KAWEAHRCIS

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KAWEAH GROUNDWATER SUBBASIN
REGIONAL CONSERVATION INVESTMENT STRATEGY

EAST KAWEAH
GROUNDWATER SUSTAINABILITY AGENCY

ICF

Kaweah Groundwater Subbasin

Regional Conservation Investment Strategy

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Acronyms and Abbreviations

ACE	Areas of Conservation Emphasis
AFY	acre-feet per year
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CCED	California Conservation Easement Database
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEHCP	California Essential Habitat Connectivity Project
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFBF	California Farm Bureau Federation
CFGC	California Fish and Game Code
CFR	Code of Federal Regulations
CHSR	California High-Speed Rail
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
CPAD	California Protected Area Database
CRPR	California Rare Plant Rank
CVP	Central Valley Project
Delta	Sacramento-San Joaquin Delta
DWR	California Department of Water Resources
EKGSA	East Kaweah Groundwater Sustainability Agency
ESA	Endangered Species Act
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
FMMP	Farmland Mapping and Monitoring Program
FTIP	Federal Transportation Improvement Program
GDE	groundwater dependent ecosystem
GIS	geographic information system
GKGSA	Greater Kaweah GSA
GPS	global positioning system
GRAT	Groundwater Recharge Assessment Tool

GSAs	groundwater sustainability agencies
GSPs	Groundwater Sustainability Plans
HCP	habitat conservation plan
HUC	Hydrologic Unit Code
HUC-8	Hydrologic Unit Code-8
ID	Irrigation District
ILRP	Irrigated Lands Regulatory Program
IPM	Integrated Pest Management
ITIP	Interregional Transportation Improvement Program
ITP	incidental take permit
JPA	Joint Powers Authorities
Kaweah RCIS	Regional Conservation Investment Strategy
Kaweah Subbasin	Kaweah Groundwater Subbasin
KCAG	Kings County Association of Governments
MCA	Mitigation Credit Agreement
MKGSA	Mid-Kaweah GSA
MOU	Memorandum of Understanding for Kaweah Subbasin RCIS Cooperation and Coordination in 20XX
MW	megawatt
NCCP	Natural Community Conservation Plan
NCED	National Conservation Easement Database
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge
O&M	operations and maintenance
PAD-US	Protected Areas Database of the United States
Program	Regional Conservation Investment Strategies Program
Program Guidelines	Regional Conservation Investment Strategies Program Guidelines
RAMNA	Regional Advance Mitigation Needs Assessment
RCIS	Regional Conservation Investment Strategy
SAGBI	Soil Agricultural Groundwater Banking Index
SCE	Southern California Edison
SGMA	Sustainable Groundwater Management Act
SHC	California Streets and Highways Code
SHOPP	State Highway Operations and Protection Program
SWAP	State Wildlife Action Plan
TBWP	Tulare Basin Watershed Partnership
TCAG	Tulare County Association of Governments

UC	University of California
UPL	Upland
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VLP	Voluntary Local Program

Chapter 1
Introduction

1.1 Background

This Kaweah Groundwater Subbasin (Kaweah Subbasin) Regional Conservation Investment Strategy (Kaweah RCIS) is a locally-driven, non-binding, and voluntary conservation strategy to guide conservation investments and compensatory mitigation in portions of Tulare and Kings Counties in the San Joaquin Valley. The creation of the Kaweah RCIS was driven by the desire of stakeholders, including representatives from local county and city municipalities, groundwater sustainability agencies, growers, disadvantaged communities, and conservation organizations to achieve multibenefit conservation and mitigation outcomes for sensitive species and their habitats that contribute to improving groundwater sustainability in the Kaweah Groundwater Subbasin.

This Kaweah RCIS is intended to support the implementation of Kaweah Subbasin Groundwater Sustainability Plans (GSPs) by identifying conservation and habitat enhancement actions that can be used to provide multibenefit compensatory mitigation projects for infrastructure or other development projects, as well as conservation investments, in the region. An important goal of this Kaweah RCIS is to provide a tool that could be used to provide financial incentives to working landowners that voluntarily participate in groundwater sustainability projects and management actions that also provide habitat values for focal species and other conservation elements addressed by this RCIS. Agriculture plays a central role in the economy, environment, and culture of the region; this Kaweah RCIS emphasizes the continued economically viable stewardship of working lands in ways that benefit native biodiversity and ecosystem processes. This Kaweah RCIS also identifies multibenefit groundwater sustainability projects and management actions that should be implemented to improve the reliability of community drinking water and increased access to open space and recreation opportunities, while buffering agricultural lands and natural lands from urban areas.

1.2 What is a Regional Conservation Investment Strategy?

In 2016, the California State Legislature passed a law to guide non-binding and voluntary conservation and mitigation actions for the State's most vulnerable species and resources and to help streamline the compensatory mitigation process for state and local projects, such as infrastructure development, rehabilitation, and improvements. The law amends the California Fish and Game Code (FGC), Division 2, Chapter 9, to add Sections 1850–1861, which creates the Regional Conservation Investment Strategies Program (Program). The "Program encourages public agencies to develop regional conservation planning documents, using the best available science to identify regional conservation priorities and other actions to help California's species populations that may be vulnerable or declining by protecting, restoring, creating, and reconnecting their habitats" (California Department of Fish and Wildlife 2018).

The Program allows the California Department of Fish and Wildlife (CDFW) or any local or state public agency to develop an RCIS to guide science-based, non-binding, and voluntary conservation and mitigation for a suite of species. The RCIS must include specific information about types of conservation and habitat enhancement actions, and conservation priorities necessary to eliminate or reduce stressors on those species.

CDFW may approve an RCIS if the RCIS contributes to the State goals of providing for conservation and public infrastructure by providing guidance on investments in resource conservation and infrastructure (per FGC Section 1852(a)). Once CDFW approves an RCIS, public agencies, conservation organizations, or other entities can use an RCIS to identify priority conservation opportunities. Public infrastructure agencies or private parties can voluntarily use an approved RCIS to inform their mitigation planning and advance mitigation investments.

A person or entity, including a state or local agency, can sponsor the development of a mitigation credit agreement (MCA) within an *RCIS Area* (i.e., the region addressed by the RCIS). Once approved, this RCIS will enable MCAs to be developed and executed in the Kaweah RCIS Area. More details on how the RCIS can be used, including preparation of MCAs, are discussed in Section 4.3, *Regulatory Uses of this RCIS*.

To support and guide development of RCISs, CDFW released an updated version of the *Regional Conservation Investment Strategies Program Guidelines* (Program Guidelines) in September, 2018 (California Department of Fish and Wildlife 2018). This Kaweah RCIS was developed to be consistent with requirements in the September 2018 Program Guidelines.

A key component of the Program Guidelines is Section 2, *Standard Terminology*, which is a detailed list of terms, abbreviations, and definitions applicable to RCISs. As required by the Program Guidelines, the Kaweah RCIS uses the terms provided in the September 2018 Guidelines. Appendix A, *Glossary,* integrates these terms and includes additional terms and abbreviations specific to this Kaweah RCIS. In this RCIS, glossary terms are shown in *italics* on first use.

The RCIS is centered on *conservation actions* and *habitat enhancement actions* for *focal species* and *other conservation elements* such as working lands and natural communities to achieve this RCIS's conservation goals and objectives. The Program Guidelines defines these terms as follows.

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

MCA would create habitat enhancement credits intended for use as compensatory mitigation for temporary impacts.[1]

Focal species are sensitive species that are identified and analyzed in an RCIS and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Focal species may benefit through both conservation investments and MCAs.

Conservation element is an element that is identified and analyzed in an RCIS that will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Conservation elements include focal species and their habitats, natural communities, biodiversity, habitat connectivity, ecosystem functions, water resources, and other natural resources. Conservation elements may benefit through both conservation investments and MCAs.

This Kaweah RCIS was developed to advance the conservation of focal species and their habitats, including working lands and natural communities, to sustain those species over time as environmental conditions in the RCIS Area change (e.g., through increased development or climate change).

1.2.1 Voluntary Strategy

This Kaweah RCIS, like all RCISs, is a non-binding and voluntary strategy. Adoption of this Kaweah RCIS by CDFW is consistent with FGC Sections 1850(e) and 1852(c)(7). This RCIS does not regulate the use of land, establish land use designations, or affect, limit, or restrict the land use authority of any public agency. Nothing in this RCIS is intended to, nor shall it be interpreted to, conflict with controlling federal, state, or local law, including FGC Sections 1850–1861, or any Guidelines adopted by CDFW pursuant to FGC Section 1858. Therefore, actions carried out as a result of this RCIS will be in compliance with all applicable state and local requirements. Furthermore, this Kaweah RCIS does not preempt the authority of local agencies to implement infrastructure and urban development described in local general plans.

In addition, this Kaweah RCIS does not conflict with the following requirements of FGC Section 1855(b)).

(1) Modify in any way the standards for issuance of incidental take permits or consistency determinations pursuant to Section 2081 or 2080.1, issuance of take authorizations pursuant to Section 2835, the issuance of lake or streambed alteration agreements pursuant to Section 1602, or any other provision of this code or regulations adopted pursuant to this code.

(2) Modify in any way the standards under the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code), or in any way limit a lead agency's or responsible agency's discretion, in connection with any determination of whether a proposed project may or may not result in significant environmental effects or in any way establish a presumption in connection with any determination of whether a proposed project may or may not result in significant environmental effects or whether a proposed project's impacts would be mitigated.

(3) Prohibit or authorize any project or project impacts.

(4) Create a presumption or guarantee that any proposed project will be approved or permitted, or that any proposed impact will be authorized, by any state or local agency.

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[1] FGC Section 1856(d) states that "…the habitat enhancement action shall remain in effect at least until the site of the environmental impact is returned to pre-impact ecological conditions."

(5) Create a presumption that any proposed project will be disapproved or prohibited, or that any proposed impact will be prohibited, by any state or local agency.

(6) Alter or affect, or create additional requirements for, the general plan of the city, county, or city and county, in which it is located.

(7) Constitute any of the following, for the purposes of the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code):

(A) A plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.

(B) A local policy or ordinance protecting biological resources.

(C) An adopted local, regional, or state habitat conservation plan.

1.2.2 Purpose and Need

1.2.2.1 Sustainable Groundwater Management

The Sustainable Groundwater Management Act (SGMA) is a combination of three bills passed by the State Legislature and signed by California Governor Jerry Brown in 2014: Assembly Bill 1739, and Senate Bills 1168 and 1319. SGMA provides a framework for locally planned and implemented sustainable groundwater management. SGMA requires medium- and high-priority basins to establish groundwater sustainability agencies (GSAs), develop and implement GSPs, and manage groundwater to achieve sustainability while avoiding undesirable results.

The Kaweah Subbasin of the San Joaquin Valley's Tulare Lake Basin is located primarily in Tulare County, with a smaller portion in Kings County. In 2016, the California Department of Water Resources (DWR) identified the Kaweah Subbasin as critically overdrafted (California Department of Water Resources 2016) and as a high-priority basin via their Basin Prioritization process.[2]

The Kaweah Subbasin is divided among three GSAs: East Kaweah GSA (EKGSA), Mid-Kaweah GSA (MKGSA), and Greater Kaweah GSA (GKGSA). Each GSA has developed its own GSP, which provide detailed road maps for how the Kaweah Subbasin will reach long-term sustainability. Under SGMA, critically overdrafted basins, including the Kaweah Subbasin, are directed to achieve sustainability within 20 years of implementing their respective GSPs.

Together, the Kaweah Subbasin GSAs developed a Subbasin-wide sustainability goal, along with other aspects of their GSPs. The Kaweah Subbasin sustainability goal, as set forth in the *Kaweah Subbasin Coordination Agreement* (Greater Kaweah Groundwater Sustainability Agency, Mid-Kaweah Groundwater Sustainability Agency, and East Kaweah Groundwater Sustainability Agency 2020) is described as follows.

> The broadly stated sustainability goal for the Kaweah Subbasin is for each GSA to manage groundwater resources to preserve the viability of existing agricultural enterprises of the region, domestic wells, and the smaller communities that provide much of their job base in the Sub-basin, including the school districts serving these communities. The goal will also strive to fulfill the water

[2] For more information about DWR's Basin Prioritization process,
refer to https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization.

> needs of existing and amended county and city general plans that commit to continued economic and population growth within Tulare County and portions of Kings County.

The East Kaweah GSP (Provost & Pritchard Consulting Group 2020) describes how the sustainability goal will be achieved, as follows.

> To accomplish this sustainability goal, the Kaweah Subbasin's aquifer supply will be managed so that the Subbasin has achieved its sustainability goal. This goal will be achieved by the combined implementation of the EKGSA, GKGSA, and MKGSA GSPs. Specifically, all GSPs are designed to identify phased implementation of projects and management actions to reduce long-term groundwater overdraft.

