Valley is an important stop for birds on the Pacific Flyway, a migration corridor extending from the Arctic to South America which is used by at least a billion birds each year (National Audubon Society, 2022). The National Audubon Society (2023) Important Bird Areas include state and global priorities.

- State Priority
  - San Joaquin River – Lower (San Joaquin River National Wildlife Refuge and Caswell Memorial State Park)
  - Merced Grasslands
  - Mendota Wildlife Area
- Global Priority
  - Grasslands Ecological Area
  - La Grange/Waterford Grasslands
  - Lone Willow Slough
- The Central Valley is a Level I Ducks Unlimited conservation priority area and the second most important and threatened waterfowl habitat in North America, providing an important wintering habitat for migrating waterfowl (Ducks Unlimited, 2023).

Barriers to Connectivity

- There are fish passage barriers throughout the RCIS area. This includes 64 dams, grade control structures, road and utility crossings, and non-structural barriers that create screened, partial, temporal, and total barriers to anadromous fish movement.
- As discussed in Chapter 2, numerous highways, rail networks, and flood and water conveyance infrastructure transect the RCIS area and serve as barriers to habitat connectivity.

Climate Change Vulnerability

With few natural habitat patches remaining in the RCIS area, further reduction of habitat connectivity and increased habitat fragmentation will impact how wildlife, plants, and natural communities respond to climate change in the RCIS area. Continued urban developments, especially installation of new linear features (e.g., roads, railways, and utilities), will impact the already limited transition space available for habitats and the species that depend on them. This can impact plant and wildlife dispersal and predator-prey relationships, leading to increased genetic isolation and potential extirpation of populations.

The corridors classified as Irreplaceable and Essential Corridors (ACE Rank 5), Conservation Planning Linkages (ACE Rank 4), and Connections with Implementation Flexibility (ACE Rank 3) are critical areas to protect and restore to increase the resilience of the RCIS area to climate change impacts. Maintaining and increasing healthy connectivity between and within terrestrial areas will allow for species to access newly suitable habitat regions that provide for shifts in range and distribution, as well as access to climate-resilient refugia and water sources. Maintaining connectivity within aquatic habitats is important for maintaining hydrological regimes, water quality, and sediment balances, and may improve climate change resilience. Land conversion and development in these areas can have greater impacts on species with restricted ranges and habitat requirements that are likely to be exacerbated by climate change impacts.

Working Lands

Molly Daniels, Environmental Incentives

REGULATORY STATUS

None

KEY STRESSORS

- Altered hydrology and flow through increases in drought frequency and severity, and more frequent extreme storms
- Changes in the salinity and chemistry of groundwater, surface water, and soils
- Lowering of groundwater levels

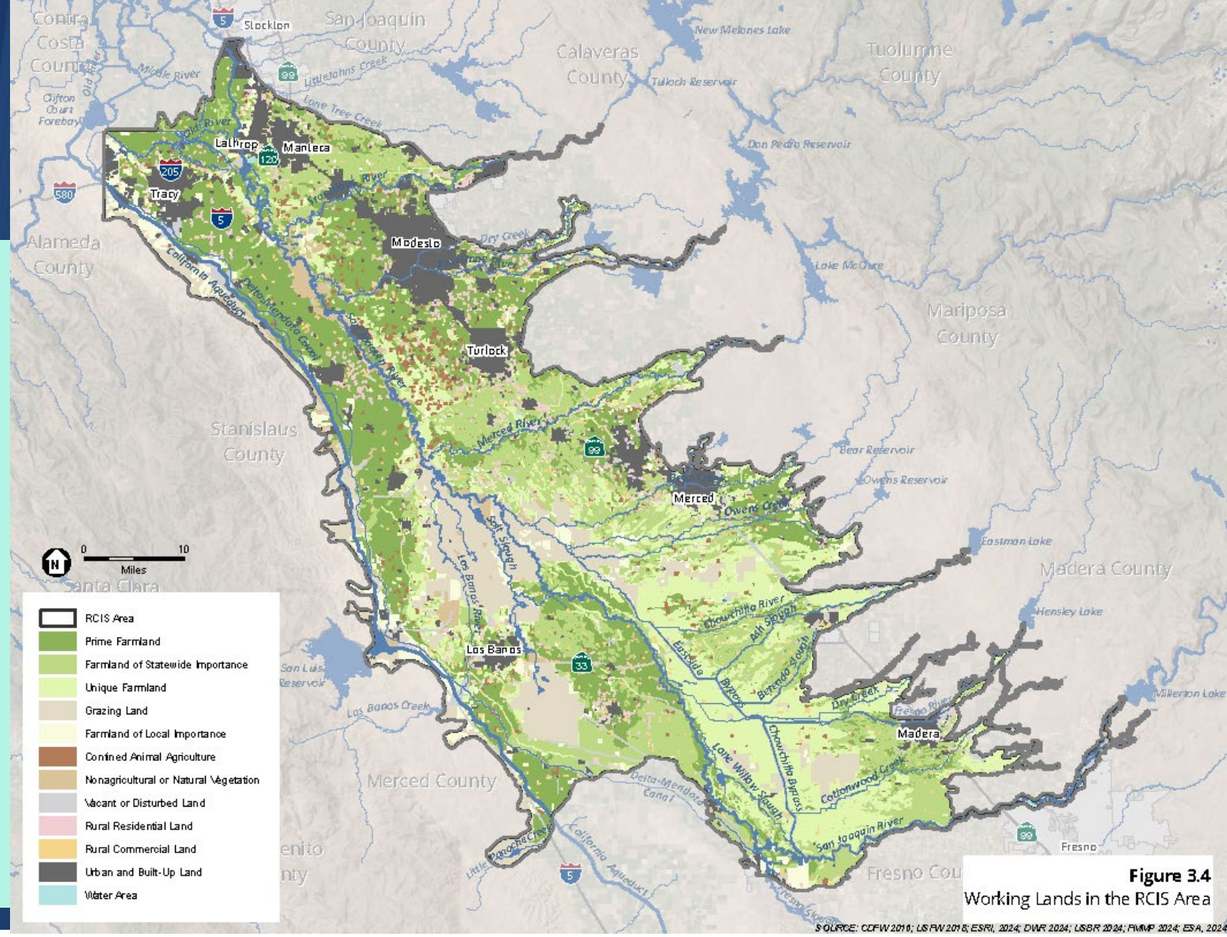


Figure 3.4
Working Lands in the RCIS Area

SOURCE: CDFW 2016; US FW 2018; ESRI, 2024; DWR 2024; USBR 2024; FMMP 2024; ESA, 2024

Ecological Requirements

- **RCIS Natural Communities:** Agriculture (Perennial, Annual, Unknown) as well as habitats that can serve as rangelands, including California Broadleaf Forest and Woodland and Grassland (Annual, Perennial)
- Farmland Mapping and Monitoring Program (California Department of Conservation, 2019) distinguishes different farmland types:
    - Prime Farmland: physical and chemical features able to sustain long-term agricultural production. Must have been used for irrigated agricultural production in the last four years.
    - Farmland of Statewide Importance: like Prime Farmland but with minor shortcomings.
    - Unique Farmland: lesser quality soil and is usually irrigated but may include non-irrigated crops.
    - Grazing Land: existing rangeland vegetation suitable for grazing livestock.
- Several cultivation practices provide ecosystem services, such as: habitat and floodplain protection, carbon sequestration, greenhouse gas level lowering (on farmland when compared to urban land), and permeable land and groundwater recharge (CDFW, 2016).
- The expansion of perennial crops, fueled by high economic return, has led to a loss of annual croplands and natural vegetation communities with relatively higher ecological value and climate resilience (Faunt et al., 2016; Mall & Herman, 2019; Peterson et al., 2020; Escriva-Bou et al., 2023).
- **Full account available:** Farmland Mapping and Monitoring Program (California Department of Conservation, 2019)

Climate Change Vulnerability

Climate change may deteriorate environmental conditions—such that there are impacts to agricultural productivity—and may limit the ability for historically grown crops to persist in the RCIS area (Fernandez-Bou et al., 2021). Direct impacts include water shortages, decrease in chill hours, and increase of extreme heat waves, while indirect impacts include increased prevalence of crop pests and water scarcity (Fernandez-Bou et al., 2021). Under predicted hydrologic scenarios of a drier and warmer climate, crop yields are likely to decline, leading to increased costs and decreased profitability (Fernandez-Bou et al., 2021). Risks will depend on the rate and severity of the change and the ability of working lands to adapt to changes (Gowda et al., 2018). Increased precipitation extremes increase the risk of surface runoff, soil erosion, and the loss of soil carbon, which has the potential to negatively impact habitats surrounding working lands (Gowda et al., 2018).

Freshwater Wetlands


Dominic Gentilcore, Adobe Stock

REGULATORY STATUS

There are three sensitive wetland vegetation communities existing within the RCIS area:

- Cismontane Alkali Marsh S1 (Critically Imperiled)
- Coastal and Valley Freshwater Marsh S2 (Imperiled)
- Valley Sink Scrub S1 (Critically Imperiled)

Freshwater wetlands may be protected under the Clean Water Act, Porter-Cologne Water Quality Act, and California Fish and Game Code.

KEY STRESSORS

- Loss of areal extent
- Changes in surface water and groundwater levels
- Increases in invasive species

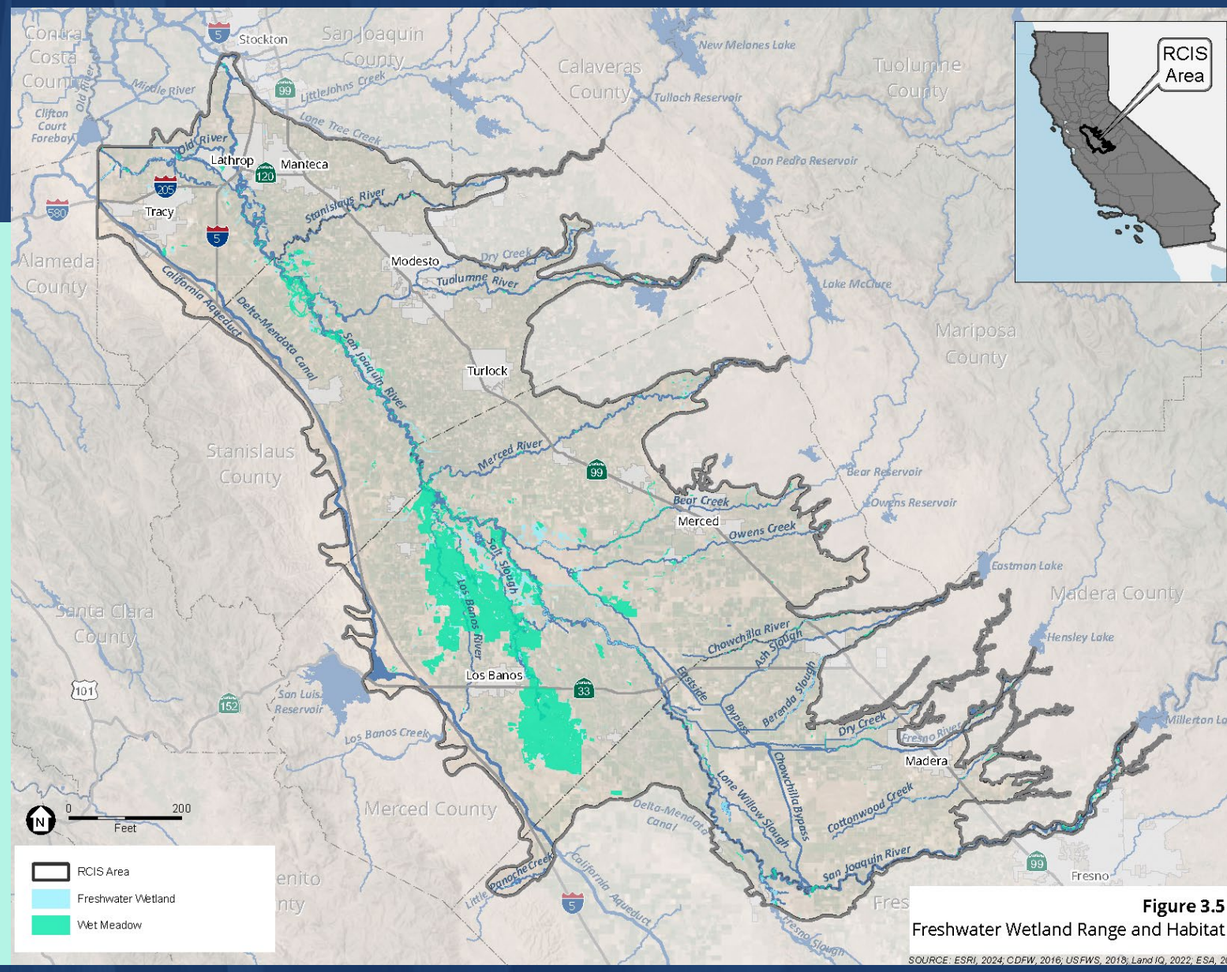


Figure 3.5
Freshwater Wetland Range and Habitat

SOURCE: ESRI, 2024; CDFW, 2016; USFWS, 2018; Land IQ, 2022; ESA, 2

Ecological Requirements

- **RCIS Natural Communities:** Freshwater Wetland, Wet Meadow
- These consist of areas covered by fresh surface or groundwater with enough frequency and duration to support plants adapted to saturated soil conditions (US Army Corps of Engineers, 1987).
- Ecosystem services include floodwater attenuation, increased water quality, and habitat.
- **Full habitat account available**: Corps of Engineers Wetlands Delineation Manual (US Army Corps of Engineers, 1987). See also The Wetlands of California's Central Valley Story map (Defenders of Wildlife, 2021) and Fish and Wildlife Groundwater Planning Considerations for Freshwater Wetlands (CDFW, 2019a)

Table 3-3. Freshwater Wetland Climate Change Vulnerability Ranking

NVCS Classification (Common Name)[1]	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Warm and Wet*	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Hot and Dry*	Mean Combined Vulnerability Rank High Emissions (RCP8.5)
Freshwater Marsh[2]	High	High	High
Wet Mountain Meadow	Mid-high	Mid-high	Mid-high

Climate Change Vulnerability

- Thorne et al. (2016) assessed the climate change exposure, spatial distribution, and vulnerability of California freshwater wetlands statewide under two general circulation models with high emissions (Table 3-3). Freshwater wetland communities could experience a 25–39% (Mid-high) to 75–100% (High) reduction in areas that are climatically suitable for the suite of species that make up these communities depending on the resulting general circulation model.
- Increased water diversions away from wetlands for human use by exacerbate impacts from increased drought frequency (CLCC, 2018). Reductions in snowpack may alter streamflow patterns and natural flooding regimes, leading to a further reduction in water supply (CLCC, 2018). Earlier snowmelt may also impact seed production, reducing the health of plant populations that make up freshwater wetlands (CLCC, 2018). Additional impacts may include:
  - Rising groundwater and salinity.
  - Erosion from increased flooding.
  - Increased mortality of wetland vegetation from severe droughts, wildfires, and flooding.
  - Changes in species composition and water quality due to changes to temperature and precipitation patterns.

Riparian and Riverine Corridors

John Greening

REGULATORY STATUS

There are five sensitive riparian vegetation communities existing within the RCIS area:

- Elderberry Savanna S2 (Imperiled)
- Great Valley Cottonwood Riparian Forest S2 (Imperiled)
- Great Valley Mixed Riparian Forest S2 (Imperiled)
- Great Valley Oak Riparian Forest S1 (Critically Imperiled)
- Sycamore Alluvial Woodland S1 (Critically Imperiled)

Riparian and riverine habitats may be protected under the Clean Water Act, Porter-Cologne Water Quality Act, and California Fish and Game Code.

KEY STRESSORS

- Altered flow and flooding regimes
- Changes in surface and groundwater levels
- Fragmentation and reduced connectivity of natural communities and species habitat

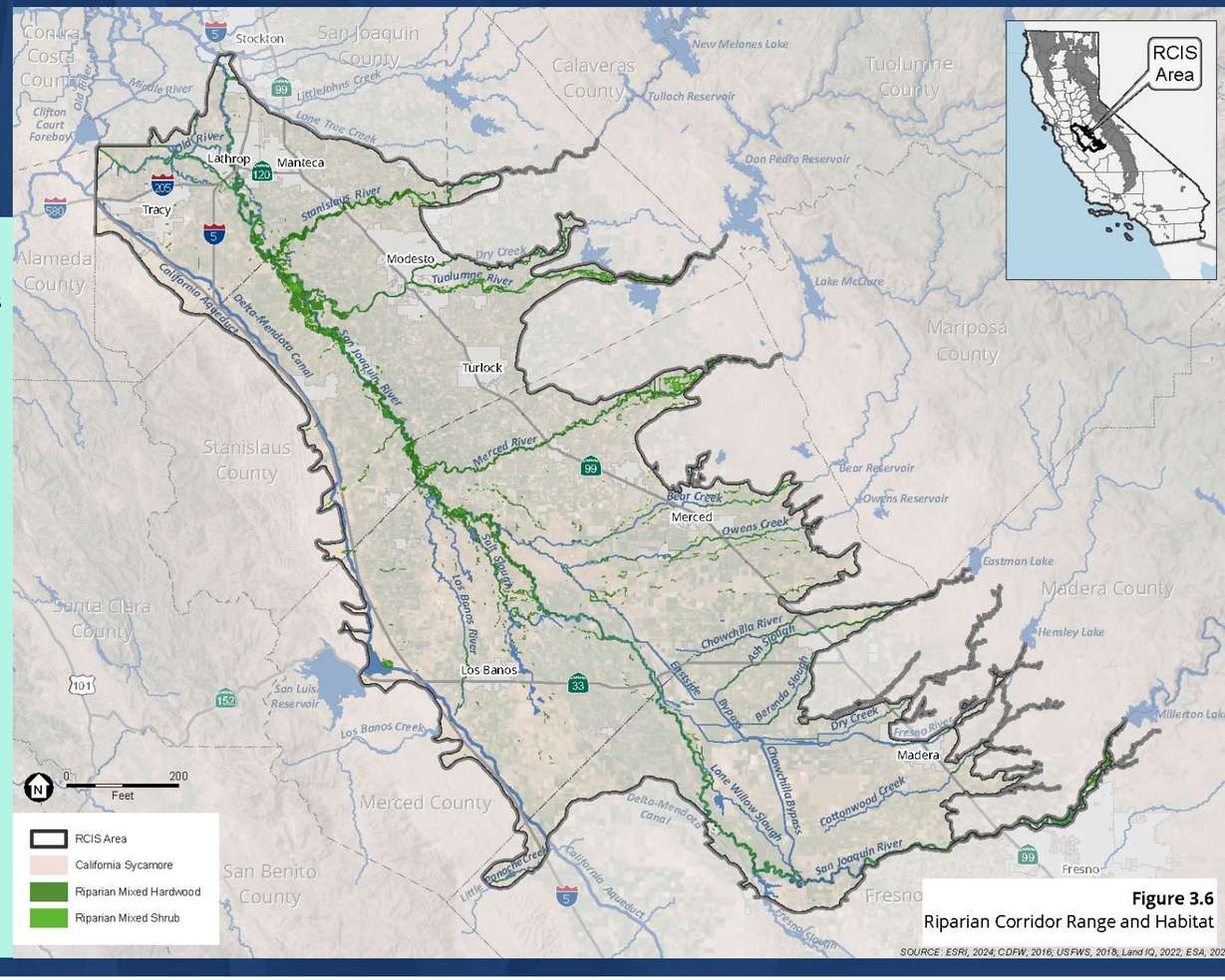


Figure 3.6
Riparian Corridor Range and Habitat

SOURCE: ESRI, 2024; CDFW, 2016; USFWS, 2018; Land IQ, 2022; ESA, 202

Ecological Requirements

Riparian Habitat

- **RCIS Natural Communities:** Riparian Mixed Hardwood, Riparian Mixed Shrub, California Sycamore
- Riparian natural communities provide food, water, migration and dispersal corridors, and cover for many wildlife species (Mayer and Laudenslayer, 1988).
- Habitat is dominated by species with large water requirements and the transition to adjacent non-riparian vegetation is usually abrupt (Mayer and Laudenslayer, 1988).
- Habitat is impacted by excessive sedimentation and flooding impacts such as excess debris and uprooting of plants (Mayer and Laudenslayer, 1988).
- **Full habitat account available**: California Wildlife Habitat Relationships System: Valley Foothill Riparian (CDFW, 2005a)

Riverine Habitat

- **RCIS Natural Communities**: Riverine
- This includes all aquatic habitats contained within a channel except for (1) wetlands dominated by vegetation and (2) habitats with water with salinities of 0.5 parts-per- thousand or greater.
- Habitat is characterized by intermittent or continually running water in a natural or artificial conduit (CDFW, 2005b; Federal Geographic Data Committee, 2013).
- Habitat is impacted by water diversions and impoundments, altered sediment dynamics, and decreased water quality.
- **Full habitat account available**: Classification of Wetlands and Deepwater Habitats of the United States (Federal Geographic Data Committee, 2013)

Climate Change Vulnerability

- Thorne et al. (2016) assessed the climate change exposure, spatial distribution, and vulnerability of California riparian corridor communities statewide under two general circulation models with high emissions (Table 3-4). Riparian communities could experience a 20–24% (Moderate), 25–39% (Mid-high), or 75–100% (High) reduction in areas that are climatically suitable for the suite of species that make up these communities depending on the resulting general circulation model.
- Storm intensity and drought severity are expected to impart negative effects on riparian vegetation (CLCC, 2018).

Changes in streamflow may result in lower diversity and abundance in vegetation and lead to flooding and erosion (CLCC, 2018). Runoff changes due to early snowmelt may lead to water stress later in the season that can stress vegetation. Additional impacts may include:

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

Table 3-4. Riparian Corridor Natural Community Climate Change Vulnerability Rankings

NVCS Classification (Common Name)[1]	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Warm and Wet*	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Hot and Dry*	Mean Combined Vulnerability Rank High Emissions (RCP8.5)
Montane Riparian Scrub and Wet Meadow	High	Mid-high	Mid-high
American Southwestern Riparian Forest and Woodland	Mid-high	Mid-high	Mid-high

Other Conservation Element

Grasslands

Jeff Goulden, iStock Photo

REGULATORY STATUS

There is one sensitive grassland vegetation community existing within the RCIS area:

- Valley Sacaton Grassland S1 (Critically Imperiled)

This grassland type is frequently near claypan vernal pools and can be floristically rich in both native and non-native species (CNPS, 2023).

KEY STRESSORS

- Loss of areal extent and habitat fragmentation
- Increases in invasive species
- Changes in precipitation patterns

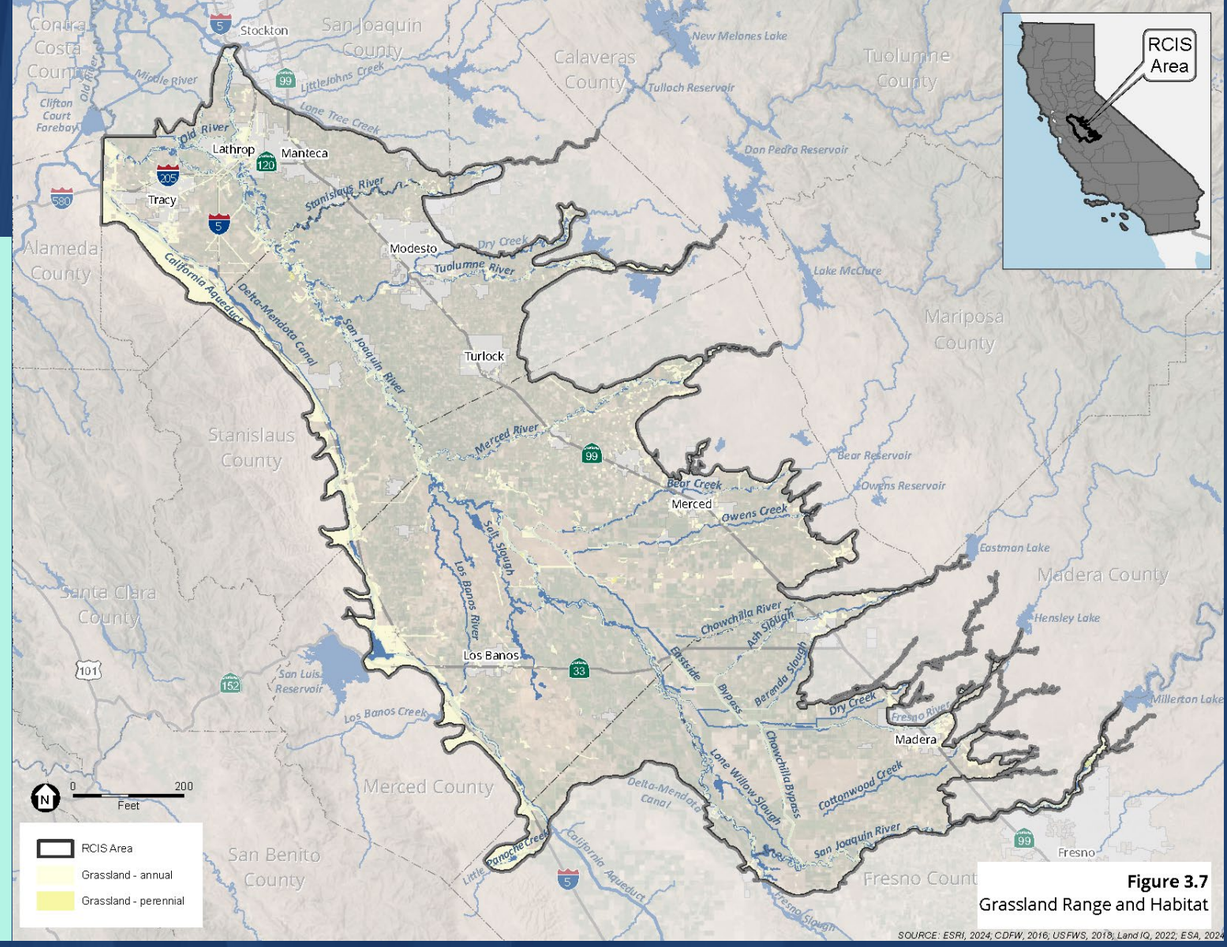


Figure 3.7
Grassland Range and Habitat

SOURCE: ESRI, 2024; CDFW, 2016; USFWS, 2018; Land IQ, 2022; ESA, 2024

Ecological Requirements

- **RCIS Natural Communities**: Grassland (Annual, Perennial).
- These are dominated by grasses (annual and perennial) and other herbaceous species with less than 10% tree canopy cover (CDFW, 2005c, 2005d; CVJV, 2020).
- Ecosystem services include nutrient and water cycling, carbon sequestration, and supporting pollinator populations (CVJV, 2020).
- **Full habitat account available**: Annual Grassland Habitat Description (CDFW, 2005c) and Perennial Grassland Habitat Description (CDFW, 2005d)

Table 3-5. Grassland Natural Community Climate Change Vulnerability Rankings

NVCS Classification (Common Name)[1]	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Warm and Wet*	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Hot and Dry*	Mean Combined Vulnerability Rank High Emissions (RCP8.5)
California Grassland and Flower Fields	Moderate	Mid-high	Mid-high

Climate Change Vulnerability

- Thorne et al. (2016) assessed the climate change exposure, spatial distribution, and vulnerability of California grassland communities statewide under two general circulation models with high emissions (Table 3-5). Grassland communities could experience a 20–24% (Moderate) to 25–39% (Mid-high) reduction in areas that are climatically suitable for the suite of species that make up these communities depending on the resulting general circulation model.
- Increasing temperatures may lead to increased snowmelt, causing flooding in grassland communities (Fernandez-Bou et al., 2021). Grasslands are also vulnerable to flooding due to an increase in extreme precipitation events. Increases in wildfire frequency and severity may also impact this community. These impacts could also result in unfavorable conditions for plant production, leading to a decrease in habitat health and resilience.

Other Conservation Element

Vernal Pools

John Greening

REGULATORY STATUS

There are two sensitive vernal pool vegetation communities existing within the RCIS area:

- Northern Claypan Vernal Pool S1 (Critically Imperiled)
- Northern Hardpan Vernal Pool S3 (Vulnerable)

Vernal pools may be protected under the Clean Water Act, Porter-Cologne Water Quality Act, and California Fish and Game Code.

KEY STRESSORS

- Loss of areal extent
- Disruption of natural clay hardpan and soil substrates by discing and cultivation
- Changes in precipitation patterns

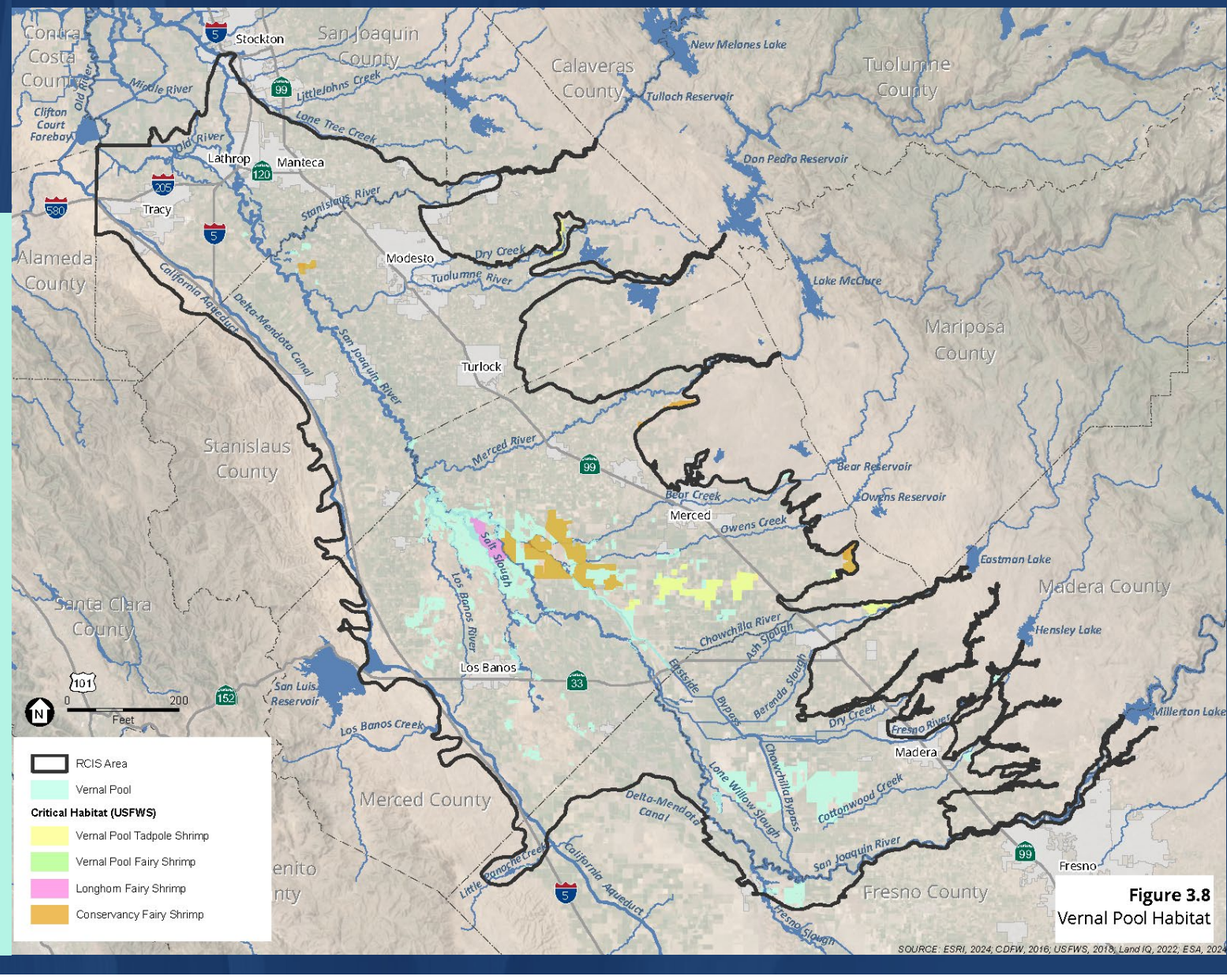


Figure 3.8
Vernal Pool Habitat

SOURCE: ESRI, 2024; CDFW, 2016; USFWS, 2018; Land IQ, 2022; ESA, 2024

Ecological Requirements

RCIS Natural Communities: Vernal Pool

- These are primarily northern claypan vernal pools, which exist as shallow, playa-like pools or more typical vernal pools in Mima mound topography (USFWS, 2005).
- Soils are alkaline and typically of the Lewis, Rossi, Waukena, Fresno, and Traver series (USFWS, 2005).
- The USFWS-designated San Joaquin Valley vernal pool region occurs within the RCIS area and includes the Caswell and Grasslands Ecological Area (USFWS, 2005).
- **Full habitat account available**: Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS, 2005)

Climate Change Vulnerability

Alterations in nitrogen deposition, an increase in carbon dioxide in the atmosphere, changes in precipitation patterns, and an increase in temperatures negatively affect vernal pool habitats (USFWS, 2005). Changes in hydrology may lead to non-native species outcompeting native species (USFWS, 2005). Different global general circulation models may affect vernal pools in both positive and negative ways. If the climate is wet and warm, increases in precipitation events could result in an increase in vernal pool habitat. If the hot and dry global climate model occurs, the resulting increases in drought intensity and frequency could increase the frequency of vernal pools drying and cause pool temperatures to increase.

Focal Species

Salmonids

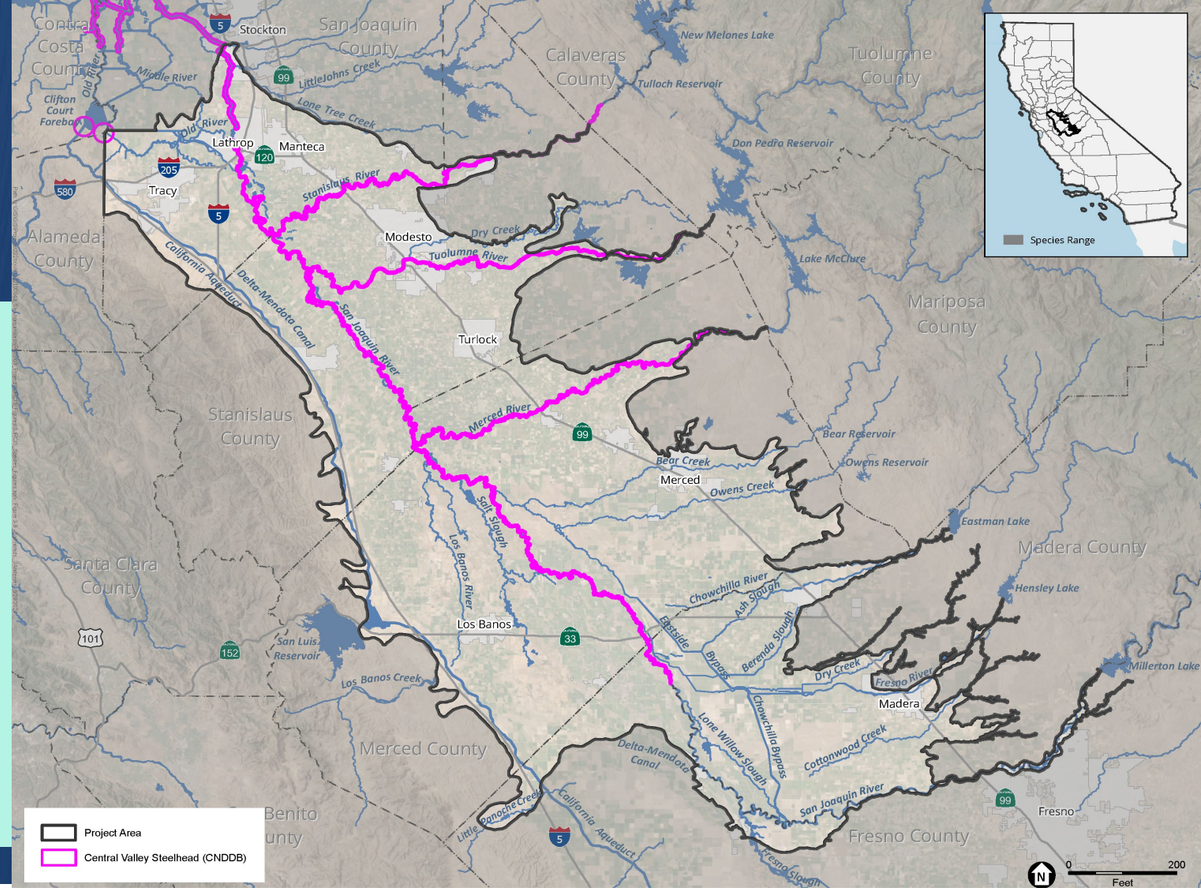
Oncorhynchus spp.

REGULATORY STATUS

Varies

KEY STRESSORS

- Altered flow and flooding regimes
- Increases in barrier to migration/movement
- Disconnected floodplains



US Fish and Wildlife Service

Ecological Requirements

- **RCIS Natural Communities:** Water, Riparian Mixed Hardwood, Riparian Mixed Shrub
- Key salmonid habitat features include:
    - Cool, clear, well-oxygenated streams with sufficient flow and cover.
    - Spawning habitat with clean, coarse gravel at the tails of holding pools; or in swift, relatively shallow riffles; or along margins of deeper river reaches.
- Freshwater juvenile rearing habitat have sufficient floodplain connectivity that allows suitable water quality and flow; availability of forage prey; and abundant cover such as submerged and overhanging vegetation, large woody debris, rocks, boulders, and undercut banks.
- Obstruction-free migration corridor.
- There is limited habitat availability in each watershed and in the mainstem San Joaquin River for spawning and juvenile rearing (NMFS, 2014).
- Threats for steelhead and Chinook salmon ESUs include:
    - Inadequate water allocation,
    - Degradation of water quality (low flows and warm water temperatures),
    - Loss and/or blockage (i.e., dams and diversions) of freshwater spawning habitats,
    - Predation by non-native or invasive species, and
    - Genetic interaction with hatchery fish (NMFS, 2014).

Climate Change Vulnerability

All focal fish conservation elements are moderately or highly vulnerable to impacts from climate change (described below), primarily due to dramatic changes in riverine habitat in the Central Valley. This may lead to a contraction of populations toward the coast unless higher-elevation habitats are restored and habitat quality in rearing areas and migration corridors is improved (Herbold et al., 2018).

Focal Species

Steelhead - California Central Valley DPS

Oncorhynchus mykiss

Fred Greaves / California Department of Water Resources

REGULATORY STATUS

- Federally Threatened

KEY STRESSORS

- Altered flow and flooding regimes
- Increases in barrier to migration/movement
- Disconnected floodplains

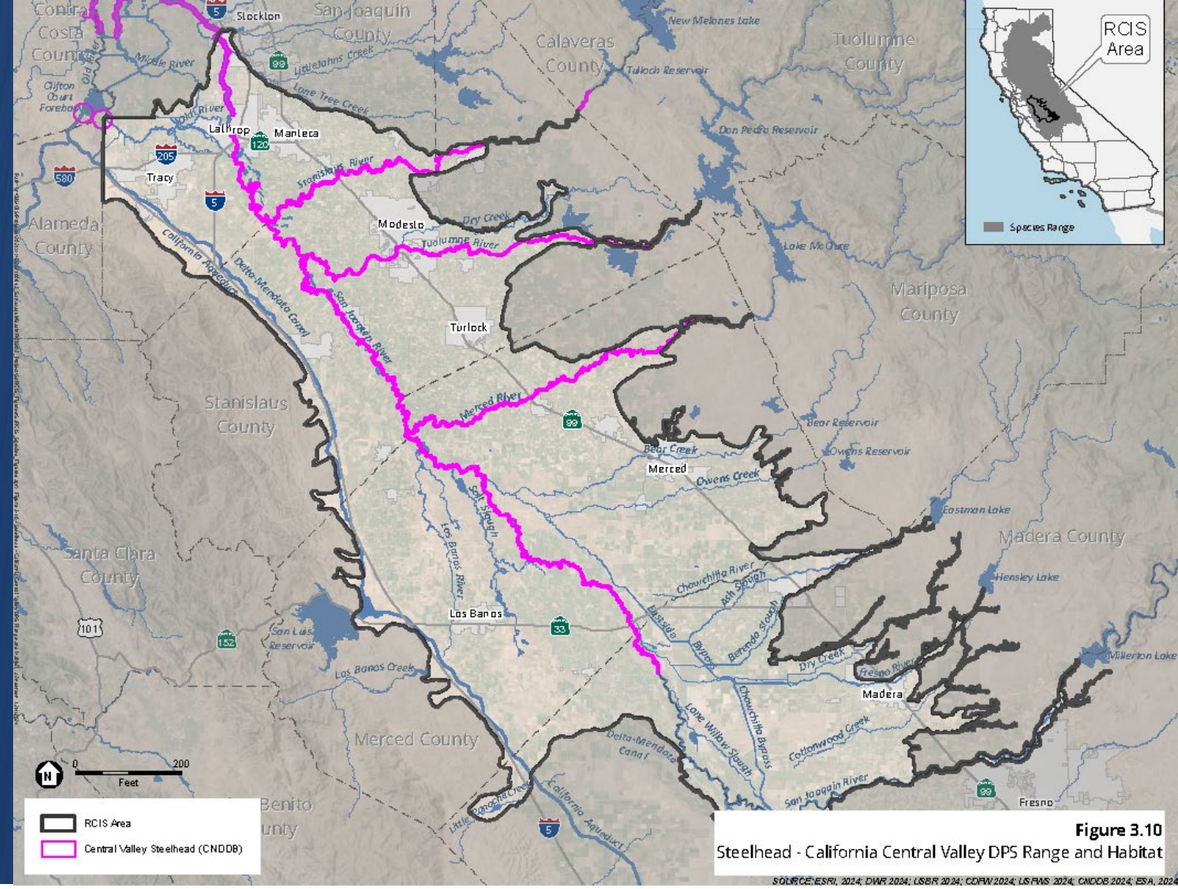


Figure 3.10
Steelhead - California Central Valley DPS Range and Habitat

SOURCE: ESRI, 2024; DWR 2024; USBR 2024; CDFW 2024; USFWS 2024; CNDDB 2024; ESA, 2024

Ecological Requirements

- See **Salmonid Ecological Requirements** for additional details.
- Spawning populations occur on Stanislaus, Tuolumne, and Merced rivers. The San Joaquin River is used for rearing by juveniles and as a migratory path to spawning locations (NMFS, 2014).
- **Full species account available**: 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 (NMFS, 2014)

Climate Change Vulnerability

- Moyle et al. (2017) discusses how longer, more frequent droughts, lower stream flow with higher summer temperatures, and larger floods in some years may impact Central Valley (CV) steelhead. This will lead to decreased availability of large pools with cool water to sustain steelhead through the summer (Moyle et al., 2017). The general prediction is that resident rainbow trout will likely persist in most places, but CV steelhead will struggle to persist without “major hatchery inputs” (Moyle et al., 2017).
- Crozier et al. (2019) assessed exposure and sensitivity factors and concluded that CV steelhead climate change vulnerability was Moderate. Crozier et al. (2019) concluded this DPS had High vulnerability to ocean acidification exposure and Moderate vulnerability to exposure from flooding, and sea surface temperatures.

Focal Species

Chinook Salmon– Central Valley Spring-Run ESU

Oncorhynchus tshawytscha

Kelly M. Grow/California Department of Water Resources

REGULATORY STATUS

- Federally Threatened
- State Threatened

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Increases in barriers to migration/movement
- Changes in surface water and groundwater levels

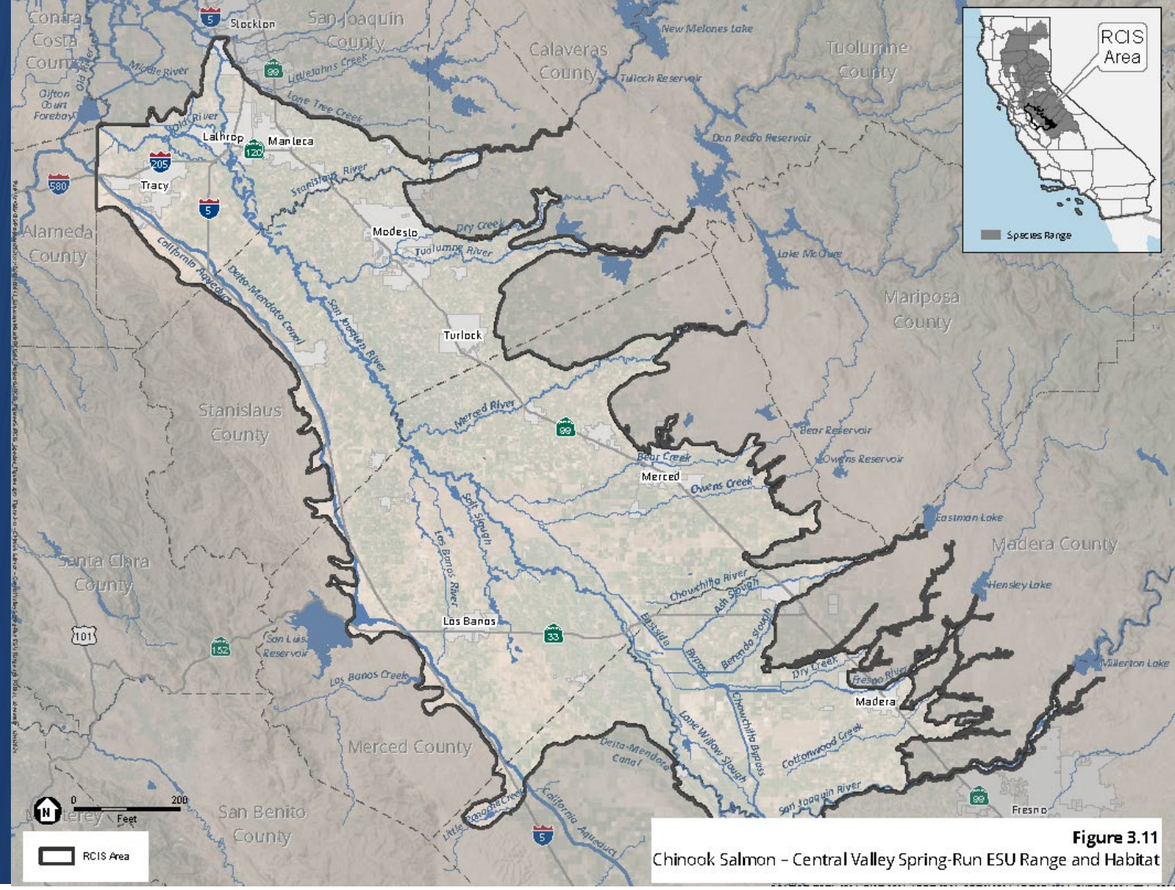


Figure 3.11
Chinook Salmon – Central Valley Spring-Run ESU Range and Habitat

Ecological Requirements

- See **Salmonid Ecological Requirements** for additional details.
- Historically, spawning populations occurred throughout the Central Valley, including the San Joaquin, Stanislaus, Tuolumne, and Merced rivers. Currently, there is no known natural population spawning or rearing in the RCIS area.
- An NMFS-designated nonessential experimental population occurs in the RCIS area (NMFS, 2013).
- The goal is to restore and maintain naturally reproducing and self-sustaining populations in the mainstem San Joaquin River below Friant Dam.
- Tagged and fin-clipped adults and juveniles are released yearly into the San Joaquin River Restoration Program Restoration Area.
- During migration, adults require river depths greater than 0.8 feet and water velocities less than 8 feet-per-second as they are less capable of maneuvering river obstacles (i.e., waterfalls, fish ladders, culverts) than steelhead (NMFS, 2014).
- Adults require deep, cool, well-oxygenated pools to hold in the summer (NMFS, 2014).
- **Full species account available**: 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 (NMFS, 2014); Endangered and Threatened Species: Designation of a Nonessential Experimental Population of Central Valley Spring-Run Chinook Salmon Below Friant Dam in the San Joaquin River, CA (NMFS, 2013)

Climate Change Vulnerability

- Currently, there are only small, self-sustaining populations of Central Valley Spring-Run (CVSR) Chinook salmon that occur in only a few watersheds, and they have a present-day elevated risk of extinction (Moyle et al., 2017). Catastrophic events such as drought or wildfire could have severe impacts on the populations' viability. The reliance on cold spring water and snowmelt for survival during the summer months further increases the risk of CVSR Chinook salmon going extinct in the next 50 years (Moyle et al., 2017).
- Several climate change vulnerability assessments have been conducted for the CVSR Chinook salmon. Quiñones and Moyle (2014) assessed this ESU as Critically Vulnerable. A ranking of Critically Vulnerable for present-day vulnerability means that the species "is at an imminent risk of extinction." A ranking of Critically Vulnerable for climate change vulnerability means the species is "extremely likely to be driven to extinction by the year 2100 without conservation measures."
- Crozier et al. (2019) assessed exposure and sensitivity factors and concluded that CVSR Chinook salmon's climate change vulnerability was Very High. Factors with Very High vulnerability rankings include sensitivity in adult freshwater stage, cumulative life-cycle effects, other stressors (e.g., altered systems of the California Central Valley and the Sacramento-San Joaquin Delta), hatchery influence, and population viability.