Each GSP defines and identifies projects and management actions that could be implemented to achieve the overall Kaweah Subbasin sustainability goals. GSP projects are implemented to augment water supply; GSP management actions are intended to reduce groundwater demand and collect data. GSP projects include those that focus on the capture, use, and recharge of available surface water supplies to supplement the Subbasin's water supply and reduce impacts of groundwater pumping. Example projects include capturing available surface water and recharging the aquifer through creek beds and recharge basins, and capturing excess water in high-flow years to recharge the aquifer, store, bank, or re-regulate supplies. GSP management actions include those that focus on education and outreach, reducing water demand, and reduction of groundwater pumping by converting to less water-intensive crops or repurposing land, incentive-based programs, regulatory policies, and enforcement actions.

1.2.2.2 Kaweah RCIS

This Kaweah RCIS provides a framework to guide voluntary conservation investments and compensatory mitigation to enhance the conservation benefits of working lands, natural communities, and sensitive species within the Kaweah Subbasin. This RCIS provides a framework within which mitigation can be designed to support desired conservation in the region by identifying areas where compensatory mitigation could be implemented and actions that could be implemented as mitigation. This RCIS does not, however, specify mitigation requirements, as stated in FGC Section 1852(a).

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

Along with its guiding framework, this Kaweah RCIS serves as a tool to identify conservation and habitat enhancement actions with groundwater sustainability co-benefits that can be achieved concurrently with implementation of Kaweah Subbasin GSPs. Linking the implementation of Kaweah Subbasin GSP projects and management actions with RCIS conservation and habitat enhancement projects creates an opportunity to provide revenue to landowners who could undertake actions to protect species with conservation and mitigation needs in the region. These actions may include a range of activities from groundwater recharge programs that can support habitat to repurposing some agricultural lands to habitat areas.

The primary land use in the Kaweah Subbasin is agriculture, with developed land concentrated in small cities and municipalities. Given that land repurposing may be part of the strategy for groundwater sustainability as defined in the GSPs, this Kaweah RCIS will help to identify strategies for land repurposing that could create dual habitat and groundwater sustainability benefits. This would enable farmers and other landowners in the region to identify where habitat or other ecological values could best be protected, restored, or enhanced. In turn, the RCIS would also create the framework for them to receive financial compensation, either by developing credits under an MCA to be sold as compensatory mitigation to public or private agencies and entities negatively impacting species or habitats, or by applying for conservation funding in the form of state or local grants, bond funding, or through private philanthropy.

1.2.2.3 Kaweah RCIS Cooperation and Coordination Memorandum of Understanding

Achieving Kaweah RCIS goals and objectives, as with GSP goals, will require cooperation and coordination among the Subbasin GSAs. The EKGSA, GKGSA, and MKGSA are planning to enter into a *Memorandum of Understanding for Kaweah Subbasin RCIS Cooperation and Coordination* in 2022 (MOU) to memorialize their intent to work together to achieve RCIS goals and objectives that are compatible with, and contribute toward, achieving Kaweah Subbasin groundwater sustainability goals. As such, the GSAs will use this RCIS as a tool to identify and potentially facilitate funding for multibenefit RCIS actions that reduce surface water and groundwater use or improve recharge while providing conservation benefits for the focal species and other conservation elements addressed by this RCIS. These actions may include wildlife-friendly recharge projects and land repurposing. Land repurposing may include habitat restoration projects that improve or return former ecological processes, ecosystem services, and habitat values to an area that has been used for different purposes (e.g., agriculture). The MOU's purpose is to set forth a mutual agreement among the GSAs to implement Kaweah RCIS actions only when such actions provide groundwater sustainability co-benefits, and are consistent with the *Kaweah Subbasin Coordination Agreement* (2020).

1.3 Planning Process

1.3.1 Regional Conservation Investment Strategy Proponent

The EKGSA is the public agency proposing this RCIS and will submit it to CDFW for approval. The role of the RCIS proponent is described further in Chapter 4, *Implementation*.

The EKGSA is a Joint Powers Authority formed pursuant to California Government Code Sections 6500 et. seq, among the County of Tulare, City of Lindsay, Exeter Irrigation District (ID), Ivanhoe ID, Lindmore ID, Lindsay-Strathmore ID, and Stone Corral ID. The County of Tulare has land use authority over the entirety of EKGSA's jurisdiction.

1.3.2 State Agency Sponsor

FGC Section 1852(a) requires that for CDFW to approve an RCIS, one or more state agencies must sponsor the RCIS. The state agency sponsor requests approval of the strategy through a letter to CDFW indicating that the proposed RCIS would contribute to meeting state goals for conservation and public infrastructure or forest management. The California Department of Transportation (Caltrans) is a key state agency partner on this Kaweah RCIS. As such, Caltrans is the RCIS state agency sponsor for this Kaweah RCIS. Caltrans may also use this Kaweah RCIS to guide its own project mitigation planning. Caltrans has requested approval of this Kaweah RCIS through a state agency sponsor letter sent to the Director of Fish and Wildlife, as required by FGC Section 1852(a). The letter summarizes the purpose of this Kaweah RCIS from both a conservation perspective and an infrastructure planning perspective. The letter is included in Appendix B, *Letter of Support*.

1.3.3 Steering Committee and Planning Team

The coordination and development of the Kaweah RCIS is guided by a Steering Committee. The Steering Committee is composed of representatives from the following organizations.

- GSAs: EKGSA, MKGSA, GKGSA
- Counties of Tulare and Kings
- Cities of Visalia, Woodlake, and Tulare
- Local growers/landowners
- Sequoia Riverlands Trust
- Tulare Basin Watershed Partnership
- Sierra Club
- Kaweah Delta Water Conservation District
- Self Help Enterprises
- Leadership Council for Justice and Accountability
- Caltrans
- New Current Water and Land (non-voting member)
- Environmental Defense Fund (non-voting member)
- Environmental Incentives (non-voting member)
- CDFW (non-voting member)

The Steering Committee met 12 times from July 2020 through August 2021 to guide RCIS development, including identifying the RCIS Area and focal species; describing the environmental setting; developing conservation goals, objectives, and priorities; and developing the Kaweah RCIS implementation structure. The Steering Committee also coordinated outreach to stakeholders and the public (Appendix C, *Public Outreach*) and reviewed drafts of this RCIS.

The Planning Team led day-to-day coordination and development of the Kaweah RCIS. The Planning Team was composed of a subset of Steering Committee member organizations and agencies: EKGSA, Environmental Defense Fund, Environmental Incentives, Tulare Basin Watershed Partnership, Sequoia Riverlands Trust, and ICF. The Planning Team met approximately every other week from July 2020 through January 2022. The Planning Team led stakeholder outreach and provided guidance to ICF (the consultant drafting the RCIS) on Steering Committee meeting agendas and development of the RCIS.

1.3.4 Consultation with Local Counties and Cities

The Program Guidelines require that an "RCIS shall be developed in consultation with local agencies that have land use authority (i.e., a city, a county, or a city and county) within the geographic area of the RCIS." The RCIS Area overlaps Tulare and Kings Counties, and the Cities of Exeter, Farmersville, Lindsay, Tulare, Visalia, and Woodlake (Figure 1-1).

Representatives from all local counties and cities were asked to participate in the Steering Committee. All but the Cities of Exeter and Tulare elected to participate. Consultation with each local city and county also included notification of the intent to prepare this Kaweah RCIS as well as notification of one public meeting held in July 2021 (Section 1.5). Notices were sent to local city and county clerks within and adjacent to the RCIS Area.

1.4 Scope of the Strategy

1.4.1 Kaweah Regional Conservation Investment Strategy Area

Because this RCIS is intended to serve as a tool to identify conservation co-benefits that can be achieved concurrently with implementation of GSPs, the RCIS Area (approximately 475,935 acres) generally aligns with the Kaweah Subbasin boundary, as identified by the boundaries of the Kaweah Subbasin GSAs in Figure 1-1. There are small gaps within the otherwise contiguous Kaweah Subbasin in the eastern half of the Kaweah Subbasin. These areas are included in the RCIS Area because the Program Guidelines require that the RCIS Area is contiguous and unfragmented.

The Kaweah Subbasin overlaps two U.S. Department of Agriculture (USDA) ecoregion sections: the Great Valley and the Sierra Nevada Foothills (Figure 1-2). The eastern border of the Kaweah Subbasin generally aligns with the border between the Great Valley and Sierra Nevada Foothills ecoregion sections, though there are some areas where the Great Valley ecoregion section extends eastward beyond the Kaweah Subbasin boundary. To address the full eastern, upslope extent of the Great Valley ecoregion section adjacent to the Kaweah Subbasin, the eastern border of the RCIS Area is aligned to match the Great Valley ecoregion section border. The Kaweah Subbasin border extends slightly upslope of the Great Valley ecoregion section into the Sierra Nevada Foothills in a few areas. In these cases, the RCIS Area boundary is the Kaweah Subbasin and the RCIS Area includes small slivers of the Sierra Nevada Foothills ecoregion section.

The Kaweah Subbasin overlaps with three U.S. Geological Survey (USGS) Hydrologic Unit Code-8 (HUC-8) watersheds, the Tulare Lake Bed, Upper Kaweah and Upper Tule and 17 smaller, HUC-10 watersheds (Figure 1-3). Watershed boundaries were not used to further adjust the RCIS Area boundary because they extend significantly into the Sierra Nevada Foothills, which is considerably beyond the ecological focus of this RCIS.

The Kaweah Subbasin is divided among the three GSAs (Figure 1-1). The EKGSA covers approximately 117,300 acres (27% of the Kaweah Subbasin) and is located along the eastern boundary of the Kaweah Subbasin. The MKGSA jurisdictional area is approximately 101,430 acres (23% of the Kaweah Subbasin) and is located in the central to western side of the Kaweah Subbasin and is surrounded by the GKGSA. The GKGSA is the largest GSA in the Kaweah Subbasin, representing nearly half of the area of the Kaweah Subbasin (approximately 216,000 acres or 49% of the Kaweah Subbasin).

1.4.2 Strategy Term

CDFW may approve an RCIS for an initial period of up to 10 years after finding that the RCIS meets the requirements of FGC Section 1852 and the Program Guidelines. Although CDFW may approve an RCIS, an approved RCIS is voluntary, non-binding, and non-regulatory. CDFW may extend the duration of an approved or amended RCIS for additional periods of up to 10 years after the RCIS is updated with the best available scientific information and a new finding is made that the RCIS continues to meet the requirements of FGC Section 1852 and the Program Guidelines. The proposed term of this RCIS is 10 years.

1.4.3 Focal Species

Focal species are species whose conservation needs are directly addressed through this RCIS. Section 2.3.10, *Habitat Connectivity*, describes the focal species selection process and lists the Kaweah RCIS focal species. The Kaweah RCIS focal species include a number of state and/or federally listed species along with indicator or umbrella species, whose conservation may benefit an array of other species, including non-focal species. Discussions in this RCIS about conservation priorities, including land protection, enhancement, and restoration (Chapter 3) are described within the context of their importance for contributing to the conservation and recovery of focal species and their habitats, as well as for other conservation elements (such as water resources) in an RCIS Area.

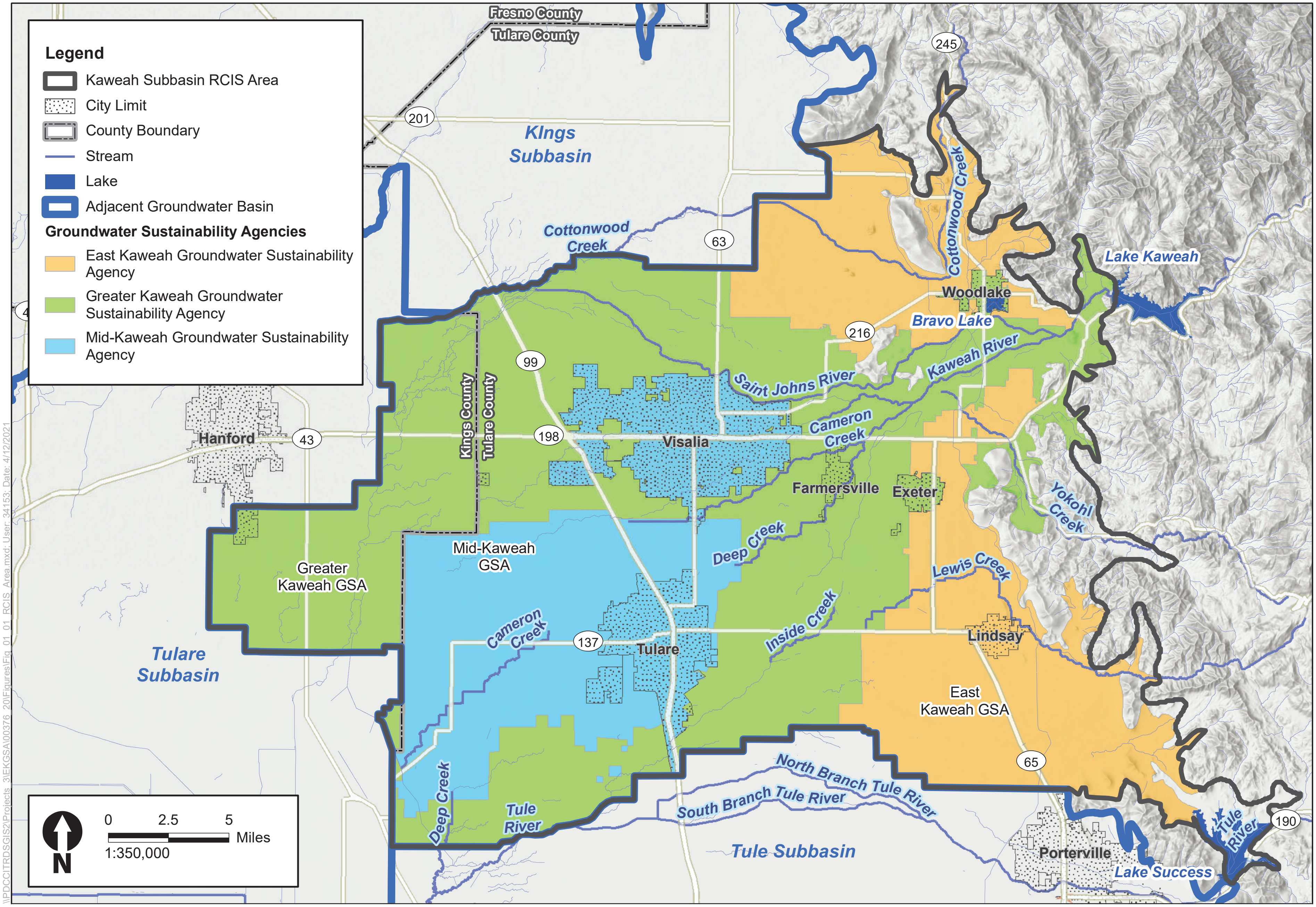

Figure 1-1
Kaweah Subbasin RCIS Area

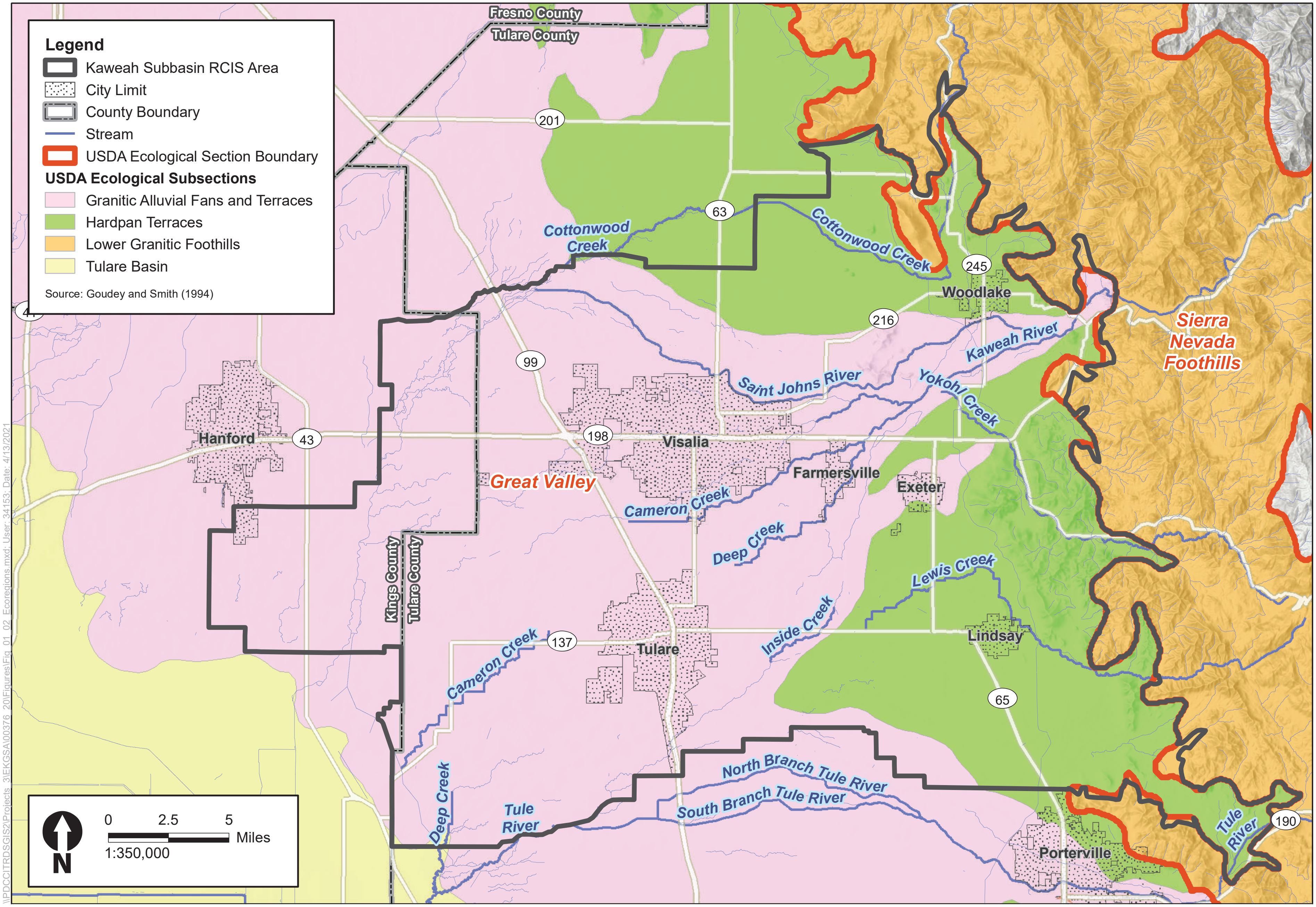

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Figure 1-2
Ecoregions

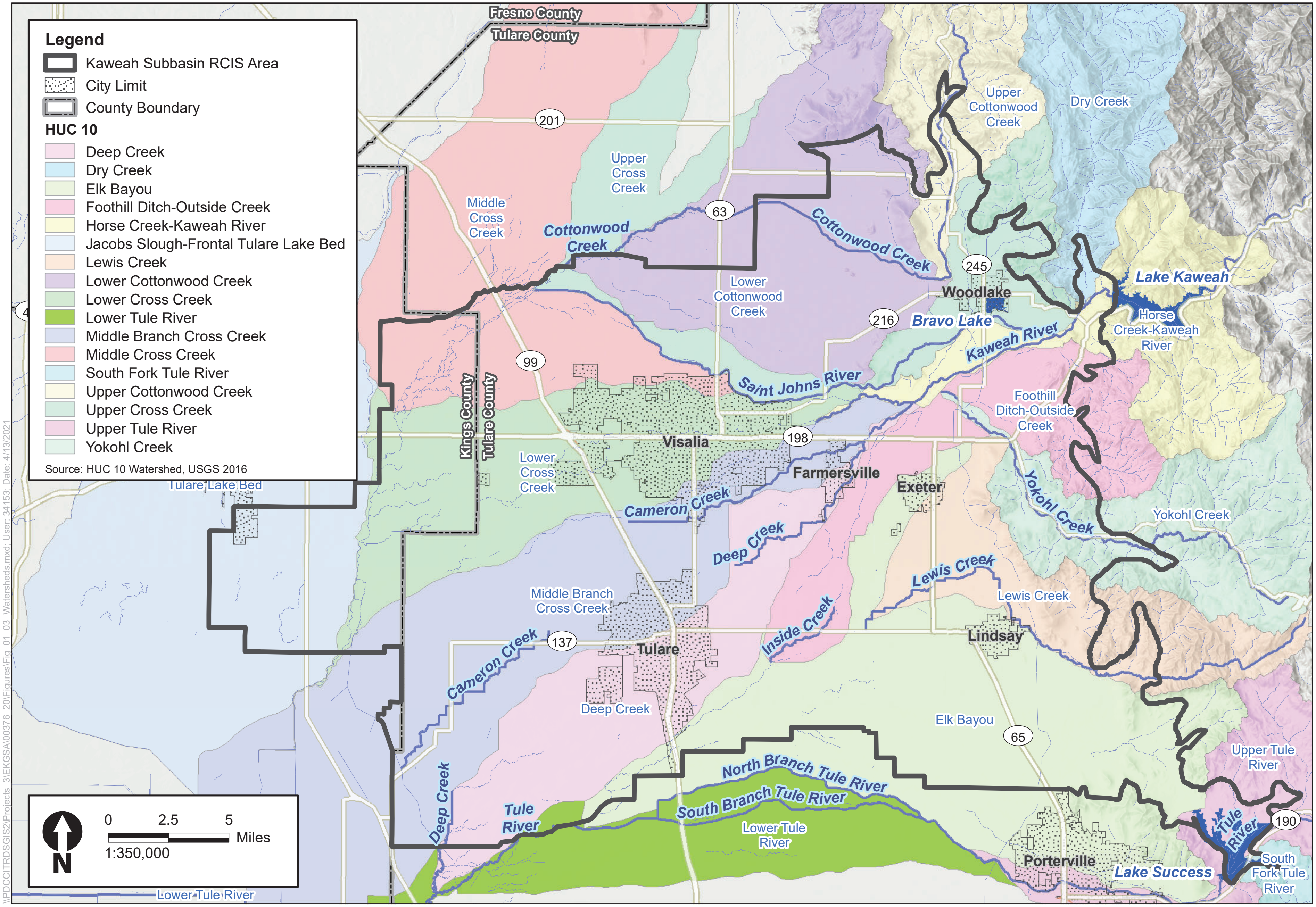


Figure 1-3
Watersheds

1.4.4 Other Conservation Elements

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

This Kaweah RCIS considers groundwater sustainability, natural communities, working landscapes, and habitat connectivity as other conservation elements (i.e., conservation elements in addition to focal and non-focal species).

1.4.4.1 Natural Communities

Natural communities are included as a conservation element because they support the ecological processes and habitats for focal species and native biodiversity. This Kaweah RCIS includes natural communities as a conservation element as a means to protect, restore, and enhance the diversity of natural habitats that support the biodiversity and ecological process representative of the Kaweah Subbasin (Section 3.7, *Conservation Strategy for Natural Communities*).

1.4.4.2 Groundwater Sustainability

Groundwater sustainability is included as a conservation element to help Kaweah Subbasin GSAs achieve sustainability goals per their respective GSPs. The conservation strategies for working lands, natural communities, and focal species will identify conservation and habitat enhancement actions that, when implemented, would provide groundwater sustainability co-benefits (Section 3.6, *Conservation Strategy to Provide Groundwater Sustainability Co-Benefits*).

1.4.4.3 Working Landscapes

Working landscapes are included as a conservation element because working lands dominate and characterize the RCIS Area. Working lands are important to the economy and social fabric of the RCIS Area and provide important habitat for native birds and other wildlife, including focal species (Section 2.3.9, *Working Landscapes*). The conservation strategy for working landscapes seeks to conserve cultivated land and working landscapes and the habitat values they provide for focal species, native wildlife, and natural communities (Section 3.8, *Working Landscapes*).

1.4.4.4 Habitat Connectivity

Habitat connectivity is included as a conservation element because movement is essential for wildlife to access shelter, food, and mates; to disperse to new territories; and to track shifting habitats or find new habitat in a changing climate (Section 2.3.10, *Habitat Connectivity*). The conservation strategy for habitat connectivity seeks to maintain interconnected working landscapes and natural communities (both terrestrial and aquatic) to provide for the movement and genetic interchange among populations of focal species, support adaptive adjustments in species distributions in response to climate change, and sustain native biodiversity (Section 3.9, *Conservation Strategy for Habitat Connectivity*).

1.5 Public Outreach and Involvement

Public outreach and involvement have been an important part of the process of developing this Kaweah RCIS. The Steering Committee led the public outreach and involvement process to ensure that FGC public meeting requirements were met and to engage potential users of this RCIS throughout the RCIS development process.

FGC Section 1854(c)(1) requires a public agency to publish a Notice of Intent to create an RCIS. EKGSA, as the proponent of this Kaweah RCIS, published a Notice of Intent to create this RCIS on February 26, 2021(Appendix C). This Notice was filed with the Governor's Office of Planning and Research and sent to CDFW, as required by FGC Section 1854(c)(1). Copies of the Notice were also sent to the local city and county clerks in the RCIS Area, including the Counties of Tulare and Kings, and the Cities of Exeter, Farmersville, Lindsay, Tulare, Visalia, Woodlake, and Hanford.

FGC Section 1854(c)(3)(A) requires that the public agency preparing an RCIS (in this case, EKGSA) hold a public meeting to allow interested persons and entities to receive information about the RCIS early in the preparation process, and to have adequate opportunity to provide written and oral comments. EKGSA and the Kaweah RCIS Steering Committee hosted one public meeting on July 21, 2021. EKGSA and the Steering Committee provided notice of the public meeting on June 16, 2021, more than 30 days before the public meeting, as required in FGC Section 1854(c)(4). EKGSA and the Steering Committee provided notice regarding development of the draft Kaweah RCIS on EKGSA's website, to CDFW, to each city and county in and adjacent to the RCIS Area, and any agency, organization, and individual who filed a written request to CDFW to receive notices about all RCIS public meetings. Interested persons were invited to provide oral and written comments to EKGSA at the public meeting.