Focal Species

Chinook Salmon– Central Valley Fall-Run ESU

Oncorhynchus tshawytscha

Kelly M. Grow/California Department of Water Resources

REGULATORY STATUS

- Species of Special Concern

KEY STRESSORS

- Altered flow and flooding regimes
- Increases in barrier to migration/movement
- Disconnected floodplains

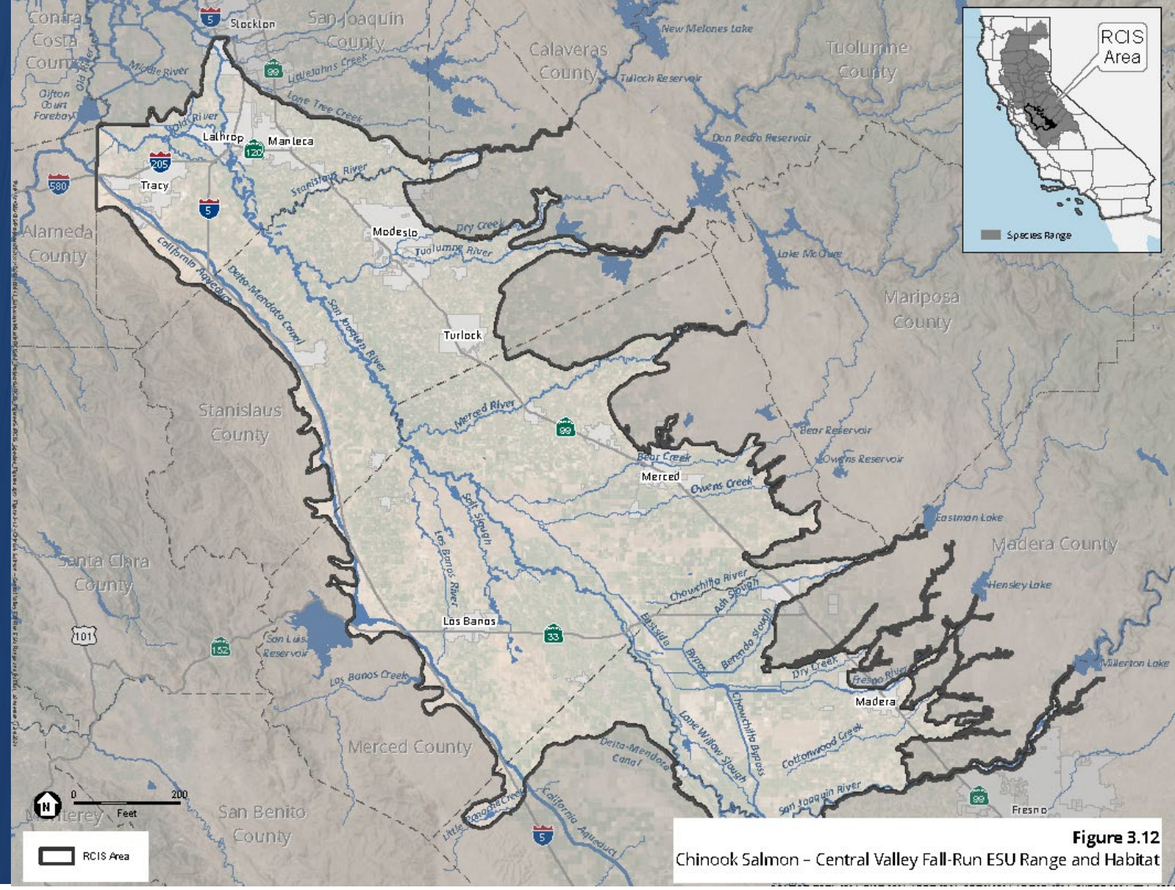


Figure 3.12
Chinook Salmon – Central Valley Fall-Run ESU Range and Habitat

Ecological Requirements

- See **Salmonid Ecological Requirements** for additional details.
- Spawning populations occur on the mainstem San Joaquin River until the CDFW-operated weir at Hills Ferry where further upstream migration is blocked.
- **Full species account available:** Fish Species of Special Concern in California (Moyle et al., 2015)

Climate Change Vulnerability

- Central Valley Fall-Run (CVFR) Chinook salmon are projected to be impacted by larger proportions of annual precipitation falling as rain, rather than snow, which may run off more quickly and earlier in the season leading to lower water availability for fishery releases (Moyle et al., 2017). Even small increases in summer water temperatures could result in lethal conditions for migrating adults (Moyle et al., 2017).
- Several climate change vulnerability assessments have been conducted for CVFR Chinook salmon. Quiñones and Moyle (2014) assessed this ESU as Critically Vulnerable. A ranking of Critically Vulnerable for present-day vulnerability means that the species "is at an imminent risk of extinction." A ranking of Critically Vulnerable for climate change vulnerability means the species is "extremely likely to be driven to extinction by the year 2100 without conservation measures."
- Crozier et al. (2019) assessed exposure and sensitivity factors and concluded that CVFR Chinook salmon's climate change vulnerability was Very High. Factors with Very High vulnerability rankings include cumulative life-cycle effects and other stressors (e.g., altered systems of the California Central Valley and the Sacramento-San Joaquin Delta). Populations are already low and the access to historical Central Valley spawning regions have been constricted by dams (Quiñones & Moyle, 2014).

Focal Species

California Tiger Salamander-Central California DPS

Ambystoma californiense

John Cleckler, U.S. Fish and Wildlife Service

REGULATORY STATUS

- Federally Threatened
- State Threatened

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Increases in barriers to migration/movement
- Changes in surface water and groundwater levels

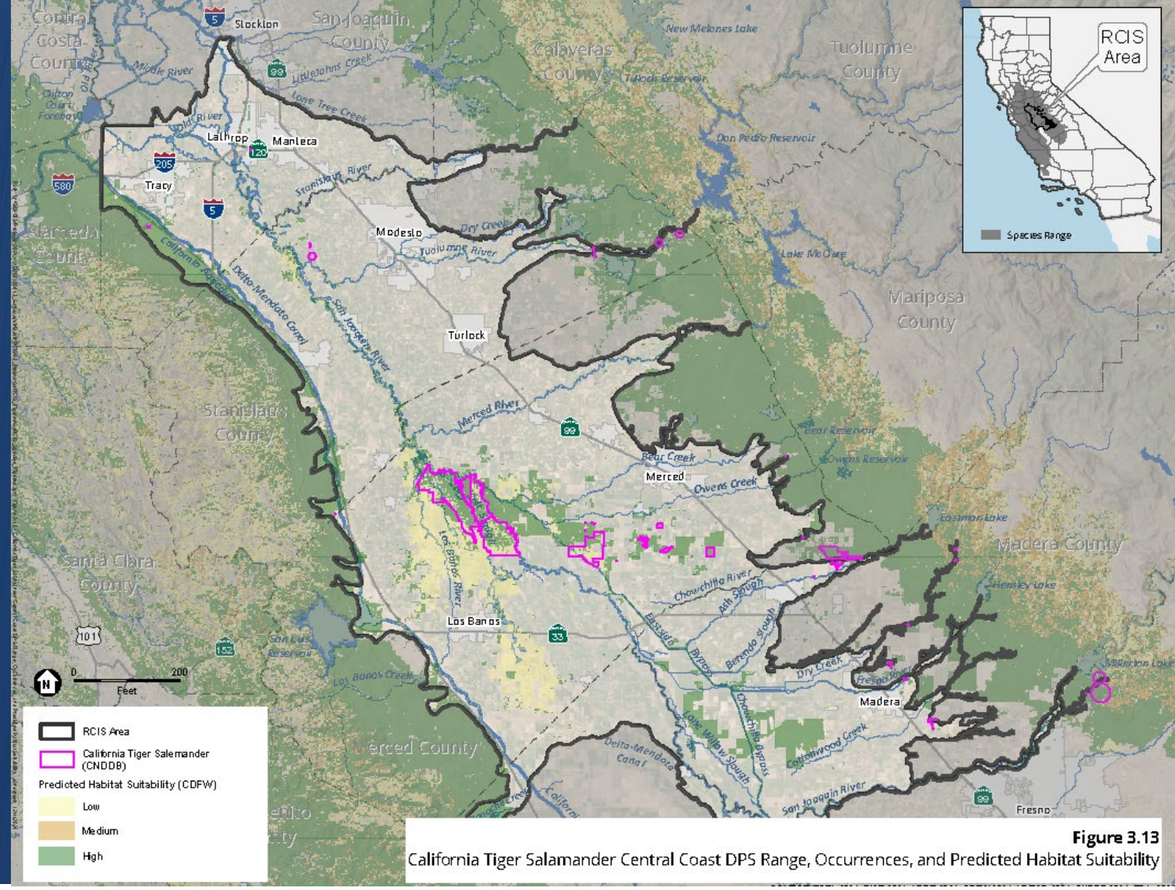


Figure 3.13
California Tiger Salamander Central Coast DPS Range, Occurrences, and Predicted Habitat Suitability

Ecological Requirements

- **RCIS Natural Communities**: Freshwater Wetland, Wet Meadow, California Broadleaf Forest and Woodland, Grassland (Annual, Perennial), Vernal Pool
- **Aquatic breeding habitat**: vernal pools and seasonal pools, including many stock ponds (USFWS, 2017a)
- **Upland aestivation and dispersal habitat**: grassland and open woodland communities
    - Animal spends most of its life aestivating in underground burrows and in other below-ground refugia (USFWS, 2017a).
- USFWS-designated management unit of San Luis National Wildlife Refuge/Sandy Mush occurs within the RCIS area (USFWS, 2017a).
- Threatened throughout range by habitat destruction and fragmentation, land conversion, predation, disease, contaminants, pesticides, hybridization, and mortality from road crossings (USFWS, 2023a).
- **Full species account available:** Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (*Ambystoma californiense*) (USFWS, 2017a)

Climate Change Vulnerability

- According to statewide modelling by Wright et al. (2013), California tiger salamander is at "intermediate risk" from climate change impacts. By 2050 under the high-emission scenario (RCP8.5), the amount of statewide, suitable habitat is projected to decrease by 50–99%; 40–80% of present-day occupied habitat is projected to become unsuitable.
- The CVLCP (2017) climate vulnerability assessment ranked the California tiger salamander as having moderate-high vulnerability to sensitivity and exposure factors, as well as low adaptive capacity. California tiger salamander's breeding success is heavily influenced by the amount and timing of precipitation (USFWS, 2017a; CVLP, 2017). While the species' breeding strategy is adapted to occasional drought conditions:
    - Increased durations of drought conditions may result in breeding ponds drying out before larvae can metamorphose
    - Increased water temperatures and fluctuations in water levels during the breeding season may result in embryo mortality (USFWS, 2017)
    - Increased air temperatures may force individuals to stay longer in terrestrial burrow refugia (CVLP, 2017).

Focal Species

Giant Garter Snake

Thamnophis gigas

U.S. Fish and Wildlife Service

REGULATORY STATUS

- Federally Threatened
- State Threatened

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Increased surface water diversions
- Degradation of water quality

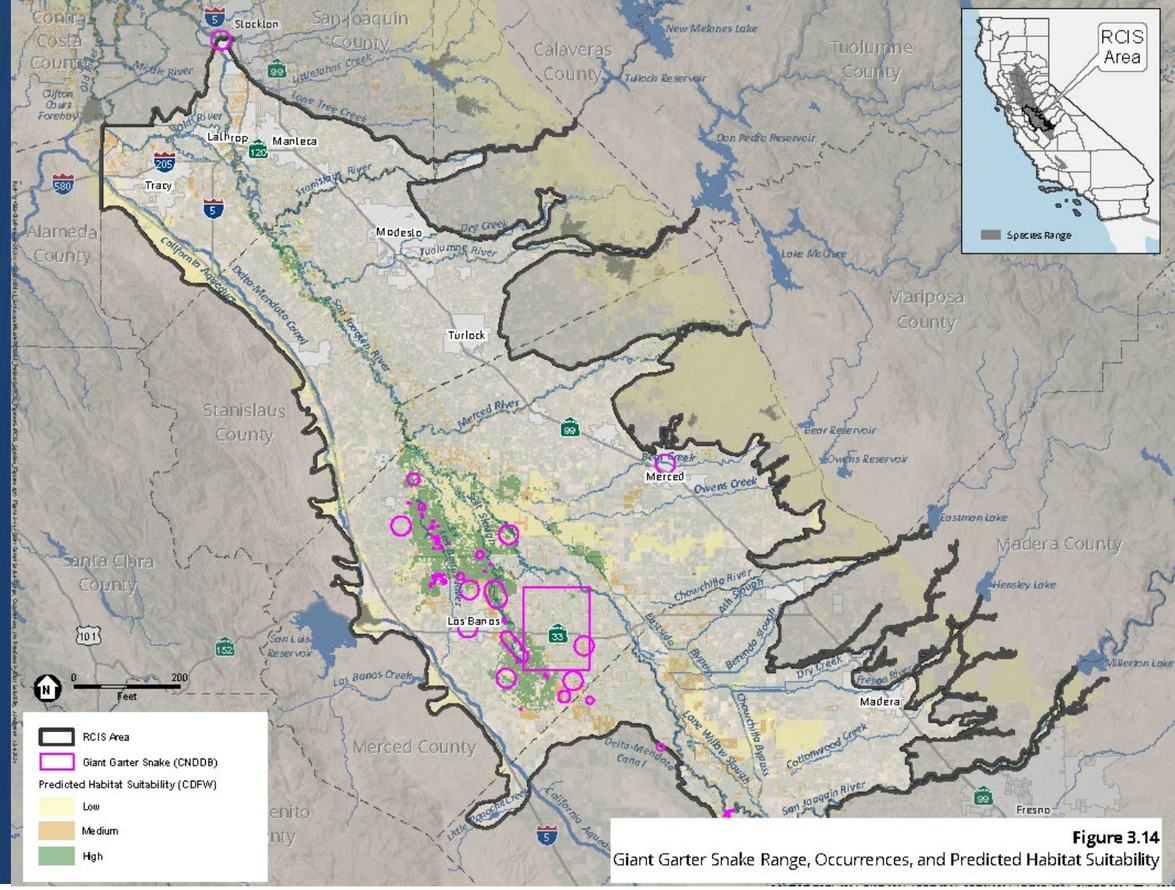


Figure 3.14
Giant Garter Snake Range, Occurrences, and Predicted Habitat Suitability

Ecological Requirements

- **RCIS Natural Communities**: Annual Grassland, Freshwater Wetland, Agriculture (Rice), Water, Wet Meadow
- **Aquatic habitat**: highly aquatic, primarily found in marshes, sloughs, canals/ditches, rice fields, sometimes low-gradient streams, ponds, and small lakes
    - Cattails, bulrushes, willows, or other emergent or water-edge vegetation are used for basking and cover (USFWS, 2017b).
- **Upland habitat**: requires an upland area near aquatic habitat during the active spring and summer seasons (USFWS, 2017b)
    - Animal overwinters in small mammal burrows or other below-ground refugia above flood elevations and near active-season foraging and breeding habitat (CDWR, 2016).
- USFWS-designated San Joaquin Basin and the Tracy Management Unit within the Delta Basin recovery unit occur in the RCIS area (USFWS, 2020a).
- **Full species account available:** Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*) (USFWS, 2017b)

Climate Change Vulnerability

- The CVLCP (2017) climate vulnerability assessment for wetland-dependent reptiles ranked the group's vulnerability to climate change impacts as moderate, with moderate-high vulnerability to sensitivity factors, moderate vulnerability to exposure factors, and low-moderate adaptive capacity. The group is most sensitive to changes in:
    - Precipitation amount,
    - Extreme drought,
    - Snowpack amount, and
    - Timing of snowmelt/runoff (CLCC, 2018).
- Exposure factors expected to most impact wetland-dependent reptiles are air temperature and snowpack amount (CLCC, 2018). Precipitation and snowpack amounts may alter the availability and location of wetland habitat, which are likely to be further exacerbated by increased water diversions for human usage away from wetlands.

Focal Species

Riparian Brush Rabbit

Sylvilagus bachmani riparius

Lee Eastman, U.S. Fish and Wildlife Service

REGULATORY STATUS

- Federally Threatened
- State Threatened

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Altered hydrology and flow regimes
- Reduction in ecosystem function and complexity

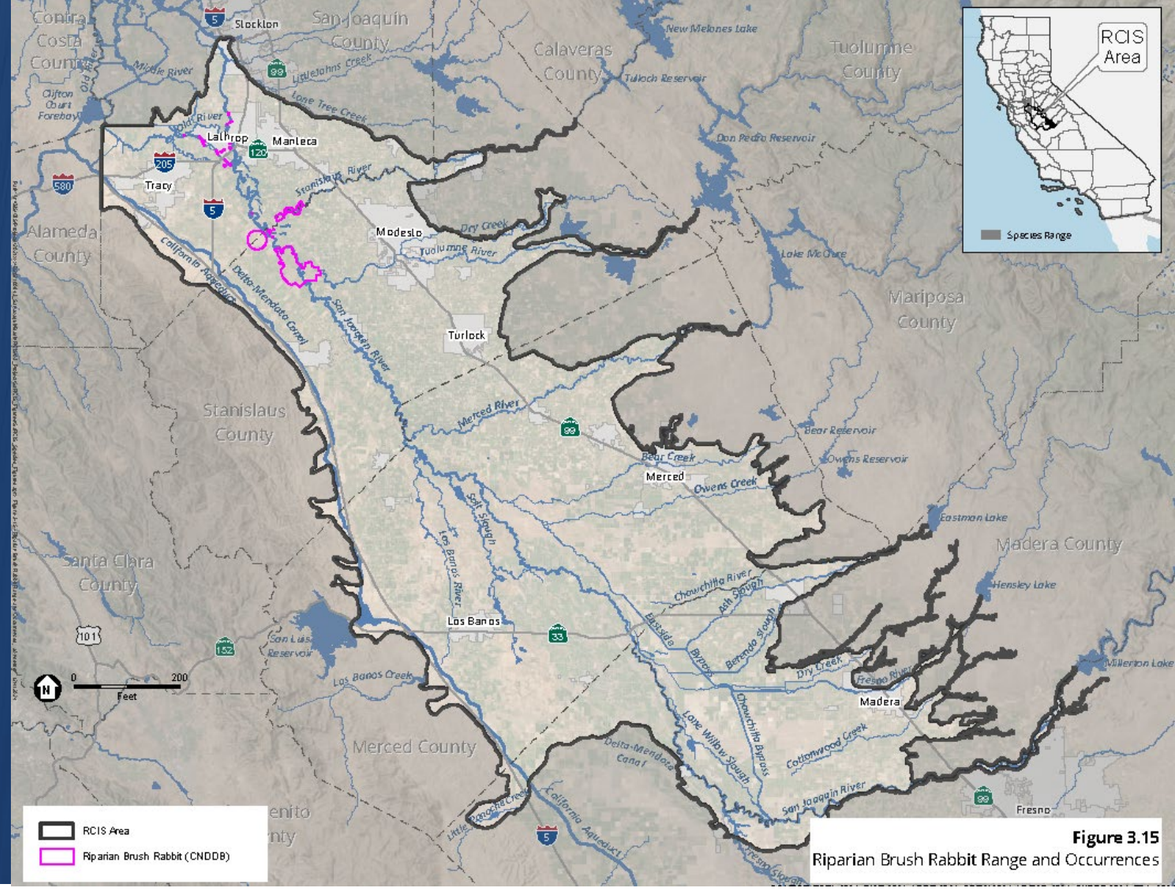


Figure 3.15
Riparian Brush Rabbit Range and Occurrences

Ecological Requirements

- **RCIS Natural Communities**: Riparian Mixed Hardwood, Riparian Mixed Shrub, California Broadleaf Woodland and Forest, Grassland (Annual, Perennial)
- **Key habitat features** include (USFWS, 2020b):
    - Thickets of dense, brushy vegetation characterized by a variety of shrubs and early successional tree species, including non-native species.
    - Grasses and herbs, including a diversity of food resources during the dry season.
    - Ecotonal edges including connectivity around open areas to provide access to herbaceous food resources as well as cover from predation.
    - Flood refugia with trees and shrubs that provide scaffolding to allow escape from floodwaters.
- **Full species account available**: Species Status Assessment for the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*) (USFWS, 2020b)

Climate Change Vulnerability

- The USFWS species status assessment (2020b) discussed climate change effects that are likely to negatively impact riparian brush rabbit. These include higher frequency of catastrophic floods, droughts, and wildfires. Climate change is likely to increase the severity and frequency of other stressors, such as habitat loss and degradation and predation.
- The CVLCP (2017) ranked the vulnerability of riparian vegetation communities (the primary habitat for riparian brush rabbit) to sensitivity and exposure factors as high, while only having a moderate adaptive capacity. Riparian brush rabbit has low population redundancy and limited resiliency, and climate change will have a significant impact on species viability and persistence (USFWS, 2020b).

Focal Species

San Joaquin Kit Fox

Vulpes macrotis mutica

Moose Peterson, U.S. Fish and Wildlife Service

REGULATORY STATUS

- Federally Threatened
- State Threatened

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Increases in barriers to migration/movement
- Changes to food webs and predator/prey dynamics

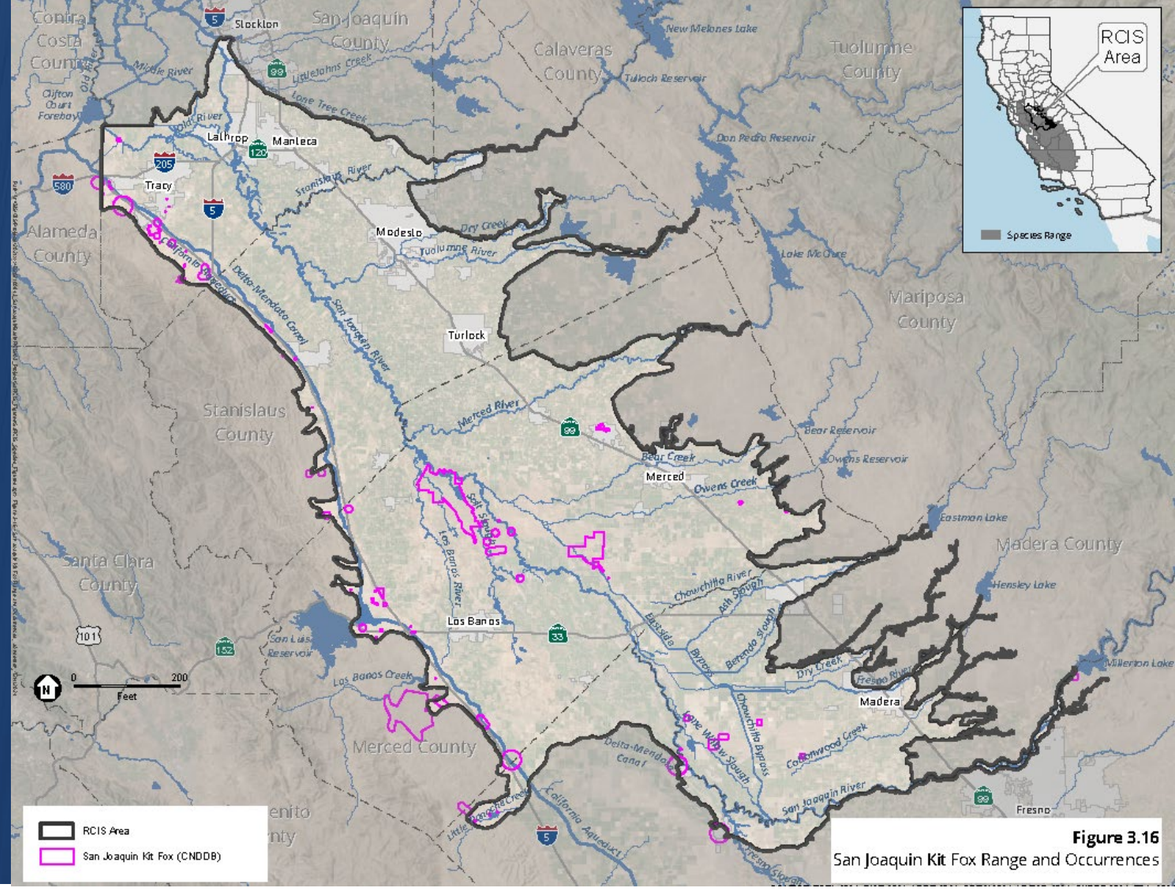


Figure 3.16
San Joaquin Kit Fox Range and Occurrences

Ecological Requirements

- **RCIS Natural Communities**: Grassland (Annual, Perennial), Agriculture (Annual, Unknown), Alkaline Mixed Scrub, California Coastal Scrub, Riparian Mixed Shrub
- RCIS area includes the eastern edges of the USFWS-designated Panoche/Western Merced Core Area and Santa Nella Satellite Area, as well as the entire Kesterson National Wildlife Refuge and Western Madera County Satellite areas (USFWS, 2020d).
- Optimal habitat includes sparsely vegetated communities with gentle slopes (USFWS, 2020d).
- Can be found in human-altered habitats such as agricultural land when in proximity to optimal habitat, but rarely in urban areas (USFWS, 2020d).
- Creates dens in loose texture soils but will also modify burrows dug by other animals in soils with high clay content (USFWS, 1998, 2020d) and will use artificial burrows (USFWS, 1998).
- Animal can forage within vernal pool, alkali meadows and playas, and fallow fields when in proximity to optimal habitat (USFWS, 1998, 2020d).
    - Diet is primarily small mammals (e.g., kangaroo rats, California ground squirrels) (USFWS, 1998, 2020d).
- **Full species account available**: Species Status Assessment Report for the San Joaquin kit fox (*Vulpes macrotis mutica*) (USFWS, 2020d)

Climate Change Vulnerability

- Stewart et al. (2016) assessed the climate change vulnerability of San Joaquin kit fox and ranked the species as moderately vulnerable when under the RCP8.5 emissions scenario. Suitable dispersal area and known locations could increase depending on climate change scenarios (Stewart et al., 2016). Approximately 26–99% of known locations may remain suitable by 2070-2099 depending on the climate change scenario (Stewart et al., 2016).
- The USFWS species status assessment (2020d) discussed climate stressors that could exacerbate present-day threats. These included:
    - Increases in severity and frequency of drought, wildfires, and flooding.
    - Extreme drought may modify the populations of San Joaquin kit fox's prey species and limit the ability of individuals to migrate to suitable habitat areas—thus impacting genetic variation .
    - Increases in precipitation amounts may cause dense, non-native grasses to impede individuals' ability to avoid predators and find prey.

Focal Species

Western Red Bat

Lasiurus blossevillii

Neptalí Ramírez Marcial / CC BY

REGULATORY STATUS

- State Species of Special Concern
- Western Bat Working Group: High

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Increases in pesticide and herbicide use
- Increases in rates of disease

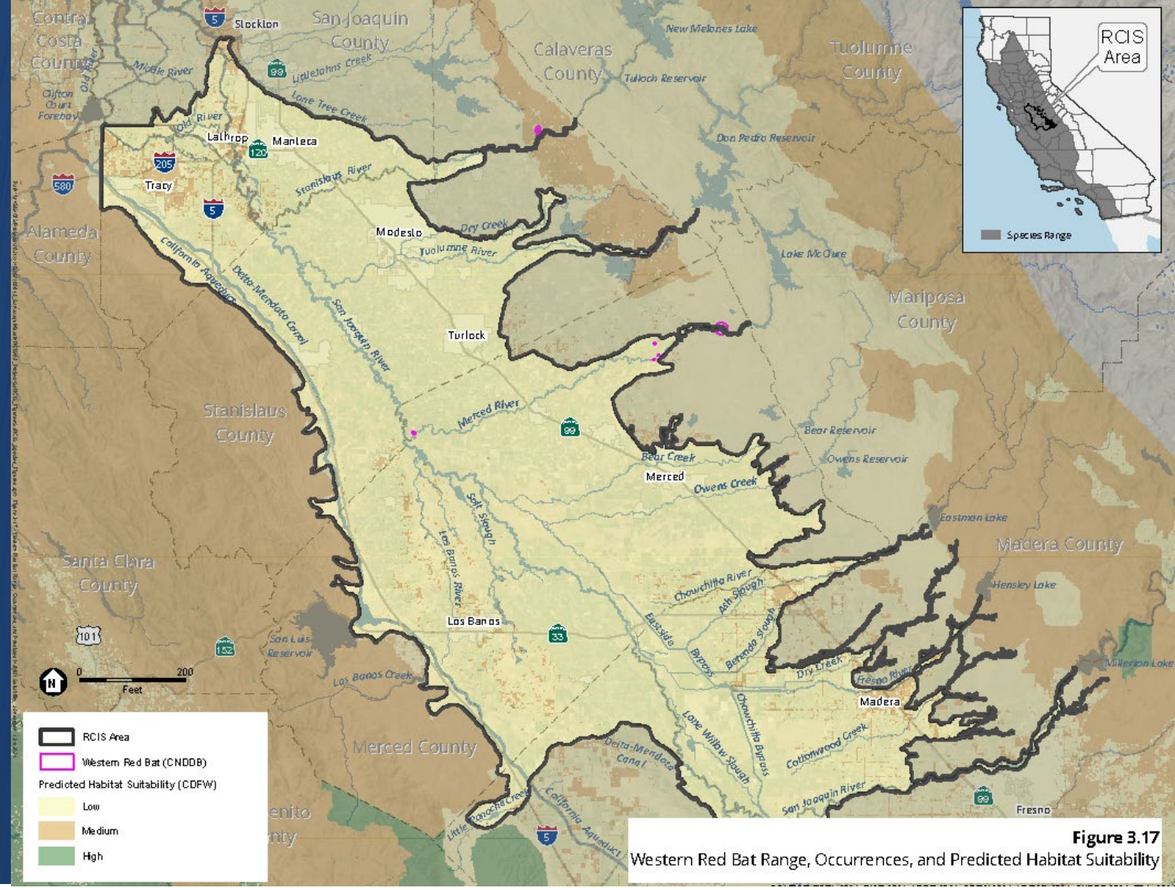


Figure 3.17
Western Red Bat Range, Occurrences, and Predicted Habitat Suitability

Ecological Requirements

- **RCIS Natural Communities:** Riparian Mixed Woodland, Riparian Mixed Shrub, California Sycamore, Grasslands (Annual, Perennial), California Conifer Forest and Woodland, California Broadleaf Forest and Woodland
- **Roosting habitat**: primarily in trees or shrubs (CDFW, 2023; Western Bat Working Group, 2017).
    - Prefers habitat edges with trees that are protected from above and open below with open areas for foraging, such as habitat associated with intact riparian habitat (CDFW, 2023).
- **Foraging habitat**: It forages for insects in a wide range of habitats, including grasslands, open woodlands and forests, and croplands (CDFW, 1988).
- **Full species account available**: Western Red Bat Life History Account (CDFW, 1988)

Climate Change Vulnerability

- Although no specific climate change vulnerability assessments exist for the western red bat, EcoAdapt (2021) evaluated climate change vulnerability for bats in the Santa Cruz Mountains region. While this geographic area has different habitats and climate when compared to the RCIS area, the response of bat species to impacts from climate stressors is likely to be similar. EcoAdapt (2021) determined that bats are overall highly vulnerable to climate stressors such as:
    - increased air temperatures,
    - increased frequency of heat waves and drought,
    - precipitation pattern changes, and
    - altered streamflow (Fellers & Halstead, 2015; Jones et al., 2009; Sherwin et al., 2013).
- These stressors can lead to reduced water and prey availability, increased energy expenditures, and interference with hibernation (EcoAdapt, 2021; Jones et al., 2009). Bats are also highly sensitive to non-climate stressors such as land use conversion, agriculture, contaminants, and disease (e.g., white-nosed syndrome), which may be exacerbated by climate stressors. Bats have a moderate adaptive capacity to respond to climate change impacts (EcoAdapt, 2021). They have a high dispersal ability with relatively general habitat and prey specializations (EcoAdapt, 2021).

Focal Species

Swainson's Hawk

Buteo swainsoni

U.S. Fish and Wildlife Service

REGULATORY STATUS

- State Threatened

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Reduction in ecosystem function and complexity
- Increases in pesticides and rodenticides

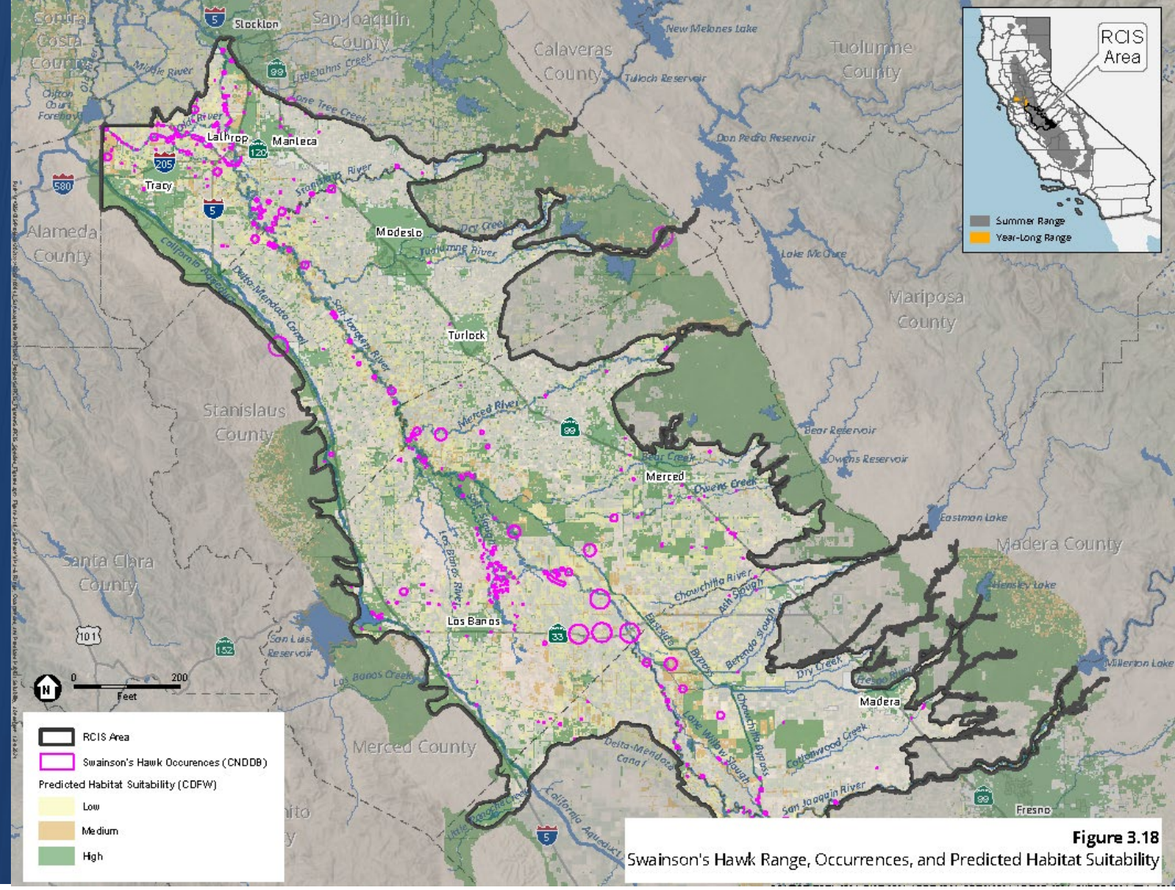


Figure 3.18
Swainson's Hawk Range, Occurrences, and Predicted Habitat Suitability

Ecological Requirements

- **RCIS Natural Communities:** Grassland (Annual, Perennial), Riparian Mixed Hardwood, Riparian Mixed Shrub, California Broadleaf Forest and Woodland, Agriculture (Annual, Unknown)
- **Nesting Habitat**: large trees in riparian areas, oak savannahs near water, and in agricultural or ranch lands with groves or lines of trees (CDFW, 2006, 2023).
    - Nest tree species in the San Joaquin Valley include Fremont's cottonwood (*Populus fremontii*), willows (*Salix* sp.), sycamores (*Platanus* sp.), valley oak (*Quercus lobata*), and northern California black walnut (*Juglans hindsii*). It will occasionally use introduced species such as *Eucalyptus* sp., pines, and redwoods (Woodbridge, 1998).
- **Foraging Habitat**: forages mainly on small rodents and insects in grasslands, suitable grain or alfalfa fields, or rangeland typically within 10 miles of breeding areas (CDFW, 2006, 2023).
- **Full species account available**: Swainson's Hawk Life History Account (CDFW, 2006).

Climate Change Vulnerability

- Statewide and larger regional climate change vulnerability assessments have been conducted for Swainson's hawk. As part of a national assessment, Wisley et al. (2019) projected that summer ranges in the RCIS area are likely to remain stable under different warming scenarios. Swainson's hawk is also included in Audubon's Priority birds (Michel et al., 2021).
- The species-specific statewide climate change vulnerability assessment conducted by Gardali et al. (2012) ranked vulnerability to exposure and sensitivity factors. Swainson's hawk had high and moderate vulnerability rankings to several exposure and sensitivity factors.
    - The species has a high vulnerability to habitat suitability exposure changes, which are "expected to decrease by greater than 50 percent," and moderate vulnerability to changes in extreme weather patterns—such that they are "likely to be exposed to some increase in extreme weather events."
    - Swainson's hawk has moderate sensitivity to changes in habitat as they can "tolerate some variability in habitat type," and a high sensitivity to impacts to migration as they are a long-distance migrant.
    - Since they are at risk for exposure to extreme weather (e.g., drought), they are included on the Climate Change Vulnerability Priority list (top 25% of highest assessed scores) (Gardali et al., 2012).

Focal Species

Tricolored Blackbird

Agelaius tricolor

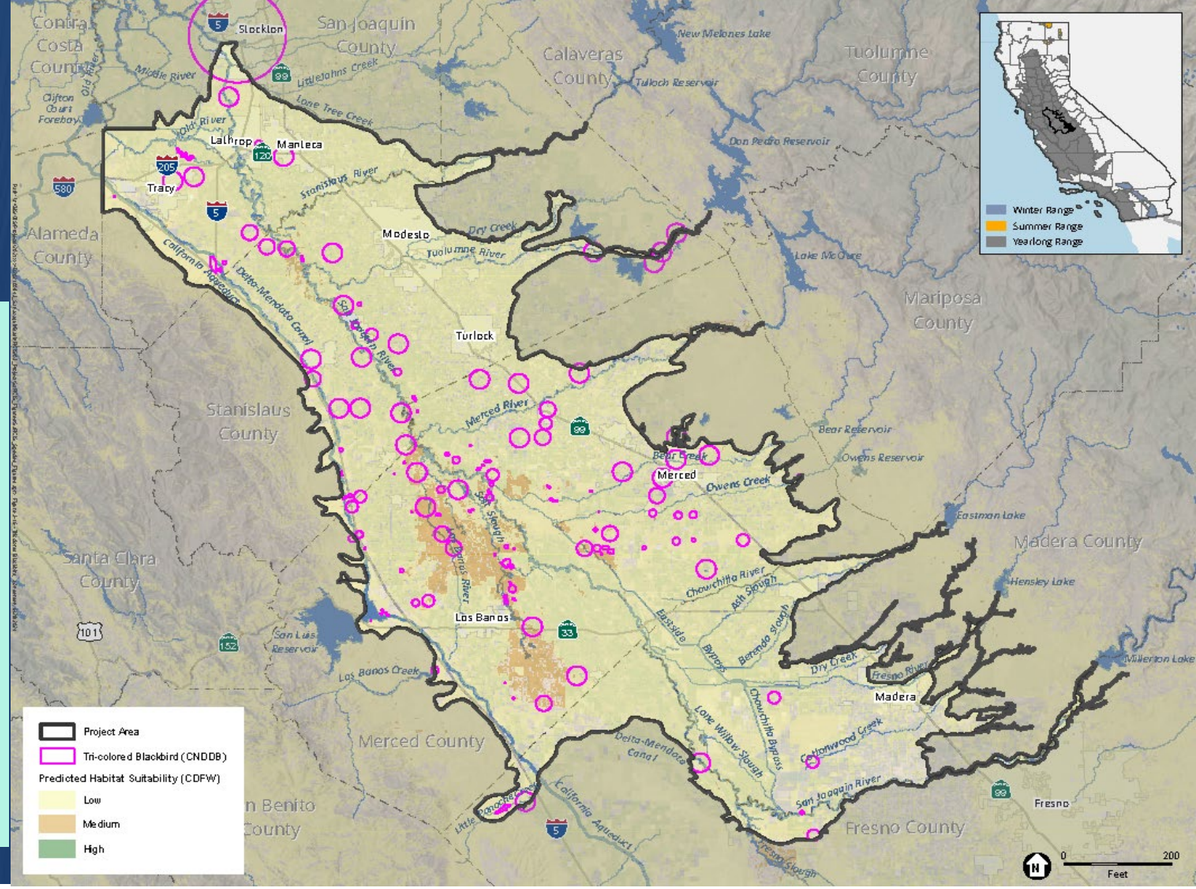
Dave Menke, U.S. Fish and Wildlife Service

REGULATORY STATUS

- State Threatened
- Species of Special Concern

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Surface water diversion
- Increases in pesticide and herbicide use



Ecological Requirements

- **RCIS Natural Communities**: Freshwater Wetland, Agriculture (Annual, Rice), Grassland (Annual, Perennial)
- Animal requires flooded wetlands for nesting habitat in spring and summer with dense, emergent cattails and bulrush adjacent to suitable natural or agricultural foraging habitat (Kyle, 2011).
    - A majority of breeding colonies occur in wetlands in mixed silage fields near dairies (Kyle, 2011).
- **Full species account available**: Tricolored Blackbird Life History Account (CDFW, 2008)

Climate Change Vulnerability

- Statewide and larger regional climate change vulnerability assessments have been conducted for tricolored blackbird. As part of a national assessment, Wisley et al. (2019) projected that up to a majority of the summer range in the RCIS area is likely to remain stable under different warming scenarios. Up to 99% of the winter range is projected to be lost and the species is ranked as extremely vulnerable (Wisley et al., 2019). It is also included in Audubon's Priority birds (Michel et al., 2021).
- The CVLVP (2017) also conducted a climate change assessment and ranked the species as having overall moderate vulnerability to climate change.
- The species-specific statewide climate change vulnerability assessment conducted by Gardali et al. (2012) ranked vulnerability to exposure and sensitivity factors. Tricolored blackbird had high and moderate vulnerability rankings to several exposure and sensitivity factors.
    - The species has a moderate vulnerability to habitat suitability exposure changes, which are "expected to decrease 10 to 50 percent," and moderate vulnerability to changes in extreme weather patterns—such that they are "likely to be exposed to some increase in extreme weather events."
    - Tricolored blackbird has moderate sensitivity to changes in habitat as can "tolerate some variability in habitat type."