FGC Section 1854(c)(4)(C) requires the public agency proposing an RCIS to also provide notice of the public meeting to the implementing entity for each Natural Community Conservation Plan or regional Habitat Conservation Plan that overlaps with the RCIS Area. There are no approved Natural Community Conservation Plans in the RCIS Area. The only regional Habitat Conservation Plan in the RCIS Area is the *Pacific Gas & Electric Company San Joaquin Valley Operations and Maintenance Habitat Conservation Plan* (Jones & Stokes 2006). EKGSA and the Steering Committee provided notice of the public meeting to Pacific Gas & Electric Company.

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, EKGSA) 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 June 16, 2021, EKGSA notified the Tulare and Kings County boards of supervisors and the Exeter, Farmersville, Lindsay, Tulare, Visalia, Woodlake, and Hanford city councils, and invited the boards of supervisors and city councils to submit written comments on the Kaweah RCIS.

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. The EKGSA will include responses to written public comments in the final Kaweah RCIS to be submitted to CDFW.

Refer to Section 1.3.4, *Consultation with Local Counties and Cities*, for a description of how EKGSA and the Planning Team consulted with the local cities and counties in the RCIS Area during RCIS development.

In addition to the required public outreach measures described above, the Planning Team conducted outreach and engagement efforts with stakeholders. Refer to Appendix C for a summary of all stakeholder and public outreach and involvement efforts, including lists of participants.

Chapter 2
Environmental Setting and the Built Environment

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

Section 2.2, *Built Environment and Land Use*, covers the following subject areas, as required in the California Fish and Game Code (FGC) Section 1850 and the RCIS Program Guidelines (California Department of Fish and Wildlife 2018a).

- Reasonably foreseeable urban development described within the context of local government planning (Section 2.2.1, *Local Government Planning*).
- Major infrastructure (i.e., water infrastructure, transportation infrastructure, transmission infrastructure, and renewable energy projects) (Section 2.2.3, *Major Infrastructure*).

This chapter describes natural resources in the RCIS Area for the following topics.

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

This chapter also identifies the following conservation elements, in addition to natural communities and focal species, that inform the conservation strategy.

- Groundwater sustainability
- Working landscapes
- Habitat connectivity

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

- Urban development
- Agriculture
- Habitat loss and fragmentation

- Climate change
- Dams and water management/use
- Invasive plants and animals
- Fire and fire suppression
- Renewable energy, mining, and quarrying

2.1 Regional Conservation Planning Environment

FGC Section 1852(c)(10) requires that an RCIS include "provisions ensuring that the strategy is consistent with and complements any administrative draft natural community conservation plan, approved natural community conservation plan, or federal habitat conservation plan that overlaps with the RCIS Area." Furthermore, FGC Section 1852(c)(11) requires an explanation of whether and to what extent an RCIS is consistent with any previously approved strategy or amended RCIS, state or federal recovery plan, or other state or federally approved conservation strategy that overlaps with the RCIS Area. Section 2.1.1, *Groundwater Sustainability Plans,* summarizes the three groundwater sustainability plans (GSPs) in the RCIS Area. Section 2.1.2, *Natural Community Conservation Plans and Habitat Conservation Plans in and Adjacent to the Strategy Area*, briefly summarizes the Habitat Conservation Plans (HCPs) that overlap the RCIS Area (there are no Natural Community Conservation Plans [NCCPs] in the RCIS Area). Section 2.1.3, *Species Recovery Plans*, summarizes state and federal recovery plans that overlap the RCIS Area, and Section 2.1.4, *Critical Habitat Designations*, summarizes the designated critical habitat in the RCIS Area.

Section 3.11, *Consistency with Approved Recovery Plans and Conservation Strategies*, describes how this Kaweah RCIS is consistent with and complements administrative draft and approved NCCPs and HCPs, and state or federally approved recovery plans that overlap the RCIS Area.

2.1.1 Groundwater Sustainability Plans

The Kaweah Subbasin is dominated by agricultural land interspersed by numerous small towns and communities, as well as the larger incorporated Cities of Tulare and Visalia. Water used for irrigated agriculture comprises the majority of water use and is sourced from both surface and groundwater. Groundwater is the main source of water for municipal and industrial uses, as well as residences and animal farms in the unincorporated areas of the Subbasin. As described in Section 1.2.2.1, *Sustainable Groundwater Management*, management of groundwater in the Kaweah Subbasin is divided among three groundwater sustainability agencies (GSAs): the East Kaweah GSA (EKGSA), the Mid-Kaweah GSA (MKGSA), and the Greater Kaweah GSA (GKGSA) (Figure 1-1). Each GSA has developed a GSP for the area of the Subbasin under its management, with the coordinated goal of jointly managing aquifer supply to achieve the Kaweah Subbasin sustainability goal. All three GSAs were formed as Joint Powers Authorities (JPA) pursuant to California Government Code Sections 65500 et. seq (Table 2-1). In general, each JPA is governed by a board of directors supported by several committees that provide assistance to the boards when developing policy, and offer guidance from technical, social, and impacted party perspectives. Each GSA has an executive director or manager who retains the management authority to implement the GSP at the direction of the board. Board members are generally appointed from the member agencies, with some GSA boards also incorporating advisory committee members or members from other local stakeholder groups.

Advisory committees are generally composed of various representatives of different stakeholder groups.

Table 2-1. Member Agencies and Governance Structure of the Kaweah Subbasin Groundwater Sustainability Agencies

GSA	Year Formed	Member Agencies	Governance Structure
East Kaweah	2017	• County of Tulare • City of Lindsay • Exeter Irrigation District • Ivanhoe Irrigation District • Lindmore Irrigation District • Lindsay-Strathmore Irrigation District • Stone Corral Irrigation District	• Board of Directors • Executive Director • Technical Advisory Committee • Advisory Committee
Mid-Kaweah	2015	• City of Tulare • City of Visalia • Tulare Irrigation District	• Board of Directors • Manager • Management Committee • Technical Advisory Subcommittee • Advisory Committee
Greater Kaweah	2016	• County of Tulare • Kaweah Delta Water Conservation District • Kings County Water District • St. Johns Water District • Lakeside Irrigation Water District • California Water Service Company[a]	• Board of Directors • General Manager • Technical Advisory Committee • Rural Communities Committee • Stakeholder Committee

[a] California Water Service Company joined the GKGSA under a Memorandum of Agreement

Regulations require a Coordination Agreement to be prepared when multiple GSPs will be implemented in a basin to ensure the GSPs use the same data and analysis methodologies for assessing groundwater elevation data, groundwater extraction data, surface water supply information, total water use, changes in groundwater storage, water budget, and sustainable yield. To that end, the three GSAs with authority in the Kaweah Subbasin entered into a *Kaweah Subbasin Coordination Agreement* in 2020 (Greater Kaweah Groundwater Sustainability Agency, Mid-Kaweah Groundwater Sustainability Agency, and East Kaweah Groundwater Sustainability Agency 2020). Coordination among the GSAs is accomplished via the Kaweah Subbasin Management Team, a nine-member panel appointed from each of the GSAs, and the Subbasin Technical Advisory Committee.

The two primary tools for sustainable groundwater management identified in the three GSPs are project development for water supply augmentation, and management actions for data collection and demand reduction. Projects generally focus on capture, use, and recharge of available surface water supplies, while management actions focus on reducing water demand with the associated reduction of groundwater pumping, increased data collection with associated education and outreach, regulatory policies, incentive-based programs, and enforcement actions. Table 2-2 lists potential GSP projects.

2.1.1.1 East Kaweah Groundwater Sustainability Plan

The EKGSA has an 11-member board of directors consisting of appointed officials. Seven members are elected officials from member agencies appointed by their respective agency boards, two members are appointed by water company special districts within the EKGSA boundary (i.e., Wutchumna Water Company and Sentinel Butte Mutual Water Company), one member is appointed by the County of Tulare and is approved by the board, and one member is appointed at large by the board. The Technical Advisory Committee consists of 11 members, each appointed by a governing board member. The Technical Advisory Committee is chaired by a non-voting board member and consists of 11 appointed members chosen via an application process to represent the following stakeholder interests: agricultural interests (three members); domestic well users (one member); rural communities (three members); environmental interests (two members); water companies (one member); and other/scientific community (one member).

To facilitate implementation of the East Kaweah GSP (Provost and Pritchard Consulting Group 2020), the EKGSA was subdivided into nine management areas and 10 threshold regions. Management areas may define different minimum thresholds and may be operated to different measurable objectives than the Subbasin at large, provided that undesirable results are defined consistently throughout the Subbasin (per Title 23 California Code of Regulations [CCR] Section 354.20). EKGSA management area boundaries largely follow the jurisdictional boundaries of the member irrigation districts with non-district areas falling within the jurisdictional boundary of Tulare County. The EKGSA was further subdivided into 10 threshold regions grouped by similar hydrogeologic characteristics; two to four threshold regions fall within each management area.

The jurisdictional area of the EKGSA is approximately 183 square miles, or roughly 26% of the Subbasin area. Current estimates of annual groundwater overdraft in the EKGSA are approximately 28,000 acre-feet per year (AFY). To meet sustainability goals by 2040, EKGSA has developed interim goals for years 5, 10 and 15 of GSP implementation that will mitigate groundwater depletion by 5, 25, and 55% respectively, and has identified several potential projects for implementation. The initial projects under consideration are primarily focused on the development of recharge, storage, conservation, and water recycling projects utilizing surface water supplies from precipitation, Kaweah River flows, and San Joaquin River water via Friant Central Valley Project (CVP) contracts to augment water supply. If fully implemented as proposed, the initial projects would result in an estimated yield of 18,200 AFY, which corresponds to approximately 65% of the estimated annual overdraft. The remainder of the overdraft is expected to be saved through future projects to be developed, and any necessary management actions.

Management actions under consideration by the EKGSA that may be implemented to achieve sustainability are grouped into the following general areas.

- Education and outreach
- Well head requirements
- Groundwater allocation
- Groundwater marketing/trading

- Fees and incentives
- Groundwater pumping restrictions

The implementation of management actions will largely be determined as a function of the success of GSP implementation in meeting interim sustainability milestones. The goal of management actions is to reduce groundwater pumping and mitigate further decline in aquifer levels. Some actions, such as education and outreach, would be ongoing throughout the term of the GSP, while other actions would only be implemented if project development is not providing sufficient gains toward sustainability. Management actions may be implemented GSA-wide, on an area by area basis, and in some cases, by individual landowners rather than the EKGSA.

2.1.1.2 Mid-Kaweah Groundwater Sustainability Plan

The MKGSA was one of the first GSAs formed in California. The six-member board of directors consists of two elected officials representing each of the founding member agencies, although the City of Tulare may appoint a member of the Tulare Board of Public Utilities to serve on its behalf. The board is supported by a Management Committee comprised of key staff from each member agency, and a Technical Advisory Subcommittee. Citizen groups and members of the public form an 11-member Technical Advisory Committee representing agriculture (three members), governmental organizations (three members), environmental organizations and disadvantaged communities (three members) and the public at large (two members).

To facilitate implementation of the Mid-Kaweah GSP (GEI Consultants, Inc. and GSI Water Solutions, Inc. 2019), three management areas were established in the MKGSA with boundaries that follow the jurisdictional areas of the three member agencies. The Tulare Irrigation District and City of Tulare management areas both contain disadvantaged communities that may require unique management actions to address localized undesirable results. The MKGSA may consider designating additional management areas in the future in the Tulare Irrigation District if sustainability needs in this area require a more focused management effort as Mid-Kaweah GSP implementation progresses.

The jurisdictional area of the MKGSA is approximately 163 square miles, or roughly 25% of the Subbasin area. Current estimates of annual groundwater overdraft in the MKGSA are approximately 12,600 AFY. The GSA has identified 18 projects and nine management actions to address this overdraft, which, if implemented as planned, are expected to accrue benefits of approximately 25,000 AFY by 2030 and approximately 31,000 AFY by 2040. Projects and management actions include the following.

- Groundwater recharge projects and programs
- Surface reservoir projects
- Leveraged surface water exchange programs
- Groundwater extraction measurement program
- Groundwater marketing program
- Groundwater conservation programs
- Groundwater allocation program

The objective of the MKGSA is to develop and implement projects to achieve the sustainable yield goals prior to implementation and enforcement of a groundwater extraction allocation program. In addition, management actions may include land fallowing or other land use conversion alternatives incorporated with a demand reduction program.

2.1.1.3 Greater Kaweah Groundwater Sustainability Plan

The GKGSA has a nine-member board of directors of consisting of appointed officials. Two elected officials are appointed from the Kaweah Delta Water Conservation District, one official is appointed from each of the four remaining member agencies, one representative each is nominated from the Rural Communities Committee and Stakeholder Committee and approved by the board, and one representative is nominated from the California Water Service Company and approved by the board. The Rural Communities Committee is comprised of members from local public agencies that are eligible to serve as a GSA per California Water Code regulations, while the Stakeholder Committee members represent private ditch companies, domestic well operators, growers, and nonprofit environmental organizations. Committee members are appointed by the board of directors via an application process. The Technical Advisory Committee consists of nine members, each appointed by a member of the board of directors.

Management areas have not yet been established in the GKGSA; however, the GSA expects to include them in future GSP revisions. There are currently two management areas under consideration, including one covering the combined jurisdictional areas of GSA members that import surface waters to the Kaweah Subbasin, and one covering the non-district lands in the GSA in the jurisdictional boundary of Tulare County.

The jurisdictional area of the GKGSA is approximately 340 square miles, or roughly 49% of the Subbasin area. Current estimates of annual groundwater overdraft in the GKGSA are approximately 34,600 AFY. To meet sustainability goals by 2040, this overdraft volume will be addressed through a combination of project implementation and management actions. Initial projects identified in the Greater Kaweah GSP were selected based on a determination of their status as currently under construction, shovel-ready, or highly feasible. If fully implemented as proposed, the projects would result in an estimated yield of 31,910 AFY, which corresponds to approximately 92% of the estimated annual overdraft.

The GKGSA proposes to implement management actions described in the Greater Kaweah GSP in a phased manner (GEI Consultants, Inc., and GSI Water Solutions 2020). The first five years of GSP implementation will be considered a pilot phase to determine feasibility and success rates for various management actions. Successful management actions would then be considered for full implementation throughout the GSA. Management actions under consideration by the GKGSA include the following.

- Communication and engagement
- Terminus reservoir reoperation program
- Groundwater extraction measurement program
- Well characterization program
- Geophysical data survey
- Assistance for impaired wells

- Agricultural water conservation and management
- Urban water conservation program
- Fee and incentive program
- Groundwater market
- Groundwater allocation program

Communication and engagement activities are expected to be implemented within six to nine months of GSP approval and to be an ongoing effort throughout the life of the GSP.

Table 2-2. Potential Groundwater Sustainability Plan Projects

Project Name	GSP	Estimated Average Annual Water Benefits (AFY)	Project Type
Lewis Creek Recharge	East Kaweah	3,000	Recharge
Cottonwood Creek Recharge	East Kaweah	1,800	Recharge
Yokohl Creek Recharge	East Kaweah	1,800	Recharge
Rancho de Kaweah Water Management and Banking Project	East Kaweah	9,000	Recharge, storage, re-regulation, banking
Lindmore/Exeter Dry Wells	East Kaweah	2,010	Recharge
Lindsay Recharge Basin	East Kaweah	150	Recharge
Wutchumna Ditch Recharge	East Kaweah	480	Recharge
Cordeniz Recharge Basin	Mid-Kaweah	1,610	Recharge
Okieville Recharge Basin	Mid-Kaweah	630	Recharge
Tulare ID/MKGSA Recharge Basin	Mid-Kaweah	5,090	Recharge
On-Farm Recharge Program	Mid-Kaweah	3,610	Recharge
McKay Point Reservoir	Mid-Kaweah	730	Storage
Kaweah Subbasin Recharge Project	Mid-Kaweah	7,630	Recharge
Vadose Zone Injection Well Battery	Mid-Kaweah	N/A	Recharge
Tulare ID River Siphon Rehabilitation	Mid-Kaweah	N/A	Local conveyance improvements
City of Visalia/Tulare ID Exchange Program	Mid-Kaweah	5,500	Water exchange for recharge
Sun World/Tulare ID Exchange Program	Mid-Kaweah	3,400	Water exchange for recharge
Friant/Tulare ID Exchange Program	Mid-Kaweah	N/A	Water exchange for recharge
Temperance Flat Reservoir	Mid-Kaweah	N/A	Storage
City of Tulare/Tulare ID Catron Basin	Mid-Kaweah	1,600	Recharge
City of Visalia/Tulare ID Cameron Creek Project	Mid-Kaweah	N/A	Recharge
City of Visalia/Tulare ID/Kaweah Delta WCD Packwood Creek Project	Mid-Kaweah	1,465	Recharge

Project Name	GSP	Estimated Average Annual Water Benefits (AFY)	Project Type
Visalia Eastside Regional Park and Groundwater Recharge	Mid-Kaweah	1,910	Recharge
Groundwater Recharge Assessment Tool	Mid-Kaweah	N/A	Recharge
Tulare ID Existing Recharge Facility Report	Mid-Kaweah	N/A	Recharge
Kings County WD/Lakeside Irrigation WD Cross Creek Layoff Basin	Greater Kaweah	640	Storage
Lakeside Irrigation WD/Kings County WD/Kaweah Delta WCD Recharge Basin Improvement	Greater Kaweah	1,600	Recharge
Lakeside Irrigation WD New Recharge Basins	Greater Kaweah	3,600	Recharge
Kings County WD Delta View Canal	Greater Kaweah	3,900	Local conveyance improvements/recharge
Kings County WD/Corcoran ID Lakeland Canal Deliveries	Greater Kaweah	2,900	Storage
Kings County WD/Lakeside Irrigation WD Kings River Floodwater Arrangement	Greater Kaweah	4,700	Storage
Kings County WD/Lakeside Irrigation WD Kings River Surplus Water	Greater Kaweah	1,800	Storage
Kings County WD/Lakeside Irrigation WD Fallowing Program	Greater Kaweah	3,750	Groundwater conservation
Kings County WD/Lakeside Irrigation WD On-Farm Recharge and Storage	Greater Kaweah	1,900	Recharge
Kaweah Delta WCD Hannah Ranch Flood Control Project	Greater Kaweah	2,250	Local conveyance improvements
Kaweah Delta WCD Paregien Flood Control and Recharge Project	Greater Kaweah	2,370	Recharge
Kaweah Delta WCD Ketchum Flood Control and Recharge Project	Greater Kaweah	300	Recharge
Kaweah Delta WCD St. Johns River Water Conservation Project	Greater Kaweah	1,400	Regional conveyance improvements
Kaweah Delta WCD Basin No. 4 Improvement Project	Greater Kaweah	500	Recharge
Kaweah Delta WCD Peoples Recharge Expansion Project	Greater Kaweah	300	Recharge

AFY = acre-feet per year; GSP = Groundwater Sustainability Plan; ID = irrigation district; MKGSA = Mid-Kaweah Groundwater Sustainability Agency; WCD = water control district; WD = water district.

2.1.2 Natural Community Conservation Plans and Habitat Conservation Plans in and Adjacent to the Strategy Area

There are four approved HCPs overlapping the Kaweah RCIS Area and one that is adjacent to the RCIS Area. There are no NCCPs overlapping or adjacent to the RCIS Area. Table 2-3 lists the approved and in-development HCPs overlapping the RCIS Area, covered species or species proposed for coverage, and those species that overlap the Kaweah Subbasin RCIS focal species.

Each of these plans is summarized below in Table 2-3; common species names shown in **boldface type** are Kaweah RCIS focal species. Common species names shown in *italicized type* are Kaweah RCIS non-focal species. Refer to Section 3.11, *Consistency with Approved Conservation Strategies and Recovery Plans* for a discussion about how this RCIS is consistent with these HCPs.

Table 2-3. Approved Habitat Conservation Plans Overlapping or Directly Adjacent to the RCIS Area

Plan	Location (Relative to RCIS)	Status	Plan Area Size (acres)	Species Covered[a]
Tulare Irrigation Main Intake Canal Lining Project HCP	Overlaps	Permit issued: 2000 Permit expired: 2005	100 acres and 9.7 linear miles	Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), **San Joaquin kit fox (*Vulpes macrotis mutica*)**
Pacific Gas & Electric Company San Joaquin Valley Operations and Maintenance HCP	Overlaps	Permit issued: 2007	276,350 across nine counties in the San Joaquin Valley	**Vernal pool fairy shrimp (*Branchinecta lynchi*)**, Midvalley fairy shrimp (*Branchinecta mesovallensis*), *vernal pool tadpole shrimp (Lepidurus packardi)*, valley elderberry longhorn beetle, **California tiger salamander (*Ambystoma californiense*)**, limestone salamander (*Hydromantes brunus*), California red-legged frog (*Rana draytonii*), **blunt-nosed leopard lizard (*Gambelia sila*)**, giant garter snake (*Thamnophis gigas*), **Swainson's hawk (*Buteo swainsoni*)**, white-tailed kite (*Elanus leucurus*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), **burrowing owl (*Athene cunicularia*)**, bank swallow (*Riparia riparia*), **tricolored blackbird (*Agelaius tricolor*)**, **Buena Vista Lake ornate shrew (*Sorex ornatus relictus*)**, riparian brush rabbit (*Sylvilagus bachmani*), riparian (San Joaquin Valley) woodrat (*Neotoma fuscipes riparia*), **Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*)**, giant kangaroo rat (*Dipodomys ingens*), Nelson's antelope squirrel (*Ammospermophilus nelsoni*), **San Joaquin kit fox**, large-flowered fiddleneck (*Amsinckia grandiflora*), lesser saltscale (*Atriplex minuscula*), Bakersfield smallscale (*Atriplex tularensis*), big tar weed (*Blepharizonia plumosa*), mariposa pussypaws (*Calyptridium pulchellum*), tree-anemone (*Carpenteria californica*), succulent owl's clover (*Castilleja campestris* ssp. *succulenta*), California jewelflower (*Caulanthus californicus*), *Hoover's spurge (Chamaesyce hooveri)*, slough thistle (*Cirsium crassicaule*), mariposa clarkia (*Clarkia biloba* ssp. *australis*), Merced clarkia (*Clarkia lingulata*), *Springville clarkia (Clarkia springvillensis)*, Vasek's clarkia (*Clarkia tembloriensis* ssp. *calientensis*), hispid bird's-beak (*Chloropyron molle* ssp. *hispidum*), palmate-bracted bird's beak, Kern mallow (*Eremalche parryi* ssp. *kernensis*), Congdon's woolly sunflower (*Eriophyllum congdonii calflora*), Delta button-celery (*Eryngium racemosum*), **striped adobe-lily (*Fritillaria striata*)**, Boggs Lake hedge-hyssop (*Gratiola heterosepala*), pale-yellow layia (*Layia heterotricha*), Comanche Point layia (*Layia*

Plan	Location (Relative to RCIS)	Status	Plan Area Size (acres)	Species Covered[a]
				leucopapppa), legenere (*Legenere limosa*), Panoche pepper grass (*Lepidium jaredii ssp. album*), Congdon's lewisia (*Lewisia congdonii*), Mason's lilaeopsis (*Lilaeopsis masonii*), mariposa lupine (*Lupinus citrinus* var. *deflexus*), showy madia (*Madia radiata*), Hall's bush mallow (*Malacothamnus hallii*), San Joaquin woollythreads (*Monolopia congdonii*), pincushion navarretia (*Navarretia myersii*), Colusa grass (*Neostapfia colusana*), Bakersfield cactus (*Opuntia basilaris* var. *treleasei*), *San Joaquin Orcutt grass (Orcuttia inaequalis)*, hairy Orcutt grass (*Orcuttia pilosa*), Hartweg's golden sunburst (*Pseudobahia bahiifolia*), *San Joaquin adobe sunburst (Pseudobahia peirsonii)*, *Keck's checkerbloom (Sidalcea keckii)*, oil neststraw (*Stylocline citroleum*), *Greene's tuctoria (Tuctoria greenei)*, kings gold (*Tropidocarpum californicum*)
Woodville Solid Waste Facility HCP	Adjacent	Permit issued: 2007	414	Hopping's blister beetle (*Lytta hoppingi*), molestan blister beetle (*Lytta molesta*), Morrison's blister beetle (*Lytta morrisoni*), **burrowing owl**, midvalley fairy shrimp, San Joaquin tiger beetle (*Cicindela tranquebarica joaquinensis*)
Southern California Edison Cross Valley HCP	Overlaps	Permit issued: 2013	3,385	Valley elderberry longhorn beetle, **vernal pool fairy shrimp**, *vernal pool tadpole shrimp*, **California tiger salamander**, **burrowing owl, San Joaquin kit fox**, *San Joaquin Orcutt grass*, *Hoover's spurge*
State Route 99/Cartmill Avenue Interchange Low-Effect HCP	Overlaps	Permit issued: 2013 Permit expired: 2018	217	**Vernal pool fairy shrimp, San Joaquin kit fox**

[a] Common species names in **boldface type** are Kaweah RCIS focal species. Common species names in *italicized type* are Kaweah RCIS non-focal species. All scientific species names are in italics.
HCP = Habitat Conservation Plan

2.1.3 Species Recovery Plans

A primary goal of the federal Endangered Species Act (ESA), as amended per Title 16 of the U.S. Code (USC) Section 1531 et seq., is the recovery of endangered or threatened animals and plants to the point where they are again secure, self-sustaining members of their ecosystems. Recovery means improving the status of listed species to the point at which listing is no longer appropriate under the criteria specified in Section 4(a)(1) of the federal ESA. Recovery plans provide a framework for targeting conservation efforts and modifying actions based on new science and changing circumstances. Recovery plans provide guidance and are voluntary; they do not have the force of law. As such, the success of recovery efforts ultimately depends on partnerships and cooperation to ensure the implementation of actions to advance species' long-term recovery.