Focal Species

Monarch Butterfly

Danaus plexippus

Dave Menke, U.S. Fish and Wildlife Service

REGULATORY STATUS

- Federal Candidate Species for Listing

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Increases in pesticide and herbicide use
- Introduced pathogens and disease

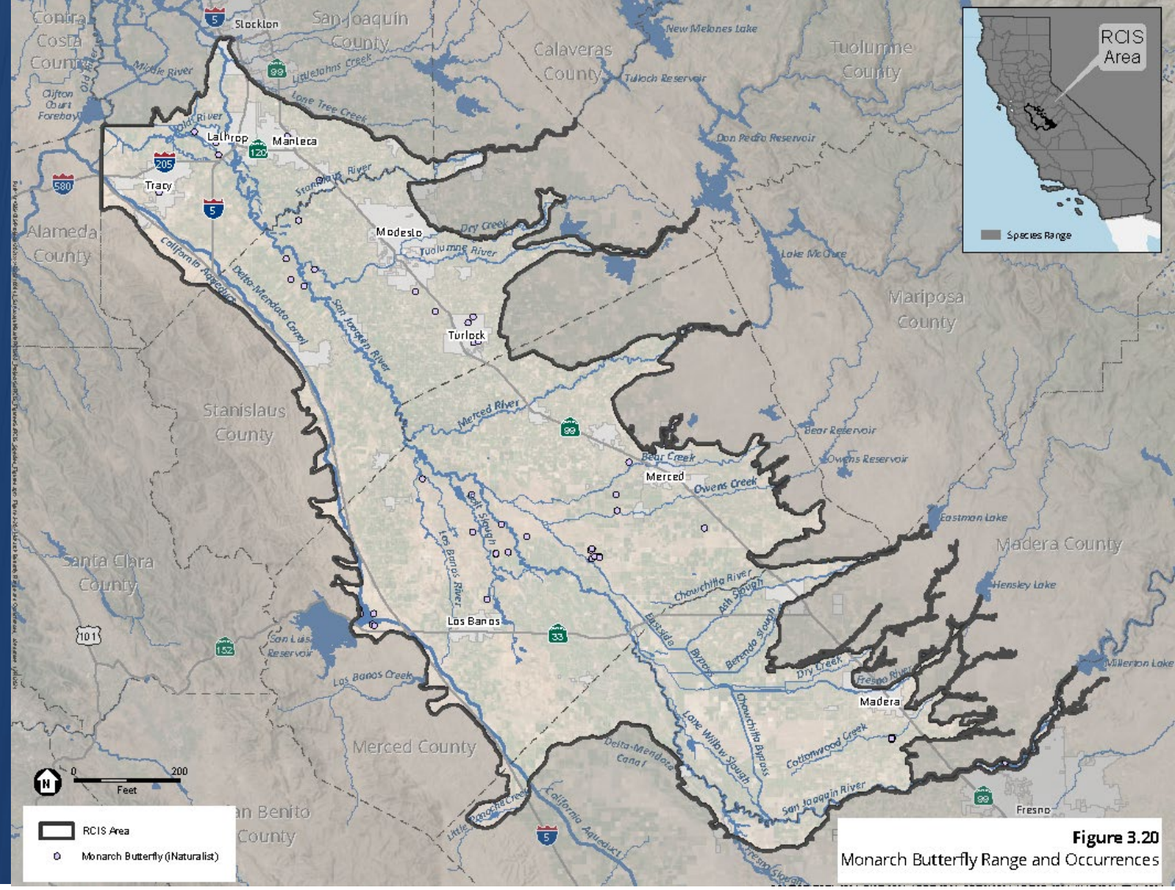


Figure 3.20
Monarch Butterfly Range and Occurrences

Ecological Requirements

- **RCIS Natural Communities**: Grasslands (Annual, Perennial), California Chaparral, California Broadleaf Forest and Woodland, Riparian Mixed Hardwood
- Adults use milkweed (*Asclepias* sp.) and other flowering plants during breeding and migration. Milkweed species are the only larval host plants (Center for Biological Diversity and Center for Food Safety, 2014).
- **Full species account available**: Petition to Protect the Monarch Butterfly (*Danaus plexippus*) Under the Endangered Species Act, Before the Secretary of the Interior (Center for Biological Diversity and Center for Food Safety, 2014)

Climate Change Vulnerability

- USFWS (2020e) conducted a species status assessment for the monarch butterfly western population. Under the current conditions, the western North American population is at risk of extinction. Climate change may impact breeding habitat due to changes in precipitation by increasing intensity of storms and increasing the length and frequency of drought (USFWS, 2020e). These projected increases in moisture and modest increases in temperature may support more habitat for milkweed and nectar plants, resulting in a positive outcome in food supply and breeding habitat (USFWS, 2020e).
- Despite these increases in breeding habitat, there is a possibility of a misalignment in timing between monarch migration and the availability of food and breeding resources. In the RCP8.5 scenario, increases in mortality and reduced reproduction due to extreme temperature over the critical threshold and intense precipitation are predicted (USFWS, 2020e).

Focal Species

Valley Elderberry Longhorn Beetle

Desmocerus californicus dimorphus

Jon Katz, U.S. Fish and Wildlife Service

REGULATORY STATUS

- Federally Threatened

KEY STRESSORS

- Loss of areal extent and fragmentation of species habitat
- Increased pesticide and herbicide use
- Increases in invasive species and pests (e.g., Argentine ants)

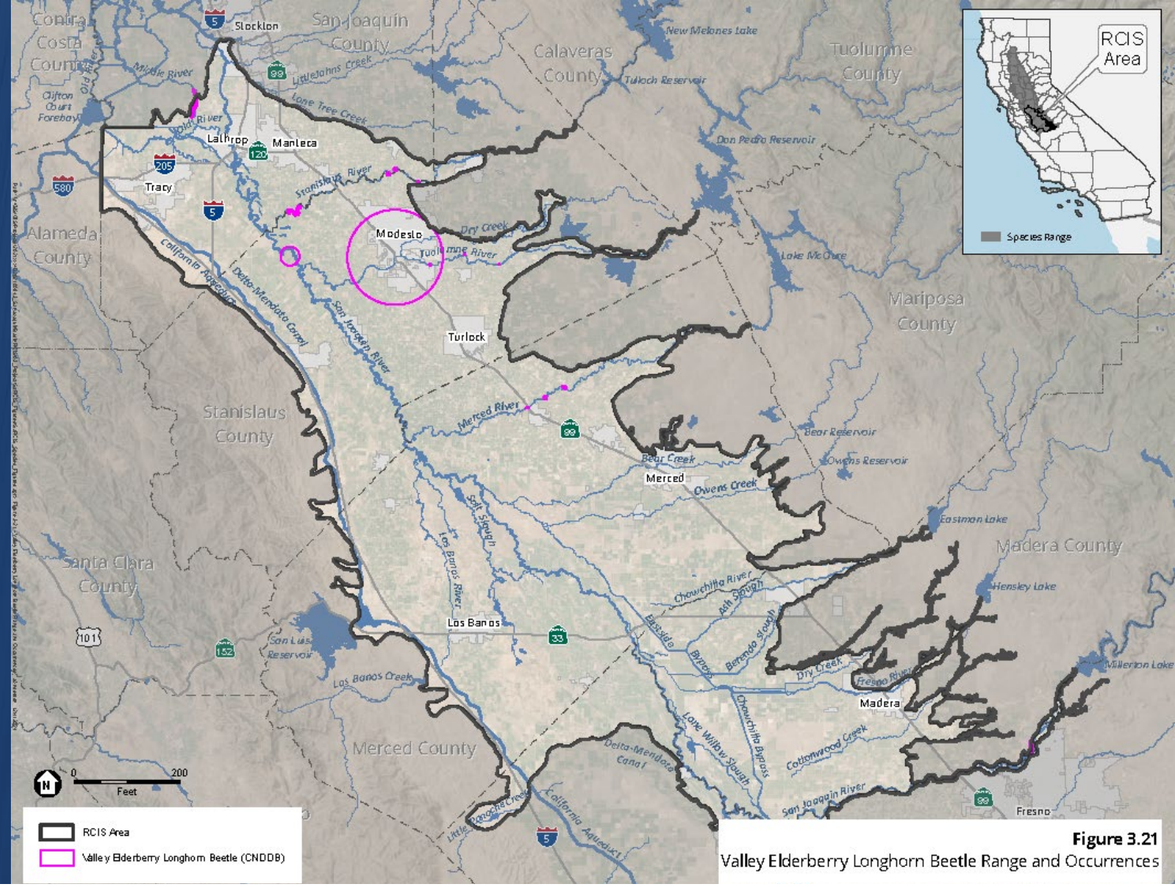


Figure 3.21
Valley Elderberry Longhorn Beetle Range and Occurrences

Ecological Requirements

- **RCIS Natural Communities**: Riparian Mixed Woodland, Riparian Mixed Shrub
- **Breeding habitat**: only found in association with elderberries (*Sambucus* spp.); prefer shrubs present in riparian communities (USFWS, 2019, 2023b)
    - Riparian communities consist of a mix of young and mature elderberry shrubs as well as signs of natural elderberry recruitment in the form of new saplings or young shoots from established elderberry shrubs (USFWS, 2019).
- Animal is naturally rare within its habitat and distributed throughout available habitat in a widely dispersed metapopulation (USFWS, 2023b).
- RCIS area includes USFWS-designated San Joaquin River Management Unit (USFWS, 2019).
- **Full species account available**: Revised Recovery Plan for Valley Elderberry Longhorn Beetle (USFWS, 2019)

Climate Change Vulnerability

Although no specific climate change vulnerability assessment for the valley elderberry longhorn beetle exists, Dobbins and Holyoak (2021) developed a model to look at the effect of the increased probability of severe drought and wildfire frequency on the valley elderberry longhorn beetle. The model showed that an increase drought and wildfire resulted in a significant increase in probability of extinction. These events may greatly reduce local site populations, which may be especially harmful as this beetle is thought to infrequently recolonize previously colonized sites. Climate change will impact the valley elderberry longhorn beetle by changing the conditions within California watersheds which will impact the riparian plant communities necessary for beetle survival.

Focal Species

Delta Button-Celery

Eryngium racemosum

Zoya Akulova / CC BY

REGULATORY STATUS

- State Endangered
- California Rare Plant Rank 1B.1

KEY STRESSORS

- Loss of areal extent and fragmentation of habitat
- Altered flow and flooding regimes
- Increases in invasive species

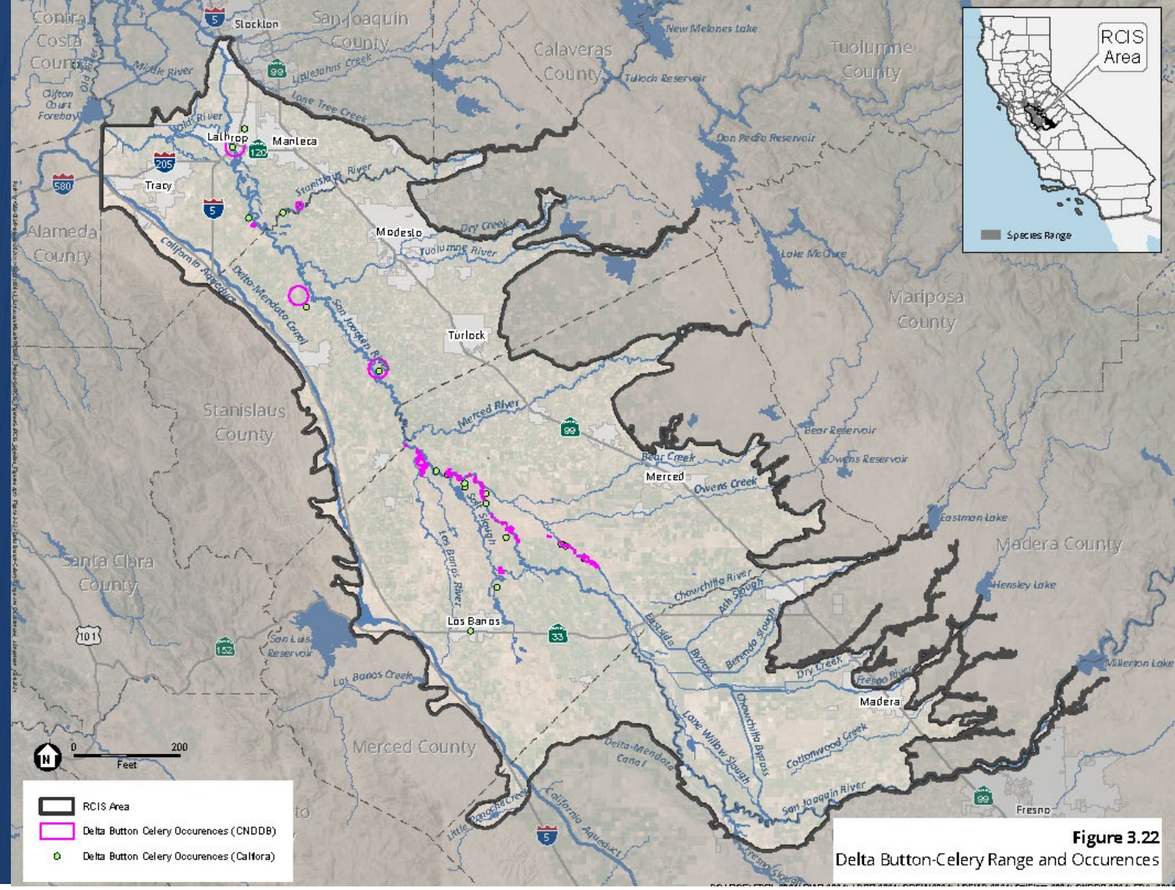


Figure 3.22
Delta Button-Celery Range and Occurences

Ecological Requirements

- **RCIS Natural Communities**: Freshwater Wetland, Alkali Mixed Scrub, Riparian Mixed Shrub (seasonally flooded clay depressions in floodplains) (Preston et al., 2012; (California Native Plant Society, 2010)
- Plant occurs on floodplains with periodic flooding in open areas without competing vegetation along the San Joaquin River, including seasonally flooded clay depressions (CDFW, 2023; CDWR, 2016; Preston et al., 2012; California Native Plant Society, 2010).
- It likely develops a persistent seedbank and can reappear at locations during favorable conditions (CDWR, 2016).
- **Full species account available**: Delta Button-celery (*Eryngium racemosum*) Life History Account (California Native Plant Society, 2010)

Table 3-6. Delta Button-Celery Natural Communities Climate Change Vulnerability Rankings

NVCS Classification (Common Name)[1]	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Warm and Wet*	Climate Exposure and Spatial Disruption Rank High Emission (RCP8.5) *Hot and Dry*	Mean Combined Vulnerability Rank High Emissions (RCP8.5)
Freshwater Marsh[2]	High	High	High
American Southwestern Riparian Forest and Woodland	Mid-high	Mid-high	Moderate to Mid-high

Climate Change Vulnerability

- The climate vulnerability of the natural communities associated with Delta button-celery can be used as an indicator, or proxy, of the species' vulnerability to climate change impacts. Thorne et al. (2016) assessed the climate change exposure, spatial distribution, and vulnerability of California freshwater wetlands and riparian vegetation communities statewide under two general circulation models with high emissions. Communities suitable for Delta button-celery could experience a 25–39% (Mid-high) to 75–100% (High) reduction in areas that are climatically suitable for the suite of species that make up these communities depending on the resulting general circulation model.
- Impacts from increased drought frequency may be exacerbated by increased water diversions for human usage away from aquatic vegetation communities (CLCC, 2018). Reductions in snowpack may alter streamflow patterns and natural flooding regimes, leading to a further reduction in water supply (CLCC, 2018). Earlier snowmelt may also impact seed production, reducing the health of plant populations, such as Delta button-celery (CLCC, 2018). Storm intensity and drought severity are expected to impart negative effects on riparian vegetation (CLCC, 2018). Changes in streamflow may result in lower diversity and abundance in vegetation and lead to flooding and erosion (CLCC, 2018). Additional impacts may include:
  - Rising groundwater and salinity.
  - Erosion from increased flooding.
  - Increased mortality of vegetation from severe droughts, wildfires, and flooding.
  - Changes in species composition and water quality due to changes to temperature and precipitation patterns.

1 Thorne et al., 2016

Note. Thorne et al. (2016) classified vegetation using the NVCS classification system which is cross walked to RCIS Natural Community types in Appendix B. Both global circulation models projected a 93–97% reduction in areas that are climatically suitable for the suite of species that make up freshwater wetlands. One hundred percent of freshwater wetland communities are projected to be climatically stressed.

4 Conservation Strategy

This San Joaquin Valley RCIS Conservation Strategy (Conservation Strategy) aims to:

1) **Conserve** and protect what species and habitats remain;
2) **Restore** sufficient area previously destroyed natural communities and habitat to achieve recovery of focal species and support resilience over time;
3) **Connect** or reconnect remaining habitat areas to facilitate species migration across the region and repopulate habitats within the region;
4) **Learn** from and improve management actions overtime to through scientific application of adaptive management; and
5) **Prevent** acute and chronic mortality factors that could jeopardize species survival.

The Conservation Strategy identifies actions and priorities that, if implemented, will advance measurable objectives in support of regional conservation goals. This strategy considers and builds upon the goals and objectives identified by previous plans and initiatives, such as federal recovery plans for threatened and endangered species, California's 30x30 initiative, the Central Valley Flood Protection Plan and its updates, and the Central Valley Joint Venture (CVJV) 2020 Implementation Plan. As a supporting document to the Central Valley Flood Protection Plan, the Conservation Strategy also considers how investments needed for other resource objectives such as sustainable groundwater management or improved water quality could be leveraged to improve outcomes for sensitive species and vice versa. An integrated approach for addressing the region's multiple resource problems would not only improve conservation outcomes, but could also help attract funding for the type of multi-benefit projects that advance multiple resource objectives with a single investment. Integrating the conservation objectives into projects that also address other objectives will hopefully reduce overall implementation, permitting and mitigation costs for all sectors.

This chapter begins with an overview of the strategy's themes and guiding principles. Then, goals and objectives for the document are introduced. The actions and priorities are then presented, organized by themes. Tables identify the conservation elements that would benefit from the actions and how the actions would be used to address regional stressors and meet regional goals and objectives.

4.1 Strategy Elements

The San Joaquin Valley RCIS conservation strategies include goals, objectives, and actions that address the pressures and stressors, including climate change, identified in Chapter 2.

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

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

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

Actions are specific activities that can be implemented to achieve the objectives. The RCIS program guidelines identify two main types of actions which are subject to different methods of crediting as part of mitigation credit agreements, conservation actions and habitat enhancement actions. Actions that do not involve land acquisition or the permanent protection of habitat would be considered habitat enhancement actions, and those that do provide permanent protection would be considered conservation actions if implemented through a mitigation credit agreement (CDFW 2023a).

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

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

4.2 Strategy Themes

Each RCIS action is categorized into one of the following five themes. In some cases, actions could fall under multiple themes, though only one is selected. The use of themes in this document helps organize the content and ensure that the strategy’s overall aims are addressed.

Conserve: Conservation and protection of remaining stands of native plant communities is essential to the survival of some rare species and the long-term recovery of native biodiversity. Approximately 80% of the RCIS area is developed for urban or agricultural land uses leaving less than 20% of historic habitat intact for conservation. In many cases, these areas of native vegetation are the only places in the RCIS area where a species persists, and they provide the majority of the biodiversity for the region. Approximately 19% of natural vegetation communities in the RCIS area are currently protected (See Table 2-4). Conserving existing species populations and habitats protects genetic diversity; sites for conservation can also then serve as

reference sites for future restoration efforts. Preservation of native habitats may require restoration of natural disturbance regimes such as fire, herbivory, and seasonal inundation and ongoing, active intervention to limit invasive species. RCIS actions that protect existing or potentially restorable habitats, populations, functions, values, or processes from harm or degradation are considered Conserve Actions.

Restore: Sustained recovery of several native species will require significant restoration to increase the area of suitable habitats. Native habitats in the San Joaquin Valley have either been lost or degraded due to large scale habitat conversion from agriculture or urbanization, intense pressure from weeds adapted to agricultural environments, and the lack of natural processes (flood, fire, and herbivory). Native plant communities and the associated habitat that they provide will not be re-established without active intervention. Restoration will be more successful when complemented by natural processes and cultural practices. RCIS actions that return an area to its prior habitat or function following loss or degradation resulting in new acreage or improved quality or function are considered Restore Actions.

Connect: The Central Valley lies between two relatively intact bioregions, the Sierra Nevada and the Central Coast, providing an important linkage across California. The Central Valley's extensive river and floodplain systems have long provided essential habitat for migratory fish and bird species. They also provide essential habitat connectivity for native species that migrate across the valley, such as the monarch butterfly, as well as dozens or resident species that are currently limited to patches of remaining habitat. The Central Valley's intensively cultivated landscape, particularly those areas dominated by vines and orchards, limit opportunities for species migration and genetic exchange. Additionally, connectivity barriers exist in the form of major north/south trending highways and concrete-lined canals. Restoring habitat and removing barriers between existing habitat and across the valley is an opportunity to not only benefit species that live in the valley but also those that migrate across the Central Valley from other parts of California and the globe. The Conservation Strategy builds upon the habitat connectivity within and across the region that will become increasingly important for biodiversity resilience as the climate changes. RCIS actions that join two or more similar or complementary habitats or functions through conservation or restoration are considered Connect Actions.

Learn and Improve: The science of conservation and restoration is complex and underdeveloped. Research into the status of native species, their life histories and needs, and the outcomes of management interventions designed to benefit them is necessary to improve the efficacy of restoration and conservation investments. This RCIS proposes to utilize the Adaptive Management Planning circle developed by the Delta Stewardship Council (DSC) to learn from and improve conservation investments overtime (DSC, 2019). RCIS actions that study habitats, species, functions, and practices to increase understanding and improve conservation and management are considered Learn Actions.

Prevent Exogenous Causes of Mortality to Focal Species: Even with significant habitat conservation and restoration, exogenous phenomena, generally originating from some human action, can cause population-level harm to species. Examples of acute mortality events include things such as mortality suffered by crossing roadways, chemical spills, bird strikes on buildings and other infrastructure, introduced diseases, and establishment of invasive species. One-time events, such as a pollution discharge, could affect the current population as well as future generations. Chronic mortality at a few road crossings can significantly reduce population gains

made through significant conservation investments. RCIS actions that stop the loss or degradation of habitats, functions, or populations are considered Prevent Actions.

4.3 Guiding Principles for Implementation

Since the RCIS is a voluntary program, implementation of the actions in this plan will depend on a number of factors, including availability of funding, willing landowners, and prevailing market conditions. When evaluating a suite of potential actions, project proponents are encouraged to prioritize the following guiding principles to provide the most benefit.

Community Engagement – Engage local communities including historically marginalized communities in conservation and restoration of habitat. Create opportunities for community members to participate in planning, implementation, and long-term stewardship activities that are consistent with conservation objectives.

Traditional Indigenous Land Management – Engage local Tribes in the design, implementation, monitoring, and management of sites. Incorporate Tribal values and practices into projects in partnership with local tribes.

Recognize the need, cost, and desirability of human presence and management on conserved and restored lands – Active human management in the form of grazing, burning, Integrated Pest Management, and educated public visitation, is often necessary to prevent degradation of high-quality habitat.

Multi-Benefit Projects – Incentivize and invest in projects that restore habitat while providing additional benefits, such as groundwater sustainability, water quality improvement, flood risk reduction, public access, and community benefits.

Occupied Habitat – Protect vulnerable lands that target species, including focal species and other special-status species, currently use over lands that do not already have target species present.

Parcel Size and Configuration – Protect large parcels to the extent possible to maximize the amount of interior land and limit negative edge effects. This includes protecting lands that are adjacent to existing protected habitat and increasing patch size (CVJV, 2020).

Diverse Habitat – Design restoration projects that address a variety of species' ecological requirements to create a diverse habitat mosaic (CVJV, 2020). Diverse habitats are often more resilient and can provide more comprehensive life-cycle benefits for species.

Connected Lands – Prioritize protection and restoration of lands that provide critical corridors connecting species populations to other populations or suitable habitat (CVJV, 2020).

Climate Resilience – When ecologically appropriate, prioritize projects that may be more resilient to the effects of climate change or that actively address climate impacts, including providing refugia habitat and corridors to land that is more suitable for vulnerable species in future climate conditions. Anticipate and prepare for future climate events, including extreme weather, and changing species-specific ecological needs (CVJV, 2020).

Nature-Based Solutions – Nature-based solutions (NBS) are planning, design, management, and engineering practices that incorporate natural features and processes into the built environment to promote adaptation and resilience (Federal Emergency Management Agency

[FEMA], 2024). Implement nature-based solutions into restoration projects to improve outcomes and site sustainability.

Restoration Potential – Focus restoration actions in areas where conditions and processes necessary to maintain habitats can be restored. Conditions and processes could include access to water, floodplain inundation, fluvial (wind or water) energy to trigger natural succession, or opportunities for management actions like grazing and fire.

4.3.1 Gaps in Existing Scientific Information

A thorough review of the scientific literature and input from technical experts was used to develop this RCIS. Gaps in scientific information exist, which if addressed could be used to improve the RCIS conservation strategy, including the goals, objectives (including metrics and targets), actions, and priorities. Actions are included that specifically address certain data gaps in the RCIS conservation strategy. The following are some of the key gaps in scientific information.

- Species population distributions, abundances, and trends
- Natural community distribution and condition to comprehensively assess the need for, and to prioritize, restoration; and
- How each focal species and natural communities will respond to the effects of climate change.

Vegetation mapping uses satellite imagery that only includes large scale objects and habitat details. Where publicly available suitable species habitat models were included, aerially mapped vegetation communities were the main parameter used and habitat quality, species' life history, dispersal barriers, and other ecological requirements were not considered. Because of these model limitations, areas and habitats that have been remotely sensed and prioritized for conservation, preservation, and restoration, should be evaluated for accuracy of the habitat qualities before further action is taken.

Species-specific climate change vulnerability assessments (CCVA) were used when available because it more accurately represents the vulnerability of a species compared to the statewide vulnerability assessment. In cases where a species-specific CCVA does not exist, the statewide vulnerability assessment for the natural communities was used as a representative analysis for focal species and natural communities without a climate change vulnerability assessment. This proxy for climate vulnerability does not include species' life history, ecological requirements, regional significance, current range, and specific threats.

The Central Valley Joint Venture 2020 Implementation Plan (CVJV 2020) outlines the need for water supply to wetland and riparian areas. Although the water supply goal is stated, the gap between the current water supply and total need of additional water needed is yet to be determined due to the limited baseline data (See section 4.3.1, Water Management (WM) Goal).

4.4 Goals and Objectives

The RCIS Program Guidelines (CDFW, 2023a) define strategy goals and objectives:

Goal

- A broad, guiding principle that describes a desired future condition. Each goal is supported by one or more objectives with one or more actions.

Objective

- A concise statement of a target outcome. Objectives must be measurable by using standard ecologically based metrics that include both area and quality of habitat.

This RCIS defines five goals, described below. Each goal includes four or more measurable objectives. The goals and objectives are intended to remain stable over the life of the RCIS document.

4.4.1 Water Management (WM) Goal

Goal 1: Promote multi-benefit water management to facilitate sustainable groundwater management, sufficient water supply for habitats, improved water quality, and flood risk reduction. A reliable water supply is essential to species conservation and human needs, such as agriculture and drinking water, in the Central Valley. Resolving the region's water scarcity challenges is beyond the reasonable purview of this voluntary effort, but there are numerous opportunities for individuals, organizations, and agencies to advance water management objectives while improving outcomes for native species. Integrating species conservation into water management investments is a promising strategy for obtaining more funding for both species' conservation and water management. The success of the RCIS to recover native species and populations will depend on the collective ability to work across sectors to promote ecosystem recovery while advancing other societal goals such as economic stability, environmental justice, and public health and safety.

WM Objective 1, Multi-Benefit Projects: Promote multi-benefit groundwater management projects that protect or restore habitat.

Metrics: # of projects benefiting focal species and communities funded through the MLRP and other funding programs benefiting multi-benefit projects.

Target: $1 billion in funded projects in the RCIS area by 2035

WM Objective 2, Water Supply: Achieve sufficient year-round and monthly water supply targets to support Central Valley Joint Venture (CVJV) wetland and riparian goals (CVJV, 2020).

Metric: # of acre-feet of additional water supply

Target: Total annual (385,778 acre-feet) and/or monthly wetland water supply targets in the CVJV San Joaquin planning region (CVJV, 2020)

WM Objective 3, Water Quality: Enhance and restore water quality, particularly in 303(d)-listed impaired water bodies and drinking-water aquifers (SWRCB, 2018).

Metric: RWQCB Basin Plan Objectives for Surface Waters and Ground Waters as noted in the Sacramento River and San Joaquin River Basin Plan (RWQCB, 2020)

Target: Increased compliance of water quality metrics (when compared to baseline levels) of Water Quality Objectives for any constituent element as noted in the Sacramento River and San Joaquin River Basin Plan (RWQCB, 2020).

WM Objective 4, Flood Management: Improve floodways along major streams to reduce conflicts between flood management and public safety and to increase opportunities to restore habitat.

Metrics: Acres of riverside lands and floodplain inundation

Target: Increase amount of floodplain inundation (CDWR, 2016):

- Additional 2,100 acres of river meander potential in the Upper San Joaquin River Conservation Planning Area (CPA) and 3,400 acres of additional river meander in the Lower San Joaquin River CPA.

4.4.2 Landscape Habitats (LH) Goal

Goal 2: Protect and restore large areas of diverse, connected, and resilient habitats to support common and rare native species. Most of the region's native vegetative cover and habitat have been lost due to agricultural and urban development in the valley. What habitat remains is often fragmented and degraded. The long-term survival of many species will depend on significantly increasing the area of habitat available for native species. Some previous planning efforts, such as the Central Valley Joint Venture Implementation Plan (CVJV 2020) and the Central Valley Flood Protection Plan's supporting Conservation Strategy (CDWR 2016) have identified potential amounts of specific habitat types needed to recover sensitive species. Where available, these numbers are used to set acreage targets for this RCISs metric targets for measuring objective success. In other cases, a target of a 10% increase from existing habitat acres was used.

LH Objective 1, Freshwater Wetlands: Increase the area, function, and resilience of freshwater wetland habitats through protection, enhancement, and restoration of seasonal habitat.

Metric: Acres of wetland habitat

Target: Increase amount of freshwater wetland habitat per CVFPP's Conservation Strategy measurable objectives for freshwater marsh and other wetland habitat in active floodplains (CDWR, 2016):

- Additional 6,700 acres of permanent marsh and 9,800 acres of seasonal wetland habitat on the active floodplain of the Upper San Joaquin River CPA and an additional 6,500 acres in the Lower San Joaquin River CPA
- Restoring 1,500 and 20,000 acres of semi-permanent (generally flooded October through July) and seasonal wetlands (generally flooded October through March), respectively, in the San Joaquin Basin

Target: CVJV goals for San Joaquin Planning region (CVJV 2020) (includes active floodplains and areas outside floodplains):

- Restoring 9,378 acres of additional managed semi-permanent wetlands
- Restoring 5,837 acres of additional managed seasonal wetlands
- Restoring 8,368 acres of additional riparian habitat
- Enhancing 5,330 acres of existing managed seasonal wetlands

LH Objective 2A, Riparian Habitat: Increase the area, width, dynamism, and resilience of riparian habitat through protection, acquisition, enhancement, and restoration of floodplain lands along both perennial rivers and ephemeral streams.

Metrics: Acres of riparian lands with native plant communities; acres and linear miles of river under ownership agreements that enable bank migration and floodplain inundation.

Target: Increase amount of riparian and riverine habitat per CVFPP's Conservation Strategy measurable objectives (CDWR, 2016) and CVJV Implementation Plan (CVJV, 2020):

- 2,100 acres of additional riparian habitat on the active floodplain of the Upper San Joaquin River CPA and an additional 8,800 acres in the Lower San Joaquin River CPA (CDWR, 2016)
- 102 miles of additional riparian-lined bank in the Upper San Joaquin River CPA and an additional 52 miles in the Lower San Joaquin River CPA (CDWR, 2016)
- 29 miles of additional natural bank in the Upper San Joaquin River CPA and an additional 25 miles in the Lower San Joaquin River CPA (CDWR, 2016)
- Up to 2,100 acres of additional river meander potential in the Upper San Joaquin River CPA and an additional 3,400 acres of river meander potential in the Lower San Joaquin River CPA (CDWR, 2016)
- Additional 83,680 acres of Riparian Habitat (CVJV 2020)

LH Objective 2B, Riverine Habitat: Improve the quality and resilience of instream habitat for native aquatic species through a variety of measures including natural process restoration, reservoir management, and active channel modification to improve habitat and increase connectivity between channels and floodplains.

Metric(s): Area of high-quality salmonid spawning habitat, linear feet of shaded riverine aquatic habitat, area of frequently inundated floodplain habitat, area of newly formed alluvial deposits or river meander potential.

Achieve San Francisco Bay/Sacramento-San Joaquin Delta Estuary Water Quality Control plan habitat and/or flow objectives for San Joaquin River tributaries (SWRCB 2018) and/or voluntary agreements for habitat and flow with irrigation districts

Targets:

- Additional 3,400 acres of floodplain inundated in the Upper San Joaquin River CPA and an additional 25,700 acres in the Lower San Joaquin River CPA (CDWR, 2016)

- Up to 2,100 acres of additional river meander potential in the Upper San Joaquin River CPA and an additional 3,400 acres of river meander potential in the Lower San Joaquin River CPA (CDWR, 2016)
- Achieve target flow rates and/or habitat values as described by the SWCB (2018) at the prescribed location located within the RCIS area.

LH Objective 3, Grasslands: Increase the area of native perennial and annual grassland habitats through protection, enhancement, and retirement and restoration of historical, present day, and potentially restorable grassland habitat (i.e., irrigated agricultural lands, lands identified by SGMA).

Metric: Acres of annual and perennial grassland habitat

Target:

- Protection of 50% (59,255 acres) of existing unprotected (118,510 acres) annual grassland habitat
- Restore an additional 150,000 acres of annual grassland habitat
- Restore an additional 15,000 acres of perennial grassland habitat

LH Objective 4, Vernal Pools: Protect and/or enhance all remaining vernal pool habitat through acquisition or enhancement/restoration of historical, present day, and potentially restorable habitat.

Metric: Acres of vernal pool habitat blocks (Volmar et al. [2023]) and mapped vernal pool habitat

Target: Protection of vernal pool habitat

- Protection of vernal pools in Habitat Block 3 (10,949 acres and Habitat Block 11 (4,492 acres) (Volmar et al. 2023)
- Protection of 20% (1,189 acres) of existing unprotected habitat (4,161 acres) in Habitat Block 5 (Volmar et al. 2023)
- Protection of 25% (814 acres) of existing unprotected habitat (1,530 acres) in Habitat Block 13 (Volmar et al. 2023)
- Protection of 25% (596 acres) of existing unprotected habitat (1,885 acres) in Habitat Block 16 (Volmar et al. 2023)
- Protection of 50% (49,224 acres) of existing unprotected (69,593 acres) vernal pool habitat (as mapped in this RCIS)

Target: Enhancement/restoration of vernal pool habitat

- Restore/enhance an additional 10,000 acres of vernal pool habitat

LH Objective 5, Working Lands: Increase the percentage of working lands (lands mapped as agricultural in this RCIS) that provide habitat for native and focal species.

Metrics: Acres of wildlife-friendly practices applied on agricultural lands or ratio of seasonal agricultural lands to perennial trees and vine.

Target: Increase number of wildlife-friendly practices applied on agricultural lands per CVFPP's Conservation Strategy measurable objectives (CDWR, 2016):

- Additional wildlife-friendly practices applied to 3,100 acres of agricultural land on the active floodplain of the Upper San Joaquin River CPA and an additional 3,100 acres in the Lower San Joaquin River CPA
- An increase in the number of landowners compared to present day protecting, enhancing, and/or restoring habitats that support a broad mosaic of species and ecological functions.
- Transition from perennial to annual crops types to 50% of total agricultural acreage (annual crops 34% total acreage in 2023)

4.4.3 Habitat Connectivity (HC) Goal

Goal 3: Have an integrated and connected landscape where species populations can move and migrate across the landscape to areas of suitable habitat or to establish new populations. The degree to which plants and animals can move across the landscape is critical to providing resilience in a changing climate, maintaining genetic diversity, expanding populations into new areas of existing or restored habitat, and allowing species to access habitat needed for life stages and functions such as rearing young or foraging. Scientists have identified key corridors that are critical for linking habitats and species populations across the Central Valley (Spencer et al 2010, Huber et al 2010). These include terrestrial (upland) connections, as well as aquatic connections, and the transition interface between upland and aquatic habitats (such as in riparian areas).

HC Objective 1, Aquatic Connectivity: Establish and improve connectivity within and/or between aquatic habitats to improve species' access to habitats and seasonal migration.

Metric: # of barriers to adult and juvenile anadromous fish passage removed or remediated

Target: 30 barriers removed and/or remediated

HC Objective 2, Terrestrial Connectivity: Establish and improve upland connectivity between landscape blocks and suitable habitat to allow species and habitats to move over space and time.

Metric: # of connectivity corridors enhanced or created

Target: 5 connectivity enhancement projects and 1 new connectivity projects (i.e., across linear infrastructure) per priority connectivity location

Metrics: # vehicle-related deaths for focal species

Target: Decrease from vehicle-related deaths by 25% from 2020-2024 average; Increase in documented successful crossing of linear infrastructure barriers compared to present day

HC Objective 3, Habitat Permeability: Reduce habitat fragmentation and species population impacts of linear infrastructure (e.g., highways and major canals).

Metric: Percentage of habitat corridors protected – increase in percentage

Target: Protection of 25% (87,873 acres) of existing unprotected (337,010 acres) identified habitat corridors

HC Objective 4, Habitat Transition Spaces: Provide upland habitat adjacent to low-lying floodplains and wetlands to provide refugia from high water events and support wildlife breeding and foraging activities.

Metric: Acreage and/or linear miles of transition habitat protected or restored

Target: Increase in acreage and/or linear miles of upland transitional habitat protected and/or restored when compared to present-day

4.4.4 Natural and Cultural Processes (NCP) Goal

Goal 4: Restore and conserve natural processes and cultural practices that improve habitat quality, ecosystem function, and climate resiliency, and retain traditional ecological knowledge. In addition to habitat loss and degradation, many natural processes and cultural practices that historically shaped the region's biodiversity have been significantly diminished. Dams, levees, and diversions have significantly reduced the frequency and magnitude of high-water events that historically rejuvenated riverine and riparian habitats. Burning and grazing maintained grasslands, reduced thatch, promoted new growth, and enhanced habitat for native species. Restoring and maintaining these processes and practices is essential for maintaining the value of existing and restored natural habitats.

NCP Objective 1, Natural Floodplain and Geomorphic Processes: Restore and enhance hydrologic and geomorphic processes.

Metric: # of projects

Target: 10 restoration and enhancement projects implemented to restore natural floodplain and geomorphic processes

NCP Objective 2, Traditional Ecological Knowledge: Engage Tribes in the region in the design, implementation, monitoring, and management of conservation and stewardship projects. Incorporate Tribal values and practices into projects in partnership with Native peoples.

Metric: # of partnerships

Target: 10 partnerships by 2025

NCP Objective 3, Integrated Pest Management: Implement integrated pest management practices, which focus first on preventative practices and cultural control methods to reduce invasive plants and animal pests before resorting to more intensive practices, such as chemical control.

Metric: Integration into agency guidance, restoration projects, project specifications

Target: 10 restoration projects that include integrated pest management practices in construction specifications

NCP Objective 4, Grazing Management: Promote and implement grazing management practices that improve soil health and improve conditions for native species.

Metric: Acres where grazing management practices that benefit species are implemented.

Target: 50 percent of grasslands and agricultural lands currently used for grazing with a conservation management plan focused on improving outcomes for focal species or communities.

NCP Objective 5, Soil Development and Retention: Promote and implement regenerative agriculture practices that build soil quantity, quality, and capacity.

Metric: # acres incorporating regenerative agriculture practices, # of projects.

Target: 10 % (128,683 acres) of existing agricultural lands (1,286,833 acres) incorporating regenerative agriculture practices

10 projects implementing regenerative agricultural practices for to increase soil resilience

4.4.5 Focal Species (FS) Goal

Goal 5: Protect and restore habitat for focal species and undertake active reintroductions where appropriate. While the provision and connection of habitat is essential for species recovery, individual species also have specific life history requirements and needs that may go beyond habitat alone. For example, populations need to be healthy and not suffer mortality because of disease, invasive species, predation, pollution, human-interactions, or other unnatural causes. Habitat also needs to have sufficient quality, quantity, and diversity to support a minimum population size and all life stages. Some previous planning efforts, such as the Central Valley Joint Venture Implementation Plan (CVJV 2020) and the Central Valley Flood Protection Plan's supporting Conservation Strategy (CDWR 2016) have identified potential amounts of specific habitat types needed to recover sensitive species. Where available, these numbers are used to set acreage targets for this RCISs metric targets for measuring objective success. In other cases, a target of a 10% increase from existing habitat acres was used. Objectives are provided for each focal species in the RCIS with targets set regarding habitat. However, additional metrics that measure population survival and expansion listed in Section 4.3.6 are also appropriate measures of success.

FS Objective 1, Salmonids: Promote the persistence of sustainable and resilient focal salmonid populations through removing passage barriers and the protection, enhancement, and restoration of habitat, particularly for spawning and rearing.

Metric 1: # of acres of accessible, quality habitat for breeding, foraging, rearing, and migrating.

Target: Increase amount of floodplain inundation per the CVFPP's CS measurable objectives (CDWR, 2016):

- Additional 3,400 acres of floodplain inundated by flows of a timing, duration, and frequency adequate for fish rearing in the Upper San Joaquin River CPA and up to an additional 25,700 acres in the Lower San Joaquin River CPA

Target: Increase amount of riparian and riverine habitat per CVFPP's Conservation Strategy measurable objectives (CDWR, 2016) and CVJV Implementation Plan (CVJV, 2020):

- 2,100 acres of additional riparian habitat on the active floodplain of the Upper San Joaquin River CPA and an additional 8,800 acres in the Lower San Joaquin River CPA (CDWR, 2016)

- 102 miles of additional riparian-lined bank in the Upper San Joaquin River CPA and an additional 52 miles in the Lower San Joaquin River CPA (CDWR, 2016)
- 29 miles of additional natural bank in the Upper San Joaquin River CPA and an additional 25 miles in the Lower San Joaquin River CPA (CDWR, 2016)
- Up to 2,100 acres of additional river meander potential in the Upper San Joaquin River CPA and an additional 3,400 acres of river meander potential in the Lower San Joaquin River CPA (CDWR, 2016)
- Additional 83,680 acres of Riparian Habitat (CVJV 2020)

Metric: # of barriers to adult and juvenile anadromous fish passage removed or remediated

Target: 30 barriers removed and/or remediated

FS Objective 2, California Tiger Salamander: Promote persistence of sustainable and resilient California tiger salamander populations through protection, enhancement, and restoration of suitable aquatic and upland habitat and habitat corridors.

Metric: # of acres of suitable aquatic breeding and upland habitat, creation of habitat preserves following USFWS guidance (USFWS 2017a)

Target: 10% (18,040 acres) increase of breeding habitat (180,401 existing acres) and a 10% (12,724 acres) increase of upland habitat (12,7,240 existing acres)

Establish 1 preserve per USFWS recovery plan in the San Luis National Wildlife Refuge/ Sandy Mush Recovery Unit (USFWS 2017a)

FS Objective 3, Giant Garter Snake: Promote persistence of sustainable and resilient giant garter snake populations through protection, enhancement, and restoration of suitable aquatic and upland habitat and habitat corridors.

Metric: # of acres of suitable habitat, creation of habitat blocks following USFWS guidance (USFWS 2017b)

Target:

Increase suitable habitat acreage per CVFPP's CS measurable objectives (CDWR, 2016):

- 3,100 acres of additional agricultural land with applied wildlife-friendly practices on the active floodplain of the Upper San Joaquin River CPA and an additional 3,100 acres in the Lower San Joaquin River CPA
- 5,200 acres of additional marsh and other wetland habitat on the active floodplain of the Upper San Joaquin River CPA and an additional 6,500 acres in the Lower San Joaquin River CPA

Preserve 2 connected blocks of wetland habitat per USFWS Recovery Plan in the San Joaquin Basin Recovery Unit (USFWS 2017b):

FS Objective 4, Riparian Brush Rabbit: Promote persistence of sustainable and resilient riparian brush rabbit populations occurring through protection, enhancement, and restoration of suitable habitat and habitat corridors.

Metric: # of acres of suitable habitat, additional habitat features

Target:

- 5,000 acres of additional riparian habitat within and/or adjacent to the San Joaquin River NWR
- Provide high ground refugia in or adjacent to all populations
- Provide high ground refugia within 1000 feet of 25% of all riparian habitat along San Joaquin River and its lower tributaries

FS Objective 5, San Joaquin Kit Fox: Promote persistence of sustainable and resilient San Joaquin kit fox populations occurring through protection, enhancement, and restoration of suitable habitat and habitat corridors.

Metric: # of acres of suitable habitat

Target: 10% (60,405 acres) increase in suitable habitat (604,058 acres existing)

FS Objective 6, Western Red Bat: Promote persistence of sustainable and resilient western red bat populations occurring through protection, enhancement, and restoration of roosting and foraging habitats.

Metric: # of acres of suitable roosting and/or foraging habitat

Target: 10% (3,101 acres) increase in suitable habitat (31,014 acres existing)

FS Objective 7, Swainson's Hawk: Promote persistence of sustainable and resilient Swainson's hawk populations occurring through protection, enhancement, and restoration of suitable nesting and foraging habitat.

Metric: # of acres of suitable breeding and foraging habitat

Target: 10% (74,932 acres) increase in suitable habitat (749,324 acres existing)

FS Objective 8, Tricolored Blackbird: Promote persistence of tricolored blackbird populations through protection and enhancement of nesting and foraging habitat.

Metric: # of acres of suitable breeding and foraging habitat

Target: 10% (45,067 acres) increase of suitable habitat (450,675 acres existing)

FS Objective 9, Monarch Butterfly: Promote persistence of sustainable and resilient monarch butterfly populations occurring through protection, enhancement, and restoration of suitable habitat and habitat corridors.

Metric: # of acres of suitable breeding and foraging habitat

Target: 10% (12,915 acres) increase of suitable habitat (129,152 acres existing)

FS Objective 10, Valley Elderberry Longhorn Beetle: Promote persistence of sustainable and resilient valley elderberry longhorn beetle populations through protection, enhancement, and restoration of suitable habitat.

Metric: Suitable habitat patches per USFWS recovery plan (USFWS 2019)

Target: Establish 1 suitable habitat patch per USFWS recovery in each HUC 8 Subbasin within the RCIS area (USFWS 2019)

FS Objective 11, Delta Button-Celery: Promote persistence of sustainable and resilient delta button-celery populations through protection, enhancement, and restoration of suitable habitat.

Metric: # of acres of suitable habitat

Target: Increase suitable habitat acreage per CVFPP's CS measurable objectives (CDWR, 2016):

- 3,100 acres of additional agricultural land with applied wildlife-friendly practices on the active floodplain of the Upper San Joaquin River CPA and an additional 3,100 acres in the Lower San Joaquin River CPA

4.4.6 Measuring Objectives

The objectives in this RCIS include metrics for tracking progress toward achieving the goals of the RCIS. Progress toward achieving these objectives should be measured over the 10-year approval period of the RCIS (CDFW, 2023). Metrics are intended to measure the net change of habitat area or habitat quality due to implementing an action. This RCIS accepts the following metrics to track progress:

- Acreage
- Linear feet
- Vigor index (health of plant on a scale of 1–4)
- Percent cover (native vs. nonnative species)
- Native species diversity
- Number of individuals
- Number of populations
- Gene pool/genetic diversity
- Evidence of presence and abundance (e.g., presence/absence, number of nests, calls, scat)
- Habitat structure (e.g., number of canopy layers, percent cover, snags)
- Distribution of key resources (e.g., nesting trees, ponds, host plants) (number per acre)
- Inundation duration (consecutive days)
- Water depth (feet)
- Water volume (acre-feet)
- Streamflow (cubic feet per second)
- Water temperature and chemical composition (e.g., dissolved oxygen)
- Stream substrate composition (e.g., percent cover, gravel size)
- Stream characterization (pool, riffle, run) (length and width)
- Habitat connectivity (e.g., connectivity structures, protected/restored land that connects habitat blocks)

4.5 Priorities and Actions

This section presents the priorities and actions identified to support each goal and objective of this RCIS. Each action is associated with at least one conservation element.

Action

- Specific activities that can be implemented to achieve the objectives. Actions include among others: preserving, restoring, or enhancing land; land management activities including cultural practices; and activities that prevent species mortality.

Priority

- A targeted list of actions (e.g., land acquisition, preservation, or habitat establishment) or locations that are important for the conservation of focal species and other conservation elements within an RCIS area.

While goals and objectives remain stable, actions and priorities should evolve over time as new knowledge is gained and the landscape changes. The plan is designed to allow for the addition of new or revised actions as they are suggested by the RCIS sponsor and approved by the California Department of Fish and Wildlife.

4.5.1 Priorities

The priorities in this RCIS were identified by considering the existing landscape, the distribution of conservation elements (including focal species), and known or anticipated future changes to the landscape that may result from land use changes as a result of development, restoration, climate change, or policy change. The priorities were initially proposed based on review of reference documents, including the CVFPP's supporting Conservation Strategy, species recovery plans, and other existing conservation strategies. These were then refined based on steering committee input. The priorities are listed here by goal and tied to the conservation elements as noted.

4.5.1.1 Priority Locations

Priority locations are those areas within the RCIS area where existing or potential conservation or restoration may have the cumulative greatest benefit for multiple conservation elements (Figure 4-1).

A. **Grasslands Ecological Area (GEA), including the Volta Wildlife Area** – GEA is a designated Ramsar site (wetland of international importance). At 250 square miles, it is the largest remaining contiguous block of freshwater wetlands in California and consists of several federal and state protected areas (Ramsar, 2005). Actions within the GEA benefit numerous conservation elements, including focal and non-focal species that live in this area (particularly giant garter snake, waterfowl, tricolored blackbird, vernal pool branchiopods, delta button-celery) and freshwater wetlands and vernal pool habitats.

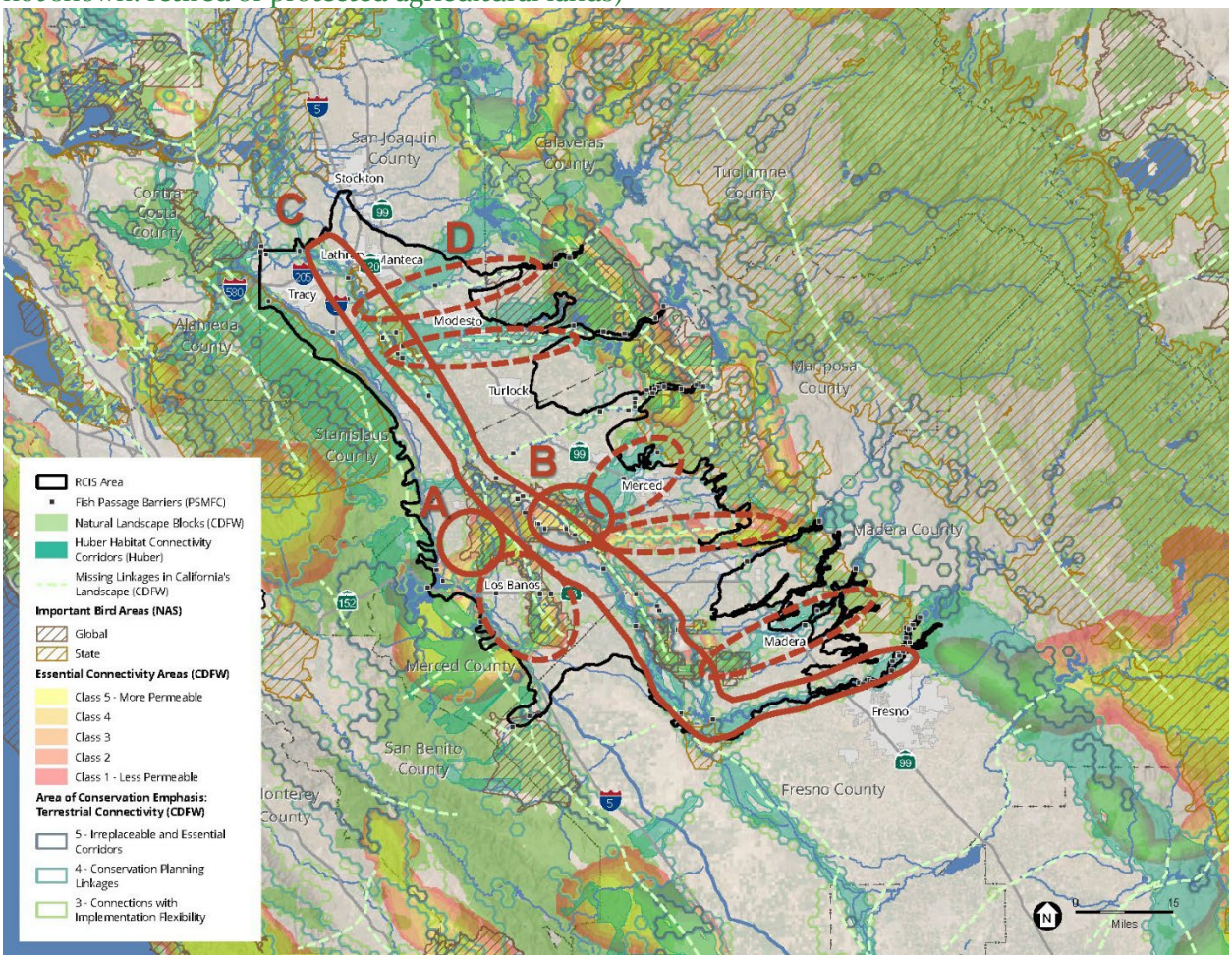
B. **Sandy Mush Road/San Luis National Wildlife Refuge (NWR) Complex Corridor** – Sandy Mush Road extends west from the Merced NWR (within the GEA and part of the San Luis NWR Complex) through grasslands and agricultural lands. This is an important corridor with potential to connect remnant patches of habitat with existing protected areas and undeveloped portions of Merced County. It benefits habitat connectivity broadly, but also California tiger salamander, San Joaquin kit fox, and grassland and vernal pool habitat. Nearby are historic stream channels that could be restored to support riverine and riparian habitat and associated aquatic species.

C. **San Joaquin River Corridor** – The San Joaquin River corridor is at the heart of this RCIS Area. Extending from the Delta to Fresno, this river system has been the focus of numerous restoration and protection efforts and serves as habitat for many of the species in this RCIS. The CVFPP's supporting Conservation Strategy identifies the need to restore natural bank, riparian cover, river meander potential, and floodplain connection (CDWR, 2022), which would benefit riparian and riverine habitats, hydrogeomorphic processes, habitat connectivity, and riverine and riparian-associated species (particularly salmonids).

D. **Other Major River Corridors (Merced, Stanislaus, Tuolumne Rivers and Los Banos Creek)** – Like the San Joaquin River, these tributaries provide valuable habitat for riverine- and riparian-dependent species (particularly salmonids and riparian brush rabbit) and connectivity across the Central Valley.

E. **Retired or Protected Agricultural Lands** – Agricultural lands retired as a result of SGMA or other market conditions, particularly those along rivers and terrestrial corridors or adjacent to existing protected habitat, provide opportunities for conservation and restoration. Working agricultural lands that are under protection for wildlife-friendly agricultural practices provide a surrogate for natural habitat. They may improve ecosystem benefits such as groundwater sustainability as well as habitat connectivity. Depending on land characteristics and location, focal species that could benefit include California tiger salamander, San Joaquin kit fox, Swainson's hawk, and tricolored blackbird, among others.

Figure 4-1. Essential Connectivity Areas and Areas of Conservation Emphasis (Priority locations not shown: retired or protected agricultural lands)



4.5.1.2 Priority Actions

For each of the five themes, priority actions are listed first in the tables below (Table 4-1, Table 4-2, Table 4-3, and Table 4-4) and are indicated with **. Additionally, actions that achieve multiple guiding principles are priorities. For example, a multi-benefit, nature-based, climate resilient project should be prioritized over a project that does not follow any of these guiding principles.

Table 4-1. Conserve Actions

Action #	Action Title	Action Description	Conservation Element	Pressures Addressed	Objectives Contributed to
Cons-1**	Protect suitable or potentially restorable habitat	Protect parcels from development through fee title purchase, conservation easement, or deed restriction. Support landowners interested in protecting parcels through the Williamson Act, Central Valley Habitat Exchange Program, or habitat easement programs as incentive to restore habitat for at-risk wildlife species (EDF, 2023).	▪ All Focal Conservation Elements	▪ Land Conversion and Development	▪ WM Objectives 1, 2, 4 ▪ All LH Objectives ▪ All HC Objectives ▪ NCP Objectives 1, 5 ▪ All FS Objectives
Cons-2**	Plan for long-term stewardship and management	Plan for long-term stewardship, funding, management, and monitoring of protected lands.	▪ All Focal Conservation Elements	▪ Land Conversion and Development	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives
Cons-3**	Collaborate with state and federal water acquisition programs	Collaborate with state and federal water supply and acquisition programs to dedicate instream water to major rivers and streams, and for managed freshwater wetlands.	▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands ▪ Hydrogeomorphic Processes ▪ Salmonids ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk ▪ Tricolored Blackbird ▪ Monarch Butterfly ▪ Valley Elderberry Longhorn Beetle ▪ Delta Button-Celery	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development ▪ Climate Change	▪ WM Objectives 2, 4 ▪ LH Objectives 1, 2A, 2B ▪ HC Objective 4 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3, 4, 6, 7, 8, 9, 10, 11

Action #	Action Title	Action Description	Conservation Element	Pressures Addressed	Objectives Contributed to
Cons-4**	Protect terrestrial migration corridor	Acquire, protect, and/or restore key migration corridors. Include habitat adjacent to crossing structures and areas that allow species to adapt to projected changes in habitat suitability. Include areas that support vitality of source and receiving populations. Preserve habitat connectivity for a diversity of habitat types across north-south and east-west gradients (CVLCP, 2017; USFWS, 1998).	▪ Habitat Connectivity ▪ Hydrogeomorphic Processes ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ California Tiger Salamander ▪ San Joaquin Kit Fox ▪ Monarch Butterfly ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk	▪ Land Conversion and Development	▪ LH Objectives 1, 2A, 2B, 3, 4 ▪ All HC Objectives ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 2, 3, 5, 6, 7, 9,
Cons-5**	Protect intermittent in-channel wetlands	Protect small patches of wetlands with dense vegetation along interconnected waterways, such as streams or unlined canals.	▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ Giant Garter Snake ▪ Delta Button-Celery	▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objectives 2, 4 ▪ LH Objectives 1, 2B ▪ HC Objectives 3, 4 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3, 11
Cons-6	Zoning and urban planning	Promote zoning and urban planning policies that restrict inappropriate urban development or conversion of undeveloped landscapes to permanent agriculture. Support local governments in developing habitat conservation plans or mitigation policies that include land-use protection measures (USFWS, 2005).	▪ All Focal Conservation Elements	▪ Land Conversion and Development	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ NCP Objectives 1, 3, 5 ▪ All FS Objectives

Action #	Action Title	Action Description	Conservation Element	Pressures Addressed	Objectives Contributed to
Cons-7	Protect federally designated critical habitat and support federal species recovery plans.	Protect areas within USFWS-designated core areas and NMFS- and USFWS-designated critical habitat for federally listed wildlife and plant species (USFWS, 2005), and support implementation of approved recovery plans for federally listed wildlife and plant species.	▪ Grasslands ▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands ▪ Vernal Pools ▪ Salmonids ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ San Joaquin Kit Fox ▪ Valley Elderberry Longhorn Beetle	▪ Land Conversion and Development	▪ WM Objectives 2, 3, 4 ▪ LH Objectives 1, 2A, 2B, 3, 4 ▪ All HC Objectives ▪ All NCP Objectives ▪ FS Objectives 1, 2, 3, 5, 10
Cons-8	Protect land surrounding sensitive aquatic habitat	Protect upland areas surrounding sensitive aquatic habitats (e.g., existing vernal pool complexes).	▪ Vernal Pools ▪ Riparian and Riverine Corridors ▪ Habitat Connectivity ▪ Hydrogeomorphic Processes ▪ Freshwater Wetlands ▪ California Tiger Salamander ▪ Swainson's Hawk ▪ Giant Garter Snake ▪ Valley Elderberry Longhorn	▪ Land Conversion and Development ▪ Disrupted Hydrology and Sediment Supply	▪ All WM Objectives ▪ LH Objectives 1, 2A, 2B, 4 ▪ HC Objective 4 ▪ NCP Objectives 4, 5 ▪ FS Objectives 2, 3, 7, 10
Cons-9	Protect parcels with known California tiger salamander habitat	Acquire parcels with known breeding occurrences and adjacent dispersal and/or terrestrial habitat, as well as parcels with unoccupied suitable habitat, for California tiger salamander through fee title purchase or conservation easement. Prioritize habitats with vernal pools or other ephemeral breeding ponds and habitat that create corridors between metapopulations (USFWS, 2017a).	▪ California Tiger Salamander ▪ Vernal Pools ▪ Habitat Connectivity ▪ Freshwater Wetlands ▪ Grasslands	▪ Land Conversion and Development	▪ WM Objective 1 ▪ LH Objectives 1, 3, 4 ▪ HC Objective 2, 3, 4 ▪ FS Objective 2

Action #	Action Title	Action Description	Conservation Element	Pressures Addressed	Objectives Contributed to
Cons-10	Create California tiger salamander preserves	Create California tiger salamander habitat preserves in accordance with guidelines developed by USFWS (2017a). This includes habitat with suitable breeding and upland characteristics, with a goal of reaching a minimum of 3,398 acres per preserve. Prioritize habitats with vernal pools or other ephemeral breeding ponds and habitats that create corridors between metapopulations in accordance with guidelines developed by USFWS (2017a).	▪ California Tiger Salamander ▪ Vernal Pools ▪ Habitat Connectivity ▪ Freshwater Wetlands ▪ Grasslands	▪ Land Conversion and Development	▪ WM Objective 1 ▪ LH Objectives 1, 3, 4 ▪ HC Objectives 2, 3, 4 ▪ FS Objective 2
Cons-11	Acquire large habitat blocks for giant garter snake	Acquire giant garter snake habitat blocks and support restoration of parcels containing habitat features in line with guidelines developed by USFWS (2017b). This includes habitat (with a goal of 539-acre blocks or larger) within 5 miles of and connected to comparable or larger areas of marsh by habitat corridors. Through the acquisition and restoration of habitat, corridors should aim to be at least 0.5 mile wide.	▪ Giant Garter Snake ▪ Habitat Connectivity ▪ Grasslands ▪ Freshwater Wetlands	▪ Land Conversion and Development	▪ WM Objective 1 ▪ LH Objective 1 ▪ HC Objectives 1, 3, 4 ▪ FS Objective 3
Cons-12	Protect buffers of focal species habitat	Work with city and county governments to protect 200- to 800-feet buffer areas around focal species habitat through property acquisition, conservation or agricultural easements, or land use planning (USFWS, 2017b). If not already protected, species habitat should be protected as well.	▪ All Focal Species and Vegetation Communities	▪ Land Conversion and Development	▪ All LH Objectives ▪ All FS Objectives
Cons-13	Protect San Joaquin kit fox dispersal corridors and large landscape blocks	Protect broad dispersal corridors (landscape linkages) through acquisition, easement, or safe harbor initiatives for large landscape blocks (ideally at least 10,000 acres) supporting known breeding occurrences of San Joaquin kit fox and adjacent dispersal habitat through fee title purchase or conservation easement (USFWS, 1998, 2020d). Focus protection efforts near already protected areas, linkage habitats, and core and/or satellite populations.	▪ San Joaquin Kit Fox ▪ Habitat Connectivity ▪ Grasslands	▪ Land Conversion and Development ▪ Climate Change	▪ WM Objective 1 ▪ LH Objective 3 ▪ HC Objectives 1, 2, 3, 4 ▪ FS Objective 5

Action #	Action Title	Action Description	Conservation Element	Pressures Addressed	Objectives Contributed to
Cons-14	Protect valley elderberry longhorn beetle preserves	Protect valley elderberry longhorn beetle habitat patches in each USGS HUC 8 subbasin hydrologic boundary (USGS, 2013) per USFWS (2019) guidance. USFWS recommends each subbasin should have 5 patches, with a goal that each is at least 656 feet long and no more than 12.4 miles from the nearest adjacent protected suitable habitat patch along the same river system of major drainage (USFWS, 2019).	▪ Valley Elderberry Longhorn Beetle ▪ Riparian and Riverine Corridors ▪ Habitat Connectivity	▪ Land Conversion and Development ▪ Climate Change	▪ LH Objective 2A ▪ HC Objectives 1, 2, 3, 4 ▪ FS Objective 10
Cons-15	Acquire protections on rail mitigation lands	Work with the California High-Speed Rail Authority to protect 10,000 acres of wildlife-friendly lands in and around the GEA (HSRA, 2022)	▪ Habitat Connectivity ▪ Grasslands ▪ Vernal Pools ▪ Freshwater Wetlands ▪ San Joaquin Kit Fox ▪ California Tiger Salamander ▪ Swainson's Hawk ▪ Tricolored Blackbird	▪ Land Conversion and Development	▪ WM Objective 1 ▪ LH Objectives 1, 3, 4 ▪ HC Objectives 2, 3, 4 ▪ FS Objectives 2, 5, 7, 8

Table 4-2. Restore Actions

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-1**	Plan and implement multi-benefit water projects	Plan and implement multi-benefit projects or actions that enhance, restore, or create natural communities and habitats for focal and non-focal conservation elements. For example, a project could create wetlands for groundwater management that also provide and hold enough water to support habitat features for tricolored blackbird during wet years (Kyle, 2011). Use tools that support multi-benefit actions, such as the Groundwater Recharge Assessment Tool or the San Joaquin Valley Decision Support Tool, to inform siting of groundwater sustainability projects. Decision support tools may need to be adapted to incorporate focal or non-focal species' habitats and ecological needs (e.g., habitat connectivity, minimum patch size) for siting projects intended to benefit focal species. Prioritize siting groundwater basins and injection wells in areas that can provide buffers to natural habitat areas when transitioning from urban to natural habitat. Support and direct funding to willing landowners or project proponents to participate in multi-benefit actions such as groundwater sustainability projects or to implement management actions that are aligned with the SGMA's or the CVFPP's conservation or groundwater sustainability objectives. This includes landowners who reduce groundwater demand and reallocate limited groundwater supplies to others for use in multi-benefit projects.	▪ All Focal Conservation Elements	▪ Disrupted Natural Hydrology and Sediment Supply	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-2**	Promote fluvial processes	Allow floods to promote fluvial processes, such that bare mineral soils are available for natural recolonization of vegetation, desirable natural community vegetation is regenerated, and structural diversity is promoted; or implement management actions that mimic those natural disturbances (SJCOG, 2000).	▪ Hydrogeomorphic Processes ▪ Groundwater Sustainability ▪ Freshwater Wetlands ▪ Working Lands ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk ▪ Tricolored Blackbird ▪ Monarch Butterfly ▪ Valley Elderberry Longhorn Beetle ▪ Delta Button-Celery	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Climate Change	▪ WM Objectives 1, 2, 4 ▪ LH Objectives 1, 2A, 2B, 5 ▪ HC Objectives 1, 4 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3, 4, 6, 7, 8, 9, 10, 11

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-3**	Support riparian structural diversity	Ensure floodplain enhancement actions include maintenance of a variety of ages, size classes, and structures of riparian vegetation (CDWR, 2016). Include plant species that will create a variety of canopy levels when planning riparian forest restoration and enhancement projects—include instream and overhanging vegetation cover. Enhance biomass of overhanging or fallen branches and instream plant material to support the aquatic food web, including terrestrial and aquatic invertebrates that provide food for fish, and to provide habitat complexity that supports a high diversity and abundance of native fish species (CVLCP, 2017).	▪ Riparian and Riverine Corridors ▪ Salmonids ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk ▪ Monarch Butterfly ▪ Valley Elderberry Longhorn Beetle	▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objectives 1, 3, 4 ▪ LH Objectives 2A, 2B ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3, 4, 6, 7, 9, 10
Rest-4	Restore native landscape and managed wetlands	Restore native vegetation and managed wetland communities by converting developed land or noncompatible agricultural land uses to habitat types beneficial to associated focal and non-focal species.	▪ All Focal Conservation Elements	▪ Land Conversion and Development	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives
Rest-5	Incorporate prescribed fire into management programs	Incorporate prescribed fire and managed wildfire into management programs where fires historically occurred naturally, where feasible.	▪ All Terrestrial Conservation Elements	▪ Land Conversion and Development ▪ Climate Change	▪ LH Objectives 3, 5 ▪ NCP Objectives 2, 3, 4 ▪ FS Objectives 2, 5, 6, 7, 8, 9

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-6	Implement water quality enhancement practices	Implement water quality enhancement practices that decrease harmful water quality issues such as selenium, nitrates, or salinity. Use practices including those that increase water circulation, control algae, and manage timing and duration of flood control actions.	▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands ▪ Salmonids ▪ Giant Garter Snake	▪ Water Pollutants and Discharges	▪ WM Objective 3 ▪ LH Objectives 1, 2A, 2B ▪ NCP Objective 2 ▪ FS Objectives 1, 3
Rest-7	Implement beneficial agricultural practices for aquatic habitats and species	Implement agricultural practices that protect wetland habitats and benefit species. This may include but is not limited to: ▪ Planting and maintaining vegetation buffers along waterways and adjacent to natural vegetation to diminish the adverse effects of agricultural practices on habitats. ▪ Increasing soil water retention and groundwater management. ▪ Improving water quality (e.g., conjunctive use, slow-it-spread-it-sink-it). ▪ Providing complementary habitat features for focal species (e.g., upland refugia and hibernacula for giant garter snake) (CDWR, 2016; CVLCP, 2017). ▪ Managing vegetation in canals/ditches and/or adjoining uplands.	▪ Groundwater Sustainability ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Vernal Pools ▪ Working Lands ▪ Salmonids ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Tricolored Blackbird ▪ Delta Button-Celery ▪ Swainson's Hawk ▪ Western Red Bat	▪ Water Pollutants and Discharges ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 1, 2, 3 ▪ LH Objectives 1, 2A, 2B, 4, 5 ▪ HC Objectives 3, 4 ▪ All NCP Objectives ▪ FS Objectives 1, 2, 3, 6, 8, 11

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-8	Utilize excess water flows for conservation	Maintain and/or restore water infrastructure to take advantage of high flow or precipitation events. Capture water to apply it to areas for groundwater management and maintenance (e.g., wetlands). In coordination with willing landowners, flood appropriate fields when excess surface water is available to provide groundwater recharge, flood control, and wildlife habitat benefits. Develop off-channel storage (new storage infrastructure). For example, use agricultural fields and wetlands for water storage during high flows, or release water later in the season (CVLCP, 2017).	▪ Groundwater Sustainability ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Working Lands ▪ Hydrogeomorphic Processes ▪ Salmonids ▪ Tricolored Blackbird	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Climate Change	▪ WM Objectives 1, 2, 4 ▪ LH Objectives 1, 2A, 2B, 5 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 8
Rest-9	Implement beneficial dam and flood release timing	Develop and apply criteria to ensure water releases from dams and other flood operations are compatible with species' ecological needs. Work with dam operators to shape hydrographs and create pulse flow in winter and spring to support native aquatic species, particularly breeding amphibians and reptiles, and to meet water flow and water temperature life stage requirements (including migration as a life stage) for multiple fish species in existing fish habitat (CVLCP, 2017). Provide flow releases that seasonally inundate floodplains, scour banks, create new floodplain, and modify floodplain topography for focal species (CDWR, 2016).	▪ Hydrogeomorphic Processes ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk ▪ Tricolored Blackbird ▪ Monarch Butterfly ▪ Valley Elderberry Longhorn Beetle ▪ Delta Button-Celery	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Climate Change	▪ WM Objectives 2, 4 ▪ LH Objectives 2A, 2B ▪ NCP Objective 1 ▪ FS Objectives 1, 2, 3, 4, 6, 7, 8, 8, 9, 10, 11

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-10	Support rotational wetlands program	Support development of a rotational wetlands program for the RCIS area that allows local landowners to temporarily fallow suitable lands by converting them to multi-benefit areas for short cycles (1-4 years) before they are returned to pre-fallow condition, to provide increased groundwater infiltration, regional benefits for focal and non-focal conservation elements, and economic benefits.	▪ Groundwater Sustainability ▪ Freshwater Wetlands ▪ Working Lands ▪ Tricolored Blackbird	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 1, 2 ▪ LH Objectives 1, 5 ▪ NCP Objective 5 ▪ FS Objective 8
Rest-11	Plant and manage pollinator friendly habitat	Plant and manage pollinator friendly habitat on and near working lands, grasslands, wet meadows, wetlands, and other appropriate native habitats (CVLCP, 2017; Monarch Joint Venture, 2021).	▪ Working Lands ▪ Grasslands ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Vernal Pools ▪ Monarch Butterfly	▪ Climate Change ▪ Agriculture and Livestock/ Ranching	▪ WM Objective 1 ▪ All LH Objectives ▪ NCP Objectives 2, 3, 5 ▪ FS Objective 9
Rest-12	Manage beneficial habitat and climate-resilient vegetation management practices	Manage grazing regimes to promote native wildlife and plant species, including through targeted removal of non-native plant species, to promote diversity of habitat structure and function. Manage vegetation of floodways to sustain habitat for focal species but not reduce flood protection (CDWR, 2016) and implement management such as grazing regimes that maximize water and soil retention. Implement rangeland best management practices to improve resiliency to drought and wildfire, such as using appropriate stocking rates, seasonal grazing, fencing, land fallowing, and fire-resilient native plant restoration (CVLCP, 2017).	▪ Working Lands ▪ Grasslands ▪ Groundwater Sustainability ▪ Swainson's Hawk ▪ Riparian and Riverine Corridors ▪ Giant Garter Snake ▪ Tricolored Blackbird ▪ San Joaquin Kit Fox ▪ Western Red Bat	▪ Land Conversion and Development ▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching ▪ Climate Change	▪ WM Objective 1 ▪ LH Objectives 2A, 2B, 3, 5 ▪ NCP Objectives 4, 5 ▪ FS Objectives 3, 5, 6, 8

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-13	Implement multi-benefit agricultural practices	Implement best management practices for agricultural land restoration demonstrated to provide multiple benefits and promote ecosystem health. This includes regenerative production practices (e.g., rotational grazing), restoration of drought- and fire-resilient native plant communities, vernal pool and grassland conservation, oak woodland regeneration or conservation, riparian corridor protection, soil and water retention, groundwater sustainability, bat and burrowing mammal habitat creation, and carbon management and sequestration processes (CVLCP, 2017). This can also include planting cover crops, conducting controlled burns, planting native hedgerows, creating secondary channels to improve flow, and removing non-native and dense vegetation that impedes flow or degrades habitat (CDFW, 2016).	▪ Working Lands ▪ Vernal Pools ▪ Grasslands ▪ Riparian and Riverine Corridors ▪ Groundwater Sustainability ▪ Western Red Bat ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ San Joaquin Kit Fox ▪ Swainson's Hawk	▪ Agriculture and Livestock/ Ranching ▪ Climate Change	▪ WM Objective 1 ▪ LH Objectives 2A, 2B, 3, 4, 5 ▪ NCP Objectives 2, 3, 4, 5 ▪ FS Objectives 2, 3, 5, 6, 7, 8
Rest-14	Restore water sources for degraded wetlands	Implement projects and practices that restore and enhance degraded wetlands, such as diverting water, removing impervious surfaces, moving livestock away from water sources, or changing vegetation to better support water availability for wetlands.	▪ Freshwater Wetlands ▪ Hydrogeomorphic Processes ▪ Working Lands ▪ Tricolored Blackbird ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Delta Button-Celery	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development	▪ WM Objectives 1, 2, 4 ▪ LH Objective 1 ▪ NCP Objectives 1, 2 ▪ FS Objectives 2, 3, 8, 11

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-15	Utilize nature-based solutions for riparian restoration	Utilize nature-based solutions that integrate riparian restoration for riverbank stabilization instead of conventional riprap.	▪ Riparian and Riverine Corridors ▪ Giant Garter Snake ▪ Salmonids ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk ▪ Tricolored Blackbird ▪ Monarch Butterfly ▪ Valley Elderberry Longhorn Beetle	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Climate Change	▪ WM Objectives 1, 3, 4 ▪ LH Objectives 2A, 2B ▪ NCP Objectives 1, 2, 5 ▪ FS Objectives 1, 4, 6, 7, 8, 9, 10
Rest-16	Implement regenerative vegetation management in riparian areas	Implement regenerative vegetation management practices, such as grazing, in riparian corridors to prevent negative impacts and enhance habitat values (CVLCP, 2017).	▪ Riparian and Riverine Corridors ▪ Working Lands ▪ Habitat Connectivity ▪ Salmonids ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk ▪ Monarch Butterfly ▪ Valley Elderberry Longhorn Beetle	▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 1, 3, 4 ▪ LH Objectives 2A, 2B, 5 ▪ HC Objectives 1, 3, 4 ▪ All NCP Objectives ▪ FS Objectives 1, 3, 4, 6, 7, 8, 10

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-17	Plant climate-resilient plant communities	Plant diverse compositions of native species to restore drought- and fire-resilient communities and manage specifically for shrubs as refugia (e.g., moderate air temperature) and perennial grasses as a food source. Restore perennial grasses and forbs (CVLCP, 2017).	▪ Grasslands ▪ Working Lands ▪ Freshwater Wetlands ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ San Joaquin Kit Fox ▪ Western Red Bat ▪ Swainson's Hawk ▪ Tricolored Blackbird ▪ Riparian Brush Rabbit	▪ Climate Change	▪ WM Objectives 1, 3, 4 ▪ LH Objectives 1, 3, 5 ▪ HC Objective 4 ▪ NCP Objectives 2, 3, 4 ▪ FS Objectives 2, 3, 4, 5, 6, 7, 8
Rest-18	Manage grasslands to support habitat values	Manage vegetation through manual clearing, grazing, or controlled burning in grasslands to reduce dominance of non-native grasses and forbs and improve habitat for wildlife, particularly where grasslands are adjacent to sensitive habitats (like vernal pools).	▪ Grasslands ▪ Vernal Pools ▪ Working Lands ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ San Joaquin Kit Fox ▪ Western Red Bat ▪ Swainson's Hawk ▪ Tricolored Blackbird	▪ Agriculture and Livestock/ Ranching ▪ Invasive Species and Pathogens	▪ WM Objective 1 ▪ LH Objectives 3, 4, 5 ▪ NCP Objectives 2, 3, 4. 5 ▪ FS Objectives 2, 3, 5, 6, 7, 8

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-19	Include vernal pool upland buffers	Include suitable upland buffers in vernal pool restoration plans to protect and promote watersheds, pollinators of vernal pool plants, dispersal of vernal pool species, and hawks and other important predators (USFWS, 2005, 2023a).	▪ Vernal Pools ▪ Grasslands ▪ California Tiger Salamander	▪ Land Conversion and Development	▪ WM Objective 1 ▪ LH Objectives 3 ,4 ▪ HC Objective 4 ▪ NCP Objectives 2, 3, 4 ▪ FS Objective 2
Rest-20	Develop and implement grazing plans for vernal pools	Develop and implement management and grazing plans that protect and enhance vernal pools with an emphasis on protecting hydroperiods and minimizing impacts of non-native species (USFWS, 2005). Plans should not negatively impact special-status plants or wildlife.	▪ Vernal Pools ▪ Working Lands ▪ California Tiger Salamander	▪ Invasive Species and Pathogens ▪ Climate Change ▪ Agriculture and Livestock/ Ranching	▪ WM Objective 1 ▪ LH Objectives 4, 5 ▪ NCP Objectives 2, 3, 4 ▪ FS Objective 2
Rest-21	Restore vernal pools	Restore large vernal pools, which provide distinct plant and invertebrate habitats and may attract waterfowl that are important to facilitate dispersal of seeds, crustation cysts, and amphibian eggs (CVLCP, 2017; USFWS, 2023a). Reconstruct the characteristic soil layers and hydrology as part of vernal pool restoration efforts (USFWS, 2005). This may include removing accumulated silt, repairing damaged hardpan layers, or installing impermeable layers to better support desired hydroperiod (CVLCP, 2017).	▪ Vernal Pools ▪ Hydrogeomorphic Processes ▪ Tricolored Blackbird ▪ California Tiger Salamander	▪ Land Conversion and Development ▪ Climate Change ▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objectives 1, 2 ▪ LH Objectives 3 ,4 ▪ All NCP Objectives ▪ FS Objectives 2, 8

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-22	Enhance streambank vegetation and large woody debris	Enhance vegetation along banks and install large woody material directly into streams and along stream banks without compromising flood protection.	▪ Salmonids ▪ Hydrogeomorphic Processes ▪ Riparian and Riverine Corridors	▪ Land Conversion and Development ▪ Climate Change	▪ WM Objectives 1, 3, 4 ▪ LH Objectives 2A, 2B ▪ HC Objective 1 ▪ NCP Objectives 1, 2 ▪ FS Objective 1
Rest-23	Restore historical salmonid habitat on San Joaquin River	Restore historical salmonid habitat on the San Joaquin River. Preferably between approximately River Mile 57 and118 by connecting historical sloughs and oxbows, restoring riparian habitat and floodplains, and removing invasive species (CDWR, 2012).	▪ Salmonids ▪ Riparian and Riverine Corridors ▪ Hydrogeomorphic Processes ▪ Habitat Connectivity	▪ Land Conversion and Development ▪ Water Pollutants and Discharges ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Invasive Species and Pathogens	▪ All WM Objectives ▪ LH Objectives 2A, 2B ▪ HC Objective 1 ▪ NCP Objectives 1, 2 ▪ FS Objective 1

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-24	Implement San Joaquin River Restoration Program recommendations	Implement the recommendations and guidelines of the San Joaquin River Restoration Program (SJRRP, 2018) including improvement of streamflow conditions; establishment of suitable habitat; and establishment of spring-run and fall-run Chinook salmon that are naturally reproducing, genetically and demographically diverse, and show no signs of hybridization (NMFS-designated Priority 1 Recovery Actions for the Southern Sierra Nevada Diversity Group) (NMFS, 2014; SJRRP, 2010).	▪ Salmonids ▪ Hydrogeomorphic Processes ▪ Riparian and Riverine Corridors	▪ Climate Change ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Water Pollutants and Discharges	▪ All WM Objectives ▪ LH Objectives 2A, 2B ▪ HC Objective 1 ▪ NCP Objectives 1, 2 ▪ FS Objective 1
Rest-25	Manage pond vegetation features for California tiger salamander	Manage upland vegetation structure and density (e.g., low-growing and less-dense non-native plants) and aquatic pond vegetation to sustain suitable habitat features for California tiger salamander.	▪ California Tiger Salamander ▪ Vernal Pools ▪ Freshwater Wetlands ▪ Grasslands ▪ Habitat Connectivity	▪ Climate Change ▪ Land Conversion and Development ▪ Invasive Species and Pathogens	▪ LH Objectives 1, 3, 4 ▪ HC Objective 2, 4 ▪ NCP Objectives 1, 2 ▪ FS Objective 2
Rest-26	Manage flood-irrigated agriculture and water supply for giant garter snake	Manage flood-irrigated fields to enhance habitat values for giant garter snake. Manage fields such that they will not overflow during winter events (CDWR, 2016). Incentivize landowners to manage water supply to giant garter snake habitat to maintain water in canals and ditches during their active period (mid-March to October) (CDWR, 2016).	▪ Giant Garter Snake ▪ Hydrogeomorphic Processes ▪ Working Lands ▪ Freshwater Wetlands	▪ Climate Change ▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objective 1, 2 ▪ LH Objectives 1, 5 ▪ HC Objectives 2, 4 ▪ NCP Objectives 2 ▪ FS Objective 3

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-27	Conduct vegetation management for riparian brush rabbit habitat	Conduct vegetation management that increases the abundance of key habitat features for riparian brush rabbit, including ecotonal edges, connectivity around open areas, and diverse food sources during the dry season (USFWS, 1998).	▪ Riparian Brush Rabbit ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors ▪ Western Red Bat ▪ Swainson's Hawk ▪ Monarch Butterfly	▪ Invasive Species and Pathogens ▪ Climate Change ▪ Land Conversion and Development	▪ WM Objectives 1, 2, 4 ▪ LH Objective 2A ▪ HC Objective 4 ▪ NCP Objectives 1, 2 ▪ FS Objectives 4, 6, 7, 9
Rest-28	Maintain vegetation structure for San Joaquin kit fox	Maintain suitable vegetation structure through compatible grazing and revegetation with low-growing and less-dense non-native plants to encourage San Joaquin kit fox occupancy in suitable habitat or areas suitable for restoration.	▪ San Joaquin Kit Fox ▪ Grasslands ▪ Working Lands	▪ Land Conversion and Development ▪ Invasive Species and Pathogens	▪ LH Objectives 3, 5 ▪ HC Objective 1, 3 ▪ NCP Objectives 3, 4 ▪ FS Objective 5
Rest-29	Increase compatible crops for Swainson's hawk foraging	Increase expanse of irrigated pasture and low-height row crops (e.g., alfalfa, beets, tomatoes), especially as alternatives to orchards and vineyards, adjacent to suitable Swainson's hawk breeding habitat to provide high prey availability throughout the crop cycle (CDWR, 2016; Woodbridge, 1998).	▪ Swainson's Hawk ▪ Working Lands	▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ LH Objective 5 ▪ HC Objective 3 ▪ FS Objective 7

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-30	Plant Swainson's hawk nest trees	Plant and maintain suitable nest trees within one mile of suitable foraging habitat for Swainson's hawk. Planted trees should be native species, such as Fremont's cottonwood (*Populus fremontii*), Goodding's black willow (*Salix gooddingii*), and valley oak (*Quercus lobata*) (Woodbridge, 1998).	▪ Swainson's Hawk ▪ Riparian and Riverine Corridors	▪ Climate Change ▪ Land Conversion and Development ▪ Invasive Species and Pathogens	▪ LH Objective 2A ▪ HC Objective 3 ▪ NCP Objectives 2, 3 ▪ FS Objective 7
Rest-31	Maintain wetland vegetation structure for tricolored blackbird	Provide appropriate cover and density of wetland vegetation for tricolored blackbird nesting near productive foraging habitat, using revegetation and vegetation management (Kyle, 2011). Maintain ecologically relevant native vegetation structure for breeding and foraging habitat through practices such as biennial prescribed burning or modified grazing practices (Tricolored Blackbird Working Group, 2007).	▪ Tricolored Blackbird ▪ Working Lands ▪ Freshwater Wetlands ▪ Grasslands	▪ Climate Change ▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 1, 2 ▪ LH Objectives 1, 3, 5 ▪ HC Objective 3 ▪ NCP Objectives 2, 3, 4 ▪ FS Objective 8

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-32	Provide floodwater habitat for tricolored blackbird	Implement suitable spring/summer flooding (i.e., standing water of 8-12 inches) of suitable tricolored blackbird breeding sites adjacent to foraging habitat to maintain habitat and reduce predator access (Kyle, 2011). Focus on locations in Merced County, especially in and adjacent to the Grasslands Ecological Area.	▪ Tricolored Blackbird ▪ Working Lands ▪ Freshwater Wetlands	▪ Climate Change ▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 1, 2 ▪ LH Objectives 1, 5 ▪ NCP Objectives 2 ▪ FS Objective 8
Rest-33	Implement tricolored blackbird-compatible agricultural practices	Implement agricultural practices that support tricolored blackbird nesting behavior and conservation options on ranches and farmlands, such as deferring harvest of grain and silage crops when possible until after the breeding season. Support community outreach programs to encourage private protection and appropriate management of active breeding colonies (Tricolored Blackbird Working Group, 2007). This may include entering into a cooperative agreement via the Tricolored Blackbird Volunteer Local Program (TRBL VLP) with the California Farm Bureau Federation to conserve nesting colonies through implementation of best management practices prescribed by the TRBL VLP (CDFW, 2019b).	▪ Tricolored Blackbird ▪ Working Lands ▪ Freshwater Wetlands ▪ Grasslands	▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 1, 2 ▪ LH Objectives 1, 3, 5 ▪ HC Objective 3 ▪ NCP Objectives 2, 3, 4 ▪ FS Objective 8
Rest-34	Plant milkweed and nectar plants	Incorporate native milkweed and a diversity of nectar plants into restored grasslands and revegetation of managed semi-natural vegetation to provide high species richness, abundance, and diversity of plants throughout the monarch butterfly breeding season (Monarch Joint Venture, 2021). Ensure that there are no areas within 100 feet of plantings where pesticides are used (USDA-NRCS and Xerces, 2014).	▪ Monarch Butterfly ▪ Grasslands ▪ Riparian and Riverine Corridors	▪ Climate Change ▪ Land Conversion and Development ▪ Invasive Species and Pathogens	▪ LH Objectives 2A, 2B, 3 ▪ NCP Objectives 2, 3 ▪ FS Objective 9

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-35	Incorporate elderberry shrubs in restoration designs for valley elderberry longhorn beetle	Incorporate elderberry shrubs into riparian restoration planning, especially within 12 miles of habitat occupied by valley elderberry longhorn beetle (CDWR, 2016) to achieve large, interconnected habitat. Plant elderberry to achieve a diversity of plant life stages and promote natural recruitment (CDWR, 2016; USFWS, 2019, 2023b).	▪ Valley Elderberry Longhorn Beetle ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors	▪ Land Conversion and Development	▪ WM Objective 4 ▪ LH Objectives 2A, 2B ▪ HC Objective 4 ▪ NCP Objectives 2, 3 ▪ FS Objective 10
Rest-36	Restore habitat near known delta celery-button occurrences	Restore seasonal wetland habitat along floodplains of the San Joaquin River and Eastside Bypass near known occurrences of delta button-celery (CDWR, 2016).	▪ Delta Button-Celery ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors	▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objective 4 ▪ LH Objectives 1, 2B ▪ HC Objective 4 ▪ NCP Objectives 1, 2, 3 ▪ FS Objective 11
Rest-37	Restore small mammal populations	Implement programs to increase small mammal populations, especially those protected by USFWS and CDFW, in areas where they have been eradicated. Work with conservation partners to increase awareness of the potential incidental adverse impacts.	▪ Working Lands ▪ Swainson's Hawk ▪ San Joaquin Kit Fox ▪ Grasslands ▪ California Tiger Salamander	▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ WM Objective 4 ▪ LH Objectives 1, 5 ▪ HC Objective 4 ▪ NCP Objectives 1, 2, 3 ▪ FS Objectives 2, 5, 7

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Rest-38	Voluntary agreements related to Bay-Delta Water Quality Control Plan	Establish voluntary agreements with the State Water Quality Control Board to implement measures to achieve water flow and habitat targets outlined in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary Plan (SWQCB 2018)	▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ Working Lands ▪ Delta Button-Celery ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Valley Elderberry Longhorn Beetle ▪ Hydrogeomorphic Processes	▪ Climate Change ▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objectives 2, 3 ▪ LH Objectives 1, 2A, 2B, 5 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3, 4, 10, 11
Rest-39	San Joaquin River Restoration Program Projects	Implement and/or support projects identified by the San Joaquin River Restoration Program to achieve compliance with the San Joaquin River Settlement Act	▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ Working Lands ▪ Delta Button-Celery ▪ Giant Garter Snake ▪ Hydrogeomorphic Processes	▪ Climate Change ▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objectives 2, 3 ▪ LH Objectives 1, 2A, 2B, 5 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3, 4, 10, 11

Table 4-3. Connect Actions

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Conn-1**	Restore fluvial connectivity and water exchange	Increase or restore fluvial connectivity and improve water exchange, temperature profiles, and dissolved oxygen concentrations through landscape restoration or installation of pumps or aerators.	▪ Groundwater Sustainability ▪ Hydrogeomorphic Processes ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands ▪ Salmonids	▪ Climate Change ▪ Water Pollutants and Discharges ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development	▪ WM Objectives 1, 2, 3 ▪ LH Objectives 1, 1, 2A, 2B ▪ HC Objective 1 ▪ NCP Objectives 1, 2 ▪ FS Objective 1
Conn-2**	Manage levees to increase adjacent habitat values	Reconstruct, improve, or maintain existing flood control structures (e.g., levees) to increase habitat values in ways that restore riparian, wetland, and floodplain habitat and reduce floodway maintenance. Providing multiple off-channel habitat opportunities is critical. This may include, but is not limited to, levee improvements around the City of Stockton, in the vicinity of Mariposa Bypass and Eastside Bypass, Deep Slough, Mud Slough and adjacent parts of the San Joaquin River (CDWR, 2012). This may also include levee setbacks and breaches between, but not limited to, Gravelly Ford and Mendota pool, in Mendota Pool Bypass and modifications of San Joaquin River Headgate Structure (NFMS, 2014). Remove levees and bank revetment or install setback levees on smaller streams. Include plans for connectivity and upland flood refugia for sensitive species into restoration designs (CDWR, 2016).	▪ Hydrogeomorphic Processes ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands ▪ Salmonids ▪ Giant Garter Snake	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development	▪ WM Objectives 2, 4 ▪ LH Objectives 1, 1, 2A, 2B ▪ HC Objectives 1, 3, 4 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Conn-3**	Lower floodway elevations for marshes	Lower floodway elevations to create marshes and to achieve greater topographic and hydrologic diversity (CDWR, 2016).	▪ Hydrogeomorphic Processes ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands ▪ Giant Garter Snake ▪ Delta Button-Celery ▪ Salmonids	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development	▪ WM Objectives 2, 4 ▪ LH Objectives 1, 1, 2A, 2B, 5 ▪ HC Objectives 1, 3, 4 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 11
Conn-4**	Improve terrestrial connectivity across infrastructure	Improve connectivity across infrastructure features (e.g., by installing large culverts, enlarging existing culverts, wildlife crossing structures, directional fencing, scuppers, barrier breaks, roadside wildlife detection systems, sound barriers), limit lighting at constructed or natural linkages, and remove existing barriers to promote wildlife movement and reduce road mortality. Design connectivity structures that consider species-specific requirements, such as structure height, surface material, vegetative screening, and lighting considerations. Focus on areas with high numbers of vehicle-related wildlife mortality, known populations, protected habitats, areas with high Area of Conservation Emphasis Terrestrial Connectivity rankings, and areas that create corridor redundancy.	▪ Habitat Connectivity ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ San Joaquin Kit Fox ▪ Riparian and Riverine Corridors	▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 2, 4 ▪ LH Objectives 1, 2A, 2B, 3 ▪ HC Objectives 2, 3, 4 ▪ NCP Objective 2 ▪ FS Objectives 2, 3, 4, 5
Conn-5	Include floodplain restoration in New South Delta Bypass design	Design, construct, and operate a new bypass in the South Delta, including or in combination with expansion of Paradise Cut or other South Delta waterways, to accommodate ecosystem restoration features and benefits. This includes conservation and restoration of aquatic and floodplain habitats and continued compatible agricultural land uses within the bypass (CDWR, 2012).	▪ Hydrogeomorphic Processes ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands ▪ Working Lands ▪ Salmonids ▪ Delta Button-Celery	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 2, 4 ▪ LH Objectives 1, 1, 2A, 2B, 5 ▪ HC Objectives 1, 3, 4 ▪ NCP Objectives 1, 2, 3, 4 ▪ FS Objectives 1, 11