A recovery plan includes scientific information about the species being addressed and provides criteria that enable the U.S. Fish and Wildlife Service (USFWS) to determine whether down-listing or delisting the species is justified. Recovery plans help guide recovery efforts by describing actions that USFWS considers necessary for each species' conservation and by estimating time and costs for implementing needed recovery measures.

Table 2-4 lists USFWS recovery plans that address species in RCIS Area. Refer to Section 3.11, *Consistency with Approved Conservation Strategies and Recovery Plans* for a discussion about how this RCIS is consistent with these recovery plans.

Table 2-4. U.S. Fish and Wildlife Service Recovery Plans Addressing Species in the RCIS Area

Recovery Plan	Year Published	Species Addressed	Recovery Areas Overlapping RCIS Area
Draft Recovery Plan for the Least Bell's Vireo (*Vireo bellii pusillus*)	1998	Least Bell's vireo	San Joaquin Valley population/metapopulation unit
Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*)	2017	Giant garter snake	Tulare Basin Recovery Unit
Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (*Ambystoma californiense*)	2017	**California tiger salamander**	Southern San Joaquin Valley Recovery Unit
Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon	2005	Succulent owl's clover, *Hoover's spurge*, Loch Lomond button-celery (*Eryngium constancei*), Contra Costa goldfields (*Lasthenia conjugens*), Butte County meadowfoam (*Limnanthes floccosa* ssp. *californica*), few-flowered navarretia (*Navarretia leucocephala* ssp. *pauciflora*), many-flowered navarretia (*Navarretia leucocephala* ssp. *plieantha*), Colusa grass, *San Joaquin Valley Orcutt grass*, hairy orcutt grass, slender Orcutt grass (*Orcuttia tenuis*), Sacramento Orcutt grass (*Orcuttia viscida*), Lake County stonecrop (*Sedella leiocarpa*), *Greene's tuctoria*, Solano grass (*Tuctoria mucronata*), Conservancy fairy shrimp (*Branchinecta conservation*), longhorn fairy shrimp (*Branchinecta longiantenna*), **vernal pool fairy shrimp**, delta green ground beetle (*Elaphrus viridis*), *vernal pool tadpole shrimp*, Ferris' milk vetch (*Astragalus tener* var. *ferrisiae*), alkali milk vetch (*Astragalus tener* var. *tener*), vernal pool smallscale (*Atriplex persistens*), spiny-sepaled button-celery (*Eryngium spinosepalum*), Boggs Lake hedge-hyssop, Ahart's dwarf rush (*Juncus leiospermus var. ahartii*), legenere, little mousetail (*Myosurus minimus* ssp. *apus*), small pincushion navarretia (*Navarretia myersii* ssp. *deminuta*), bearded popcorn flower (*Plagiobothrys hystriculus*), midvalley fairy shrimp, California fairy shrimp (*Linderiella occidentalis*), **western spadefoot toad (*Spea hammondii*)**	Cross Creek, Pixley, Cottonwood, Tulare, Yokohl, Lake Success, and Kaweah Core Areas

Recovery Plan	Year Published	Species Addressed	Recovery Areas Overlapping RCIS Area
Recovery Plan for Upland Species of the San Joaquin Valley, California	1998	California jewelflower, palmate-bracted bird's-beak, Kern mallow, San Joaquin woollythreads, Bakersfield cactus, Hoover's woolly-star (*Eriastrum hooveri*), giant kangaroo rat, Fresno kangaroo rat (*Dipodomys nitratoides exilis*), **Tipton kangaroo rat, blunt-nosed leopard lizard**, **San Joaquin kit fox,** lesser saltscale, Bakersfield smallscale, Lost Hills saltbush (*Atriplex vallicola*), Vasek's clarkia, Temblor buckwheat (*Eriogonum temblorense*), Tejon poppy (*Eschscholzia lemmonii* ssp. *kernensis*), diamond-petaled California poppy (*Eschscholzia rhombipetala*), Comanche Point layia, Munz's tidy-tips (*Layia munzii*), Jared's pepper grass (*Lepidium jaredii*), Merced monardella (*Monardella leucocephala*), Merced phacelia (*Phacelia ciliate* var. *opaca*), oil neststraw, Ciervo aegialian scarab beetle (*Aegialia concinna*), San Joaquin dune beetle (*Coelus gracilus*), Doyen's dune weevil (*Trigonoscuta* sp.), San Joaquin antelope squirrel, short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*), riparian (San Joaquin Valley) woodrat, Tulare grasshopper mouse (*Onychomys torridus tularensis*), **Buena Vista Lake ornate shrew**, LeConte's thrasher (*Toxostoma lecontei*)	Recovery areas are species-specific. See Table 4 in the *Upland Species of the San Joaquin Valley* for recovery area locations

[a] Common species names in **boldface type** are Kaweah RCIS focal species. Common species names in *italicized type* are Kaweah RCIS non-focal species. All scientific species names are in italics.

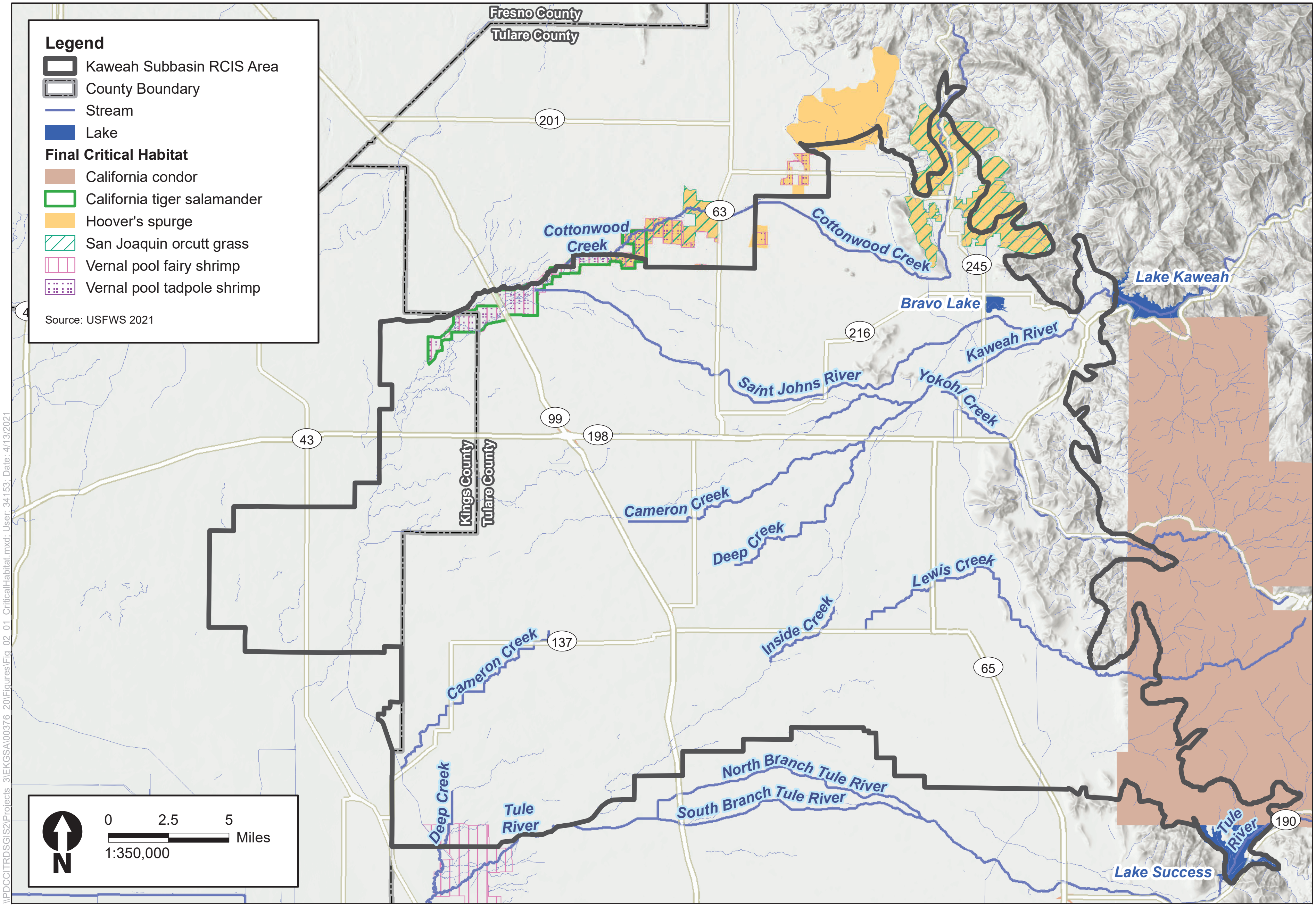
2.1.4 Critical Habitat Designations

Critical habitat is a term defined by and used in the federal ESA as specific geographic areas that contain features essential to the conservation of an endangered or threatened species and that may require special management and protection. Critical habitat may also include areas that are not currently occupied by the species but will be needed for its recovery.

To be included in a critical habitat designation, the habitat within the area occupied by the species must first have features that are ''essential to the conservation of the species.'' Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas on which are found those physical and biological features essential to the conservation of the species (i.e., primary constituent elements), as defined in Title 50 of the Code of Federal Regulations (CFR) Section 424.12(b). Six species have designated critical habitat that occurs in the RCIS Area (Table 2-5 and Figure 2-1).

Table 2-5. U.S. Fish and Wildlife Service Designated Critical Habitat in the RCIS Area

Species with Critical Habitat	Final Designation Citation (Federal Register) Year	Critical Habitat Unit(s) in RCIS Area	Total Critical Habitat Designated (acres)	Critical Habitat in RCIS Area (acres)
California condor (*Gymnogyps californianus*) (not a focal species)	42 FR 47840 1977	Tulare County Rangelands	605,553	13,703
California tiger salamander (focal species)	70 FR 79380 2005	Unit 5A	257,745	3,627
Hoover's spurge (non-focal species)	71 FR 7118 2006	Unit 7A, B, C, D, E, F, and G	114,658	7,456
San Joaquin Orcutt grass (non-focal species)	71 FR 7118 2006	Unit 6A, B, C, and D	136,188	6,427
Vernal pool fairy shrimp (focal species)	71 FR 7118 2006	Unit 26A, B, D, E, and 27A	598,023	5,370
Vernal pool tadpole shrimp (non-focal species)	71 FR 7118 2006	Unit 18A, D, E, and F	229,119	3,948



ICF

Figure 2-1
Critical Habitat

2.1.5 Tricolored Blackbird Voluntary Local Program

Under a Voluntary Local Program (VLP), take of state endangered, threatened or candidate species covered by the VLP and incidental to routine and ongoing agricultural activities is not prohibited by Division 3, Chapter 1.5 of the FGC, as long as the take arises from routine and ongoing agricultural activities incorporating management practices covered under the VLP. According to 14 CCR Section 786.0(a), the purpose of a VLP “is to encourage farmers and ranchers engaged in agricultural activities to establish locally designed programs to voluntarily enhance and maintain habitat for endangered and threatened species.” These activities are to be carried out on public and private lands while providing take authorization as a result of conservation efforts to increase numbers of, and provide habitat for, special-status species on their lands.

The California Department of Fish and Wildlife (CDFW) prepared a VLP for tricolored blackbird (*Agelaius tricolor*) covering Stanislaus, San Benito, Merced, Madera, Fresno, Kings, Tulare, and Kern Counties, and overlapping the RCIS Area which contains approximately 2,973,920 acres planted in grain crops likely to provide nesting and foraging habitat for the species (California Department of Fish and Wildlife 2019a). The Tricolored Blackbird VLP is entered into by and between the California Farm Bureau Federation (CFBF) working as the program administrator, and CDFW. Audubon California assists CFBF with biological monitoring and annual reporting.

The Tricolored Blackbird VLP conveys authorization for take of tricolored blackbird, a species listed under the California Endangered Species Act (CESA)[1], incidental to routine and ongoing agricultural activities. Tricolored blackbirds nest in large colonies on approximately seven to 10 dairies annually in the San Joaquin Valley. Additional colonies are regularly found on a few farms growing grain crops in or near the Central Valley. Farmers and ranchers who voluntarily participate in the Tricolored Blackbird VLP receive access to technical assistance to implement colony protection management practices, and also receive protection from legal liability for take that may result from their routine agricultural activities. Take authorization is provided to those farmers and ranchers who enroll and implement management practices when tricolored blackbirds nest in their grain crops to delay harvest and allow tricolored blackbird colonies to complete their nesting and fledging cycle. The Tricolored Blackbird VLP will remain in effect for 5 years and will expire April 24, 2024.