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Conn-6	Create aquatic-upland connectivity	Create and maintain connectivity within and between suitable aquatic habitat and associated upland habitats to provide inundated floodplain habitats and floodwater management. This may include management of agricultural lands and refuges through vegetation management or water management to increase water use efficiency, wildlife habitat, or ecosystem function (CVLCP, 2017).	▪ Habitat Connectivity ▪ Working Lands ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Western Red Bat ▪ Vallery Elderberry Longhorn Beetle ▪ Delta Button-Celery ▪ Tricolored Blackbird ▪ Swainson's Hawk ▪ Riparian Brush Rabbit	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 2, 4 ▪ LH Objectives 1, 2A, 2B ▪ HC Objectives 2, 3, 4 ▪ NCP Objective 2 ▪ FS Objectives 1, 2, 3, 4, 6, 7, 8, 10, 11
Conn-7	Remove and mitigate aquatic barriers to migration	Maintain, enhance, and create undercrossings to facilitate movement and dispersal for aquatic species, such as modifying and expanding culverts to create more natural ecological conditions and flow (CDWR, 2016). This may be done through removal of barriers (including dams and weirs) and constrictions, expanding culverts, and breaching levees to restore fluvial connectivity and passage for fish and other aquatic species and reduce canal mortality (CVLCP, 2017). Additionally, installing fish passage structures, managing flows, and creating instream habitat between Friant Dam and Gravelly Ford and at the Sand Slough Control Structure, Stevenson Weir, Helm Canal, Sack Dam, and the Chowchilla Bypass Bifurcation Structure (CDWR, 2012) will support fish passage and aquatic habitat connectivity.	▪ Habitat Connectivity ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ Giant Garter Snake	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objective 4 ▪ LH Objectives 1, 2B ▪ HC Objectives 1, 3 ▪ NCP Objective 2 ▪ FS Objectives 1, 3

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Conn-8	Enhance riparian connectivity	Implement riparian restoration efforts that improve connectivity between existing tracts of riparian habitat, widen narrow riparian corridors, and minimize habitat edges (CVJV, 2020).	▪ Riparian and Riverine Corridors ▪ Hydrogeomorphic Processes ▪ Habitat Connectivity ▪ Salmonids ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Swainson's Hawk ▪ Monarch Butterfly ▪ Valley Elderberry Longhorn Beetle	▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching ▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objectives 2, 4 ▪ LH Objectives 2A, 2B ▪ HC Objectives 3, 4 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 4, 6, 7, 9, 10
Conn-9	Maintain key habitat linkages for San Joaquin kit fox	Maintain and enhance opportunities for movement of San Joaquin kit fox by providing linkages between key habitat areas, such as habitat within the Mendota area, Chowchilla area, Eastside Bypass, Fresno County, Ciervo-Panoche Natural Area, western Madera County, and Merced County (Sandy Mush Road and refuges) (USFWS, 1998). This may be accomplished through restoration of habitat on retired, drainage-problem farmland.	▪ San Joaquin Kit Fox ▪ Habitat Connectivity ▪ Grasslands	▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objective 1 ▪ LH Objective 3 ▪ HC Objectives 3, 4 ▪ NCP Objectives 1, 2 ▪ FS Objective 5
Conn-10	Restore riparian brush rabbit corridors	Identify and restore riparian corridors between known riparian brush rabbit populations (CDFW, 2016).	▪ Riparian Brush Rabbit ▪ Riparian and Riverine Corridors ▪ Habitat Connectivity	▪ Land Conversion and Development	▪ WM Objective 1 ▪ LH Objective 2A, 2B ▪ HC Objectives 3, 4 ▪ NCP Objectives 2, 3 ▪ FS Objective 4

Table 4-4. Learn Actions

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-1**	Identify projected climate change impacts to hydrogeomorphic conditions	Identify anticipated hydrogeomorphic conditions throughout the RCIS area in consideration of management actions and climate change; inventory natural banks and revetment locations; and update mapping of meander migration potential to support restoration project planning (CDWR, 2022). This includes efforts to update and complete mapping of natural and riparian-lined banks to support project planning (CDWR, 2022).	▪ Hydrogeomorphic Processes ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ All Focal Species	▪ Disrupted Natural Hydrology and Sediment Supply ▪ Climate Change	▪ WM Objectives 1, 2, 4 ▪ LH Objectives 1, 2A, 2B ▪ NCP Objectives 1, 2 ▪ All FS Objectives
Learn-2**	Monitor groundwater sustainability metrics	Incorporate appropriate sustainability metrics into groundwater monitoring programs and adaptive management plans to measure metrics, such as groundwater and subsidence. Groundwater monitoring may include groundwater extraction volumes, surface water application volumes, total water use, and calculated recharge potential.	▪ Groundwater Sustainability ▪ Working Lands	▪ Climate Change ▪ Land Conversion and Development	▪ WM Objectives 1, 2 ▪ LH Objective 5 ▪ NCP Objective 2
Learn-3**	Implement natural resource monitoring programs	Implement local and regional resource monitoring programs. Monitoring programs may measure habitat quantity or quality as well as species' population size, dynamics (including movement), and health. Share knowledge and results to further the goals of regional monitoring efforts and scientific databases, such as the California Natural Diversity Database and the Biogeographic Information and Observation System (BIOS). Use the results to inform conservation and restoration efforts (USFWS, 2023b).	▪ All Focal Conservation Elements	▪ Climate Change ▪ Land Conversion and Development ▪ Water Pollutants and Discharges ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-4**	Evaluate water supply and determine needs for habitat and focal conservation elements	Evaluate the existing water supply and determine whether additional water supply is necessary to meet habitat needs and management goals. For areas where additional water supply needs have been identified, secure sufficient water supply to fully develop or manage habitat for focal conservation elements. Investigate how regional differences in water conservation and water supply impact implementation of federal, state, and local initiatives and programs. This may include investigations in improvements to agricultural and urban water-use efficiency and recycling (NMFS, 2014).	▪ Working Lands ▪ Groundwater Sustainability ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Salmonids ▪ Giant Garter Snake ▪ Tricolored Blackbird ▪ Valley Elderberry Longhorn Beetle ▪ Delta Button-Celery	▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ WM Objectives 1, 2 ▪ LH Objectives 1, 2A, 2B, 5 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 3, 8, 10, 11
Learn-5	Research scientific knowledge gaps	Conduct scientific research, biological inventories, and surveys focusing on species and habitats where prior research is limited (Tricolored Blackbird Working Group, 2007; WBWG, 2017). Partner with local communities, including tribes, and schools/universities for citizen science and stewardship opportunities when possible.	▪ All Focal Conservation Elements	▪ Climate Change ▪ Land Conversion and Development ▪ Water Pollutants and Discharges ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-6	Promote residential green infrastructure awareness	Develop and promote public information programs that foster homeowner awareness of green infrastructure practices—such as installation of xeriscaping with native plants, rain gardens, pollinator gardens, and rainwater catchment systems—and the benefits these provide for water conservation, increased property values, and enhancement of urban wildlife habitat.	▪ All Focal Conservation Elements	▪ Climate Change ▪ Land Conversion and Development ▪ Water Pollutants and Discharges ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives
Learn-7	Implement environmental stewardship programs	Develop and implement education and outreach programs to encourage land and water resource stewardship, including educational programs on the value of natural landscapes and volunteer restoration and maintenance programs. Incorporate traditional ecological knowledge as well as best available science.	▪ All Focal Conservation Elements	▪ Climate Change ▪ Land Conversion and Development ▪ Water Pollutants and Discharges ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-8	Develop partnerships for water transactions and pollution management	Develop partnerships with landowners, tribes, and communities to identify and implement water and pollution management solutions. Establish agreements that promote water transactions, water transfers, shared storage, and integrated operations that benefit species' needs and water supply reliability.	▪ Groundwater Sustainability ▪ Working Lands ▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors ▪ Vernal Pools ▪ Salmonids ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Tricolored Blackbird ▪ Valley Elderberry Longhorn Beetle ▪ Delta Button-Celery	▪ Land Conversion and Development ▪ Water Pollutants and Discharges	▪ WM Objectives 1, 2, 3 ▪ LH Objectives 1, 2A, 2B, 4, 5 ▪ NCP Objectives 1, 2 ▪ FS Objectives 1, 2, 3, 4, 8, 10, 11
Learn-9	Monitor wildlife connectivity structure success	Conduct post-construction monitoring of installed crossing structures to understand species usage and any changes in vehicle-related mortality. Use study results to inform future crossing designs.	▪ Habitat Connectivity ▪ California Tiger Salamander ▪ San Joaquin Kit Fox ▪ Salmonids	▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ HC Objectives 1, 2 ▪ FS Objectives 1, 5

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-10	Identify urban habitat refuges	Collaborate with partners to increase urban farming and pollinator garden projects in developed areas that serve as habitat refuges and forage locations for migrating pollinators.	▪ Habitat Connectivity ▪ Working Lands ▪ Monarch Butterfly	▪ Land Conversion and Development	▪ LH Objective 5 ▪ HC Objective 4 ▪ NCP Objectives 2, 3 ▪ FS Objective 9
Learn-11	Identify low drainage lands	Identify parcels with low drainage capacity for land retirement (USBR, 2021). With willing landowners, consider retiring or enrolling lands in repurposing programs, if appropriate, and restore lands to support species habitat.	▪ Groundwater Sustainability ▪ Freshwater Wetlands	▪ Climate Change ▪ Land Conversion and Development	▪ WM Objectives 1, 2 ▪ LH Objective 1
Learn-12	Provide farm and habitat technical assistance	Train farm and habitat technical assistance providers on precision agriculture for pollinator habitat restoration on low production working lands (Monarch Joint Venture, 2021).	▪ Working Lands ▪ Monarch Butterfly	▪ Climate Change ▪ Land Conversion and Development	▪ LH Objective 5 ▪ FS Objective 9
Learn-13	Utilize conservation partnership programs	Enroll in conservation partnership programs such as: ▪ USDA Farm Service Agency Conservation Reserve Program, which removes environmentally sensitive land from agricultural production. ▪ Environmental Quality Incentives Program (EQIP) which supports integrating conservation actions into working lands. ▪ USDA Regional Conservation Partnership Programs, which funds conservation activities on agricultural land.	▪ Working Lands	▪ Land Conversion and Development	▪ LH Objective 5 ▪ NCP Objectives 2, 3, 4, 5

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-14	Study potential habitat benefits of rangeland and grazing practices	Evaluate the benefits of rangeland management and livestock grazing practices on species and habitats (CVJV, 2020). Develop guidance pertaining to sustainable livestock grazing (i.e., no overgrazing to the point where rangeland is denuded and compacted), stock pond management and maintenance (i.e., hydroperiod management, conducting management activities outside native amphibian breeding period), rodent control, and fire prevention management (USFWS, 2004).	▪ Working Lands ▪ Grasslands ▪ California Tiger Salamander ▪ Swainson's Hawk ▪ San Joaquin Kit Fox ▪ Western Red Bat ▪ Tricolored Blackbird	▪ Land Conversion and Development ▪ Water Pollutants and Discharges Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ LH Objectives 3, 5 ▪ HC Objective 3 ▪ NCP Objectives 2, 3, 4, 5 ▪ FS Objectives 2, 5, 6, 7, 8
Learn-15	Support environmental education and outreach programs	Support and collaborate with programs aimed at educational outreach and local involvement in restoration and watershed stewardship, including programs like Salmonids in the Classroom, Aquatic Wild, Adopt a Watershed, Grassland Environmental Education Center, school district environmental camps, and other programs teaching the effects of human land and water use on anadromous fish, wildlife, and habitat.	▪ All Focal Conservation Elements	▪ Land Conversion and Development	▪ All WM Objectives ▪ All LH Objectives ▪ All HC Objectives ▪ All NCP Objectives ▪ All FS Objectives

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-16	Conduct studies that contribute to understanding of salmonids and their habitats	Conduct studies that benefit salmonids, such as: ▪ Determining the quantity and distribution of shaded riverine aquatic habitat needed for recovery of focal salmonid species through modeling or other methods (CDWR, 2022). ▪ Identifying baseline conditions that may help identify why there are higher resident steelhead populations than anadromous steelhead in the Stanislaus and Tuolumne Rivers (NMFS-designated Priority 1 Recovery Actions for the Southern Sierra Nevada Diversity Group) (NMFS, 2014). ▪ Evaluating whether pulse flows are beneficial to Chinook salmon and steelhead outmigration survival through the lower San Joaquin River (NMFS-designated Priority 1 Recovery Actions for the Southern Sierra Nevada Diversity Group) (NMFS, 2014).	▪ Salmonids ▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands	▪ Climate Change ▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Water Pollutants and Discharges	▪ WM Objectives 2, 3, 4 ▪ LH Objectives 1, 2A, 2B ▪ FS Objective 1
Learn-17	Evaluate California tiger salamander genetic studies to inform corridors	Evaluate the genetics of metapopulations prior to creating corridor linkages to avoid connecting hybrid populations with native California tiger salamander populations (USFWS, 2017a).	▪ California Tiger Salamander ▪ Freshwater Wetlands ▪ Grasslands ▪ Vernal Pools ▪ Habitat Connectivity	▪ Land Conversion and Development ▪ Climate Change	▪ LH Objectives 1, 3, 4 ▪ HC Objectives 2, 3 ▪ FS Objective 2
Learn-18	Conduct studies to inform restoration plans for giant garter snake	Conduct studies that benefit giant garter snake, such as: ▪ Investigations into the effects of selenium, mercury, and other contaminants on giant garter snake and their prey. ▪ Abundance and distribution studies, including genetic analysis. This could include using eDNA as a survey method (USFWS, 2020a).	▪ Giant Garter Snake ▪ Freshwater Wetlands ▪ Grasslands	▪ Water Pollutants and Discharges ▪ Land Conversion and Development ▪ Climate Change	▪ WM Objective 3 ▪ LH Objective 1 ▪ FS Objective 3

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-19	Support giant garter snake reintroduction program	Support the development and implementation of a captive giant garter snake propagation and repatriation plan (including a genetics management plan) for specific sites if repatriation is feasible and determined to be necessary to prevent local extirpation.	▪ Giant Garter Snake ▪ Freshwater Wetlands ▪ Grasslands	▪ Climate Change ▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ LH Objectives 1, 3 ▪ FS Objective 3
Learn-20	Support plans to enhance riparian brush rabbit population resilience	Support, advocate for, or collaborate on plans that enhance riparian brush rabbit population resilience such as: ▪ Development of a USFWS species-specific recovery plan for riparian brush rabbit (USFWS, 2020c) ▪ Ongoing riparian brush rabbit reintroduction efforts. ▪ Emergency plan and monitoring system to rescue riparian brush rabbit and habitat in the event of flooding, wildfire, or a disease epidemic (USFWS, 2020c).	▪ Riparian Brush Rabbit ▪ Riparian and Riverine Corridors ▪ Grasslands ▪ Habitat Connectivity	▪ Land Conversion and Development ▪ Invasive Species and Pathogens ▪ Disrupted Natural Hydrology and Sediment Supply ▪ Climate Change	▪ LH Objectives 2A, 2B, 3 ▪ HC Objective 4 ▪ FS Objective 4
Learn-21	Study San Joaquin kit fox movement and priority locations	Develop a regional inventory of constraints on San Joaquin kit fox movement that identifies high-priority locations for improving permeability of movement and population connectivity (USFWS, 1998, 2010).	▪ San Joaquin Kit Fox ▪ Habitat Connectivity	▪ Land Conversion and Development	▪ HC Objective 3 ▪ FS Objective 5
Learn-22	Study pesticide impacts on western red bat	Study the effects of pesticide use in orchards on bats (WBWG, 2017).	▪ Western Red Bat	▪ Invasive Species and Pathogens	▪ NCP Objective 2, 3 ▪ FS Objective 6
Learn-23	Assess Swainson's hawk nesting trees and foraging habitat availability	Conduct landscape-level assessments of Swainson's hawk nesting tree availability, active nest trees, and the distribution of suitable foraging habitat. Determine where trees are the limiting factor for Swainson's hawks to indicate potential benefits and inform siting of restored nesting habitat (Woodbridge, 1998).	▪ Swainson's Hawk ▪ Working Lands ▪ Riparian and Riverine Corridors ▪ Grasslands	▪ Climate Change ▪ Land Conversion and Development ▪ Agriculture and Livestock/ Ranching	▪ LH Objectives 2A, 3. 5 ▪ FS Objective 7

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-24	Report data on monarch butterfly in USFWS database and other databases	Integrate habitat reporting and observations with the USFWS Monarch Conservation Database, Integrated Monarch Monitoring Program, and Western Monarch Milkweed Mapper; use these data to identify high-priority breeding and migratory pathways (Monarch Joint Venture, 2021; WAFWA, 2019).	▪ Monarch Butterfly ▪ Grasslands ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors	▪ Land Conversion and Development ▪ Climate Change	▪ LH Objectives 2A, 3 ▪ HC Objective 3 ▪ FS Objective 9
Learn-25	Research monarch butterfly survival	Support research into how habitat quality affects monarch butterfly recruitment, reproduction, and survival (Monarch Joint Venture, 2021).	▪ Monarch Butterfly ▪ Grasslands ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors	▪ Climate Change ▪ Land Conversion and Development	▪ LH Objectives 2A, 3 ▪ HC Objective 3 ▪ FS Objective 9
Learn-26	Increase awareness about native plants for monarch butterfly	Conduct outreach about the use of native, local ecotype, pesticide-free plants and seeds, as well as negative impacts from the introduction and spread of tropical milkweed species that can increase risks of pathogen transmission to monarch butterfly (Center for Biological Diversity and Center for Food Safety, 2014; Monarch Joint Venture, 2021).	▪ Monarch Butterfly ▪ Grasslands ▪ Riparian and Riverine Corridors	▪ Climate Change ▪ Land Conversion and Development ▪ Invasive Species and Pathogens	▪ LH Objectives 2A, 3 ▪ NCP Objective 2, 3 ▪ FS Objective 9
Learn-27	Support valley elderberry longhorn beetle studies and management plans	Support the development of comprehensive management plans for the valley elderberry longhorn beetle related to protected areas that maintain, prevent, or create habitat values and address potential threats such as Argentine ants, invasive plants, and pesticide use. Plans should also address habitat maintenance and enhancement (USFWS, 2019, 2023b).	▪ Valley Elderberry Longhorn Beetle ▪ Riparian and Riverine Corridors	▪ Invasive Species and Pathogens ▪ Land Conversion and Development	▪ WM Objective 2 ▪ LH Objective 2A ▪ HC Objective 3 ▪ NCP Objective 2, 3 ▪ FS Objective 10

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Learn-28	Determine delta button-celery distribution	Study button-celery populations and habitat, such as: ▪ Survey known extant and historical occurrences to determine current distribution of delta button-celery (CDWR, 2022). ▪ Study delta button-celery habitat requirements for flow regime and soils (CDWR, 2016). ▪ Study ways to improve propagation methods.	▪ Delta Button-Celery ▪ Freshwater Wetlands	▪ Land Conversion and Development ▪ Climate Change	▪ WM Objective 2 ▪ LH Objectives 1 ▪ HC Objective 3 ▪ NCP Objective 2, 3 ▪ FS Objective 11
Learn-29	Study and maintain delta button-celery seeds	Store and maintain seeds to promote genetic diversity for later use in research, restoration, and other conservation and habitat enhancement actions. This may include collaboration and supporting California Plant Rescue.	▪ Delta Button-Celery	▪ Land Conversion and Development ▪ Climate Change	▪ NCP Objective 2 ▪ FS Objective 11
Learn-30	Conduct studies that contribute to understanding of avifauna and their habitats	Conduct studies that benefit migratory and non-migratory birds, such as aerial flights and other population survey counts and habitat surveys to determine and improve the quantity and distribution of avifauna nesting, brooding, and overwintering habitat.	▪ Swainson's Hawk ▪ Tricolored Blackbird	▪ Land Conversion and Development ▪ Climate Change	▪ LH Objectives 1, 2A, 2B, 3, 4 ▪ FS Objective 7, 8

Table 4-5. Prevent Actions

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-1**	Control non-native/invasive species	Control non-native or invasive plant and wildlife species to reduce impacts on ecosystem processes and restore natural communities (CVLCP, 2017; Woodbridge, 1998). Manage or eliminate invasive plant species that create large monotypic stands lacking structural diversity reduced function of habitat features for species. Prioritize control in occupied and/or suitable focal or non-focal species habitat and areas designated by the USFWS or NMFS as critical habitat.	▪ All Focal Conservation Elements	▪ Land Conversion and Development ▪ Invasive Species and Pathogens	▪ All LH Objectives ▪ HC Objective 3 ▪ NCP Objectives 2, 3, 4 ▪ All FS Objectives
Prev-2**	Prepare for increased drought and storm resilience**	Restore and enhance landscapes to prepare for more frequent and severe drought conditions and storm events by implementing projects to increase groundwater; improving water use efficiency; reducing anthropogenic water consumption; and developing nature-based designs to slow, retain, filter, or redirect floodwater.	▪ All Focal Conservation Elements	▪ Land Conversion and Development ▪ Disrupted Natural Hydrology and Sediment Supply	▪ WM Objectives 1, 2, 4 ▪ All LH Objectives ▪ HC Objectives 3, 4 ▪ NCP Objective 2 ▪ All FS Objectives
Prev-3	Implement sanitation and decontamination procedures	Implement best practices to sanitize all equipment and tools prior to entering sensitive environments, including aquatic areas and restoration sites, and after leaving sites or handling species to prevent the spread of pathogens and disease (including chytrid fungus, phytophthora, and white-nose syndrome, among others). Follow best-practice sanitation and decontamination protocols, such as those developed by CDFW (CDFW, 2022; USFWS, 2012).	▪ All Focal Conservation Elements	▪ Land Conversion and Development ▪ Water Pollutants and Discharges	▪ WM Objective 3 ▪ All LH Objectives ▪ All FS Objectives

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-4	Implement Best Management Practices programs	Protect species and habitats from anthropogenic impacts due to construction, vegetation management, recreation, and/or maintenance activities by surveying areas and implementing species- or habitat-appropriate protection measures (e.g., seasonal work windows, work buffers around sensitive resources, fencing, lighting, or signage).	▪ All Focal Conservation Elements	▪ Land Conversion and Development ▪ Water Pollutants and Discharges ▪ Invasive Species and Pathogens	▪ WM Objective 3 ▪ All LH Objectives ▪ HC Objectives 3, 4 ▪ NCP Objective 2 ▪ All FS Objectives

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-5	Implement water quality policies to reduce pollutants	Implement policies and projects that reduce pollutants, such as pesticides, herbicides, sewage effluent, and other non-point source waste discharges near sensitive habitat, including aquatic resources and sensitive species habitat (SWRCB, 2018).	▪ Groundwater Sustainability ▪ Freshwater Wetlands ▪ Working Lands ▪ Riparian and Riverine Corridors ▪ Vernal Pools ▪ Grasslands ▪ Salmonids ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Riparian Brush Rabbit ▪ Western Red Bat ▪ Tricolored Blackbird ▪ Valley Elderberry Longhorn Beetle ▪ Delta Button-Celery	▪ Land Conversion and Development ▪ Water Pollutants and Discharges ▪ Invasive Species and Pathogens	▪ WM Objective 1, 3 ▪ All LH Objectives ▪ NCP Objectives 2, 3 ▪ FS Objectives 1, 2, 3, 4, 6, 8, 10, 11

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-6	Implement water contaminant reduction during agricultural and road maintenance	Improve agricultural and road maintenance practices to reduce water contaminants (e.g., heavy metals, fertilizers, or pesticides) (CVLCP, 2017) from entering sensitive habitats (USFWS, 2005). Implement agricultural drainage management projects to treat, store, convey, and/or dispose of agricultural drainage.	▪ Working Lands ▪ Riparian and Riverine Corridors ▪ Vernal Pools ▪ Freshwater Wetlands Salmonids ▪ California Tiger Salamander ▪ Giant Garter Snake ▪ Delta Button-Celery	▪ Land Conversion and Development ▪ Water Pollutants and Discharges	▪ WM Objective 3 ▪ All LH Objectives ▪ NCP Objectives 2, 3 ▪ FS Objectives 1, 2, 3, 11
Prev-7	Implement wastewater and stormwater treatment projects	Implement projects that improve wastewater and stormwater treatment in residential, commercial, and industrial areas throughout the San Joaquin River watershed to ensure that the water quality criteria established in the Central Valley Water Quality Control Plan (Basin Plan) are met for all potential pollutants.	▪ Salmonids ▪ Riparian and Riverine Corridors ▪ Grasslands ▪ Working Lands ▪ Freshwater Wetland ▪ Giant Garter Snake ▪ California Tiger Salamander ▪ Delta Button-Celery	▪ Water Pollutants and Discharges ▪ Land Conversion and Development	▪ WM Objective 3 ▪ All LH Objectives ▪ NCP Objectives 2, 3 ▪ FS Objectives 1, 2, 3, 11

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-8	Implement nutrient filtration projects	Create nutrient filtration projects—such as treatment wetlands, detention basins, or bioswales—to filter nutrients prior to entry into groundwater or streams.	▪ Groundwater Sustainability ▪ Riparian and Riverine Corridors ▪ Freshwater Wetlands	▪ Water Pollutants and Discharges ▪ Land Conversion and Development	▪ WM Objectives 1, 3 ▪ LH Objectives 1, 2A, 2B ▪ NCP Objective 2
Prev-9	Install trash racks and catchment systems	Install trash racks or other catchment systems to arrest trash and prevent discharges into waterways.	▪ Riparian and Riverine Corridors ▪ Working Lands ▪ Freshwater Wetlands	▪ Water Pollutants and Discharges ▪ Land Conversion and Development	▪ WM Objective 3 ▪ LH Objectives 1, 2A, 2B, 5
Prev-10	Implement integrated pest management	Use integrated pest management to minimize harm to focal conservation elements, such as beneficial insects on farms and in adjacent landscapes (Monarch Joint Venture, 2021), including reducing pesticide and herbicide use.	▪ Working Lands ▪ Monarch Butterfly ▪ Swainson's Hawk ▪ San Joaquin Kit Fox ▪ California Tiger Salamander ▪ Western Red Bat ▪ Tricolored Blackbird ▪ Valley Elderberry Longhorn Beetle	▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ WM Objective 3 ▪ LH Objective 5 ▪ NCP Objectives 2, 3 ▪ FS Objectives 2, 5, 6, 7, 8, 9, 10

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-11	Reduce small mammal control efforts	Reduce or eliminate small mammal control efforts (e.g., reducing rodenticide and pesticide use) (USFWS, 2010).	▪ Working Lands ▪ Swainson's Hawk ▪ San Joaquin Kit Fox ▪ Grasslands ▪ California Tiger Salamander	▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ LH Objectives 3, 5 ▪ NCP Objectives 2, 3 ▪ FS Objectives 2, 5
Prev-12	Minimize vernal pool disturbance	Minimize disturbances in existing vernal pool areas (e.g., soil disturbance or alteration of surface topography). This may include limiting ground disturbance per deed restriction, conservation easement, or management plan.	▪ Vernal Pools ▪ California Tiger Salamander	▪ Agriculture and Livestock/ Ranching ▪ Land Conversion and Development	▪ LH Objective 4 ▪ FS Objective 2
Prev-13	Increase funding for species and habitat protections	Support and advocate for additional funding for increased law enforcement to reduce illegal take of sensitive species, ecologically harmful stream alterations, and water pollution.	▪ Salmonids ▪ Hydrogeomorphic Processes ▪ Habitat Connectivity ▪ Riparian and Riverine Corridors	▪ Agriculture and Livestock/ Ranching ▪ Land Conversion and Development	▪ WM 3 ▪ LH Objective 2B ▪ NCP Objective 1, 3 ▪ HC Objective 1 ▪ FS Objective 1
Prev-14	Remove non-native species in California tiger salamander breeding habitat	Remove non-native plant and wildlife species from seasonal ponds where California tiger salamander breeding occurs by draining perennial ponds annually (USFWS, 2017a).	▪ California Tiger Salamander ▪ Vernal Pools ▪ Freshwater Wetlands	▪ Invasive Species and Pathogens ▪ Land Conversion and Development	▪ LH Objectives 1, 4 ▪ NCP Objective 3 ▪ FS Objective 2

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-15	Reduce transmission of California tiger salamander diseases	Monitor for diseases that affect California tiger salamander populations, using traditional and eDNA methods. Implement management actions to reduce disease transmission and impacts on the species.	▪ California Tiger Salamander ▪ Vernal Pools ▪ Freshwater Wetlands	▪ Invasive Species and Pathogens ▪ Land Conversion and Development	▪ LH Objectives 1, 4 ▪ FS Objective 2
Prev-16	Reduce transmission of snake fungal disease for giant garter snake	Monitor for emerging snake fungal disease (SFD, *Ophidiomyces ophiodiicola*) (USFWS, 2020a). Implement management actions to reduce disease transmission and impacts on the species.	▪ Giant Garter Snake	▪ Invasive Species and Pathogens ▪ Land Conversion and Development	▪ FS Objective 3
Prev-17	Reduce disease transmission in western red bat	Investigate, monitor, track, and test western red bat carcasses for emerging diseases (e.g., white-nose syndrome). Implement management actions to reduce disease transmission and impacts on the species.	▪ Western Red Bat	▪ Invasive Species and Pathogens ▪ Land Conversion and Development	▪ FS Objective 6
Prev-18	Implement aquatic buffer for tricolored blackbird breeding	Implement 100-foot harvest buffer zones around active breeding colonies in agricultural fields and avoid use of heavy equipment or other activities within that buffer that may cause tricolored blackbird nest abandonment (CDFW, 2019b).	▪ Tricolored Blackbird ▪ Working Lands ▪ Freshwater Wetlands	▪ Agriculture and Livestock/ Ranching ▪ Land Conversion and Development	▪ LH Objectives 1, 5 ▪ FS Objective 8

Action #	Action Title	Description	Focal Conservation Element	Pressures Addressed	Objectives Contributed to
Prev-19	Integrate Xerces Society Best Management Practices related to monarch butterfly	Integrate Xerces Society Best Management Practices related to monarch butterfly into land management and conservation projects, including recommendations for low intensity and rotational grazing; limited mowing, particularly during the breeding season; targeted prescribed burning; pesticide, herbicide, and insecticide applications; restoration, including milkweed establishment; and invasive plant management (Xerces Society, 2018).	▪ Monarch Butterfly ▪ Grasslands ▪ Working Lands ▪ Riparian and Riverine Corridors	▪ Climate Change ▪ Land Conversion and Development ▪ Invasive Species and Pathogens ▪ Agriculture and Livestock/ Ranching	▪ LH Objectives 2A, 3, 5 ▪ NCP Objectives 2, 3, 4 ▪ FS Objective 9
Prev-20	Implement Argentine ants control program	Implement a control or eradication program for Argentine ants at each conservation block or other conservation area (USFWS, 2019, 2023b).	▪ Valley Elderberry Longhorn Beetle ▪ Riparian and Riverine Corridors	▪ Invasive Species and Pathogens	▪ LH Objectives 2A ▪ NCP Objectives 2, 3 ▪ FS Objective 10
Prev-21	Implement nutria eradication program	Implement a control or eradication program for invasive nutria in freshwater wetlands, streams and riparian areas, and conservation areas.	▪ Freshwater Wetlands ▪ Riparian and Riverine Corridors	▪ Invasive Species and Pathogens	▪ LH Objectives 1, 2B ▪ NCP Objectives 2, 3

4.6 Strategy Consistency with Existing Conservation Plans

The Conservation Strategy identified here was developed in consideration of existing conservation plans and species recovery plans. More information on the consistency between this and other documents is provided in Appendix D.

5 RCIS Implementation and Adaptive Management

Photo Credit: California Department of Water Resources

5.1 Implementation Goals

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

Implementation of the RCIS is not the purview or responsibility of any one entity. Rather, the strategy will be implemented through the actions of many agencies, organizations, and individuals seeking to conduct conservation projects through a variety of mechanisms. Projects in the region should aim to provide multiple benefits and align with other existing regional planning efforts when possible. Coordinated implementation of the RCIS can enhance the effectiveness of the strategy at achieving its goals. The following are some existing collaboratives that can help to facilitate implementation of the RCIS:

- California 30x30 Initiative
- California Biodiversity Initiative
- California Department of Food and Agriculture AgVision for the Next Decade
- California EcoRestore
- California Essential Habitat Connectivity Project
- California Tribal Water Summit
- California Water Plan
- Central Valley Basin and Bay Delta Water Quality Control Plans
- Central Valley Flood Protection Plan
- Central Valley Joint Venture 2020 Implementation Plan
- Central Valley Landscape Conservation Project
- Central Valley Project Improvement Act Near-term Restoration Strategy
- Governor's Water Resilience Portfolio
- Groundwater Sustainability Plans
- Integrated Regional Water Management Plans
- Lower, Mid-, and Upper San Joaquin Regional Flood Management Plans
- Madera County LandFlex grant
- Madera County and Valley Vision Sustainable Agricultural Lands Conservation Program grants
- Merced Subbasin, East Turlock Subbasin, and Madera County Multibenefit Land Repurposing Program block grants
- Safeguarding California Plan 2018
- Safe and Affordable Funding for Equity and Resilience Drinking Water Program
- San Joaquin Council of Governments Regional Transportation Plan
- San Joaquin County Multi-Species Habitat Conservation and Open Space Plan
- San Joaquin Valley Collaborative Action Plan
- San Joaquin River National Wildlife Refuge Expansion Plan
- San Joaquin River Restoration Program
- San Luis National Wildlife Refuge Comprehensive Conservation Plan
- San Joaquin Valley Blueprint
- San Joaquin Valley Land and Water Conservation Collaborative
- State Wildlife Action Plan
- Statement of Administration Policy: Native American Ancestral Lands

The above plans, partnerships, and collaboratives represent regulatory, governmental, nonprofit, Tribal, and private organizations working together to achieve conservation goals in the region that are aligned with the goals of this RCIS.

Because an RCIS is a non-binding, voluntary document, CDFW approval does not trigger any specific implementation actions. However, an approved RCIS can be used and referenced by a variety of interested parties. The San Joaquin Valley RCIS may help to achieve the following:

- Guide conservation and funding organizations in making investments in the RCIS area.
- Provide a regional conservation framework for state or federal agencies to evaluate grant or permit applications for local conservation or research projects.
- Help inform proponents of regulated projects in siting and designing proposed compensatory mitigation actions, such as implementation of habitat enhancement and conservation, which may be required pursuant to any of the following:
    - A California Endangered Species Act (CESA) permit.
    - A Lake or Streambed Alteration Agreement (LSAA) under California Fish and Game Code (FGC) 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 (ESA).
- Federal Clean Water Act Sections 404 and 401.
    - State Porter-Cologne Water Quality Control Act.
    - California Water Code.
- Inform 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).

5.2 Advance Mitigation Planning

5.2.1 Mitigation Credit Agreements (MCAs)

Following RCIS approval, any entity may develop an MCA, which can be used in whole or in part to fulfill compensatory mitigation requirements. This RCIS is intended to support the creation of MCAs; as a result, it includes the required elements as specified in Section 4.3.8 of the RCIS Guidelines (CDFW, 2023a) which include:

- An outline for adaptive management and monitoring of conserved habitat and other conserved natural resources consistent with the goals and objectives for focal species and other conservation elements in the RCIS (Section 5.3.6.4, *Long-term Management and Monitoring Plan*).
- A process for MCA sponsors to provide information to the RCIS proponent to allow the RCIS proponent to track the progress of, and evaluate the effectiveness of, the RCIS actions in achieving the goals and objectives for focal species and other conservation elements.

- Identification of either the RCIS proponent or another public or private entity that has agreed to be responsible for evaluating and reporting on the effectiveness of achieving the RCIS's goals and objectives.

MCAs developed under this RCIS are encouraged to consider regional mitigation need, bundle credits (i.e., include multiple species attributes), and create co-benefits (i.e., provide benefits to multiple species). MCAs are also encouraged to provide habitat connectivity where relevant.

5.2.2 Mitigation and Conservation Banks

Mitigation banks and conservation banks are privately or publicly owned lands protected and managed for their natural resource values. In exchange for permanently protecting, managing, and monitoring the land, the bank sponsor can sell or transfer habitat credits to compensate for the impacts of development projects. Conservation banks generally protect endangered species and habitats while mitigation banks protect, restore, create, and/or enhance wetlands, streams, or other aquatic habitats (CDFW 2024). There are five conservation banks and one mitigation bank in the RCIS area, and 19 conservation banks and four mitigation banks that have overlapping service areas (see Chapter 2, Table 2-7).

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

5.2.3 In-Lieu Fee Programs

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

The National Fish and Wildlife Foundation has established an in-lieu fee program that encompasses the USACE Sacramento District, which overlaps the entire RCIS Area, and provides credits for wetlands, streams, and vernal pools.

5.2.4 Permittee Responsible Mitigation

The implementation of advance mitigation requires funding for planning, implementation of actions, and long-term maintenance and stewardship. For example, the California Department of Transportation (Caltrans), explores different potential funding sources for advance mitigation, including private investors, a variety of transportation funds (at the federal, state, regional, and local levels), private philanthropy, and other funds. Caltrans Advance Mitigation Program, which oversees a small revolving account and invests statewide, is also authorized to invest in specific advance mitigation projects. Some of the funding sources may be applicable to establishing advance mitigation projects within

the RCIS area. Mitigation credit agreements are an example of a start-up funding opportunity for mitigation projects in advance of their reimbursement.

5.2.5 Advance Mitigation Funding

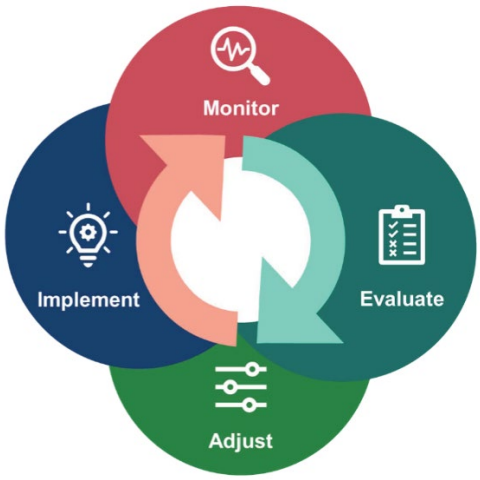
Conservation funding (often provided as grants) typically cannot be used for funding mitigation; however, projects can potentially be jointly funded using mitigation and conservation funds when the conservation benefit exceeds the mitigation need. For example, the US Army Corps of Engineers has approved projects jointly funded with mitigation and conservation funds. Projects can benefit from a diversity of funding sources but require transparent accounting to ensure that mitigation funds are spent on mitigation needs. A number of conservation grant programs, such as ones administered by CDFW, NMFS, or the US Environmental Protection Agency, apply in the RCIS area and may be used to fund conservation and habitat enhancement actions identified in this plan.

5.3 Adaptative Management and Monitoring Program

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

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

Figure 5-1. Cycle of Implementation, Monitoring, and Response



5.3.1 Baseline Inventory

The baseline inventory should be conducted before the implementation of conservation and habitat enhancement actions. Quantitative and qualitative information collected will be used to document the baseline conditions of habitat and other natural resources, and to assess the effectiveness of conservation and habitat enhancement actions.

5.3.2 Management and Monitoring Plan

After the baseline inventory, a management and monitoring plan will be developed and will describe conservation or habitat enhancement actions, desired outcomes, adaptive management, a monitoring protocol, criteria for success, reporting, and other activities. At a minimum, the management and monitoring plan will include the following elements, consistent with Section 5.3.6.4 of the RCIS Guidelines (CDFW, 2023a):

- The purpose identified in Section 3 of the draft MCA (see Section 5.3.3) and the purpose of the long-term management and monitoring plan for each action and site.
    - Map(s) of the overall final site design indicating the location, delineation, dimensions, types, and amounts of each credit type.
- A description of the setting, location, types of land use activities, climate, hydrology, and species and habitats expected to be present during long-term management. Overall management, including maintenance and monitoring goals, specific tasks and timing of implementation, and the RCIS metrics outlined in the development plan. This should include the long-term management needs (e.g., management of invasive species, inspections, fencing) on the site and any temporary or long-term structural management requirements (e.g., levees, weirs, culverts, water development for grazing) needed to ensure site functions.
    - The performance standards, thresholds, or criteria that must be maintained during the long-term management period in order to verify that the site continues to provide the intended credits and/or conservation values.
    - Discussion of adaptive management actions for reasonably foreseeable events and possible thresholds for evaluating and implementing adaptive management.
- Monitoring and reporting requirements and schedule, with requirements for reporting MCA monitoring results to CDFW, including if the performance standards, thresholds, or criteria that are tied to the long-term effectiveness of the MCA are being met.
- Funding for long-term management, such as the Endowment Fund Analysis and Endowment Fund Schedule (see Section 5.3.9.2, *Long-term Management Funding*).
    - Rights of access to the MCA site and prohibited uses of the MCA site as provided in the real estate instrument as approved by CDFW.
    - Procedures for amendments and notices.
- A reference to a cultural resource protection plan, if applicable.

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

5.3.3 Interim and Long-Term Monitoring and Adaptive Management

Whether actions are implemented under an MCA or not, monitoring periods can be separated into interim and long-term periods.

For MCAs, the interim monitoring period begins when the MCA is established and continues until performance-based milestones and standards have been met and the full funding of the appropriate financial instrument has occurred (see the MCA portion of CDFW's RCIS Program Guidelines for more details). The long-term monitoring period begins upon the conclusion of the interim monitoring period and continues in perpetuity or for the duration of the habitat enhancement action, during which the MCA site is to be managed, monitored, and maintained pursuant to the long-term monitoring and management plan.

For other projects, not implemented under an MCA, interim monitoring typically begins at the completion of construction and extends for a specified establishment period (often three, five, or 10 years, depending on habitat type). Long-term monitoring would begin once interim performance metrics are met and continue in perpetuity or as specified in the long-term monitoring and management plan.

The quantitative and qualitative information gathered during monitoring will be used to evaluate the progress of the conservation and habitat enhancement actions. This evaluation will determine whether unforeseen challenges are threatening the success of the actions and will identify specific problems. Management and monitoring should occur for the length of time specified in the management and monitoring plan and will include the following elements:

- Monitoring of response to the conservation and habitat enhancement actions described in the management and monitoring plan.
- Determination of success according to the performance standards established in the management and monitoring plan.
- Implementation of management actions identified in the management and monitoring plan. Examples include management of invasive species, property inspections, and infrastructure or structural management needed to ensure hydrological or ecological restoration and functionality.
- Routine monitoring and effectiveness monitoring to determine progress toward achieving the goals of the RCIS.

If the ecological performance standards identified for the MCA per CDFW guidelines are not met, an adjustment of conservation actions or habitat enhancement actions will be required and implemented. Note this applies to the MCA, and not the RCIS, as the RCIS is a voluntary plan.

5.3.4 Evaluating Progress toward the Goals and Objectives

The effectiveness of the conservation actions and habitat enhancement actions at achieving the goals and objectives for the conservation elements will be evaluated. This evaluation will include the extent to which the actions offset the effects of identified pressures and stressors. This monitoring and reporting will be implemented by Reclamation District (RD) 2092 as the RCIS proponent, unless and until RD 2092

transfers the requirement to another entity with CDFW's approval, as noted in Section 4.7 of the RCIS Guidelines (CDFW, 2023a).

This section identifies the metrics that will be used to evaluate effectiveness and outlines the contents of and process for preparing the monitoring reports. This is a requirement for developing an MCA and extending the RCIS. For more specific guidance on evaluating the progress of actions under an MCA, refer to the latest CDFW guidelines (CDFW, 2023a).

The objectives in this RCIS include metrics for tracking progress toward achieving the goals of the RCIS. Metrics are intended to measure the net change of habitat area or habitat quality. The following metrics are acceptable in this RCIS for measuring the net change in habitat area and habitat quality resulting from habitat restoration actions:

- Acreage
- Linear feet
- Vigor index (health of plant on a scale of 1–4)
- Percent cover (native vs. nonnative species)
- Native species diversity
- Number of individuals
- Number of populations
- Gene pool/genetic diversity
- Evidence of presence and abundance (e.g., presence/absence, number of nests, calls, scat)
- Habitat structure (e.g., number of canopy layers, percent cover, snags)
- Habitat connectivity
- Distribution of key resources (e.g., nesting trees, ponds, host plants) (number per acre)
- Inundation duration (consecutive days)
- Water depth (feet)
- Water volume (acre-feet)
- Streamflow (cubic feet-per-second)
- Water temperature and chemical composition (e.g., dissolved oxygen)
- Stream substrate composition (e.g., percent cover, gravel size)
- Stream characterization (pool, riffle, run; length and width)

5.3.5 Reporting

If an MCA is being implemented under the approved RCIS, an MCA evaluation report will be submitted to CDFW at the end of the 10-year term (i.e., 10 years after approval of the MCA). The report will document the status of RCIS habitat enhancement and conservation actions associated with approved MCAs in achieving goals and objectives for focal species and other conservation elements, including how these actions have offset the effects of identified pressures and stressors. The MCA sponsor is required to submit information to the RCIS proponent, who can then specify how that information is submitted. At minimum, the evaluation must use the information provided by MCA sponsors outlined in the RCIS Guidelines (CDFW, 2023a).

5.4 RCIS Maintenance, Amendment, and Extension

5.4.1 Responsible Parties

Implementation of RCIS conservation and habitat enhancement actions is voluntary for all RCIS users. It is envisioned that partnerships will be key in implementing actions toward achieving the vision, goals, and objectives of the RCIS. As the RCIS proponent, RD 2092 will periodically complete technical and administrative updates to this RCIS consistent with the approved RCIS Guidelines, including:

- Assessing progress toward achieving the vision, goals, and objectives of the RCIS at least every 10 years or until all MCA credits are used.
- Updating the RCIS at least once every 10 years so that it includes the best available scientific information.

5.4.2 RCIS Updates and Extensions Amendments

The RCIS has a 10-year term, after which CDFW cannot approve new MCAs unless the RCIS term is extended. CDFW can renew the RCIS if the strategy continues to meet the requirements of California FGC Section 1852 and Section 4.7 of the RCIS Guidelines (CDFW, 2023a). Updates to the RCIS may be appropriate during the 10-year approval period to reflect best available scientific information, geographic information system data, minor changes to numbers or text, and minor changes to RCIS goals, objectives, or actions. An update does not include updates or amendments to the geographic area, focal species, or other conservation elements.

These minor updates to the RCIS should occur as data are available and no less than every 10 years, or until all MCA credits are used. These updates can be submitted to CDFW in the 10-year progress report or in a stand-alone document. CDFW may extend the duration of an approved RCIS for additional periods of up to 10 years after scientific information has been updated. If a more substantial update—such as a change to the fundamental aspects of the RCIS—is determined to be required, then the RCIS should be amended to address these changes.

5.4.3 RCIS Amendments

Changes to the RCIS within the 10-year term that go beyond updating scientific information require an amendment process as described in California FGC Section 1854(a). Reasons for amending an RCIS may include:

- A change in the RCIS geographic area.
- The addition or removal of focal species.
- Substantial changes in best-available science.
- Substantial changes in goals, objectives, and actions.

There are two types of amendments: simple and complex. The processes required for these amendments are described in detail in the RCIS Guidelines (CDFW, 2023a).

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Appendix A. Public Outreach

San Joaquin Valley RCIS Steering Committee

Organizations and agencies were invited to participate in the San Joaquin Valley RCIS Steering Committee through direct communication, meetings, and public notices. Of the organizations listed throughout this appendix, those that participated are noted with an asterisk.

Regulatory Agency Outreach

The following regulatory agencies were invited to participate in the development of the San Joaquin Valley RCIS through agency-specific meetings as well as participation in the Steering Committee:

- California Department of Fish and Wildlife–Region 4*
- California Department of Fish and Wildlife–Headquarters*
- California Department of Water Resources*
- US Fish and Wildlife Service–Sacramento Office*

Public Notices

Two public notices were published in preparation for the development of the RCIS.

A notice was published on March 13, 2024, of the intent to prepare the San Joaquin Valley RCIS. The notice of intent to prepare the San Joaquin Valley RCIS was sent to the Governor's Office of Planning and Research, the county clerk of each county overlapping with the RCIS area, and RCIS@wildlife.ca.gov, as required by the RCIS Program Guidelines Section 4.5.1.2. A copy of the notice is included in this appendix below.

A notice was published on March 21, 2024, of a public meeting to be held on April 24, 2024, about the San Joaquin Valley RCIS. As required by the RCIS Program Guidelines, Section 4.5.1.3, the notice of the public meeting was published on the San Joaquin Valley RCIS website and sent to the following recipients:

RCIS@wildlife.ca.gov.
Each city and county within or adjacent to the RCIS area.
The implementing entities of the NCCPs and HCPs overlapping with the RCIS area.
Public agencies, organizations, and individuals who filed a request for notices of RCIS public meetings.

The following county and city clerks received the two notices:

County boards of supervisors

- Fresno
- Madera
- Merced
- San Joaquin
- Stanislaus
- Tuolumne

City councils

- Atwater
- Ceres
- Chowchilla
- Lathrop
- Livingston
- Los Banos
- Madera
- Manteca
- Merced
- Modesto
- Oakdale
- Patterson
- Ripon
- Salida
- Tracy
- Turlock
- Dos Palos
- Escalon
- Firebaugh
- Gustine
- Hughson
- Mendota
- Newman
- Riverbank
- Stockton
- Waterford

Contacts associated with the following tribes and tribal organizations also received the two notices:

- Amah Mutsun Tribal Band
- Big Sandy Rancheria (Mono Indians)
- Big Sandy Rancheria of Western Mono Indians
- Buena Vista Rancheria (Me-Wuk Indians)
- Buena Vista Rancheria of Me-Wuk Indians
- CA Indian Environmental Alliance
- CA Natural Resources Agency
- Calaveras Band of Mi-Wuk Indians
- Calaveras Band of Mi-Wuk Indians - Grimes
- California Valley Miwok Tribe
- Chicken Ranch Rancheria of Me-Wuk Indians
- Cold Springs Rancheria of Mono Indians of California
- Confederated Villages of Lisjan Nation
- Dumna Wo-Wah Tribal Government
- Dunlap Band of Mono Indians
- Intertribal Agricultural Council
- Ione Band of Miwok Indians
- Muwekma Ohlone Indian Tribe of the SF Bay Area
- Nashville Enterprise Miwok-Maidu-Nishinam Tribe
- North Fork Mono Tribe
- North Fork Rancheria (Mono Indians of California)
- North Fork Rancheria of Mono Indians
- North Valley Yokuts Tribe
- Picayune Rancheria (Chuchansi Indians)
- Picayune Rancheria of the Chukchansi Indians
- Railroad Flat Band of Miwok
- Salinan Tribe of Monterey, San Luis Obispo Counties
- Shingle Springs Band of Miwok
- Southern Sierra Miwuk Nation
- Table Mountain Rancheria
- Table Mountain Rancheria (Chukchansi band of Yokuts and Monache tribe)
- Traditional Choinumni Tribe
- Tuolumne Band of Me-Wuk Indians
- Wilton Rancheria
- Wuksachi Indian Tribe/Eshom Valley Band
- Xolon-Salinan Tribe

Public Meeting Summary and Comments

A public meeting, as required by AB 2087, for the San Joaquin Valley RCIS was held on April 24, 2024, both in-person at the Merced County Library and virtually, via Zoom, to provide information about the development of the RCIS and solicit comments. There was a brief presentation to introduce the RCIS, followed by public questions and input. Twenty-one participants joined in person and virtually.

During the meeting, members of the Planning Team (including John Cain from River Partners, Katie Dudney from ESA, and Molly Daniels from Environmental Incentives) addressed oral comments and questions. Comment cards along with a factsheet about the RCIS were distributed at the beginning of the meeting to facilitate receipt of written comments.

The Planning Team received 1 written comment and 18 oral comments and questions, listed in Table A-1 below.

Table A-1. Public Meeting Comments and Questions, and Associated Responses

Comment/ Question #	Comment/Question	Response
1	Have you discussed/planned species lists for seed and plant needs for these projects? Great Valley Seed Company is a native seed producer focusing on regionally appropriate seed and plants in the San Joaquin Valley. Contact: emma@greatvalleyseed.com	No, seed and plant species lists have not been discussed or planned.
2	What does BMP stand for?	BMP stands for Best Management Practice.
3	Will restoration of riparian habitat feature in the plan? What is the list of species that will be included in the plan?	Yes, this will be a key part of the plan and the riparian areas often have the potential to be used for multiple benefits. We hope that these areas will help to form connections between ecological zones and potentially help meet the goal of a Sierra foothills to grasslands corridor. Riparian habitat would be a Conservation Element in the document with an objective and recognized actions. Focal species and non-focal species that use riparian habitats will also have objectives and actions that benefit riparian habitats.
4	Would a non-focal species be pushed into the focal species category if they were state or federally listed?	Not necessarily. A species will only become a focal species if they have unique needs (e.g., habitat requirement, specialized life history constraints, unique threats) that are not covered through the objectives and actions developed for focal species or other conservation element. They will remain a non-focal species if they benefit from other strategies of the plan. In the RCIS focal species have defined strategies and targets where non-focal species do not. The RCIS has to show benefits to non-focal species.

Comment/ Question #	Comment/Question	Response
5	How will implementation of this plan occur if the program is voluntary and non-binding?	Non-profit organizations, private citizens, and local governments will be key partners in instituting this plan. Water providers and related organizations need to comply with Sustainable Groundwater Management Act (SGMA and this plan will help them secure additional benefits while taking on those projects. Kaweah RCIS was able to use their plan and apply for project funding from grant funds. A variety of users may use the plan to help guide conservation efforts or attract funding even if voluntary.
6	Do this RCIS have any overlap with CEQA reviews?	The RCIS does not influence CEQA reviews but can provide guidance to potential projects. The RCIS can help facilitate the process for determining how to receive mitigation credits that could be required by an environmental review. Potentially RCIS-aligned projects could be streamlined with state regulatory agencies.
7	How does the SJ RCIS interact with the Merced MLRP Block Grant program given they have similar goals and board members who may be in contact with members of the steering committee?	The RCIS is about bringing multiple parties together on shared goals. There is a lot of overlap with the Multibenefit Land Repurposing Program (MLRP).
8	Has the team considered what plant seeds or plugs they may need in their restoration efforts?	The RCIS isn't at the level of detail of providing a seed list. Where focal species rely on specific plants (such as host or nectar plants), these may be called out in the actions. Species that are key or dominant in target habitat types may also be specified. Seed lists would be developed at the project level, but the RCIS could be used to better understand the habitats that could be restored in the future and help forecast what species may be needed for future restoration projects. There may be requirements about collecting seeds from the same area or watershed (provenance). There may also be actions that recommend planting by seed or implementing nursey best management practices to reduce the potential for diseases.
9	How are riparian areas defined? How do canals factor into this?	The most basic definition is a parcel which fronts on the river itself. If a stream runs through the property, that would also be included. Beyond that, floodplains meeting certain requirements would likely be included. A challenge is prioritizing different types of areas. Natural waterways will likely be prioritized over canals. There are opportunities for creating riparian areas around drainage ditches and canals. Canals areas may also present recreational space opportunities.

Comment/ Question #	Comment/Question	Response
10	How will prioritization occur?	This will be done at a high level. There will not be a high priority map by design because the areas are dependent on the goal you are working towards. Areas with the most benefits for conservation will likely be prioritized. Large, connected parcels in riparian and/or in corridors are priorities.
11	How will scale factor into this? Is there a minimum property size?	Almost all riparian property in the Central Valley has been eliminated. The Central Valley Joint Venture has goals of 30,000 acres restored by 2030 and 100,000 acres by 2100. To meet SGMA requirements, large quantities of acreage will need to go out of production. The minimum quantity of habitat restored to sustain species is a significant consideration. If a property owner had 40 acres of river front property, would that be sufficient to participate? Location would be critical in determining benefits. A parcel likely wouldn't be ineligible to participate based on specific size thresholds. The RCIS wouldn't be looking at specific parcels. CDFW submittals often use total acres protected or restored as measurements. Permits will likely feature monitoring requirements which will help track progress of projects.
12	How will verification be conducted and effectiveness and permanence monitored?	The type and purpose of an acquisition may mean variance in the permanence. However, most acquisitions are permanent or in perpetuity. There are 30-year wetlands agreements and 10-year range management agreements. These are more suitable for working lands. An agreement might have different timelines based on certain species needs. Mitigation Credit Agreements, under an RCIS, have the potential to be used to offset temporary project impacts with non-permanent mitigation actions.
13	How will this interact with SGMA and small farmers who are fallowing fields? How to involve farmers so they don't just fallow fields?	An important part of the plan is determining how to retire lots of farmland while complying with SGMA and the Multi-Benefit Land Repurposing Plan. There is guidance from the DWR on land fallowing.
14	Will solar projects be involved?	The RCIS mentions potential development, such as solar projects, but as a conservation-based plan, there is no guidance specifically around solar development in the RCIS.
15	Funding for public projects like bikeways could be coupled with plans for creating wildlife corridors.	Thank you for this suggestion. Leveraging aligned funding is a great way to enhance beneficial outcomes of public projects.

Comment/ Question #	Comment/Question	Response
16	Noted that big projects in the RCIS area can receive benefits from clarity on mitigations requirements which could save them time and money.	Thank you for this recommendation. Clarifying project mitigation requirements will likely reduce time and money needed to complete a project.
17	There are many channelized sections of natural streams or drainages that may be considered focal areas.	The San Joaquin Valley RCIS includes many streams and agricultural areas within the list of priority locations (referred to in the comment as “focal areas”).
18	Areas near canals might be good locations for working in combination of restoration of floodplains and creating new recreation areas.	The RCIS Planning Team will review areas near canals when developing the list of priority locations.
19	Angela from DWR Delta Levees Program wants to be part of the steering committee.	The RCIS Planning Team will contact Angela regarding participation in the steering committee.

Public Review of the Draft RCIS

California Fish and Game Code (FGC) and California Department of Fish and Wildlife’s (CDFW) RCIS Program Guidelines require that the RCIS proponent respond to written comments that are 1) submitted during the public meeting(s) and during the public comment period (FGC Section 1854(c)(3)) and 2) provided by the cities and counties within the RCIS area (FGC Section1854(c)(5)).

This appendix contains the written comments received on the draft San Joaquin Valley RCIS and responses to those written comments. The draft San Joaquin Valley RCIS was made available on the CDFW website for a 60-day public review and comment period from X X, 202X to X X, 202X.

A total of X comment letters was received during the public review period. Responses to these public comments are included chronologically in Table A-x. Each comment within the comment card is assigned a unique number, noted in the right margin. For example, the code “1-3” indicates the third distinct comment (indicated by the “3”) in the first comment letter. Immediately following the comment letter is a summary of each distinct comment and the San Joaquin Valley RCIS Steering Committee’s response. Table X-X summarizes the commenting party, comment letter signatory, and date of the comment letter.

Table A-2. List of Comment Letters

Letter	Agency/Organization/Individual	Comment Letter Signatory	Date
1			
2			
3			
4			

[insert comment letter 1]

Comments and Responses

Name, Title, Date of Comment Letter

Summary of Comment 1-1

Response to Comment 1-1

Summary of Comment x-x

Response to Comment x-x

[insert comment letter 2]

Comments and Responses

Name, Title, Date of Comment Letter

Summary of Comment x-x

Response to Comment x-x

Appendix B: Vegetation Spatial Data Sources and Crosswalk

RCIS Vegetation Data Layer Compilation

The RCIS uses a detailed GIS-based map of land cover types to spatially characterize the distribution of existing natural communities and habitat within the RCIS area. The landcover map is a composite of multiple data sources representing the most recent and finest scale vegetation mapping available for the RCIS study area. The majority of the data sources (CDFW 2011, 2014, 2018, 2019, 2022) were created under the auspices of the Vegetation Classification and Mapping Program (VegCAMP) in compliance with the Survey of California Vegetation Classification and Mapping Standards (SCV). Existing Vegetation (EVeg) from the U.S. Forest Service (USFS, 2019) were used for locations where VegCAMP data were not available. To create a consistent classification system across the complete RCIS study area, all datasets were cross-walked with the California Wildlife Habitat Relationship System (CWHR), then further reclassified using CWHR and other more fine-scale information (e.g., NVCS Alliance) to distinguish the most prevalent and significant natural communities and habitats for the RCIS. In areas classified as agriculture within the VegCAMP and EVeg datasets, crop data developed by Land IQ for the California Department of Water Resources (Land IQ, 2022) were used to distinguish annual versus perennial agriculture.

Table B-1 below provides a crosswalk between the data sources, identifying the names used to establish the RCIS vegetation name. The original data source is noted in the *Source* column.

Table B-1. Vegetation Crosswalk

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Agriculture - annual	Agriculture	Agriculture	Grain and Crop Agriculture	Delta Vegetation [ds2855]
Agriculture - annual	Barren	Agriculture	Tilled Earth Agriculture	Delta Vegetation [ds2855]
Agriculture - annual	Cropland	(blank)	(blank)	EVeg
Agriculture - annual	Dryland Grain Crops	Agriculture	Grain and Crop Agriculture	Delta Vegetation [ds2855]
Agriculture - annual	Irrigated Grain Crops	Agriculture	Grain and Crop Agriculture	Delta Vegetation [ds2855]
Agriculture - annual	Irrigated Row and Field Crops	Agriculture	Grain and Crop Agriculture	Delta Vegetation [ds2855]
Agriculture - annual	Pasture	Agriculture	Agriculture	Delta Vegetation [ds2855]
Agriculture - annual	Pasture	(blank)	(blank)	EVeg
Agriculture - perennial	Agriculture	(blank)	(blank)	Delta Vegetation [ds2855]
Agriculture - perennial	Deciduous Orchard	Agriculture	Orchard Agriculture	Delta Vegetation [ds2855]
Agriculture - perennial	Deciduous Orchard	(blank)	(blank)	EVeg
Agriculture - perennial	Evergreen Orchard	Agriculture	Orchard Agriculture	Delta Vegetation [ds2855]
Agriculture - perennial	Vineyard	Agriculture	Vineyard - Shrub Agriculture	Delta Vegetation [ds2855]
Agriculture - unknown	Agriculture	Agriculture	Orchard Agriculture, Vineyard-Shrub Agriculture, Pastures and Crop Agriculture	Delta Vegetation [ds2855]
Agriculture - unknown	Agriculture	Agriculture	Orchard Agriculture, Vineyard-Shrub Agriculture, Pastures and Crop Agriculture	Great Valley Extension [ds2632]
Agriculture - unknown	Agriculture	Cropland, Orchard - Vineyard	Agriculture	Central Valley Riparian Remap [ds2890]
Agriculture - unknown	Agriculture	(blank)	(blank)	Central Valley Riparian Remap [ds2890]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Alkaline Mixed Scrub	Alkali Desert Scrub	*Allenrolfea occidentalis*	Alkaline Mixed Scrub	Central Valley Riparian Remap [ds2890]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Allenrolfea occidentalis*	Alkaline Mixed Scrub	Great Valley Extension [ds2632]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Atriplex lentiformis*	Saltbush	Central Valley Riparian Remap [ds2890]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Atriplex lentiformis*	Saltbush	Great Valley Extension [ds2632]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Atriplex polycarpa*	Saltbush	Central Valley Riparian Remap [ds2890]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Atriplex spinifera*	Saltbush	Central Valley Riparian Remap [ds2890]
Alkaline Mixed Scrub	Alkali Desert Scrub	Southwestern North American salt basin and high marsh group	Alkaline Mixed Scrub	Central Valley Riparian Remap [ds2890]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Suaeda moquinii*	Alkaline Mixed Scrub	Central Valley Riparian Remap [ds2890]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Suaeda moquinii*	Alkaline Mixed Scrub	Great Valley Extension [ds2632]
Alkaline Mixed Scrub	Alkali Desert Scrub	*Suaeda moquinii*	Soft Scrub - Mixed Chaparral, Alkaline Mixed Scrub	Great Valley Extension [ds2632]
Alkaline Mixed Scrub	Desert Scrub	*Atriplex polycarpa*	Alkaline Mixed Scrub, Desert Mixed Shrub, Saltbush	Great Valley Extension [ds2632]
Alkaline Mixed Scrub	Desert Wash	*Lepidospartum squamatum*	Scalebroom	Great Valley Extension [ds2632]
Alkaline Mixed Scrub	Saline Emergent Wetland	*Bassia* (*hyssopifolia*, *scoparia*)	Alkaline Mixed Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Alkaline Mixed Scrub	Saline Emergent Wetland	Western North American disturbed alkaline marsh and meadow	Alkaline Mixed Grasses and Forbs	Great Valley Extension [ds2632]
Alkali-Saline Wetland	Fresh Emergent Wetland	*Leymus cinereus* - *Leymus triticoides*	Wet Meadows	Great Valley Extension [ds2632]
Alkali-Saline Wetland	Saline Emergent Wetland	*Distichlis spicata*	Alkaline Mixed Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Alkali-Saline Wetland	Saline Emergent Wetland	*Distichlis spicata*	Alkaline Mixed Grasses and Forbs	Delta Vegetation [ds2855]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Alkali-Saline Wetland	Saline Emergent Wetland	*Distichlis spicata*	Alkaline Mixed Grasses and Forbs	Great Valley Extension [ds2632]
Alkali-Saline Wetland	Saline Emergent Wetland	*Frankenia salina*	Pickleweed - Cordgrass	Central Valley Riparian Remap [ds2890]
Alkali-Saline Wetland	Saline Emergent Wetland	*Frankenia salina*	Pickleweed - Cordgrass	Great Valley Extension [ds2632]
Alkali-Saline Wetland	Saline Emergent Wetland	*Sarcocornia pacifica* (*Salicornia depressa*)	Pickleweed - Cordgrass	Delta Vegetation [ds2855]
Alkali-Saline Wetland	Saline Emergent Wetland	Southwestern North American alkali marsh/seep vegetation	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Alkali-Saline Wetland	Saline Emergent Wetland	*Sporobolus airoides - Muhlenbergia asperifolia - Spartina gracilis*	Alkaline Mixed Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Alkali-Saline Wetland	Saline Emergent Wetland	Temperate Pacific tidal salt and brackish meadow	Alkaline Mixed Grasses and Forbs, Pickleweed - Cordgrass	Central Valley Riparian Remap [ds2890]
Alkali-Saline Wetland	Saline Emergent Wetland	Western North American disturbed alkaline marsh and meadow	Alkaline Mixed Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Alkali-Saline Wetland	Saline Emergent Wetland	Western North American disturbed alkaline marsh and meadow	Alkaline Mixed Grasses and Forbs	Great Valley Extension [ds2632]
Barren	Barren	Barren	Barren	Central Valley Riparian Remap [ds2890]
Barren	Barren	Barren	Barren	Delta Vegetation [ds2855]
Barren	Barren	Barren	Barren	Great Valley Extension [ds2632]
Barren	Barren	(blank)	(blank)	EVeg
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Aesculus californica*	California Buckeye	Central Valley Riparian Remap [ds2890]
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Aesculus californica*	California Buckeye	Northern Sierra Nevada Foothills [ds566]
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Aesculus californica*	(blank)	Western Madera County [ds1057]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Quercus douglasii*	Blue Oak	Central Valley Riparian Remap [ds2890]
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Quercus douglasii*	Blue Oak	Great Valley Extension [ds2632]
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Quercus douglasii*	Blue Oak	Northern Sierra Nevada Foothills [ds566]
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Quercus douglasii*	(blank)	Western Madera County [ds1057]
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Quercus wislizeni*	Interior Live Oak	Northern Sierra Nevada Foothills [ds566]
California Broadleaf Forest & Woodland	Blue Oak Woodland	*Quercus wislizeni*	(blank)	Western Madera County [ds1057]
California Broadleaf Forest & Woodland	Blue Oak Woodland	(blank)	(blank)	EVeg
California Broadleaf Forest & Woodland	Blue Oak Foothill Pine	*Quercus wislizeni* - *Quercus parvula* (tree)	Interior Live Oak	Central Valley Riparian Remap [ds2890]
California Broadleaf Forest & Woodland	Montane Hardwood	*Aesculus californica*	California Buckeye	Great Valley Extension [ds2632]
California Broadleaf Forest & Woodland	Montane Hardwood	*Quercus wislizeni* (tree)	Interior Like Oak	Great Valley Extension [ds2632]
California Broadleaf Forest & Woodland	Valley Foothill Riparian	*Quercus lobata*	Valley Oak	Delta Vegetation [ds2855]
California Broadleaf Forest & Woodland	Valley Foothill Riparian	*Quercus lobata*	Valley Oak	Great Valley Extension [ds2632]
California Broadleaf Forest & Woodland	Valley Oak Woodland	*Quercus lobata*	Valley Oak	Central Valley Riparian Remap [ds2890]
California Broadleaf Forest & Woodland	Valley Oak Woodland	*Quercus lobata*	Valley Oak	Delta Vegetation [ds2855]
California Broadleaf Forest & Woodland	Valley Oak Woodland	*Quercus lobata*	Valley Oak, Riparian Mixed Hardwood	Northern Sierra Nevada Foothills [ds566]
California Chaparral	Chamise-Redshank Chaparral	(blank)	(blank)	EVeg
California Chaparral	Mixed Chaparral	*Ceanothus cuneatus*	Wedgeleaf Ceanothus	Central Valley Riparian Remap [ds2890]
California Chaparral	Mixed Chaparral	*Ceanothus cuneatus*	Wedgeleaf Ceanothus, Lower Montane Mixed Chaparral	Northern Sierra Nevada Foothills [ds566]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
California Chaparral	Mixed Chaparral	*Gutierrezia californica*	Semi-Desert Chaparral	Great Valley Extension [ds2632]
California Chaparral	Mixed Chaparral	*Lotus scoparius* - *Lupinus albifrons* - *Eriodictyon* spp.	Mixed Soft Scrub - Chaparral	Central Valley Riparian Remap [ds2890]
California Coastal Scrub	Coastal Scrub	*Artemisia californica*	California Sagebrush	Great Valley Extension [ds2632]
California Coastal Scrub	Coastal Scrub	*Baccharis pilularis*	Coyote Brush	Central Valley Riparian Remap [ds2890]
California Coastal Scrub	Coastal Scrub	*Baccharis pilularis*	Coyote Brush	Delta Vegetation [ds2855]
California Coastal Scrub	Coastal Scrub	*Baccharis pilularis*	Coyote Brush	Great Valley Extension [ds2632]
California Coastal Scrub	Coastal Scrub	Central and south coastal California seral scrub	Soft Scrub - Mixed Chaparral, North Coastal Scrub	Great Valley Extension [ds2632]
California Coastal Scrub	Coastal Scrub	Central and south coastal California seral scrub	Soft Scrub Mixed Chaparral	Central Valley Riparian Remap [ds2890]
California Coastal Scrub	Coastal Scrub	*Corethrogyne filaginifolia* - *Eriogonum* (*elongatum*, *nudum*)	Soft Scrub - Mixed Chaparral	Great Valley Extension [ds2632]
California Coastal Scrub	Coastal Scrub	*Ericameria linearifolia* - *Cleome isomeris*	Bladderpod	Great Valley Extension [ds2632]
California Coastal Scrub	Coastal Scrub	*Eriogonum fasciculatum*	Buckwheat	Great Valley Extension [ds2632]
California Coastal Scrub	Mixed Chaparral	*Eriogonum fasciculatum*	Buckwheat	Central Valley Riparian Remap [ds2890]
California Conifer Forest & Woodland	Ponderosa Pine	*Pinus ponderosa*	Ponderosa Pine	Great Valley Extension [ds2632]
California Sycamore	Valley Foothill Riparian	*Platanus racemosa*	California Sycamore	Delta Vegetation [ds2855]
California Sycamore	Valley Foothill Riparian	*Platanus racemosa*	California Sycamore	Great Valley Extension [ds2632]
California Sycamore	Valley Foothill Riparian	*Platanus racemosa* - *Quercus agrifolia*	California Sycamore	Central Valley Riparian Remap [ds2890]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Cliffs and Rock Outcroppings	Barren	North American warm desert bedrock cliff and outcrop	Barren	Central Valley Riparian Remap [ds2890]
Cliffs and Rock Outcroppings	Barren	North American warm semi-desert cliff, scree, and other rock vegetation	Barren	Great Valley Extension [ds2632]
Cliffs and Rock Outcroppings	Barren	Sierra Nevada cliff and canyon	Barren	Northern Sierra Nevada Foothills [ds566]
Freshwater Wetland	Fresh Emergent Wetland	Arid West freshwater emergent marsh	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Freshwater Wetland	Fresh Emergent Wetland	Arid West freshwater emergent marsh	Tule - Cattail	Delta Vegetation [ds2855]
Freshwater Wetland	Fresh Emergent Wetland	Arid West freshwater emergent marsh	Tule - Cattail	Great Valley Extension [ds2632]
Freshwater Wetland	Fresh Emergent Wetland	*Juncus effusus*	Wet Meadows	Central Valley Riparian Remap [ds2890]
Freshwater Wetland	Fresh Emergent Wetland	*Juncus effusus*	Wet Meadows	Great Valley Extension [ds2632]
Freshwater Wetland	Fresh Emergent Wetland	*Phragmites australis* - *Arundo donax*	Giant Reed/Pampas Grass	Great Valley Extension [ds2632]
Freshwater Wetland	Fresh Emergent Wetland	*Schoenoplectus* (*acutus*, *californicus*)	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Freshwater Wetland	Fresh Emergent Wetland	*Schoenoplectus* (*acutus*, *californicus*)	Tule - Cattail	Delta Vegetation [ds2855]
Freshwater Wetland	Fresh Emergent Wetland	*Schoenoplectus* (*acutus*, *californicus*)	Tule - Cattail	Great Valley Extension [ds2632]
Freshwater Wetland	Fresh Emergent Wetland	*Typha* (*angustifolia*, *domingensis*, *latifolia*)	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Freshwater Wetland	Fresh Emergent Wetland	*Typha* (*angustifolia*, *domingensis*, *latifolia*)	Tule - Cattail	Delta Vegetation [ds2855]
Freshwater Wetland	Fresh Emergent Wetland	*Typha* (*angustifolia*, *domingensis*, *latifolia*)	Tule - Cattail	Great Valley Extension [ds2632]
Freshwater Wetland	Fresh Emergent Wetland	*Typha* (*angustifolia*, *latifolia*, *domingensis*)	(blank)	Western Madera County [ds1057]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Freshwater Wetlands	Fresh Emergent Wetland	*Phragmites australis* - *Arundo donax*	Giant Reed/Pampas Grass	Central Valley Riparian Remap [ds2890]
Grassland - annual	Annual Grassland	California Annual and Perennial Grassland	Annual Grasses and Forbs, Non-Native/Ornamental Grasses	Great Valley Extension [ds2632]
Grassland - annual	Annual Grassland	California annual herb/grass group	Annual Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Grassland - annual	Annual Grassland	California annual herb/grass group	Annual Grasses and Forbs	Delta Vegetation [ds2855]
Grassland - annual	Annual Grassland	California annual herb/grass group	Annual Grasses and Forbs	Great Valley Extension [ds2632]
Grassland - annual	Annual Grassland	*Centaurea* (*solstitialis*, *melitensis*)	Annual Grasses and Forbs	Delta Vegetation [ds2855]
Grassland - annual	Annual Grassland	*Centaurea* (*virgata*)	Annual Grasses and Forbs	Great Valley Extension [ds2632]
Grassland - annual	Annual Grassland	*Conium maculatum* - *Foeniculum vulgare*	Annual Grasses and Forbs	Delta Vegetation [ds2855]
Grassland - annual	Annual Grassland	*Cynodon dactylon* - *Crypsis* spp. - *Paspalum* spp. [pending]	Annual Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Grassland - annual	Annual Grassland	(blank)	(blank)	EVeg
Grassland - annual	Annual Grassland	(blank)	(blank)	Great Valley Extension [ds2632]
Grassland - annual	Grassland	California annual & perennial grassland macrogroup	(blank)	Western Madera County [ds1057]
Grassland - annual	Grassland	California annual and perennial grassland	Annual Grasses and Forbs	Northern Sierra Nevada Foothills [ds566]
Grassland - annual	Grassland	Mediterranean California naturalized annual and perennial grassland	Annual Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Grassland - annual	Grassland	Mediterranean California naturalized annual and perennial grassland	Annual Grasses and Forbs, Non-Native/Ornamental Grasses	Delta Vegetation [ds2855]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Grassland - annual	Grassland	Mediterranean California naturalized annual and perennial grassland	Annual Grasses and Forbs, Non-Native/Ornamental Grasses	Great Valley Extension [ds2632]
Grassland - annual	Grassland	(blank)	(blank)	Central Valley Riparian Remap [ds2890]
Grassland - perennial	Perennial Grassland	California perennial grassland	Perennial Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Grassland - perennial	Perennial Grassland	*Leymus cinereus* - *Leymus triticoides*	Perennial Grasses and Forbs	Central Valley Riparian Remap [ds2890]
Non-Native/Ornamental Hardwood	Eucalyptus	*Ailanthus altissima*	Eucalyptus	Central Valley Riparian Remap [ds2890]
Non-Native/Ornamental Hardwood	Eucalyptus	*Eucalyptus* (*globulus*, *camaldulensis*)	Eucalyptus	Central Valley Riparian Remap [ds2890]
Non-Native/Ornamental Hardwood	Eucalyptus	*Eucalyptus* spp. - *Ailanthus altissima* - *Robinia pseudoacacia*	Eucalyptus	Delta Vegetation [ds2855]
Non-Native/Ornamental Hardwood	Eucalyptus	*Eucalyptus* spp. - *Ailanthus altissima* - *Robinia pseudoacacia*	Eucalyptus	Great Valley Extension [ds2632]
Non-Native/Ornamental Hardwood	Eucalyptus	Introduced North American Mediterranean woodland and forest	Eucalyptus	Central Valley Riparian Remap [ds2890]
Non-Native/Ornamental Hardwood	Eucalyptus	Introduced North American Mediterranean woodland and forest	Non-Native/Ornamental Hardwood	Delta Vegetation [ds2855]
Non-Native/Ornamental Hardwood	Eucalyptus	*Robinia pseudoacacia*	Eucalyptus	Central Valley Riparian Remap [ds2890]
Non-Native/Ornamental Hardwood	Eucalyptus	(blank)	(blank)	EVeg
Non-Native/Ornamental Hardwood	Urban	*Ailanthus altissima*	Non-Native/Ornamental Hardwood	Great Valley Extension [ds2632]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Non-Native/Ornamental Hardwood	Urban	Introduced North American Mediterranean woodland and forest	Non-Native/Ornamental Hardwood	Great Valley Extension [ds2632]
Non-Native/Ornamental Hardwood	Urban	Urban	Non-Native/Ornamental Hardwood	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Acer negundo*	Riparian Mixed Hardwood	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Acer negundo*	Riparian Mixed Hardwood	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Acer negundo*	Riparian Mixed Hardwood	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Alnus rhombifolia*	White Alder	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Alnus rhombifolia*	White Alder	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Alnus rhombifolia*	White Alder	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Fraxinus latifolia*	Riparian Mixed Hardwood	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Fraxinus latifolia*	Riparian Mixed Hardwood	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Fraxinus latifolia*	Riparian Mixed Hardwood	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Juglans hindsii* and Hybrids	Riparian Mixed Hardwood	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Juglans hindsii* and Hybrids	Riparian Mixed Hardwood	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Juglans hindsii* and Hybrids	Riparian Mixed Hardwood	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Populus fremontii*	Fremont Cottonwood	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Populus fremontii*	Fremont Cottonwood	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Populus fremontii*	Fremont Cottonwood, Riparian Mixed Hardwood	Northern Sierra Nevada Foothills [ds566]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Riparian Mixed Hardwood	Valley Foothill Riparian	*Populus fremontii*	(blank)	Western Madera County [ds1057]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Populus fremontii - Fraxinus velutina -Salix gooddingii*	Fremont Cottonwood	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Quercus lobata*	Valley Oak	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Quercus lobata* (Riparian)	Valley Oak	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Salix gooddingii*	Riparian Mixed Hardwood	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Salix gooddingii*	Riparian Mixed Hardwood	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Salix gooddingii - Salix laevigata*	Willow	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Salix laevigata*	Willow	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Salix laevigata*	Willow	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Salix laevigata*	Willow, Riparian Mixed Hardwood	Northern Sierra Nevada Foothills [ds566]
Riparian Mixed Hardwood	Valley Foothill Riparian	*Salix laevigata*	(blank)	Western Madera County [ds1057]
Riparian Mixed Hardwood	Valley Foothill Riparian	Sonoran-Chihuahuan Warm Desert Riparian Woodland Group	(blank)	Western Madera County [ds1057]
Riparian Mixed Hardwood	Valley Foothill Riparian	Southwestern North American riparian evergreen and deciduous woodland	Riparian Mixed Hardwood	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	Southwestern North American riparian evergreen and deciduous woodland	Riparian Mixed Hardwood	Delta Vegetation [ds2855]
Riparian Mixed Hardwood	Valley Foothill Riparian	Southwestern North American riparian	Riparian Mixed Hardwood	Great Valley Extension [ds2632]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
		evergreen and deciduous woodland		
Riparian Mixed Hardwood	Valley Foothill Riparian	Vancouverian riparian deciduous forest	Riparian Mixed Hardwood	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	(blank)	(blank)	Central Valley Riparian Remap [ds2890]
Riparian Mixed Hardwood	Valley Foothill Riparian	(blank)	(blank)	EVeg
Riparian Mixed Hardwood	Valley Foothill Riparian	(blank)	(blank)	Great Valley Extension [ds2632]
Riparian Mixed Hardwood	Vineyard	(blank)	(blank)	EVeg
Riparian Mixed Shrub	Desert Riparian	*Prosopis glandulosa - Prosopis velutina - Prosopis pubescens*	Mesquite	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Fresh Emergent Wetland	*Baccharis salicifolia*	*Baccharis* (Riparian)	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Fresh Emergent Wetland	*Phragmites australis - Arundo donax*	Giant Reed/Pampas Grass	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Baccharis salicifolia*	*Baccharis* (Riparian)	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Baccharis salicifolia*	(blank)	Western Madera County [ds1057]
Riparian Mixed Shrub	Valley Foothill Riparian	*Cephalanthus occidentalis*	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Cephalanthus occidentalis*	Riparian Mixed Shrub	Delta Vegetation [ds2855]
Riparian Mixed Shrub	Valley Foothill Riparian	*Phragmites australis - Arundo donax*	Riparian Mixed Shrub	Delta Vegetation [ds2855]
Riparian Mixed Shrub	Valley Foothill Riparian	*Rhus trilobata - Crataegus rivularis - Forestiera pubescens*	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Rosa californica*	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Rosa californica*	Riparian Mixed Shrub	Great Valley Extension [ds2632]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Riparian Mixed Shrub	Valley Foothill Riparian	*Rubus armeniacus*	Riparian Mixed Shrub	Delta Vegetation [ds2855]
Riparian Mixed Shrub	Valley Foothill Riparian	*Rubus armeniacus* - *Sesbania punicea* - *Ficus carica*	Riparian Mixed Shrub	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Valley Foothill Riparian	*Rubus armeniacus* - *Sesbania punicea* - *Ficus carica*	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix exigua*	Willow (Shrub)	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix exigua*	Willow (Shrub)	Delta Vegetation [ds2855]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix exigua*	Willow (Shrub)	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix exigua*	Willow (Shrub), Riparian Mixed Shrub	Northern Sierra Nevada Foothills [ds566]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix exigua*	(blank)	Western Madera County [ds1057]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix lasiolepis*	Willow (Shrub)	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix lasiolepis*	Willow (Shrub)	Delta Vegetation [ds2855]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix lasiolepis*	Willow (Shrub)	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Valley Foothill Riparian	*Salix lucida* ssp. *lasiandra*	Willow (Shrub)	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Sambucus nigra*	Riparian Mixed Shrub	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Valley Foothill Riparian	*Sesbania punicea*	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	Southwestern North American introduced riparian scrub	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	Southwestern North American introduced riparian scrub	Riparian Mixed Shrub	Delta Vegetation [ds2855]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Riparian Mixed Shrub	Valley Foothill Riparian	Southwestern North American introduced riparian scrub	Riparian Mixed Shrub	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Valley Foothill Riparian	Southwestern North American riparian/wash scrub	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	Southwestern North American riparian/wash scrub	Riparian Mixed Shrub	Delta Vegetation [ds2855]
Riparian Mixed Shrub	Valley Foothill Riparian	Southwestern North American riparian/wash scrub	Riparian Mixed Shrub	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Valley Foothill Riparian	*Tamarix* spp.	Tamarisk	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Tamarix* spp.	Tamarisk	Delta Vegetation [ds2855]
Riparian Mixed Shrub	Valley Foothill Riparian	*Tamarix* spp.	Tamarisk	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Valley Foothill Riparian	*Vitis californica*	Riparian Mixed Shrub	Central Valley Riparian Remap [ds2890]
Riparian Mixed Shrub	Valley Foothill Riparian	*Vitis californica*	Riparian Mixed Shrub	Great Valley Extension [ds2632]
Riparian Mixed Shrub	Wet Meadow	*Heterotheca oregona*	Wet Meadows	Central Valley Riparian Remap [ds2890]
Urban/Developed	Urban	(blank)	Urban/Developed (General)	Northern Sierra Nevada Foothills [ds566]
Urban/Developed	Urban	Built-up and Urban Disturbance	(blank)	Western Madera County [ds1057]
Urban/Developed	Urban	*Cynodon dactylon*	Non-Native/Ornamental Grass	Great Valley Extension [ds2632]
Urban/Developed	Urban	Urban	Urban	Delta Vegetation [ds2855]
Urban/Developed	Urban	Urban	Urban	Great Valley Extension [ds2632]
Urban/Developed	Urban	Urban	Urban/Developed (General)	Central Valley Riparian Remap [ds2890]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Urban/Developed	Urban	(blank)	(blank)	Central Valley Riparian Remap [ds2890]
Urban/Developed	Urban	(blank)	(blank)	EVeg
Urban/Developed	Urban	(blank)	(blank)	Great Valley Extension [ds2632]
Vernal Pool	Alkali Grassland-Playa/Pool Matrix	Californian mixed annual/perennial freshwater vernal pool/swale bottomland	Vernal Pool	Great Valley Extension [ds2632]
Vernal Pool	Annual Grassland	Californian mixed annual/perennial freshwater vernal pool/swale bottomland	Vernal Pool	Central Valley Riparian Remap [ds2890]
Vernal Pool	Annual Grassland	Californian mixed annual/perennial freshwater vernal pool/swale bottomland	Vernal Pool	Delta Vegetation [ds2855]
Vernal Pool	Annual Grassland	Californian mixed annual/perennial freshwater vernal pool/swale bottomland	Vernal Pool	Great Valley Extension [ds2632]
Vernal Pool	Annual Grassland	(blank)	(blank)	Central Valley Riparian Remap [ds2890]
Vernal Pool	Sparsely vegetated playa/pool	Californian mixed annual/perennial freshwater vernal pool/swale bottomland	Vernal Pool	Great Valley Extension [ds2632]
Vernal Pool	Vernal Pool and Grassland Matrix	Californian mixed annual/perennial freshwater vernal pool/swale bottomland	Vernal Pool	Great Valley Extension [ds2632]
Water	Fresh Emergent Wetland	*Azolla* (*filiculoides*, *microphylla*)	Water	Great Valley Extension [ds2632]
Water	Fresh Emergent Wetland	*Eichhornia crassipes*	Water	Great Valley Extension [ds2632]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Water	Fresh Emergent Wetland	*Lemna* (minor) and Relatives	Water	Great Valley Extension [ds2632]
Water	Fresh Emergent Wetland	*Ludwigia* (*hexapetala*, *peploides*)	Water	Great Valley Extension [ds2632]
Water	Fresh Emergent Wetland	Naturalized temperate Pacific freshwater vegetation	Water	Great Valley Extension [ds2632]
Water	Fresh Emergent Wetland	Temperate freshwater floating mat	Tule - Cattail, Water	Great Valley Extension [ds2632]
Water	Lacustrine	(blank)	Perennial Lakes and Ponds, Agriculture Ponds/Water Features	Northern Sierra Nevada Foothills [ds566]
Water	Lacustrine	(blank)	Reservoirs	Northern Sierra Nevada Foothills [ds566]
Water	Lacustrine	Water	Reservoirs, Perennial Lakes and Ponds, Water	Great Valley Extension [ds2632]
Water	Lacustrine	(blank)	(blank)	EVeg
Water	Riverine	(blank)	High Water Line/Gravel/Sand Bar	Northern Sierra Nevada Foothills [ds566]
Water	Riverine	(blank)	Rivers and Streams, Intermittent Stream Channel	Northern Sierra Nevada Foothills [ds566]
Water	Riverine	(blank)	Water (General)	Northern Sierra Nevada Foothills [ds566]
Water	Riverine	*Azolla* (*filiculoides*, *microphylla*)	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Water	Riverine	*Eichhornia crassipes*	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Water	Riverine	*Eichhornia crassipes*	Water	Delta Vegetation [ds2855]
Water	Riverine	*Hydrilla verticillata* - *Myriophyllum spicatum*	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Water	Riverine	*Lemna* (minor) and relatives	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Water	Riverine	*Lemna* (minor) and relatives	Water	Delta Vegetation [ds2855]
Water	Riverine	*Ludwigia* (*hexapetala*, *peploides*)	Water	Delta Vegetation [ds2855]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Water	Riverine	*Ludwigia* (*hexapetala*, *peploides*) - *Eichhornia crassipes*	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Water	Riverine	Naturalized temperate Pacific freshwater vegetation	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Water	Riverine	Naturalized temperate Pacific freshwater vegetation	Water	Delta Vegetation [ds2855]
Water	Riverine	Riverine, Lacustrine	Water (General)	Central Valley Riparian Remap [ds2890]
Water	Riverine	Temperate freshwater floating mat	Tule - Cattail	Central Valley Riparian Remap [ds2890]
Water	Riverine	Temperate freshwater floating mat	Water	Delta Vegetation [ds2855]
Water	Riverine	Water	Reservoirs, Perennial Lakes and Ponds, Water	Delta Vegetation [ds2855]
Water	Riverine	Water	Reservoirs, Perennial Lakes and Ponds, Water	Great Valley Extension [ds2632]
Water	Riverine	(blank)	(blank)	EVeg
Wet Meadow	Fresh Emergent Wetland	*Artemisia douglasiana*	Wet Meadows	Central Valley Riparian Remap [ds2890]
Wet Meadow	Fresh Emergent Wetland	Californian warm temperate marsh/seep	Wet Meadows	Central Valley Riparian Remap [ds2890]
Wet Meadow	Fresh Emergent Wetland	Californian warm temperate marsh/seep	Wet Meadows, Perennial Grasses and Forbs	Delta Vegetation [ds2855]
Wet Meadow	Fresh Emergent Wetland	Californian warm temperate marsh/seep	Wet Meadows, Perennial Grasses and Forbs	Great Valley Extension [ds2632]
Wet Meadow	Fresh Emergent Wetland	Californian Warm Temperate Marsh/Seep Group	Wet Meadows, Tule - Cattail	Northern Sierra Nevada Foothills [ds566]
Wet Meadow	Fresh Emergent Wetland	*Carex barbarae*	Wet Meadow	Central Valley Riparian Remap [ds2890]
Wet Meadow	Fresh Emergent Wetland	*Carex barbarae*	Wet Meadow	Delta Vegetation [ds2855]

RCIS Vegetation Community Name	CWHR	NVCS Classification	CalVeg	Source
Wet Meadow	Fresh Emergent Wetland	*Equisetum* (*arvense*, *variegatum*, *hyemale*)	Wet Meadows, Perennial Grasses and Forbs	Delta Vegetation [ds2855]
Wet Meadow	Fresh Emergent Wetland	*Juncus arcticus* (var. *balticus*, *mexicanus*)	Perennial Grasses and Forbs	Great Valley Extension [ds2632]
Wet Meadow	Fresh Emergent Wetland	Naturalized warm-temperate riparian and wetland group	Wet Meadows	Central Valley Riparian Remap [ds2890]
Wet Meadow	Fresh Emergent Wetland	Naturalized warm-temperate riparian and wetland group	Wet Meadows, Non-Native/Ornamental Grass	Delta Vegetation [ds2855]
Wet Meadow	Fresh Emergent Wetland	Naturalized warm-temperate riparian and wetland group	Wet Meadows, Non-Native/Ornamental Grass	Great Valley Extension [ds2632]
Wet Meadow	Fresh Emergent Wetland	*Polygonum lapathifolium - Xanthium strumarium*	Wet Meadows	Great Valley Extension [ds2632]
Wet Meadow	Fresh Emergent Wetland	*Polygonum lapathifolium - Xanthium strumarium*	Wet Meadows	Central Valley Riparian Remap [ds2890]
Wet Meadow	Fresh Emergent Wetland	Vancouverian freshwater wet meadow & marsh group	(blank)	Western Madera County [ds1057]
Wet Meadow	Fresh Emergent Wetland	(blank)	(blank)	Central Valley Riparian Remap [ds2890]
Wet Meadow	Wet Meadow	*Juncus arcticus* (var. *balticus*, *mexicanus*)	Wet Meadows	Central Valley Riparian Remap [ds2890]
Wet Meadow	Wet Meadow	*Lepidium latifolium*	Wet Meadows	Great Valley Extension [ds2632]
Wet Meadow	Wet Meadow	*Lepidium latifolium* - (*Lactuca serriola*)	Wet Meadows	Central Valley Riparian Remap [ds2890]
Wet Meadow	Wet Meadow	(blank)	(blank)	EVeg

Note: Cropland data (Land IQ, 2022) was used to further classify agriculture land cover into perennial and annual classifications. The cropland sources were sorted as follows:

-Perennial—Citrus and Subtropical, Deciduous Fruits and Nuts, Truck Nursery and Berry Crops, Vineyard, and Young Perennial.