The Natural Resources Conservation Service (NRCS) provides technical assistance for projects covered under the Tricolored Blackbird VLP that are funded by the Farm Bill through oversight, planning, and monitoring of the projects. The NRCS also offers financial and technical assistance for harvest management practices, including delaying harvesting to allow tricolored blackbirds time to fledge their young.

Appendix A of the Tricolored Blackbird VLP (California Department of Fish and Wildlife 2019a) provides a list of management practices that could be implemented under the Tricolored Blackbird VLP, and routine and ongoing agricultural activities that could be covered under the Tricolored Blackbird VLP. The Kaweah RCIS tricolored blackbird conservation strategy (Section 3.10.8) incorporates Tricolored Blackbird VLP management actions.

[1] FGC Section 2050 et seq.

2.2 Built Environment and Land Use

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

2.2.1 Local Government Planning

FGC Section 1852(c)(6) requires "… consideration of …city and county general plan designations that accounts for reasonably foreseeable development of …housing in the RCIS Area." The RCIS Area overlaps Tulare County (423,348 acres) and a small portion of Kings County (52,587acres) (Figure 1-1). There are six incorporated cities entirely within the RCIS Area, all within Tulare County: the Cities of Tulare, Exeter, Farmersville, Lindsay, Visalia, and Woodlake. A small portion of the City of Hanford is located in the western portion of the RCIS Area in Kings County.

The Kaweah RCIS Area includes census tracts, census blocks, and census designated places identified as disadvantaged or severely disadvantaged communities (California Department of Water Resources 2021) (Figure 2-2). Disadvantaged communities were represented on the Kaweah RCIS Steering Committee by Self Help Enterprises and the Leadership Council for Justice and Accountability. Consultation with disadvantaged communities' representatives through the Steering Committee served as a forum to identify and resolve potential issues that could be addressed within the scope of this Kaweah RCIS.

The RCIS Area has a rural character, consisting primarily of lands under agricultural uses, and to a lesser extent, low density residential, with existing urban development clustered in the incorporated cities. The *Tulare County General Plan 2030 Update* (County of Tulare 2012) promotes sustainable growth while protecting agricultural lands by directing growth to urban areas. Similarly, the *2035 Kings County General Plan* (County of Kings 2010) prioritizes protection of prime agricultural land, the direction of urban growth to existing cities and community districts, and an increase in economic and community stability.

The Kaweah Subbasin RCIS conservation strategy (Chapter 3) is intended to be implemented consistent with county and city general plan designations within the RCIS Area. Generally, conservation actions and habitat enhancement actions would be implemented outside the boundaries of incorporated cities and within areas designated by the Tulare County and Kings County general plans as valley agriculture and foothill agriculture (Tulare County) and natural resource conservation and agricultural open space (Kings County) (Figure 2-3). Table 2-6 lists applicable county and city general plans in the RCIS Area. Table 2-7 provides definitions of the major land use designations.

Table 2-6. County and City General Plans

Plan	Plan Area	Land Use Designations	Citation
Tulare County General Plan 2030 Update	Tulare County (Unincorporated)	Resource: Valley Agricultural, Foothill Agricultural, Resource Conservation, Timber Production, Native American Reserve, Urban Reserve; Residential, Commercial, Mixed Use, Industrial, Public	County of Tulare 2012
2035 Kings County General Plan	Kings County (Unincorporated)	Agriculture, Residential, Commercial, Mixed Use, Industrial, Open Space, Natural Resource Conservation, Public, Urban Reserve	County of Kings 2010
Comprehensive General Plan for the City of Lindsay, California	City of Lindsay	Residential, Commercial, Industrial, Public and Semi-Public, Open Space/Natural Resources/Scenic Beauty	City of Lindsay 1989
Exeter General Plan and Draft Environmental Impact Report 2000–2020	City of Exeter	Residential, Office, Commercial, Industry, Public Facilities, Open Space, Urban Reserve (Agriculture)	City of Exeter 2003
Farmersville General Plan Update	City of Farmersville	Residential, Commercial, Industrial, Public, Open Space, Agricultural/Urban Reserve	City of Farmersville 2002
Tulare General Plan for the City of Tulare	City of Tulare	Residential, Commercial, Industrial, Public/Quasi-Public, Parks and Recreation, Open Space/Agriculture, Mixed Use, Village, Transit-Oriented Development	City of Tulare 2014
Visalia General Plan Update	City of Visalia	Residential, Mixed Use, Commercial/Office, Industrial, Public	City of Visalia 2014
Woodlake General Plan 2008–2028	City of Woodlake	Residential, Office, Commercial, Industrial, Public Facilities, Open Space, Urban Reserve (Agriculture)	City of Woodlake 2008

Table 2-7. General Plan Land Use Designation Definitions

Land Use Designation	Definition
Tulare County	
Rural Residential	Areas for single-family dwellings and farm worker housing located away from cities and communities in agricultural or rural areas.
Residential	*Low Density*: areas for single-family residences with individual homes on lots generally ranging from 12,500 square feet to one acre. Designation used inside communities or on the outside edge of UDBs[a]. *Low-Medium Density*: areas for single-family neighborhoods at relatively low densities on lots ranging from 5,000 to 12,000 square feet. Designation used only within UDBs. *Medium Density*: areas for single-family and low-density multi-family dwellings. Designation used only within UDBs.
Commercial	*Neighborhood Commercial*: areas for small-scale, general retail, and service businesses that provide goods to the immediate surrounding area. Designation used primarily within UDBs.

Land Use Designation	Definition
	General Commercial: areas for small, localized retail, recreational, and service businesses that provide goods and services to the surrounding community. Designation used primarily within UDBs. *Community Commercial:* areas for a full range of retail commercial establishments serving multiple neighborhoods or an entire community and surrounding area. Designation used primarily within UDBs. *Highway Commercial:* areas for retail, recreational, and service-based businesses which provide goods and services to tourists and commuters along major highways. Designation used primarily within UDBs and pursuant to regional growth corridor plans and policies. *Service Commercial:* areas for service commercial uses in urbanizing areas. Designation used primarily within UDBs.
Industrial	*Light Industrial:* areas for a range of non-intensive business park, industrial park, and storage uses that do not have detrimental noise or odor impacts on surrounding urban uses. Designation used primarily within UDBs and pursuant to regional growth corridor plans and policies. *Heavy Industrial:* areas for the full range of industrial uses, which may cause noise or odor impacts on surrounding urban uses. Designation used primarily within UDBs and pursuant to regional growth corridor plans and policies.
Mixed Use	Any combination of retail/commercial, service, office, residential, hotel, or other use in the same building or on the same site.
Urban Reserve	A holding zone whereby properties remain zoned for agriculture or open space use until such time as conversion to urban uses is deemed appropriate. Designation used primarily within UDBs.
Public/Quasi-Public	Areas for public and quasi-public services and facilities that are necessary to maintain the welfare of County residents and businesses (e.g., churches, schools, civic centers, fire stations).
Valley Agriculture	Areas established for intensive agricultural activities on prime valley agricultural soils and other productive or potentially productive valley lands where commercial agricultural uses can exist without conflicting with other uses, or where conflicts can be mitigated.
Foothill Agriculture	Areas established for agricultural activities primarily located in the foothill and mountain regions where extensive commercial agricultural uses can exist without conflicting with other uses or where conflicts can be mitigated.
Agriculture Rural Conservation	Areas preserved for agricultural and resource conservation. Incidental residential uses with septic systems are allowed, subject to health and environmental standards. Clustered housing is strongly encouraged because it makes the provision of other infrastructure, such as roads and electricity, more cost-effective and limits the impact on natural resources.
Kings County	
Agriculture Open Space[b]	The Agricultural land use designations (*Limited Agriculture, General Agriculture 20 Acre, General Agriculture 40 Acre, and Exclusive Agriculture*) are used for distinct areas of agricultural intensity to protect agricultural land from the encroachment of incompatible uses. Small areas designated Open Space and Public are intermixed throughout.
Natural Lands[b]	Areas of natural land resources that are to be preserved in a natural or quasi-natural state, primarily consisting of high slope areas of the Coast Ranges and waterway channels of the Kings River and Cross Creek.

[a] UDB = Urban Development Boundary.

[b] Identified as Valley Agriculture on Figure 2-3. GIS data for the Kings County General Plan were not available.