-Annual—Field Crops, Grain and Hay Crop, Idle, Pasture, Rice, and Unclassified.

-Urban—Urban Unspecified and Urban Landscape.

Appendix C: Focal Conservation Element Selection Criteria

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Fish															
Acipenser medirostris	Green sturgeon – southern DPS	3	No	Threatened	None	SSC	G2T1	S1	N/A	Aquatic, Sacramento/San Joaquin flowing waters	Yes	Yes	Yes	No	Non-Focal Species
Entosphenus tridentatus	Pacific lamprey	0	No	None	None	None	G4	S3	N/A	Aquatic, Sacramento/San Joaquin flowing waters	No	Yes	Yes	No	Non-Focal Species
Lampetra hubbsi	Kern brook lamprey	1	No	None	None	SSC	G1G2	S1S2	N/A	Aquatic, Sacramento/San Joaquin flowing waters	No	Yes	Yes	Yes	Not Included
Mylopharodon conocephalus	Hardhead	11	Yes	None	None	SSC	G3	S3	N/A	Sacramento/San Joaquin flowing waters	No	Yes	No	No	Not Included
Oncorhynchus mykiss irideus pop. 11	Steelhead – Central Valley DPS	6	Yes	Threatened	None	None	G5T2Q	S2	N/A	Aquatic, Sacramento/San Joaquin flowing waters	No	Yes	Yes	No	Focal Species
Oncorhynchus tshawytscha pop. 13	Chinook salmon - Central Valley fall-/late fall-run ESU	0	No	None	None	SSC	G5T3Q	S3	N/A	Aquatic, Sacramento/San Joaquin flowing waters	No	Yes	Yes	No	Focal Species
Oncorhynchus tshawytscha pop. 11	Chinook salmon – Central Valley spring run ESU	0	No	Threatened	Threatened	None	G5T2Q	S2	N/A	Aquatic, Sacramento/San Joaquin flowing waters	No	Yes	Yes	No	Not Included
Pogonichthys macrolepidotus	Sacramento splittail	1	No	None	None	SSC	G3	S3	N/A	Aquatic, estuary, freshwater marsh, Sacramento/San Joaquin flowing waters	Yes	Yes	No	No	Not Included
Spirinchus thaleichthys	Longfin smelt	1	No	Endangered	Threatened	None	G5	S1	N/A	Aquatic, estuary	Yes	Yes	Yes	No	Not Included
Mollusks															

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Gonidea angulata	Western ridged mussel	5	Yes (possibly extirpated)	None	None	None	G3	S2	N/A	Aquatic	No	Yes	Yes	No	Not Included
Monadenia mormonum buttoni	Button Sierra sideband	1	No	None	None	None	G2T1	S1S2	N/A	Chaparral, cismontane woodland, valley and foothill grassland	No	Yes	No	No	Not Included
Crustaceans															
Branchinecta conservatio	Conservancy fairy shrimp	16	Yes	Endangered	None	None	G2	S2	N/A	Valley and foothill grassland, vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Branchinecta longiantenna	Longhorn fairy shrimp	4	No	Endangered	None	None	G1	S2	N/A	Valley and foothill grassland, vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Branchinecta lynchi	Vernal pool fairy shrimp	92	Yes	Threatened	None	None	G3	S3	N/A	Valley and foothill grassland, vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Branchinecta mesovallensis	Midvalley fairy shrimp	23	Yes	None	None	None	G2	S2S3	N/A	Vernal pool, wetland	Yes	No	No	Yes	Not Included
Lepidurus packardi	Vernal pool tadpole shrimp	34	Yes	Endangered	None	None	G4	S3	N/A	Valley and foothill grassland, vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Linderiella occidentalis	California linderiella	66	Yes	None	None	None	G2G3	S2S3	N/A	Vernal pool	No	No	No	Yes	Not Included
Arachnids															
Calicina breva	Stanislaus harvestman	1	No	None	None	None	G1	S1	N/A	Valley and foothill grassland	No	Yes	No	No	Not Included
Insects															
Anthicus sacramento	Sacramento anthicid beetle	4	No	None	None	None	G1	S4	N/A	Interior dunes	No	Yes	No	Yes	Not Included
Bombus caliginosus	Obscure bumble bee	1	No	None	None	None	G2G3	S1S2	N/A	Grassland	No	Yes	No	No	Not Included
Bombus crotchii	Crotch’s bumble bee	4	No	None	Candidate Endangered	None	G2	S2	N/A	Grassland, scrub	No	Yes	No	No	Non-Focal Species
Bombus morrisoni	Morrison bumble bee	1	No	None	None	None	G3	S1S2	N/A	Grassland	No	Yes	No	No	Not Included
Bombus occidentalis	Western bumble bee	1	No	None	Candidate Endangered	None	G3	S1	N/A	Grassland	No	Yes	No	No	Non-Focal Species
Ceratochrysis menkei	Menke's cuckoo wasp	1	No	None	None	None	G1	S2	N/A	Unknown	No	Yes	No	No	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Danaus plexippus	Monarch butterfly	0	No	Candidate	None	None	G4T1T2Q	S2	N/A	Grassland, chaparral, forest and woodland	No	Yes	No	No	Focal Species
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	17	Yes	Threatened	None	None	G3T2T3	S3	N/A	Riparian	Yes	Yes	No	Yes	Focal Species
Efferia antiochi	Antioch efferian robberfly	2	No	None	None	None	G1G2	S1S2	N/A	Interior dunes	No	No	No	Yes	Not Included
Hygrotus curvipes	Curved-foot hygrotus diving beetle	1	No	None	None	None	G1	S2	N/A	Aquatic	Yes	Yes	No	No	Not Included
Lytta morrisoni	Morrison's blister beetle	5	Yes (possibly extirpated)	None	None	None	G2	S2	N/A	Valley and foothill grassland	No	No	No	No	Not Included
Lytta molesta	Molestan blister beetle	3	No (possibly extirpated)	None	None	None	G2	S2	N/A	Vernal pool, wetland	Yes	No	No	Yes	Not Included
Metapogon hurdi	Hurd's metapogon robberfly	1	No (possibly extirpated)	None	None	None	G1G2	S1S2	N/A	Interior dunes	No	No	No	yes	Not Included
Rhaphiomidas trochilus	San Joaquin Valley giant flower-loving fly	2	No (extirpated)	None	None	None	G1	S1	N/A	Interior dunes	No	Yes	No	yes	Not Included
Amphibians															
Ambystoma californiense pop. 1	California tiger salamander - central California DPS	100	Yes	Threatened	Threatened	WL	G2G3T3	S3	N/A	Valley and foothill grassland, vernal pool, wetland	Yes	Yes	Yes	Yes	Focal Species
Lithobates pipiens	Northern leopard frog	1	No	None	None	SSC	G5	S2	N/A	Freshwater marsh	No	Yes	Yes	No	Not Included
Rana draytonii	California red-legged frog	4	No	Threatened	None	SSC	G2G3	S2S3	N/A	Freshwater marsh, riparian scrub, riparian woodland	Yes	Yes	No	No	Not Included
Spea hammondii	Western spadefoot	94	Yes	Proposed Threatened	None	SSC	G2G3	S3S4	N/A	Valley and foothill grassland, vernal pool, wetland	No	Yes	No	Yes	Non-Focal Species
Reptiles															
Anniella pulchra	Northern California legless lizard	6	Yes	None	None	SSC	G3	S2S3	N/A	Chaparral	No	Yes	Yes	Yes	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Arizona elegans occidentalis	California glossy snake	1	No	None	None	SSC	G5T2	S2	N/A	Scrub, grassland	No	Yes	No	No	Not Included
Actinemys marmorata	Northwestern pond turtle	35	Yes	Proposed Threatened	None	SSC	G3G4	S3	N/A	Freshwater wetland	Yes	Yes	No	No	Non-Focal Species
Gambelia sila	Blunt-nosed leopard lizard	28	Yes	Endangered	Endangered	FP	G1	S1	N/A	Chenopod scrub	Yes	Yes	No	Yes	Not Included
Masticophis flagellum ruddocki	San Joaquin coachwhip	1	No	None	None	SSC	G5T2T3	S3	N/A	Chenopod scrub, valley and foothill grassland	No	Yes	No	No	Not Included
Phrynosoma blainvillii	Coast horned lizard	6	Yes	None	None	SSC	G3G4	S4	N/A	Chaparral, cismontane woodland, riparian scrub, riparian woodland, valley and foothill grassland	No	Yes	No	No	Not Included
Thamnophis gigas	Giant garter snake	28	Yes	Threatened	Threatened	None	G2	S2	N/A	Marsh and swamp, riparian scrub, wetland	Yes	Yes	No	Yes	Focal Species
Thamnophis hammondii	Two-striped gartersnake	1	No	None	None	SSC	G4	S3S4	N/A	Riparian scrub, riparian woodland, wetland	No	Yes	No	No	Not Included
Birds															
Agelaius tricolor	Tricolored blackbird	107	Yes	None	Threatened	SSC	G1G2	S1S2	N/A	Freshwater marsh	Yes	Yes	No	No	Focal Species
Antigone canadensis tabida	Greater sandhill crane	0	No	None	Threatened	FP	G5T5	S2	N/A	Freshwater marsh	Yes	Yes	No	No	Non-Focal Species
Aquila chrysaetos	Golden eagle	1	No	None	None	FP, WL	G5	S3	N/A	Broadleaved upland forest, cismontane woodland, valley & foothill grassland	Yes	No	No	No	Not Included
Ardea alba	Great egret	2	No	None	None	None	G5	S4	N/A	Estuary, freshwater marsh, riparian forest,	Yes	No	No	No	Not Included
Ardea herodias	Great blue heron	2	No	None	None	None	G5	S4	N/A	Brackish marsh, freshwater marsh, riparian forest, wetland	Yes	No	No	No	Not Included
Athene cunicularia	Burrowing owl	61	Yes	None	Candidate	SSC	G4	S3	N/A	Valley & foothill grassland	Yes	Yes	No	No	Non-Focal Species

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Branta hutchinsii leucopareia	Cackling (=Aleutian Canada) goose	10	Yes	Delisted	None	WL	G5T3	S3	N/A	Artificial standing waters, valley & foothill grassland	No	No	No	No	Not Included
Buteo regalis	Ferruginous hawk	1	No	None	None	WL	G4	S3S4	N/A	Valley & foothill grassland	Yes	No	No	No	Not Included
Buteo swainsoni	Swainson's hawk	297	Yes	None	Threatened	WL	G5	S3	N/A	Riparian forest, riparian woodland, valley & foothill grassland	Yes	Yes	Yes	No	Focal Species
Charadrius montanus	Mountain plover	1	No	None	None	SSC	G3	S2S3	N/A	Chenopod scrub, valley & foothill grassland	Yes	Yes	No	No	Not Included
Circus hudsonius	Northern harrier	5	Yes	None	None	SSC	G5	S3	N/A	Riparian scrub, valley & foothill grassland, wetland	Yes	Yes	No	No	Not Included
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	3	No (possibly extirpated)	Threatened	Endangered	None	G5T2T3	S1	N/A	Riparian forest	Yes	Yes	Yes	yes	Not Included
Egretta thula	Snowy egret	1	No	None	None	none	G5	S4	N/A	Freshwater wetland, riparian forest, riparian woodland	Yes	No	No	No	Not Included
Eremophila alpestris actia	California horned lark	5	Yes	None	None	WL	G5T4Q	S4	N/A	Valley & foothill grassland	Yes	No	No	No	Not Included
Falco columbarius	Merlin	2	No	None	None	WL	G5	S3S4	N/A	Valley & foothill grassland	Yes	No	No	No	Not Included
Falco mexicanus	Prairie falcon	1	No	None	None	WL	G5	S4	N/A	Valley & foothill grassland	Yes	No	No	No	Not Included
Haliaeetus leucocephalus	Bald eagle	4	No	Delisted	Endangered	FP	G5	S3	N/A	Lower montane coniferous forest, old growth	No	Yes	No	Yes	Not Included
Icteria virens	Yellow-breasted chat	1	No	None	None	SSC	G5	S3	N/A	Riparian forest, riparian scrub, riparian woodland	Yes	Yes	No	Yes	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Lanius ludovicianus	Loggerhead shrike	4	No	None	None	SSC	G4	S4	N/A	Broadleaved upland forest, riparian woodland	Yes	Yes	No	No	Not Included
Melospiza melodia pop. 1	Song sparrow ("Modesto" population)	5	Yes	None	None	SSC	G5T3	S3	N/A	Freshwater marsh, riparian forest, riparian scrub, riparian woodland	No	Yes	Yes	Yes	Not Included
Pandion haliaetus	Osprey	2	No	None	None	WL	G5	S4	N/A	Riparian forest	Yes	No	No	Yes	Not Included
Pica nuttalli	Yellow-billed magpie	0	No	None	None	None	G3	S3S4	N/A	Riparian woodland, riverine corridors, valley & foothill grassland	No	No	No	No	Non-Focal Species
Riparia riparia	Bank swallow	1	No	None	Threatened	None	G5	S2	N/A	Riparian scrub, riparian woodland	Yes	Yes	No	Yes	Non-Focal Species
Vireo bellii pusillus	Least Bell's vireo	4	No	Endangered	Endangered	None	G5T2	S2	N/A	Riparian forest, riparian scrub, riparian woodland	No	Yes	Yes	Yes	Not Included
Xanthocephalus xanthocephalus	Yellow-headed blackbird	1	No	None	None	SSC	G5	S3	N/A	Marsh & swamp, wetland	No	Yes	No	Yes	Not Included
Mammals															
Ammospermophilus nelsoni	Nelson's (=San Joaquin) antelope squirrel	1	No	None	Threatened	None	G2G3	S2S3	N/A	Chenopod scrub	Yes	Yes	No	Yes	Not Included
Antrozous pallidus	Pallid bat	8	Yes	None	None	SSC	G4	S3	N/A	Chaparral, riparian woodland, valley & foothill grassland	No	Yes	No	No	Non-Focal Species
Cervus canadensis nannodes	Tule elk	0	No	None	None	None	G5T3	S3	N/A	Chenopod scrub, valley & foothill grassland	No	Yes	No	Yes	Non-Focal Species
Corynorhinus townsendii	Townsend's big-eared bat	4	No	None	None	SSC	G4	S2	N/A	Broadleaved upland forest, chaparral, chenopod scrub, meadow & seep, riparian forest, riparian woodland, valley & foothill grassland	Yes	Yes	No	No	Non-Focal Species
Dipodomys heermanni dixoni	Merced kangaroo rat	6	Yes	None	None	None	G4T2T3	S2	N/A	Valley & foothill grassland	No	Yes	No	No	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Dipodomys nitratoides exilis	Fresno kangaroo rat	4	No (possibly extirpated)	Endangered	Endangered	None	G3TH	SH	N/A	Chenopod scrub	No	Yes	No	Yes	Not Included
Euderma maculatum	Spotted bat	1	No	None	None	SSC	G4	S3	N/A	Chaparral, cismontane woodland, coastal scrub, valley & foothill grassland	No	No	No	No	Not Included
Eumops perotis californicus	Western mastiff bat	9	Yes	None	None	SSC	G4G5T4	S3S4	N/A	Chaparral, cismontane woodland, coastal scrub, valley & foothill grassland	Yes	No	No	No	Not Included
Lasionycteris noctivagans	Silver-haired bat	1	No	None	None	None	G3G4	S3S4	N/A	Lower montane coniferous forest, old growth, riparian forest	No	No	No	Yes	Not Included
Lasiurus cinereus	Hoary bat	13	Yes	None	None	None	G3G4	S4	N/A	Broadleaved upland forest, chaparral, cismontane woodland	No	No	No	Yes	Not Included
Lasiurus frantzii	Western red bat	12	Yes	None	None	SSC	G4	S3	N/A	Cismontane woodland, lower montane coniferous forest, riparian forest, riparian woodland	No	No	No	Yes	Focal Species
Myotis yumanensis	Yuma myotis	13	Yes	None	None	None	G5	S4	N/A	Lower montane coniferous forest, riparian forest, riparian woodland, upper montane coniferous forest	Yes	No	No	Yes	Not Included
Neotoma fuscipes riparia	Riparian (=San Joaquin Valley) woodrat	8	Yes (2 occ extirpated)	Endangered	None	SSC	G5T1Q	S1	N/A	Riparian forest, riparian scrub	Yes	Yes	No	Yes	Non-Focal Species
Perognathus inornatus	San Joaquin pocket mouse	6	Yes	None	None	None	G2G3	S2S3	N/A	Cismontane woodland, valley & foothill grassland	Yes	Yes	No	No	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Sylvilagus bachmani riparius	Riparian brush rabbit	14	Yes	Endangered	Endangered	None	G5T1	S1	N/A	Riparian forest	Yes	Yes	No	Yes	Focal Species
Taxidea taxus	American badger	13	Yes	None	None	SSC	G5	S3	N/A	Broadleaved upland forest, chaparral, chenopod scrub, cismontane woodland, freshwater marsh, marsh & swamp, meadow & seep, riparian forest, riparian scrub, riparian woodland, valley & foothill grassland	Yes	Yes	No	No	Non-Focal Species
Vulpes macrotis mutica	San Joaquin kit fox	34	Yes	Endangered	Threatened	None	G4T2	S2	N/A	Chenopod scrub, valley & foothill grassland	Yes	Yes	No	No	Focal Species
Dicots															
Astragalus tener var. tener	Alkali milk-vetch	10	Yes	None	None	None	G2T1	S1	1B.2	Alkali playa, valley & foothill grassland, vernal pool, wetland	Yes	No	No	Yes	Not Included
Atriplex cordulata var. cordulata	Heartscale	30	Yes	None	None	None	G3T2	S2	1B.2	Chenopod scrub, meadow & seep, valley & foothill grassland	Yes	No	No	No	Not Included
Atriplex coronata var. vallicola	Lost Hills crownscale	3	No	None	None	None	G4T3	S3	1B.2	Chenopod scrub, vernal pool, valley & foothill grassland	No	No	No	Yes	Not Included
Atriplex depressa	Brittlescale	5	Yes	None	None	None	G2	S2	1B.2	Alkali playa, chenopod scrub, meadow & seep, valley & foothill grassland, vernal pool, wetland	Yes	No	No	Yes	Not Included
Atriplex minuscula	Lesser saltscale	18	Yes	None	None	None	G2	S2	1B.1	Alkali playa, chenopod scrub, valley & foothill grassland	Yes	Yes	No	No	Not Included
Atriplex persistens	Vernal pool smallscale	18	Yes	None	None	None	G2	S2	1B.2	Vernal pool, wetland	No	No	No	Yes	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Atriplex subtilis	Subtle orache	6	Yes	None	None	None	G1	S1	1B.2	Valley & foothill grassland	No	No	No	No	Not Included
Blepharizonia plumosa	Big tarplant	3	No	None	None	None	G1G2	S1S2	1B.1	Valley & foothill grassland	Yes	Yes	No	No	Not Included
Brasenia schreberi	Watershield	1	No	None	None	None	G5	S3	2B.3	Marsh & swamp, wetland	No	No	No	No	Not Included
Calycadenia hooveri	Hoover's calycadenia	4	No	None	None	None	G2	S2	1B.3	Cismontane woodland, valley & foothill grassland	Yes	No	No	No	Not Included
Castilleja campestris var. succulenta	Succulent owl's-clover	27	Yes	Threatened	Endangered	None	G4?T2T3	S2S3	1B.2	Venal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Caulanthus lemmonii	Lemmon's jewelflower	1	No	None	None	None	G3	S3	1B.2	Valley & foothill grassland	No	No	No	No	Not Included
Chloropyron molle ssp. hispidum	Hispid salty bird's-beak	20	Yes	None	None	None	G2T1	S1	1B.1	Alkali play, meadow & seep, wetland	Yes	Yes	No	Yes	Not Included
Chloropyron palmatum	Palmate-bracted bird's-beak	8	Yes	Endangered	Endangered	None	G1	S1	1B.1	Chenopod scrub, meadow & seep, valley & foothill grassland, wetland	Yes	Yes	No	No	Not Included
Cirsium crassicaule	Slough thistle	2	No (1 occ possibly extirpated)	None	None	None	G1	S1	1B.1	Chenopod scrub, freshwater marsh, marsh & swamp, riparian scrub, wetland	Yes	Yes	No	Yes	Not Included
Clarkia rostrata	Beaked clarkia	3	No	None	None	None	G2G3	S2S3	1B.3	Cismontane woodland, valley & foothill grassland	No	No	No	No	Not Included
Cryptantha hooveri	Hoover's cryptantha	2	No (possibly extirpated)	None	None	None	GH	SH	1A	Interior dunes, valley & foothill grassland	No	No	No	No	Not Included
Cryptantha mariposae	Mariposa cryptantha	1	No	None	None	None	G2G3	S2S3	1B.3	Chaparral, ultramafic	No	No	No	Yes	Not Included
Cuscuta obtusiflora var. glandulosa	Peruvian dodder	1	No	None	None	None	G5T4?	SH	2B.2	Marsh & swamp, wetland	No	No	No	Yes	Not Included
Delphinium recurvatum	Recurved larkspur	4	No	None	None	None	G2?	S2?	1B.2	Chenopod scrub, cismontane woodland, valley & foothill grassland	Yes	No	No	No	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Downingia pusilla	Dwarf downingia	6	Yes	None	None	None	GU	S2	2B.2	Valley & foothill grassland, vernal pool, wetland	No	No	No	Yes	Not Included
Eriastrum hooveri	Hoover's eriastrum	4	No	Delisted	None	None	G3	S3	4.2	Chenopod scrub, valley & foothill grassland	No	No	No	No	Not Included
Eryngium racemosum	Delta button-celery	23	Yes	None	Endangered	None	G1	S1	1B.1	Riparian scrub, wetland	Yes	Yes	No	Yes	Focal Species
Eryngium spinosepalum	Spiny-sepaled button-celery	24	Yes	None	None	None	G2	S2	1B.2	Valley & foothill grassland, vernal pool, wetland	No	No	No	Yes	Not Included
Erythranthe marmorata	Stanislaus monkeyflower	1	No	None	None	None	G2?	S2?	1B.1	Cismontane woodland, lower montane coniferous forest	No	No	No	No	Not Included
Eschscholzia rhombipetala	Diamond-petaled California poppy	1	No	None	None	None	G1	S1	1B.1	Valley & foothill grassland	Yes	Yes	No	No	Not Included
Euphorbia hooveri	Hoover's spurge	1	No	Threatened	None	None	G1	S1	1B.2	Vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Extriplex joaquinana	San Joaquin spearscale	3	No	None	None	None	G2	S2	1B.2	Alkali playa, chenopod scrub, meadow & seep, valley & foothill grassland	No	No	No	No	Not Included
Hibiscus lasiocarpos var. occidentalis	Woolly rose-mallow	2	No	None	None	None	G5T3	S3	1B.2	Freshwater marsh, marsh & swamp, wetland	No	No	No	Yes	Not Included
Lagophylla dichotoma	Forked hare-leaf	2	No	None	None	None	G2	S2	1B.1	Cismontane woodland, valley & foothill grassland	No	Yes	No	No	Not Included
Lasthenia chrysantha	Alkali-sink goldfields	16	No	None	None	None	G2	S2	1B.1	Vernal pool	No	No	No	Yes	Not Included
Lasthenia glabrata ssp. coulteri	Coulter's goldfields	3	No	None	None	None	G4T2	S2	1B.1	Alkali playa, marsh & swamp, salt marsh, vernal pool, wetland	No	Yes	No	Yes	Not Included
Layia munzii	Munz's tidy-tips	4	No	None	None	None	G2	S2	1B.2	Chenopod scrub, valley & foothill grassland	No	No	No	No	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Lepidium latipes var. heckardii	Heckard's pepper-grass	1	No	None	None	None	G4T1	S1	1B.2	Valley & foothill grassland, vernal pool	No	No	No	Yes	Not Included
Leptosiphon serrulatus	Madera leptosiphon	2	No	None	None	None	G3	S3	1B.2	Cismontane woodland, lower montane coniferous forest	No	No	No	No	Not Included
Lilaeopsis masonii	Mason's lilaeopsis	5	Yes	None	Rare	None	G2	S2	1B.1	Freshwater marsh, marsh & swamp, riparian scrub, wetland	Yes	Yes	No	Yes	Not Included
Mordella leucocephala	Merced mordella	3	No (extirpated)	None	None	None	GX	SX	1A	Valley & foothill grassland	No	No	No	No	Not Included
Navarretia nigelliformis ssp. radians	Shining navarretia	13	Yes	None	None	None	G4T2	S2	1B.2	Cismontane woodland, valley & foothill grassland, vernal pool, wetland	No	No	No	No	Not Included
Navarretia prostrata	Pprostrate vernal pool navarretia	7	Yes	None	None	None	G2	S2	1B.2	Coastal scrub, meadow & seep, valley & foothill grassland, venal pool, wetland	No	Yes	No	Yes	Not Included
Phacelia ciliata var. opaca	Merced phacelia	5	Yes	None	None	None	G5TH	SH	3.2	Valley & foothill grassland	No	No	No	No	Not Included
Pseudobahia bahiifolia	Hartweg's golden sunburst	7	Yes	Endangered	Endangered	None	G1	S1	1B.1	Cismontane woodland, valley & foothill grassland	Yes	Yes	No	No	Not Included
Trichocoronis wrightii var. wrightii	Wright's trichocoronis	5	Yes	None	None	None	G4T3	S1	2B.1	Marsh & swamp, meadow & seep, riparian forest, vernal pool, wetland	Yes	No	No	Yes	Not Included
Tropidocarpum capparideum	Caper-fruited tropidocarpum	6	No (possibly extirpated)	None	None	None	G1	S1	1B.1	Valley & foothill grassland	Yes	Yes	No	No	Not Included
Monocots															

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Agrostis hendersonii	Henderson's bent grass	1	No	None	None	None	G2Q	S2	3.2	Valley & foothill grassland, vernal pool, wetland	No	No	No	Yes	Not Included
Imperata brevifolia	California satintail	1	No	None	None	None	G3	S3	2B.1	Chaparral, meadow & seep, riparian scrub, wetland	No	No	No	Yes	Not Included
Neostapfia colusa	Colusa grass	22	Yes	Threatened	Endangered	None	G1	S1	1B.1	Vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	17	Yes (8 occ extirpated, 1 occ possibly extirapted)	Threatened	Endangered	None	G1	S1	1B.1	Vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Orcuttia pilosa	Hairy Orcutt grass	13	Yes (6 occ extirpated, 2 occ possibly extirpated)	Endangered	Endangered	None	G1	S1	1B.1	Vernal pool, wetland	Yes	Yes	No	Yes	Non-Focal Species
Potamogeton zosteriformis	Eel-grass pondweed	1	No	None	None	None	G5	S3	2B.2	Marsh & swamp, wetland	No	No	No	Yes	Not Included
Puccinellia simplex	California alkali grass	7	Yes	None	None	None	G2	S2	1B.2	Chenopod scrub, meadow & seep, valley & foothill grassland, vernal pool	No	No	No	Yes	Not Included
Sagittaria sanfordii	Sanford's arrowhead	10	Yes	None	None	None	G3	S3	1B.2	Marsh & swamp, wetland	Yes	No	No	Yes	Not Included
Sphenopholis obtusata	Prairie wedge grass	1	No	None	None	None	G5	S2	2B.2	Cismontane woodland, meadow & seep, wetland	No	No	No	Yes	Not Included
Stuckenia filiformis ssp. alpina	Northern slender pondweed	1	No	None	None	None	G5T5	S2S3	2B.2	Marsh & swamp, wetland	No	No	No	Yes	Not Included
Tuctoria greenei	Greene's tuctoria	14	Yes (4 occ extirpated, 1 occ possibly extirpated)	Endangered	Rare	None	G1	S1	1B.1	Marsh & swamp, wetland	Yes	Yes	No	Yes	Not Included

Scientific Name	Common Name	Occurrence in Preliminary Study Area*		Protections						Habitat	Other Considerations				Determination for inclusion in the RCIS**
		CNDDB Occ. Count	Sufficient data (>5)	Federal Status	State Status	CDFW Status	Global Rank	State Rank	Rare Plant Rank		HCP	SGCN (SWAP)	Climate change vulnerability list	Habitat limited or already protected	
Sensitive Natural Communities															
Cismontane Alkali Marsh	Cismontane Alkali Marsh	1	No	None	None	None	G1	S1.1	N/A	Marsh & swamp, wetland	No	No	Yes	Yes	OCE
Coastal and Valley Freshwater Marsh	Coastal and Valley Freshwater Marsh	3	No	None	None	None	G3	S2.1	N/A	Marsh & swamp, wetland	No	No	Yes	Yes	OCE
Elderberry Savanna	Elderberry Savanna	1	No	None	None	None	G2	S2.1	N/A	Riparian scrub	No	No	Yes	Yes	OCE
Great Valley Cottonwood Riparian Forest	Great Valley Cottonwood Riparian Forest	2	No	None	None	None	G2	S2.1	N/A	Riparian forest	No	No	Yes	Yes	OCE
Great Valley Mixed Riparian Forest	Great Valley Mixed Riparian Forest	2	No	None	None	None	G2	S2.2	N/A	Riparian forest	No	No	Yes	Yes	OCE
Great Valley Valley Oak Riparian Forest	Great Valley Valley Oak Riparian Forest	4	No	None	None	None	G1	S1.1	N/A	Riparian forest	No	No	Yes	Yes	Non-Focal Species
Northern Claypan Venal Pool	Northern Claypan Vernal Pool	7	Yes	None	None	None	G1	S1.1	N/A	Vernal pool	No	No	No	Yes	OCE
Northern Hardpan Vernal Pool	Northern Hardpan Vernal Pool	9	Yes	None	None	None	G3	S3.1	N/A	Vernal pool	No	No	No	Yes	OCE
Sycamore Alluvial Woodland	Sycamore Alluvial Woodland	2	Yes	None	None	None	G1	S1.1	N/A	Riparian woodland	No	No	Yes	Yes	OCE
Valley Sacaton Grassland	Valley Sacaton Grassland	5	Yes	None	None	None	G1	S1.1	N/A	Valley & foothill grassland	No	No	No	Yes	OCE

*CNDDB is one source of occurrence data. It provides insights as to a species/community abundance in the RCIS but should not be considered a comprehensive representation of all populations. Also, not all species are included in the CNDDB. Some conservation elements were selected despite having low reported occurrences either because of an interest in expanding the species population or ranges or because additional data sources were available to inform the conservation strategy.

**The process for how this list was developed and analyzed is described in Section 3.1 of the RCIS document. Inclusion of species and communities as focal, non-focal, or other conservation elements were determined by a combination of factors, including federal and state listings, range and occurrence of species in the RCIS area, climate vulnerability, existing habitat protections, representation of major taxonomic groups, and representation of important natural communities and ecosystem processes, and input from local experts.

Appendix D: Consistency with Recovery Plans and Habitat Conservation Plans

A recovery plan is a document published by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), or California Department of Fish and Wildlife (CDFW) that lists the status of a listed species and the actions necessary to remove the species from the endangered species list (CDFW, 2023a). Table D-1 summarizes how this RCIS is consistent with regional and project habitat conservation plans (HCPs) that overlap with the RCIS area. Table D-2 summarizes how this RCIS is consistent with recovery plans that overlap with the geography and species covered in the RCIS.

Table D-1. Consistency with Habitat Conservation Plans

Document	Goals/Objectives	Consistency with RCIS
San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJCG, 2000)	▪ Provide a strategy for balancing the need to conserve Open Space and the need to convert Open Space to non-Open Space uses while protecting the region's agricultural economy ▪ Preserve landowner property rights ▪ Provide for the long-term management of 97 plant, fish, and wildlife species—especially those that are currently listed, or may be listed in the future, under the Federal Endangered Species Act or the California Endangered Species Act ▪ Provide and maintain multiple-use Open Space which contributes to the quality of life of San Joaquin County residents ▪ Accommodate a growing population while minimizing costs to project proponents and society at large	This RCIS includes 23 species as focal or non-focal conservation elements that are included in the HCP. The conservation value of working lands has been integrated into many actions included in the conservation strategy. This will allow for mitigation opportunities for entities or projects that are not eligible for coverage under the HCP, while still supporting the HCP's goals for long-term management of species and habitats.
City of Waterford (expired) (City of Waterford, 1995)	▪ Allowed for the incidental take of valley elderberry longhorn beetle during the City of Waterford Wastewater Treatment Facility Reconfiguration and Expansion Project in Waterford, California	This RCIS is not a regulatory document and does not provide for incidental take of any listed species. While valley elderberry longhorn beetle is included as a focal conservation element, no actions included in the conservation strategy approve or disapprove of any development.
PG&E's San Joaquin Valley Operations and Maintenance Habitat Conservation Plan (PG&E, 2006)	▪ Allows for incidental take of 23 wildlife and 42 plant species during operations and maintenance of transmission and distribution infrastructure and minor maintenance activities ▪ Supports implementation of conservation, management, and monitoring measures to mitigate impacts on listed species	This RCIS does not prevent PG&E from conducting its required operations and maintenance of its infrastructure. This RCIS includes 12 species as focal or non-focal conservation elements that are included in the HCP. Implemented RCIS actions may be used by PG&E as mitigation for their operations and maintenance impacts.

Document	Goals/Objectives	Consistency with RCIS
Stanislaus Regional Water Authority Surface Water Supply Project (completed) (Stanislaus Regional Water Authority, 2020)	▪ Allowed for the incidental take of valley elderberry longhorn beetle during the construction and operation of the Surface Water Supply Project	This RCIS is not a regulatory document and does not provide for incidental take of any listed species. While valley elderberry longhorn beetle is included as a focal conservation element, no actions included in the conservation strategy approve or disapprove of any development.
Teichert Vernalis Project Phases I & II (completed) (now covered by the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan [SJCG, 2000])	▪ Allowed for the incidental take of California red-legged frog and San Joaquin kit fox during the construction and operation of the Vernalis Project	This RCIS is not a regulatory document and does not provide for incidental take of any listed species. While San Joaquin kit fox is included as a focal conservation element, no actions included in the conservation strategy approve or disapprove of any development. California red-legged frog was not included in this RCIS given its extirpation from the floor of the Central Valley, which is the majority of the RCIS area.

Table D-2. Consistency with Recovery Plans

Document	Goals/Objectives	How Considered in the RCIS
Recovery Plan for the California Tiger Salamander (USFWS, 2016)	▪ Secure self-sustaining populations of Central California tiger salamander (CTS) and ensure conservation of genetic variability and diverse habitat types ▪ Reduce threats that caused the species to be listed and any future threats ▪ Restore and conserve a healthy ecosystem supportive of CTS populations	The RCIS aims to protect, restore, and enhance suitable and potentially suitable aquatic and upland habitats. This includes conserving genetic variability and addressing loss of species habitat, increase in barriers in migration, and changes in surface water level threats. Examples of actions to reduce threats to CTS habitat include maintaining connectivity, restoring aquatic plant communities, and restoring large vernal pools. The RCIS also includes actions to enhance and restore occupied, suitable, and USFWS-designated critical habitat. The RCIS is consistent with this recovery plan.
Recovery Plan for the Giant Garter Snake, (USFWS, 2017)	▪ Protect existing and establish (and protect) self-sustaining populations of the giant garter snake (GGS) throughout the full ecological, geographical, and genetic range of the species ▪ Restore and conserve healthy Central Valley wetland ecosystems that function to support GGS ▪ Ameliorate or eliminate, to the extent possible, threats that caused the species to be listed or are of concern and any foreseeable future threats	The RCIS aims to protect, restore, and enhance upland and aquatic habitats and address loss of species habitat through expansion of suitable habitats. Examples of actions to reduce threats to GGS habitat include acquiring GGS habitat restoration, implementing water quality enhancements, and addressing surface water availability. The RCIS also includes actions to enhance and restore occupied, suitable, and USFWS-designated critical habitat. The RCIS is consistent with this recovery plan.
Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS, 1998)	▪ Delist the 11 endangered and threatened species and ensure long-term conservation of 23 candidates and species of concern ○ San Joaquin kit fox: Work towards the establishment of viable kit fox populations throughout geographic range ○ Riparian woodrat: Reduce effects of population fragmentation by establishing linkages between riparian habitat	The RCIS aims to protect, restore, and enhance upland habitats and allow expansion of suitable habitats. Examples of actions to reduce threats to San Joaquin kit fox include maintaining suitable vegetation structure through compatible grazing and revegetation, improving connectivity across infrastructure features, and maintaining and enhancing movement opportunities. Examples of actions to reduce threats to riparian woodrat are protection and restoration of riparian habitat and connecting riparian habitat patches. The RCIS also includes actions to enhance and restore occupied, suitable, and USFWS-designated critical habitat. The RCIS is consistent with this recovery plan.

Document	Goals/Objectives	How Considered in the RCIS
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 (NMFS, 2014)	▪ Secure existing populations by addressing stressors ▪ Reintroduce populations into historically occupied or other suitable areas ▪ Reduce the present or threatened destruction, modification, or curtailment of habitat or range ▪ Ameliorate utilization for commercial, recreational, scientific, or educational purposes ▪ Abate disease and predation ▪ Establish the adequacy of existing regulatory mechanisms for protecting the ESUs and DPSs now and into the future (i.e., post-delisting)	The RCIS aims to provide habitat and support sustainable and resilient populations by addressing stressors. Specific actions include developing fish-friendly water operations, improving water quality, removing fish passage barriers, and protecting and enhancing rearing habitats. The RCIS also includes actions to enhance and restore occupied, suitable, and NMFS-designated critical habitat. The RCIS is consistent with this recovery plan.
Conservation Plan for the Tricolored Blackbird (*Agelaius tricolor*) (Tricolored Blackbird Working Group, 2007)	▪ Protect, create, restore, and manage habitats needed to support viable, self-sustaining populations ▪ Protect silage-nesting birds until permanent breeding habitat is available ▪ Establish biological objectives to inform habitat management and restoration efforts ▪ Improve understanding of population dynamics and factors influencing reproductive success	The RCIS aims to protect, restore, and enhance upland habitats; allow expansion of suitable habitats; and address loss of species habitat and surface water diversion. Examples of actions to reduce threats to tricolored blackbird habitat includes protection of silage-nesting birds, preservation of freshwater wetland breeding habitat, and restoration of annual and perennial grasslands. The RCIS also includes actions to enhance and restore occupied and suitable habitat. The RCIS is consistent with this recovery plan.
Revised Recovery Plan for Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) (USFWS, 2019)	▪ Preserve resilient populations of valley elderberry longhorn beetle across the historical range of the species by maintaining occupancy in at least 80% of the HUC8 subbasins within each management ▪ Protect and manage a system of connected habitat patches along each river or major drainage within each HUC8 subbasin	The RCIS aims to protect, restore, and enhance upland habitats and allow expansion of suitable habitats. Examples of actions to reduce threats to the valley elderberry longhorn beetle include protection and restoration of riparian habitat patches and water supply enhancements. The RCIS also includes actions to enhance and restore occupied, suitable, and USFWS-designated critical habitat and the USFWS-designated San Joaquin River Management Unit. The RCIS is consistent with this recovery plan.

Document	Goals/Objectives	How Considered in the RCIS
Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS, 2005)	Achieve and protect in perpetuity self-sustaining populations of each species Promote natural ecosystem processes and functions by protecting and conserving intact vernal pools and vernal pool complexes ▪ Stabilize and protect populations to prevent further decline of each species	The RCIS aims to provide habitat and support sustainable and resilient populations by addressing stressors. Specific actions include improving water quality and supply and protecting and enhancing adjacent upland habitats. The RCIS also includes actions to enhance and restore occupied, suitable, and USFWS-designated critical habitat. The RCIS is consistent with this recovery plan.

Appendix E: Non-Focal Species

A non-focal species is associated with a focal species or other conservation element and will benefit from conservation actions and habitat enhancement actions in the RCIS. The RCIS Program Guidelines (CDFW, 2023a) require that an RCIS includes a brief, science-based justification indicating how the non-focal species' ecological requirements align with those of a focal species or other conservation element and how actions benefit the non-focal species. Co-benefited natural resources are habitats that benefit from the RCIS conservation strategy for focal species and other conservation elements and unlike non-focal species are not eligible for MCAs. Information for these non-focal conservation elements is provided below in Table E-2. Table E-3 provides a matrix linking the non-focal conservation elements with focal conservation elements.

Greater Sandhill Crane (*Antigone canadensis tabida*)

Greater sandhill crane shares ecological functions and/or similar habitats as its associated focal conservation elements: giant garter snake, Swainson's hawk, tricolored blackbird, delta button-celery, working lands, freshwater wetlands, grasslands, hydrogeomorphic processes, habitat connectivity, and groundwater suitability. This species forages in habitats used by giant garter snake, Swainson's hawk, tricolored blackbird, and delta button-celery, as well as habitats found in working lands, freshwater wetlands, and grasslands. Increasing habitat connectivity could increase foraging habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit greater sandhill cranes. For example, implementation of Rest-12 promotes multi-benefit agricultural practices which will benefit greater sandhill crane.

See Table E-1 for greater sandhill crane climate vulnerability assessment.

Burrowing Owl (*Athene cunicularia*)

Burrowing owl shares ecological functions and/or similar habitats as its associated focal conservation elements: California giant salamander, San Joaquin kit fox, Swainson's hawk, tricolored blackbird, working lands, grasslands, and habitat connectivity. This species forages and breeds in habitats used by California giant salamander, San Joaquin kit fox, Swainson's hawk, and tricolored blackbird, as well as habitats found in working lands and grasslands. Increasing habitat connectivity could increase foraging and breeding habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit burrowing owls. For example, implementation of Rest-28 will maintain vegetation structure for San Joaquin kit fox which will also benefit burrowing owl.

See Table E-1 for greater sandhill crane climate vulnerability assessment.

Bank Swallow (*Riparia riparia*), Least Bell's Vireo (*Vireo bellii pusillus*), and Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*)

Bank swallow, least Bell's vireo, and western yellow-billed cuckoo share ecological functions and/or similar habitats as its associated focal conservation elements: salmonids, riparian brush rabbit, western red bat, monarch butterfly, valley elderberry longhorn beetle, riparian and riverine corridors, hydrogeomorphic processes, and habitat connectivity. These are riparian species that breed in habitats used by salmonids, riparian brush rabbits, and valley elderberry

longhorn beetle, as well as in habitats associated with riparian and riverine corridors. These species forage in habitat used by western red bat and monarch butterfly. Increasing habitat connectivity could increase foraging and breeding habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit bank swallow, least Bell's vireo, and western yellow-billed cuckoo. For example, implementation of Rest-6 which will allow floods to promote fluvial processes; Rest-15 promotes inclusion of riparian structural diversity; and Learn-7, which inventories natural banks and revetment locations, will also benefit bank swallow, least Bell's vireo, and western yellow-billed cuckoo.

See Table E-1 for bank swallow, least Bell's vireo, and western yellow-billed cuckoo climate vulnerability assessment.

Yellow-Billed Magpie (*Pica nuttalli*)

Yellow-billed magpie shares ecological functions and/or similar habitats as its associated focal conservation elements: Riparian and riverine corridors, hydrogeomorphic processes, habitat connectivity, and groundwater suitability. This species forages and breeds in habitats associated with salmonids and in habitats associated with riparian and riverine corridors. Increasing habitat connectivity could increase foraging and breeding habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit yellow-billed magpies. For example, implementation of Rest-15—which promotes inclusion of riparian structural diversity—and Conn-2—which manages levees to increase adjacent habitat values—will also benefit yellow-billed magpie.

See Table E-1 for yellow-billed magpie climate vulnerability assessment.

Avian Non-Focal Species Climate Change Vulnerability Assessment

Gardali et al. (2012) assessed the climate change vulnerability of 358 at-risk California bird species; those of non-focal bird species are shown in Table E-1. The primary sensitivity factor affecting non-focal bird species is habitat specialization—most species had high vulnerability in this category. Most species also had moderate to high vulnerability to migratory status sensitivity and habitat suitability exposure. This is likely because of many non-focal avian species' reliance on riparian habitats that are projected to be affected by climate change.

Table E-1. Non-Focal Avian Species Climate Change Vulnerability Assessment

Species	*Habitat Suitability Exposure*	*Food Availability Exposure*	*Extreme Weather Exposure*	*Habitat Specialization Sensitivity*	*Physiological Tolerances Sensitivity*	*Migratory Status Sensitivity*	*Dispersal Ability Sensitivity*	*Climate Vulnerability Priority List*
Bank swallow	Moderate	Low	Low	High	Low	High	Low	Low
Burrowing owl	Low	Low	Low	High	Low	Moderate	Low	N/A
Greater sandhill crane	Moderate	Low	Low	High	Low	Moderate	Low	N/A
Least Bell's vireo[1]	Low	Low	High	High	Low	High	Low	Moderate
Western yellow-billed cuckoo	Moderate	Low	Moderate	High	Low	High	Low	Moderate
Yellow-billed magpie	High	Low	Moderate	Low	Low	Low	Moderate	Low

N/A = not applicable
Source: Gardali et al., 2012

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

Green sturgeon (southern DPS) shares ecological functions and/or similar habitats as its associated focal conservation elements: salmonids, riparian and riverine corridors, hydrogeomorphic processes, and habitat connectivity. This species breeds in habitats used by Steelhead (California Central Valley DPS), Chinook salmon (Central Valley ESU), and Chinook salmon (Central Valley fall-run ESU), as well as habitats associated with riparian and riverine corridors. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit green sturgeon (southern DPS). For example, implementation of Rest-14 and Cons-8, which will implement riparian restoration projects; support and collaborate with restoration project planning efforts; and protect historical, present-day, and potentially restorable acres of riparian and instream habitat will also benefit green sturgeon.

Green Sturgeon Climate Change Vulnerability Assessment

Green sturgeon (southern DPS) is vulnerable to direct effects from climate change from increasing water temperatures and decreased water flows (NMFS 2021). Spawning habitat suitability and timing in rivers may be impacted by climate change due to a reduction in water flows in the spring and changes in water temperature. Ocean acidification may impact prey, while other ocean changes may have unknown impacts given the adaptability of subadults and adults who are able to occupy the habitat. A climate change vulnerability assessment conducted by Quiñones and Moyle (2014) ranked green sturgeon's present-day vulnerability as *Highly Vulnerable*, meaning the "species is currently approaching extinction and is likely to be re-categorized as critically vulnerable if their populations are diminished further." Its climate change vulnerability is *Less Vulnerable*, meaning the "species [is] likely to decline or become more limited in distribution but extinction is unlikely by 2100." Given its present-day and climate change vulnerability scores, the green sturgeon's combined vulnerability score is *Highly Vulnerable*.

Pacific Lamprey (*Entosphenus tridentatus*)

Pacific lamprey shares ecological functions and/or similar habitats as its associated focal conservation elements: salmonids, riparian and riverine corridors, hydrogeomorphic processes, and habitat connectivity. This species breeds in habitats used by steelhead (California Central Valley DPS), Chinook salmon (Central Valley spring-run ESU), and Chinook salmon (Central Valley fall-run ESU), as well as habitats associated with riparian and riverine corridors. Increasing habitat connectivity could create breeding habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit pacific lamprey. For example, implementation of Learn-7—which identifies projected climate change impacts to hydrogeomorphic conditions throughout the RCIS area, inventories natural banks and revetment locations, and updates mapping of meander migration potential to support restoration project planning—will also benefit Pacific lamprey.

Pacific Lamprey Climate Change Vulnerability Assessment

The climate change vulnerability of freshwater fishes conducted by Quiñones and Moyle (2014) ranked Pacific lamprey's present-day vulnerability as *Highly Vulnerable*, meaning the "species is currently approaching extinction and is likely to be re-categorized as critically vulnerable if their populations are diminished further." Given its present-day and climate change vulnerability

scores, the Pacific lamprey's combined vulnerability score is *Highly Vulnerable* (Quiñones and Moyle, 2014).

Western Spadefoot (*Spea hammondii*)

Western spadefoot shares ecological functions and/or similar habitats as its associated focal conservation elements: Swainson's hawk, tricolored blackbird, delta button-celery, working lands, freshwater wetlands, grasslands, vernal pools, habitat connectivity, and groundwater suitability. This species forages and breeds in habitats used by Swainson's hawk, tricolored blackbird, and delta button-celery, as well as habitats found in working lands, freshwater wetlands, grasslands, and vernal pools. Increasing habitat connectivity could increase breeding and upland habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit western spadefoot. For example, implementation of Cons-2 encourages support of local governments to develop habitat conservation plans that include land use protection measures, and Cons-7 encourages protection of areas within USFWS-designated core areas and critical habitat for special-status vernal pool wildlife and plants species. Both of these actions will also benefit western spadefoot.

Western Spadefoot Climate Change Vulnerability Assessment

Climate stressors that could impact western spadefoot include increased drought frequency and severity, increase wildfire frequency, extreme precipitation events, and altered hydrology (USFWS, 2023). According to modelling by Wright et al. (2013), western spadefoot is at "neutral risk" from climate change across its statewide range. These projections indicate that in 2050, more than 80% of the current distribution of western spadefoot will remain and there will be no greater than a 20% change in available suitable habitat under low and high emission scenarios; thus, most of the climatically suitable habitat in the RCIS area is likely to remain suitable in 2050. It is important to note that this was a statewide-scale analysis, and local conditions in the RCIS area may vary.

Western Pond Turtle (*Emys marmorata*)

Western pond turtle shares ecological functions and/or similar habitats as its associated focal conservation elements: California tiger salamander, giant garter snake, riparian brush rabbit, tricolored blackbird, delta button-celery, working lands, freshwater wetlands, hydrogeomorphic processes, habitat connectivity, and groundwater suitability. This species forages and breeds in habitats used by California tiger salamander, giant garter snake, riparian brush rabbit, tricolored blackbird, and delta button-celery, as well as habitats found in working lands and freshwater wetlands. Increasing habitat connectivity could increase breeding and upland habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit western pond turtles. For example, implementation of Conn-2 will manage levees to increase adjacent habitat values (e.g., flood refugia and basking sites) to aquatic habitat, and Rest-25 will incentivize private landowners on working lands to provide water for giant garter snakes during the snake's active season. Both actions will also benefit western pond turtle.

Western Pond Turtle Climate Change Vulnerability Assessment

Climate stressors could impact western pond turtle sex ratios and result in skewed population and population decline (Western Pond Turtle Range-wide Conservation Coalition [WPTRWCC], 2020). Some of these stressors include (WPTRWCC, 2020): increased drought and severity,

extreme precipitation events, altered hydrology, and early drying of breeding habitat leading to mortality of juveniles and decreased adult survival. Decreased flows, coupled with agricultural and urban water demands, could result in increased water salinity.

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

Riparian Woodrat (*Neotoma fuscipes riparia*)

Riparian woodrat shares ecological functions and/or similar habitats as its associated focal conservation elements: salmonids, riparian brush rabbit, western red bat, monarch butterfly, valley elderberry longhorn beetle, riparian and riverine corridors, hydrogeomorphic processes, and habitat connectivity. This species forages and breeds in habitats used by salmonids, riparian brush rabbit, western red bat, monarch butterfly, and valley elderberry longhorn beetle, as well as in habitats associated with riparian and riverine corridors. Increasing habitat connectivity could increase foraging and breeding habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit riparian woodrat. For example, implementation of Conn-2 will manage levees to increase adjacent habitat values (e.g., flood refugia) to aquatic habitat, which will also benefit riparian woodrat.

Riparian Woodrat Climate Change Vulnerability Assessment

Climate change is likely to cause higher frequency of catastrophic floods, drought, and wildfires, as well as increase the severity and frequency of other stressors, such as habitat loss and degradation and predation, which will impact riparian woodrats. The CVLCP (2017) ranked riparian vegetation communities—the primary habitat for riparian woodrat—as being highly vulnerable to sensitivity and exposure factors, while only having a moderate adaptive capacity. Riparian woodrat has low population redundancy and limited resiliency, and climate change will have a significant impact on species viability and persistence (USFWS, 2020f).

Tule Elk (*Cervus canadensis nannodes*)

Tule elk shares ecological functions and/or similar habitats as its associated focal conservation elements: San Joaquin kit fox, Swainson's hawk, working lands, grasslands, and habitat connectivity. This species forages and breeds in habitats used by San Joaquin kit fox and Swainson's hawk, as well as in habitats associated with working lands and grasslands. Increasing habitat connectivity could increase foraging and breeding habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit tule elk. For example, implementation of Rest-17 will plant diverse compositions of native species to restore drought and fire resilient communities and manage specifically for shrubs such as refugia and perennial grasses as a food source; this action will also benefit tule elk.

Tule Elk Climate Change Vulnerability Assessment

The CVLCP (2017) assessed climate change vulnerability for large wide-ranging mammals and included tule elk. Large-ranging mammals overall had low-moderate sensitivity and future exposure to all climate factors assessed. Riparian areas were identified as potential refugia from changes in air temperature, changes in precipitation and snowfall patterns, streamflow, changes in water temperature, drought, and heat waves (CVLCP, 2017). Sensitivity and exposure to non-climate factors have the largest contribution to this group's overall climate vulnerability. Tule elk have high sensitivity and high current exposure to agriculture and rangeland practices, land use change, and linear transportation infrastructure (CVLCP, 2017). The pattern of exposure to these factors is consistent across the Central Valley. Though tule elk use a variety of habitat types and are forage generalists, their populations are relatively small and isolated, making them susceptible to stochastic events.

American Badger (*Taxidea taxus*)

American badger shares ecological functions and/or similar habitats as its associated focal conservation elements: San Joaquin kit fox, Swainson's hawk, working lands, grasslands, and habitat connectivity. This species forages and breeds in habitats used by San Joaquin kit fox and Swainson's hawk, as well as in habitats associated with working lands and grasslands. Increasing habitat connectivity could increase foraging and breeding habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit American badger. For example, implementation of Rest-28 will maintain suitable vegetation structure through compatible grazing and revegetation with low-growing and less-dense native plants, which will also benefit American badger.

American Badger Climate Change Vulnerability Assessment

EcoAdapt (2021) assessed the climate change vulnerability of the American badger in the Santa Cruz Mountains, and the factors assessed would likely have a similar impact on American badgers in the San Joaquin Valley. For American badgers, measures of relative vulnerability and confidence are climate and climate-driven factors, disturbance regimes, future climate exposure, non-climate stressors, and dependencies. The results of the assessment show that there is low adaptive capacity and high sensitivity and exposure when considering climate trends and projections generated by the Basin Characterization model (EcoAdapt 2021). Disturbances such as drought, storms, and flooding can lead to reduced food and other resources for badger kits. Although American badgers have a high trait variability and behavior plasticity, juveniles have a high rate of mortality resulting in slow population recovery when coupled with disturbances.

Bats: Pallid Bat (*Antrozous pallidus*) and Townsend's Big-Eared Bat (*Corynorhinus townsendii*)

Pallid bat and Townsend's big-eared bat share ecological functions and/or similar habitats as their associated focal conservation elements: riparian brush rabbit, San Joaquin kit fox, Swainson's hawk, tricolored blackbird, working lands, grasslands, habitat connectivity, and groundwater suitability. These species forage or roost in habitats used by riparian brush rabbit, San Joaquin kit fox, Swainson's hawk, and tricolored blackbird, as well as habitats found in working lands and grasslands. Increasing habitat connectivity could create roosting habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit pallid bat and Townsend's big-

eared bat. For example, implementation of Rest-25 will conduct vegetation management that increases the abundance of key habitat features for riparian brush rabbit—including ecotonal edges, connectivity around open areas, and diverse food sources during the dry season—and acquire lands adjacent to existing populations where suitable riparian brush rabbit habitat occurs. This action will also benefit pallid bat and Townsend's big-eared bat.

Non-Focal Bat Species Climate Change Vulnerability Assessment

Although no specific climate change vulnerability assessments exist for non-focal bat species, EcoAdapt (2021) evaluated climate change vulnerability for bats in the Santa Cruz Mountains region. While this geographic area has different habitats and climate when compared to the RCIS area, the response of focal and non-focal bat species to impacts from climate stressors is likely to be similar. EcoAdapt (2021) determined that bats are overall highly vulnerable to climate stressors such as increased air temperatures, increased frequency of heat waves and drought, precipitation pattern changes, and altered streamflow (Fellers & Halstead, 2015; Jones et al., 2009; Sherwin et al., 2013). These stressors can lead to reduced water and prey availability, increased energy expenditures, and interference with hibernation (EcoAdapt, 2021; Jones et al., 2009). Bats are also extremely sensitive to non-climate stressors such as land use conversion, agriculture, contaminants, and disease (e.g., white-nosed syndrome), which may be exacerbated by climate stressors. Bats have a moderate adaptive capacity to respond to climate change impacts (EcoAdapt, 2021). They have a high dispersal ability and relatively general habitat and prey specializations (EcoAdapt, 2021).

Vernal Pool Branchiopods: Conservancy Fairy Shrimp (*Branchinecta conservatio*), Longhorn Fairy Shrimp (*Branchinecta longiantenna*), Vernal Pool Fairy Shrimp (*Branchinecta lynchi*), and Vernal Pool Tadpole Shrimp (*Lepidurus packardi*)

Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp share ecological functions and/or similar habitats as their associated focal conservation elements: California tiger salamander and vernal pools. These species breed and forage in habitats used by California tiger salamander, as well as other vernal pool habitats. Increasing habitat connectivity could allow for more suitable breeding and foraging habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp. For example, implementation of Rest-21 will restore vernal pool habitats and will benefit conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp.

Vernal Pool Crustacean Climate Change Vulnerability Assessment

Limited climate change vulnerability assessments have been conducted for vernal pool species, and many have been region-specific. The USFWS 2024 5-Year Review for vernal pool fairy shrimp, vernal pool tadpole shrimp, and conservancy fairy shrimp projects potential climate change impacts on vernal pool communities in California; many of these impacts are closely connected to the vernal pool inundation timing, inundation duration, and temperature on vernal pool ecosystems (USFWS, 2024). Shifts in rainfall timing could negatively impact vernal pool fairy shrimp and vernal pool tadpole shrimp populations (USFWS, 2024). The hydrology of vernal pools was most sensitive to climate change around Merced and less sensitive further north and south (USFWS, 2024). Droughts could negatively affect the amount of vernal pool

habitat and increase the frequency of vernal pools drying before vernal pool crustaceans have completed their life cycle or cause pool temperatures to exceed suitable temperatures for breeding.

Bumble Bees: Crotch's Bumble Bee (*Bombus crotchii*) and Western Bumble Bee (*Bombus occidentalis*)

Crotch's bumble bee and western bumble bee share ecological functions and/or similar habitats as their associated focal conservation elements: San Joaquin kit fox, Swainson's hawk, tricolored blackbird, monarch butterfly, working lands, and grasslands. These species breed and forage in habitats used by San Joaquin kit fox, Swainson's hawk, tricolored blackbird, and monarch butterfly, as well as habitats associated with working lands and grasslands. Increasing habitat connectivity could allow for more suitable breeding and foraging habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit Crotch's bumble bee and western bumble bee. For example, implementation of Rest-17 will plant diverse compositions of native species to restore drought- and fire-resilient communities, which will also benefit Crotch's bumble bee and western bumble bee.

Non-Focal Bumble Bee Climate Change Vulnerability Assessment

Climate change has been identified as a threat to many bumble bee species (Sirois-Delisle & Kerr, 2018; Hatfield & Jepsen, 2021). Exposure variables such as temperature, precipitation, temperature and precipitation variability and extremes, snow melt, and floral resource availability are likely to negatively impact these species (Jackson et al., 2022; Xerces Society et al., 2018). Stressors exacerbated due to climate change include increased pathogen exposure, decreased floral and refuge resource availability, and a decrease in nesting habitat availability (Xerces Society et al., 2018). Janousek et al. (2023) modeled climate change impacts on western bumble bee and showed that temperature during the warmest quarter of the year had the largest negative effect on occupancy, though warmer temperatures could be a stressor year-round with increased temperatures impacting life stages, queens while overwintering, soil heat, and the ability to forage during hot days. Drought can have a similar effect of limiting floral resource availability, changing pollen quality and quantity. High intensity precipitation may cause nests to be flooded or disrupt bee foraging (Janousek et al., 2023). Sirois-Delisle and Kerr (2018) also conducted a climate change vulnerability assessment on North American bumble bees, including western bumble bees, by using two variables—dispersal abilities and climate scenarios. Even though dispersal rate varied, it was clear that bumble bee range sizes would likely decrease from an increase in temperature.

Vernal Pool Plants: Succulent Owl's-Clover (*Castilleja campestris var. succulenta*), Colusa Grass (*Neostapfia colusana*), San Joaquin Valley Orcutt Grass (*Orcuttia inaequalis*), Hairy Orcutt Grass (*Orcuttia pilosa*), and Hoover's Spurge (*Euphorbia hooveri*)

Succulent owl's-clover, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, and Hoover's spurge share ecological functions and/or similar habitats as their associated focal conservation elements: California tiger salamander and vernal pools. These species are found in habitats used by California tiger salamander, as well as other vernal pool habitats. Increasing habitat connectivity could allow for more suitable vernal pool habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or

restore all natural communities may benefit succulent owl's-clover, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, and Hoover's spurge. For example, implementation of Rest-21 will restore vernal pool habitats and will also benefit succulent owl's-clover, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, and Hoover's spurge.

Non-Focal Vernal Pool Plant Climate Change Vulnerability Assessment

Alterations in nitrogen deposition, an increase in carbon dioxide in the atmosphere, changes in precipitation patterns, and an increase in temperatures negatively affect vernal pool habitats and plant species that depend on them (USFWS, 2005). Increasing durations of the dry season with 20% less precipitation is expected to occur overall on average throughout the San Joaquin Valley (Fernandez-Bou et al., 2021). Changes in hydrology may lead to non-native species outcompeting native vernal pool plant species (USFWS, 2005). Different global general circulation models may affect vernal pool habitats in both positive and negative ways. If the climate is wet and warm, increases in precipitation events could result in an increase in vernal pool habitat. If the hot and dry global climate model occurs, the resulting increases in drought intensity and frequency could increase the frequency of vernal pools drying and cause pool temperatures to increase.

Valley Oak (*Quercus lobata*)

Valley oak shares ecological functions and/or similar habitats as its associated focal conservation elements: California tiger salamander, giant garter snake, riparian brush rabbit, San Joaquin kit fox, Swainson's hawk, monarch butterfly, valley elderberry longhorn beetle, working lands, riparian and riverine corridors, habitat connectivity, and groundwater suitability. This species is associated with habitats used by California tiger salamander, giant garter snake, riparian brush rabbit, San Joaquin kit fox, Swainson's hawk, monarch butterfly, and valley elderberry longhorn beetle, as well as habitats associated with working lands and riparian and riverine corridors. Increasing habitat connectivity could allow for more suitable habitat. Actions for the associated focal conservation elements and regional strategies in Table E-2 that protect, enhance, or restore all natural communities may benefit valley oak. For example, implementating Rest-15 encourages maintenance of a variety of age and size classes of riparian vegetation; this will also benefit valley oak habitat.

Valley Oak Climate Change Vulnerability Assessment

CVLCP (2017) assessed the climate change vulnerability of valley oak focusing on two climate factors that impact water availability: the amount of precipitation and the alteration of streamflow regimes. Increased precipitation may help recruitment but also may cause increased competition between other plants and oak seedling and saplings. Altered streamflow may cause change in flow volume and timing which would impact species distribution, establishment, and recruitment. Changes in snowmelt volume and timing may impact the flooding regime. Precipitation and snowpack both may influence the discharge pattern and water availability. Habitat suitability is likely to decrease and shift to northerly and higher-elevated locations for cool, moist conditions. Sensitivity was scored at *moderate*, future exposure was scored at *low-moderate*, adaptive capacity was scored at *moderate-high*, and the overall climate change vulnerability score is *low-moderate* with a management potential score of *moderate-high*.

Table E-2. Non-Focal Species Ecological Requirements, Associated Focal Conservation Elements, and Beneficial Actions

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Green sturgeon (southern DPS) *Acipenser medirostris* ▪ Status: Federally Threatened; State Species of Special Concern	▪ Special status ▪ SWAP species ▪ Climate Change Vulnerability list ▪ Habitat limited or already protected	▪ Riparian mixed Hardwood ▪ Riparian mixed scrub ▪ Water	▪ Facultative anadromous fish ▪ Shaded riverine aquatic habitat, including overhanging vegetation, instream cover, and natural eroding banks (Fris & DeHaven, 1993) ▪ Spawn in deep pools or “holes” in large, turbulent, freshwater rivers (Moyle et al., 1995; Wyman et al., 2018)	▪ Salmonids ▪ Riparian and riverine corridors ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-5 ▪ Conn-6 ▪ Conn-7 ▪ Conn-8 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-5** ▪ Cons-7 ▪ Cons-8 ▪ Learn-1** ▪ Learn-4** ▪ Learn-8 ▪ Learn-9 ▪ Learn-16 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-13 ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-22 ▪ Rest-23 ▪ Rest-24 ▪ Rest-36 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Pacific lamprey *Entosphenus tridentatus* ▪ Status: State Species of Special Concern	▪ Special status ▪ SWAP species ▪ Habitat limited or already protected	▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Water	▪ Facultative anadromous fish ▪ Requires relatively pristine freshwater rivers and streams for spawning and rearing, mainstem river conditions conducive to migration to the ocean and back, and favorable ocean conditions (Goodman & Reid, 2012)	▪ Salmonids ▪ Riparian and riverine corridors ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-5 ▪ Conn-6 ▪ Conn-7 ▪ Conn-8 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-5** ▪ Cons-7 ▪ Cons-8 ▪ Learn-1** ▪ Learn-4** ▪ Learn-8 ▪ Learn-9 ▪ Learn-16 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-13 ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-22 ▪ Rest-23 ▪ Rest-24 ▪ Rest-36 ▪ Rest-38 ▪ Rest-39

Western spadefoot *Spea hammondii* ▪ Status: Federally Proposed Threatened; State Species of Special Concern	▪ Special status ▪ SWAP species ▪ Climate Change Vulnerability list ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ Alkali mixed shrub ▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Wet meadow ▪ Vernal pool	▪ Inhabits grassland habitats ▪ Requires temporary pools of water, lacking predators such as fish, bullfrogs, or crayfish, for egg laying (Jennings & Hayes, 1994)	▪ Swainson's hawk ▪ Tricolored blackbird ▪ Delta button-celery ▪ Working lands ▪ Freshwater wetlands ▪ Grasslands ▪ Vernal pools ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Conn-7 ▪ Conn-8 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-5** ▪ Cons-6 ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-11 ▪ Learn-1** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-10 ▪ Learn-11 ▪ Learn-12 ▪ Learn-13 ▪ Learn-17 ▪ Learn-18 ▪ Learn-30 ▪ Learn-4** ▪ Learn-8 ▪ Learn-9	▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-10 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-23 ▪ Rest-25 ▪ Rest-26 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Western pond turtle *Emys marmorata* ▪ Status: Federally Proposed Threatened; State Species of Special Concern	▪ Special status ▪ Climate Change Vulnerability list ▪ Habitat limited or already protected	▪ Agriculture—annual ▪ Alkali mixed scrub ▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Water ▪ Wet meadow	▪ Occurs in ponds, streams, and other wetland habitats (Bury & Germano, 2008) ▪ Occurs in ponds or slack-water pools with suitable basking sites (e.g., logs) ▪ Breeds in upland habitats, in clay or silty soils in unshaded (often south-facing) areas (Jennings & Hayes, 1994)	▪ California tiger salamander ▪ Giant garter snake ▪ Riparian brush rabbit ▪ Tricolored blackbird ▪ Delta button-celery ▪ Working lands ▪ Freshwater wetlands ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Cons-3** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-11 ▪ Cons-15 ▪ Learn-1** ▪ Learn-4** ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Learn-11 ▪ Learn-12 ▪ Learn-13 ▪ Learn-14 ▪ Learn-16 ▪ Prev-2** ▪ Prev-3 ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-10 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-4 ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-10 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-22 ▪ Rest-24 ▪ Rest-25 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions	
Greater sandhill crane *Antigone canadensis tabida* ▪ Status: State Threatened; State Fully Protected	▪ Special status ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Water ▪ Wet meadow	▪ Winters in RCIS area ▪ Roosts on shallow lakes or rivers at night and spends the day in irrigated croplands, pastures, grasslands, or wetlands (Cornell Lab of Ornithology, 2019)	▪ Giant garter snake ▪ Swainson's hawk ▪ Tricolored blackbird ▪ Delta button-celery ▪ Working lands ▪ Freshwater wetlands ▪ Grasslands ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-5 ▪ Conn-6 ▪ Conn-8 ▪ Cons-3** ▪ Cons-5** ▪ Cons-7 ▪ Cons-8 ▪ Cons-12 ▪ Cons-15 ▪ Learn-1** ▪ Learn-2** ▪ Learn-4** ▪ Learn-8 ▪ Learn-10 ▪ Learn-11 ▪ Learn-12 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-16 ▪ Learn-30 ▪ Prev-1** ▪ Prev-2** ▪ Prev-3 ▪ Prev-4 ▪ Prev-5 ▪ Prev-6	▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-10 ▪ Prev-11 ▪ Prev-13 ▪ Prev-14 ▪ Prev-21 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-4 ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-10 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-22 ▪ Rest-23 ▪ Rest-24 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Burrowing owl *Athene cunicularia* ▪ Status: Species of Special Concern	▪ Special status ▪ SWAP species ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Wet meadow	▪ Wintering, foraging, and breeding habitat: open, well drained terrain; short, sparse vegetation generally lacking trees; and underground burrows or artificial burrows (Klute et al., 2003) ▪ Dependent on burrows at all times of the year for survival or reproduction (CDFW, 2012)	▪ California tiger salamander ▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Tricolored blackbird ▪ Working lands ▪ Grasslands ▪ Habitat connectivity	▪ Conn-4** ▪ Conn-9 ▪ Cons-1** ▪ Cons-2** ▪ Cons-4** ▪ Cons-6 ▪ Cons-7 ▪ Cons-13 ▪ Cons-15 ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-9 ▪ Learn-10 ▪ Learn-12 ▪ Learn-13 ▪ Learn-14 ▪ Learn-17 ▪ Learn-21 ▪ Learn-30 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-19 ▪ Rest-8 ▪ Rest-11 ▪ Rest-12 ▪ Rest-13 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25 ▪ Rest-26 ▪ Rest-28 ▪ Rest-29 ▪ Rest-37

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Bank swallow *Riparia riparia* ▪ Status: State Threatened	▪ Special status ▪ SWAP species ▪ Climate Change Vulnerability list ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf woodland and forest ▪ California chaparral ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub	▪ Nests found on cut banks and bluffs composed of friable soils ▪ Rely on the foraging habitat provided by grasslands and riparian vegetation adjacent to their breeding habitat (Zeiner et al., 1990)	▪ Salmonids ▪ Riparian brush rabbit ▪ Western red bat ▪ Monarch butterfly ▪ Valley elderberry longhorn beetle ▪ Riparian and riverine corridors ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-5 ▪ Conn-6 ▪ Conn-7 ▪ Conn-8 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-5** ▪ Cons-6 ▪ Cons-7 ▪ Cons-8 ▪ Cons-11 ▪ Cons-12 ▪ Learn-1** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Learn-12 ▪ Prev-1** ▪ Prev-2** ▪ Prev-3 ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-10 ▪ Prev-13 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-22 ▪ Rest-23 ▪ Rest-24 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Least Bell's vireo *Vireo bellii pusillus* ▪ Status: Federally Endangered; State Endangered	▪ Special status ▪ SWAP species ▪ Climate Change Vulnerability list ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Wet meadow	▪ Riparian-obligate breeder (Kus, 1998) ▪ Nesting in dense thickets of willows and other low bushes along perennial or ephemeral streams (Franzreb et al., 1994; Kus, 2002)	▪ Salmonids ▪ Riparian brush rabbit ▪ Western red bat ▪ Monarch butterfly ▪ Valley elderberry longhorn beetle ▪ Riparian and riverine corridors ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-5 ▪ Conn-6 ▪ Conn-7 ▪ Conn-8 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-5** ▪ Cons-6 ▪ Cons-7 ▪ Cons-8 ▪ Cons-11 ▪ Cons-12 ▪ Learn-1** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Learn-12 ▪ Prev-1** ▪ Prev-2** ▪ Prev-3 ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-10 ▪ Prev-13 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-22 ▪ Rest-23 ▪ Rest-24 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Western yellow-billed cuckoo *Coccyzus americanus occidentalis* ▪ Status: Federally Threatened; State Endangered	▪ Special status ▪ SWAP species ▪ Climate Change Vulnerability list ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Wet meadow	▪ Wooded habitat with dense cover and water nearby, including woodlands with low, scrubby vegetation; overgrown orchards; abandoned farmland; and dense thickets along streams and marshes ▪ Nests in deciduous riparian woodlands	▪ Salmonids ▪ Riparian brush rabbit ▪ Western red bat ▪ Monarch butterfly ▪ Valley elderberry longhorn beetle ▪ Riparian and riverine corridors ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-5 ▪ Conn-6 ▪ Conn-7 ▪ Conn-8 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-5** ▪ Cons-6 ▪ Cons-7 ▪ Cons-8 ▪ Cons-11 ▪ Cons-12 ▪ Learn-1** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Learn-12 ▪ Prev-1** ▪ Prev-2** ▪ Prev-3 ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-10 ▪ Prev-13 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-22 ▪ Rest-23 ▪ Rest-24 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Yellow-billed magpie *Pica nuttalli* ▪ Status: None	▪ Climate Change Vulnerability list	▪ California broadleaf woodland and forest ▪ California chaparral ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub	▪ Permanent residents in open oak woodlands and grassy oak savannas (Cornell Lab of Ornithology, 2019) ▪ Forage and nest in agricultural areas and pastures that feature tall trees for nesting; also in riparian areas, orchards, and lower foothills, so long as there are insects and water available year-round	▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Conn-7 ▪ Conn-8 ▪ Conn-9 ▪ Conn-10 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-4** ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-11 ▪ Cons-13 ▪ Cons-14 ▪ Learn-1** ▪ Learn-9 ▪ Learn-10 ▪ Prev-1** ▪ Prev-2** ▪ Prev-13 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-8 ▪ Rest-9 ▪ Rest-14 ▪ Rest-16 ▪ Rest-22 ▪ Rest-35 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Riparian (San Joaquin Valley) woodrat *Neotoma fuscipes riparia* ▪ Status: Federally Endangered; State Species of Special Concern	▪ Special Status ▪ SWAP species ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Wet meadow	▪ Prefer habitat with a large amount of overall structure, with both understory vegetation and overstory cover (Gerber et al., 2003)	▪ Salmonids ▪ Riparian brush rabbit ▪ Western red bat ▪ Monarch butterfly ▪ Valley elderberry longhorn beetle ▪ Riparian and riverine corridors ▪ Hydrogeomorphic processes ▪ Habitat connectivity	▪ Conn-2** ▪ Conn-3** ▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Conn-8 ▪ Conn-9 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-4** ▪ Cons-7 ▪ Cons-13 ▪ Cons-14 ▪ Learn-1** ▪ Learn-3** ▪ Learn-4** ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Learn-12 ▪ Learn-14 ▪ Learn-15 ▪ Prev-1** ▪ Prev-2** ▪ Prev-3 ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-8 ▪ Prev-9 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Rest-1** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-21 ▪ Rest-22 ▪ Rest-24 ▪ Rest-37 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Tule elk *Cervus canadensis nannodes* ▪ Status: None	▪ SWAP species	▪ Agriculture—annual and unknown ▪ California broadleaf forest and woodland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub	▪ Prefer more open habitats in semi-arid environments dominated by shrubs, grasses, forbs, and gentle topography, sharing rangelands and desert scrub communities (Zeiner et al., 1988) ▪ Feed on a variety of herbaceous vegetation, including annual forbs and grasses; perennial forbs, grasses, and grass-like plants (McCullough, 1969)	▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Grasslands ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Conn-8 ▪ Conn-9 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-12 ▪ Cons-13 ▪ Cons-14 ▪ Cons-15 ▪ Learn-1** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-9 ▪ Learn-14 ▪ Learn-15 ▪ Learn-21 ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-10 ▪ Prev-11 ▪ Prev-13 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-4 ▪ Rest-5 ▪ Rest-7 ▪ Rest-12 ▪ Rest-13 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-28 ▪ Rest-29

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
American badger *Taxidea taxus* ▪ Status: State Species of Special Concern	▪ Special status ▪ SWAP species ▪ Habitat limited or already protected	▪ Agriculture—annual, unknown ▪ California broadleaf forest and woodland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub	▪ Typically occur in annual grasslands, oak woodland savannas, semi-arid shrub/scrublands, and any habitat with stable ground squirrel populations or other fossorial rodents (i.e., ground squirrels, gophers, kangaroo rats, and chipmunks (Zeiner et al., 1990)	▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Working lands ▪ Grasslands ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-4** ▪ Conn-6 ▪ Conn-8 ▪ Conn-9 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-13 ▪ Cons-15 ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-12 ▪ Learn-13 ▪ Learn-14 ▪ Learn-21 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-9 ▪ Prev-10 ▪ Prev-11 ▪ Prev-13 ▪ Rest-1** ▪ Rest-3** ▪ Rest-7 ▪ Rest-8 ▪ Rest-12 ▪ Rest-13 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-28 ▪ Rest-29 ▪ Rest-30 ▪ Rest-37 ▪ Rest-38 ▪ Rest-39

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Pallid bat *Antrozous pallidus* ▪ Status: State Species of Special Concern	▪ Special status ▪ SWAP species ▪ Western Bat Working Group High Priority species ▪ Habitat limited or already protected	▪ All terrestrial communities	▪ Most commonly found in oak savannah and in open dry habitats with rocky areas, trees, buildings, or bridge structures that are used for roosting (Zeiner et al., 1990; Ferguson & Azerrad, 2004)	▪ Riparian brush rabbit ▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Tricolored blackbird ▪ Working lands ▪ Grasslands ▪ Habitat connectivity	▪ Conn-4** ▪ Conn-6 ▪ Conn-9 ▪ Conn-10 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-4** ▪ Cons-7 ▪ Cons-12 ▪ Cons-13 ▪ Cons-15 ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Learn-12 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-21 ▪ Learn-22 ▪ Learn-23 ▪ Learn-30 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Rest-1** ▪ Rest-7 ▪ Rest-8 ▪ Rest-11 ▪ Rest-12 ▪ Rest-13 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-28 ▪ Rest-29 ▪ Rest-30 ▪ Rest-31 ▪ Rest-33 ▪ Rest-37

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions	
Townsend's big-eared bat *Corynorhinus townsendii* ▪ Status: State Species of Special Concern	▪ Special status ▪ Western Bat Working Group High Priority species ▪ Habitat limited or already protected	▪ All terrestrial communities	▪ Colonial species and females aggregate in the spring at maternity colonies ▪ Known roost sites in California include limestone caves, lava tubes, mine tunnels, buildings, and other structures (Williams, 1986)	▪ Riparian brush rabbit ▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Tricolored blackbird ▪ Working lands ▪ Grasslands ▪ Habitat connectivity	▪ Conn-4** ▪ Conn-6 ▪ Conn-9 ▪ Conn-10 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-4** ▪ Cons-7 ▪ Cons-12 ▪ Cons-13 ▪ Cons-15 ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Learn-12 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-21 ▪ Learn-22 ▪ Learn-23 ▪ Learn-30	▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Rest-1** ▪ Rest-7 ▪ Rest-8 ▪ Rest-11 ▪ Rest-12 ▪ Rest-13 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-28 ▪ Rest-29 ▪ Rest-30 ▪ Rest-31 ▪ Rest-33 ▪ Rest-37

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Conservancy fairy shrimp *Branchinecta conservatio* ▪ Status: Federally Endangered	▪ Special status ▪ SWAP species ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Endemic to ephemeral freshwater habitats referred to as playa pools—shallow depressions filled with rainwater during fall and winter and that dry in spring (Eng et al., 1990; USFWS, 2007)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Cons-10 ▪ Cons-1** ▪ Cons-2** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-1** ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-14 ▪ Rest-1** ▪ Rest-7 ▪ Rest-9 ▪ Rest-10 ▪ Rest-11 ▪ Rest-13 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Longhorn fairy shrimp *Branchinecta longiantenna* ▪ Status: Federally Endangered	▪ Special status ▪ SWAP species ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Endemic to ephemeral freshwater vernal pools (Eng et al., 1990)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Cons-10 ▪ Cons-1** ▪ Cons-2** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-1** ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-14 ▪ Rest-1** ▪ Rest-7 ▪ Rest-9 ▪ Rest-10 ▪ Rest-11 ▪ Rest-13 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Vernal pool fairy shrimp *Branchinecta lynchi* ▪ Status: Federally Threatened	▪ Special status ▪ SWAP species ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool	▪ Endemic to ephemeral freshwater vernal pools (Eng et al., 1990)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Cons-10 ▪ Cons-1** ▪ Cons-2** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-1** ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-14 ▪ Rest-1** ▪ Rest-7 ▪ Rest-9 ▪ Rest-10 ▪ Rest-11 ▪ Rest-13 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Vernal pool tadpole shrimp *Lepidurus packardi* ▪ Status: Federally Endangered	▪ Special status ▪ SWAP species ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ Freshwater wetland ▪ Wet meadow ▪ California broadleaf forest and woodland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Ephemeral fresh water vernal pools in the Central Valley and in the San Francisco Bay Area (USFWS, 2007)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Cons-10 ▪ Cons-1** ▪ Cons-2** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-1** ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-14 ▪ Rest-1** ▪ Rest-7 ▪ Rest-9 ▪ Rest-10 ▪ Rest-11 ▪ Rest-13 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Crotch's bumble bee *Bombus crotchii* ▪ Status: State Candidate Endangered	▪ Special status ▪ SWAP species ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ California chaparral ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Wet meadow	▪ Found in open grassland and scrub habitats (Xerces Society et al., 2018) ▪ Primarily nests underground (Xerces Society et al., 2018) ▪ Generalist foragers visiting a variety of flowering plants (Xerces Society et al., 2018)	▪ California tiger salamander ▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Tricolored blackbird ▪ Monarch butterfly ▪ Working lands ▪ Grasslands	▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Conn-8 ▪ Conn-9 ▪ Cons-3** ▪ Cons-1** ▪ Cons-2** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-13 ▪ Learn-1** ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-6 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-10 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-10 ▪ Rest-11 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-28 ▪ Rest-29 ▪ Rest-30 ▪ Rest-31

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Western bumble bee *Bombus occidentalis* ▪ Status: State Candidate Endangered	▪ Special status ▪ SWAP species ▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ California chaparral ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Wet meadow	▪ Found in open grassland and scrub habitats (Xerces Society et al., 2018) ▪ Primarily nests underground (Xerces Society et al., 2018) ▪ Generalist foragers visiting a variety of flowering plants (Xerces Society et al., 2018)	▪ California tiger salamander ▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Tricolored blackbird ▪ Monarch butterfly ▪ Working lands ▪ Grasslands	▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Conn-8 ▪ Conn-9 ▪ Cons-3** ▪ Cons-1** ▪ Cons-2** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-13 ▪ Learn-1** ▪ Learn-2** ▪ Learn-3** ▪ Learn-4** ▪ Learn-5 ▪ Learn-6 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-10 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5 ▪ Prev-6 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-10 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-10 ▪ Rest-11 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-28 ▪ Rest-29 ▪ Rest-30 ▪ Rest-31

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Succulent owl's-clover *Castilleja campestris var. succulenta* ▪ Status: Federally Threatened; State Endangered; California Rare Plant Rank (CRPR) 1B.2	▪ Special status ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Found in vernal pools of the eastern San Joaquin Valley of the Southern Sierra Foothills Vernal Pool Region (USFWS, 2011) ▪ Typically occurs on the margins of vernal pools, swales, and some seasonal wetlands, and often grows as widely scattered individuals observed from both small and large pools (USFWS, 2011)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Conn-9 ▪ Cons-1** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-3** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-1** ▪ Rest-4 ▪ Rest-7 ▪ Rest-9 ▪ Rest-11 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25 ▪ Rest-36

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Colusa grass *Neostapfia colusana* ▪ Status: Federally Threatened; State Endangered; CRPR 1B.1	▪ Special status ▪ SWAP species ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Grows in large or deep vernal pools, in lakes and shallow playas, or in saline/alkaline adobe clay soils (USFWS, 1997)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Conn-9 ▪ Cons-1** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-3** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-1** ▪ Rest-4 ▪ Rest-7 ▪ Rest-9 ▪ Rest-11 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25 ▪ Rest-36

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
San Joaquin Valley Orcutt grass *Orcuttia inaequalis* ▪ Status: Federally Threatened; State Endangered; CRPR 1B.1	▪ Special status ▪ SWAP species ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Dependent on deep vernal pools for survival and requires inundated soils for at least part of the year for seed germination, seed bank storage, and its juvenile aquatic growth stage (USFWS, 2022)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Conn-9 ▪ Cons-1** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-3** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-1** ▪ Rest-4 ▪ Rest-7 ▪ Rest-9 ▪ Rest-11 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25 ▪ Rest-36

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Hairy Orcutt grass *Orcuttia pilosa* ▪ Status: Federally Endangered; State Endangered; CRPR 1B.1	▪ Special status ▪ SWAP species ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Endemic to vernal pools of the Central Valley and San Joaquin Valley of California (CNPS, 2024)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Conn-9 ▪ Cons-1** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-3** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-1** ▪ Rest-4 ▪ Rest-7 ▪ Rest-9 ▪ Rest-11 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25 ▪ Rest-36

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions
Hoover's spurge *Euphorbia hooveri* ▪ Status: Federally Threatened; CRPR 1B.2	▪ Special status ▪ Critical habitat connectivity needed ▪ Habitat limited or already protected	▪ California broadleaf forest and woodland ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Vernal pool ▪ Wet meadow	▪ Generally grows in relatively large, deep vernal pools among the rolling hills, remnant alluvial fans and depositional stream terraces at the base of the Sierra Nevada foothills (USFWS, 2009)	▪ California tiger salamander ▪ Vernal pools	▪ Conn-4** ▪ Conn-6 ▪ Conn-9 ▪ Cons-1** ▪ Cons-4** ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-15 ▪ Learn-3** ▪ Learn-5 ▪ Learn-7 ▪ Learn-8 ▪ Learn-9 ▪ Learn-13 ▪ Learn-14 ▪ Learn-15 ▪ Learn-17 ▪ Prev-1** ▪ Prev-2** ▪ Prev-5 ▪ Prev-6 ▪ Prev-7 ▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Rest-1** ▪ Rest-4 ▪ Rest-7 ▪ Rest-9 ▪ Rest-11 ▪ Rest-13 ▪ Rest-14 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-25 ▪ Rest-36

Non-Focal Species	Justification for Inclusion	RCIS Natural Communities	Ecological Requirements	Associated Focal Conservation Elements	Beneficial Conservation and Habitat Enhancement Actions	
Valley oak *Quercus lobata* ▪ Status: None	▪ Habitat limited or already protected	▪ Agriculture—annual, perennial, and unknown ▪ California broadleaf forest and woodland ▪ California chaparral ▪ Freshwater wetland ▪ Grassland—annual, perennial ▪ Riparian mixed hardwood ▪ Riparian mixed shrub ▪ Vernal pool ▪ Wet meadow	▪ Prefers fertile, well-drained bottomland soils, streambeds, and lower foothills (Beckman et al., 2019) ▪ Found in dense riparian forests, open foothill woodlands, and valley savannas (Beckman et al., 2019)	▪ California tiger salamander ▪ Giant garter snake ▪ Riparian brush rabbit ▪ San Joaquin kit fox ▪ Swainson's hawk ▪ Monarch butterfly ▪ Valley elderberry longhorn beetle ▪ Working lands ▪ Riparian and riverine corridors ▪ Habitat connectivity	▪ Conn-1** ▪ Conn-2** ▪ Conn-3** ▪ Conn-4** ▪ Conn-5 ▪ Conn-6 ▪ Conn-8 ▪ Conn-9 ▪ Cons-1** ▪ Cons-2** ▪ Cons-3** ▪ Cons-4** ▪ Cons-5** ▪ Cons-6 ▪ Cons-7 ▪ Cons-8 ▪ Cons-9 ▪ Cons-10 ▪ Cons-11 ▪ Learn-1** ▪ Learn-3** ▪ Learn-4** ▪ Learn-10 ▪ Learn-12 ▪ Learn-14 ▪ Learn-15 ▪ Learn-16 ▪ Prev-1** ▪ Prev-2** ▪ Prev-4 ▪ Prev-5	▪ Prev-10 ▪ Prev-11 ▪ Prev-12 ▪ Prev-13 ▪ Prev-14 ▪ Prev-18 ▪ Prev-19 ▪ Prev-20 ▪ Prev-21 ▪ Rest-1** ▪ Rest-2** ▪ Rest-3** ▪ Rest-4 ▪ Rest-5 ▪ Rest-6 ▪ Rest-7 ▪ Rest-8 ▪ Rest-9 ▪ Rest-10 ▪ Rest-12 ▪ Rest-13 ▪ Rest-14 ▪ Rest-15 ▪ Rest-16 ▪ Rest-17 ▪ Rest-18 ▪ Rest-19 ▪ Rest-20 ▪ Rest-21 ▪ Rest-22 ▪ Rest-23

Table E-3. Matrix of Non-Focal Species to Associated Focal Conservation Elements

Non-Focal Species	Steelhead (California Central Valley DPS)	Chinook Salmon (Central Valley spring-run ESU)	Chinook Salmon (Central Valley fall-run ESU)	California Tiger Salamander (Central California DPS)	Giant Garter Snake	Riparian Brush Rabbit	San Joaquin Kit Fox	Western Red Bat	Swainson's Hawk	Tricolored Blackbird	Monarch Butterfly	Valley Elderberry Longhorn Beetle	Delta Button-Celery	Working Lands	Freshwater Wetlands	Riparian and Riverine Corridors	Grasslands	Vernal Pools	Hydrogeomorphic Processes	Habitat Connectivity	Groundwater Suitability
Green sturgeon (southern DPS)	X	X	X													X			X	X	
Pacific lamprey	X	X	X													X			X	X	
Western spadefoot									X	X			X	X	X		X	X		X	X
Western pond turtle				X	X	X				X			X	X	X				X	X	X
Greater sandhill crane					X				X	X			X	X	X		X		X	X	X
Burrowing owl				X			X		X	X				X			X			X	
Bank swallow	X	X	X			X		X			X	X				X			X	X	
Least Bell's vireo	X	X	X			X		X			X	X				X			X	X	X
Western yellow-billed cuckoo	X	X	X			X		X			X	X				X			X	X	X

Non-Focal Species	Steelhead (California Central Valley DPS)	Chinook Salmon (Central Valley spring-run ESU)	Chinook Salmon (Central Valley fall-run ESU)	California Tiger Salamander (Central California DPS)	Giant Garter Snake	Riparian Brush Rabbit	San Joaquin Kit Fox	Western Red Bat	Swainson's Hawk	Tricolored Blackbird	Monarch Butterfly	Valley Elderberry Longhorn Beetle	Delta Button-Celery	Working Lands	Freshwater Wetlands	Riparian and Riverine Corridors	Grasslands	Vernal Pools	Hydrogeomorphic Processes	Habitat Connectivity	Groundwater Suitability
Yellow-billed magpie																			X	X	X
Riparian (=San Joaquin Valley) woodrat	X	X	X			X		X			X	X				X			X	X	
Tule elk							X		X								X			X	
American badger							X		X					X			X			X	
Pallid bat							X	X	X	X				X			X			X	X
Townsend's big-eared bat							X	X	X	X				X			X			X	X
Conservancy fairy shrimp				X														X			
Longhorn fairy shrimp				X														X			
Vernal pool fairy shrimp				X														X			
Vernal pool tadpole shrimp				X														X			
Crotch bumble bee				X			X		X	X	X			X			X				

Non-Focal Species	Steelhead (California Central Valley DPS)	Chinook Salmon (Central Valley spring-run ESU)	Chinook Salmon (Central Valley fall-run ESU)	California Tiger Salamander (Central California DPS)	Giant Garter Snake	Riparian Brush Rabbit	San Joaquin Kit Fox	Western Red Bat	Swainson's Hawk	Tricolored Blackbird	Monarch Butterfly	Valley Elderberry Longhorn Beetle	Delta Button-Celery	Working Lands	Freshwater Wetlands	Riparian and Riverine Corridors	Grasslands	Vernal Pools	Hydrogeomorphic Processes	Habitat Connectivity	Groundwater Suitability
Western bumble bee				X			X		X	X	X			X			X				
Succulent owl's-clover				X														X			
Colusa grass				X														X			
San Joaquin Valley Orcutt grass				X														X			
Hairy Orcutt grass				X														X			
Hoover's spurge				X														X			
Valley oak				X	X	X	X		X		X	X		X		X				X	X