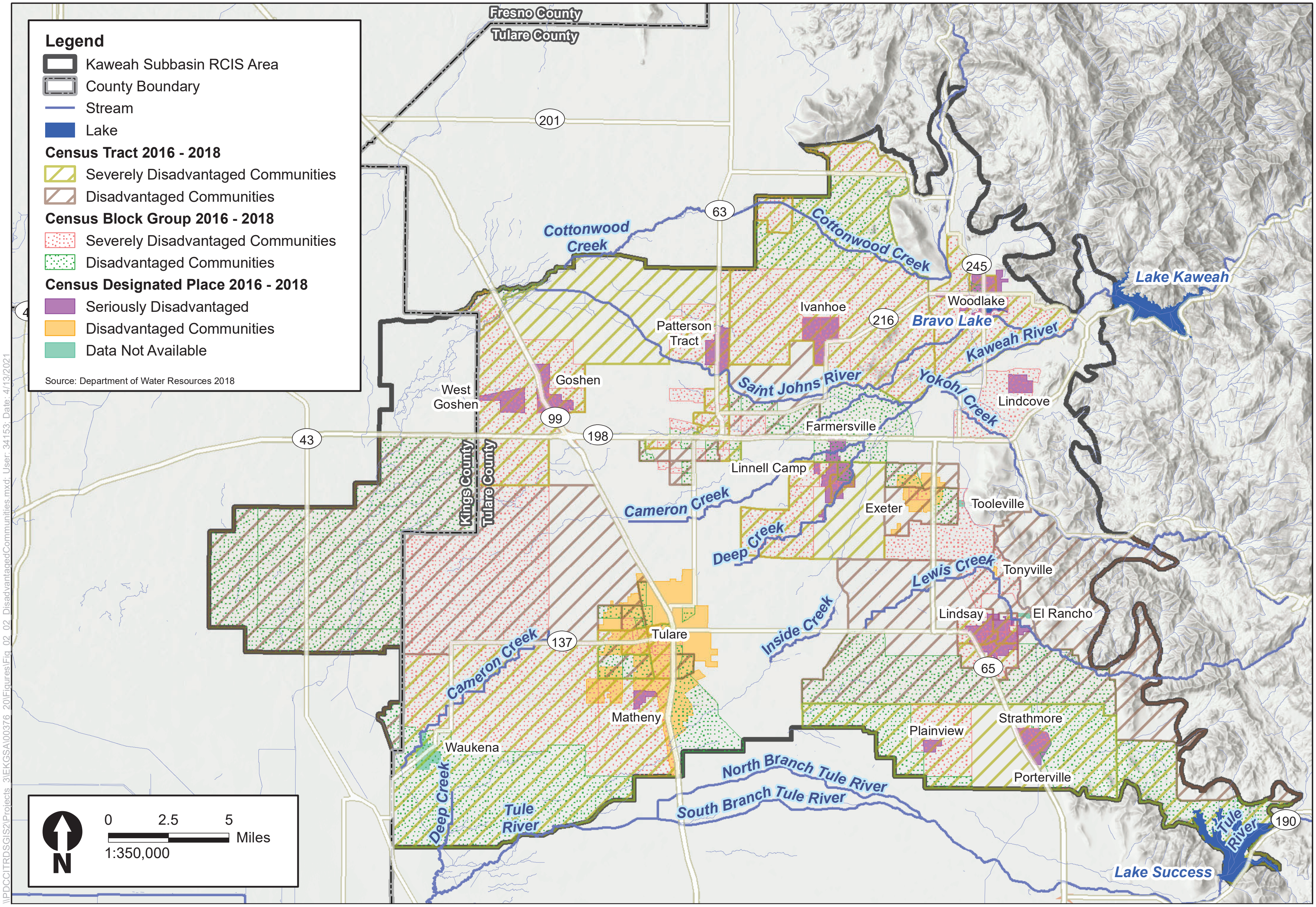


Figure 2-2
Disadvantaged and Severely Disadvantaged Communities

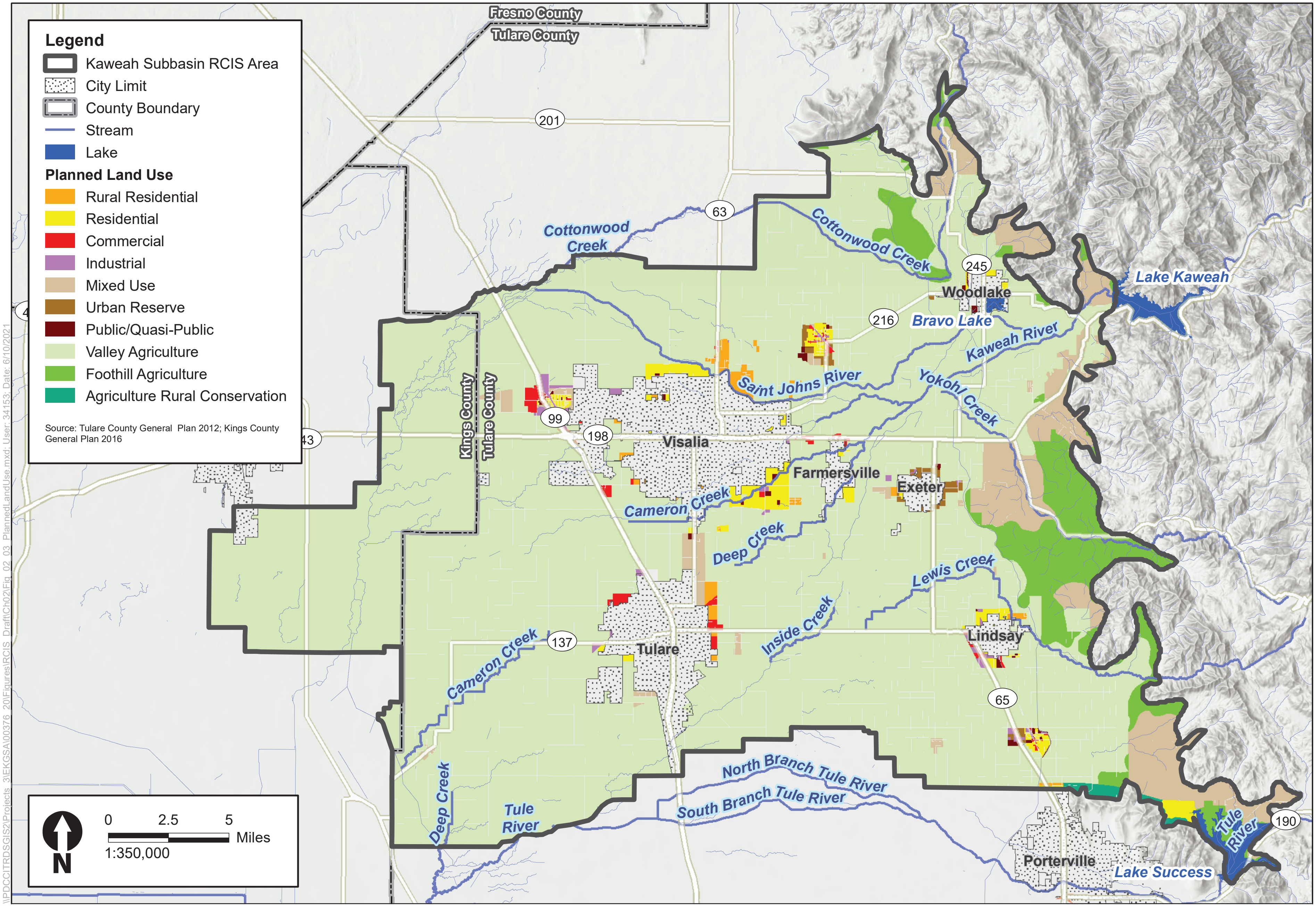


Figure 2-3
Planned Land Use

2.2.2 Land Use

Land use information was obtained from the California Department of Conservation Farmland Mapping and Monitoring Program (FMMP) Land Use Data (California Department of Conservation 2018) to characterize the land use in the Kaweah RCIS Area (Figure 2-4). Land use categories are described in Table 2-8 as characterized by the FMMP. FMMP-mapped land use generally aligns with planned land use shown in Figure 2-3 but provides more insight into the importance of farmland.

Land use in the RCIS Area is primarily Prime Farmland and Farmland of Statewide Importance with some large areas of Farmland of Local Importance and Unique Farmland, Urban and Built-Up Land, and Grazing Land (Table 2-9).

Table 2-8. California Department of Conservation Farmland Mapping and Monitoring Program Land Use Designation Definitions

Land Use Designation	Definition
Urban and Built-Up Land	Urban and Built-Up Land is occupied by structures with a building density of at least one unit per 1.5 acres, or approximately six structures to a 10-acre parcel. Common examples include residential, industrial, commercial, institutional facilities, cemeteries, airports, golf courses, sanitary landfills, sewage treatment facilities, and water control structures.
Grazing Land	Grazing Land is land on which the existing vegetation is suited to the grazing of livestock. Typical uses of grazing land can also include compatible low-density rural development, or government land with restrictions on use but that allow grazing.
Prime Farmland and Farmland of Statewide Importance	Prime Farmland is irrigated land with the best combination of physical and chemical features able to sustain long-term production of agricultural crops. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for production of irrigated crops at some time during the four years prior to the mapping date. Farmland of Statewide Importance is irrigated land similar to Prime Farmland that has a good combination of physical and chemical characteristics for the production of agricultural crops. This land has minor shortcomings, such as greater slopes or less ability to store soil moisture than Prime Farmland. Land must have been used for production of irrigated crops at some time during the four years prior to the mapping date.
Rural Residential Land	Rural Residential Land includes residential areas with one to five structures per 10 acres.
Semi-Agricultural and Rural Commercial Land	Semi-Agricultural and Rural Commercial Land is defined as farmsteads, agricultural storage and packing sheds, unpaved parking areas, composting facilities, equine facilities, firewood lots, and campgrounds.
Vacant or Disturbed Land	Vacant or Disturbed Land is defined as open field areas that do not qualify as an agricultural category, mineral and oil extraction areas, off-road vehicle areas, electrical substations, channelized canals, and rural freeway interchanges.
Confined Animal Agriculture	Confined Animal Agricultural lands include poultry facilities, feedlots, dairy facilities, and fish farms. Confined Animal Agriculture qualifies for Farmland of Local Importance in Kings and Tulare Counties.

Land Use Designation	Definition
Nonagricultural or Natural Vegetation	Nonagricultural or Natural Vegetation includes heavily wooded, rocky or barren areas, riparian and wetland areas, grassland areas that do not qualify for grazing land due to their size or land management restrictions, small water bodies and recreational water ski lakes. Constructed wetlands are also included in this category.
Water	Water as a land use is defined as perennial water bodies with an extent of at least 40 acres.

Table 2-9. Land Use in the RCIS Area

Land Use Category	Amount in RCIS Area (acres)	Percent of RCIS Area
Urban and Built-Up Land	40,041	8
Grazing Land	35,153	7
Prime Farmland & Farmland of Statewide Importance	318,108	67
Farmland of Local Importance & Unique Farmland	42,323	9
Rural Residential Land	3,005	1
Semi-Agricultural and Rural Commercial Land	4,668	1
Vacant or Disturbed Land	13,341	3
Confined Animal Agriculture	5,409	1
Nonagricultural or Natural Vegetation	2,723	1
Water	40,041	8
Total	**475,935**	**100**

Source: California Department of Conservation 2018

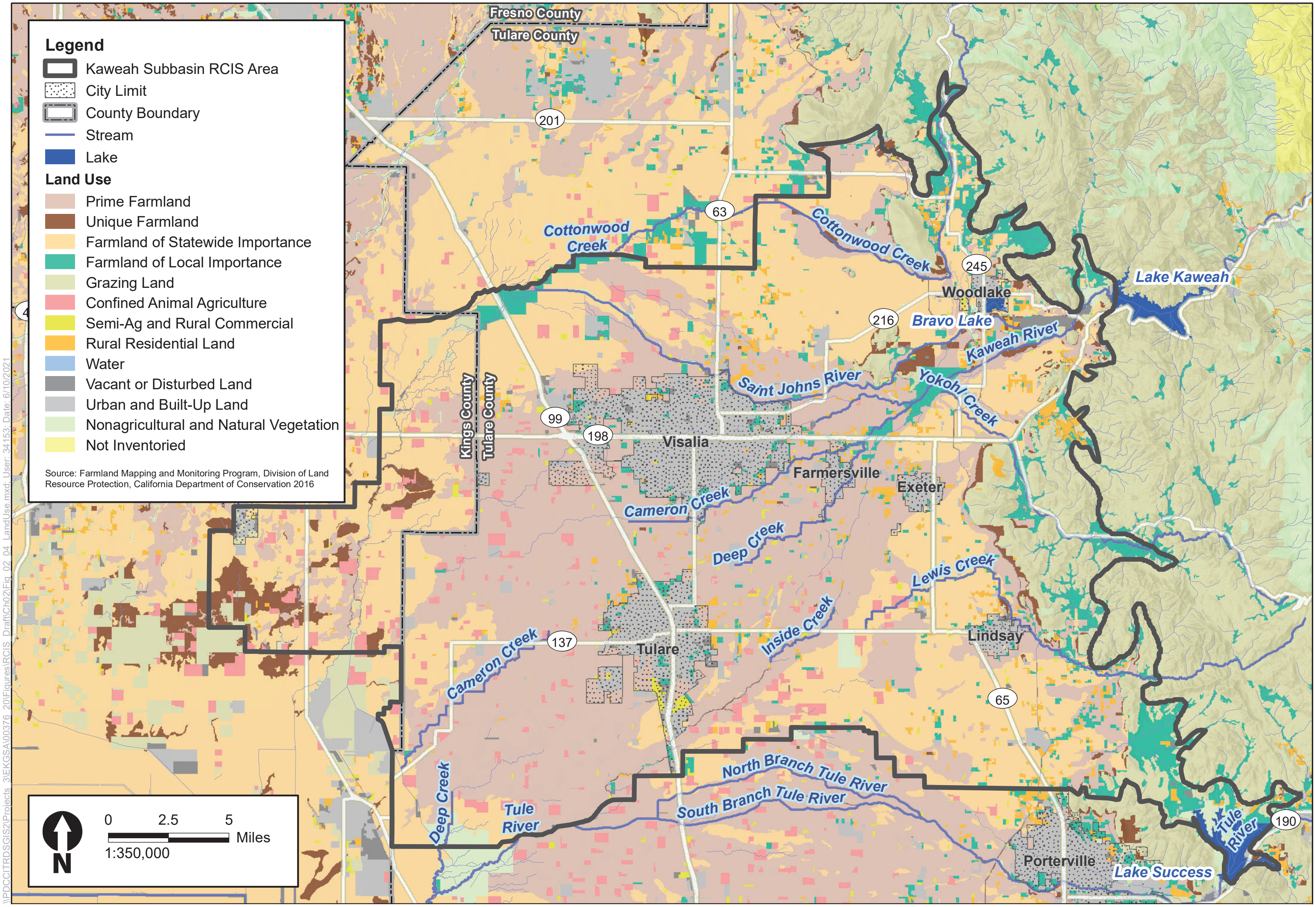


Figure 2-4
Land Use

2.2.3 Major Infrastructure

This section considers existing and reasonably foreseeable development of major infrastructure facilities in the RCIS Area, including water, transportation, transmission facilities, and renewable energy projects, as required by FGC Section 1852(c)(6). Infrastructure agencies may use this RCIS to inform siting of projects to reduce conflicts with natural resources and to identify conservation actions or habitat enhancement actions that could be used as mitigation to offset impacts from infrastructure projects or operations and maintenance.

2.2.3.1 Water

The primary sources of surface water in the Kaweah Subbasin are precipitation, Kaweah River flows, and water from the San Joaquin River via the Friant Unit of the CVP. Most urban communities and industrial uses in the Kaweah Subbasin rely exclusively on groundwater. Major water infrastructure in the RCIS Area includes canals, engineered channels, reservoirs, groundwater recharge basins, constructed wetlands, water treatment facilities, and flood control channels that distribute water for agricultural purposes, flood control, and groundwater recharge. Public and private water agencies, IDs, and municipalities provide water services to agriculture, residents, and industry in the RCIS Area.

A primary purpose of the Kaweah RCIS is to support implementation of the three Kaweah Subbasin GSPs by identifying conservation and habitat enhancement actions that can be used to provide multibenefit compensatory mitigation projects for infrastructure or other development projects. GSP projects include those that focus on the capture, use, and recharge of available surface water supplies to supplement the Subbasin's water supply and reduce impacts of groundwater pumping. Example GSP projects specifically include capturing available surface water and recharging the aquifer through creek beds and recharge basins and capturing excess water in high-flow years to recharge the aquifer, store, bank, or re-regulate supplies. Each Kaweah Subbasin GSP includes a description of potential projects envisioned for GSP implementation. Table 2-2 lists potential GSP projects.

2.2.3.2 Transportation

Roads and Highways

California Department of Transportation

Major transportation planning agencies in the RCIS Area include California Department of Transportation (Caltrans), Tulare County Transportation Authority, and the Kings County Roads and Bridges Division. Caltrans District 6 is the second largest of the 12 Caltrans districts statewide, stretching from the southernmost part of Yosemite National Park in the north to the Mojave Desert in the south. District 6 includes Madera, Fresno, Tulare, Kings and Kern Counties, and consists of 476 miles of freeway and 1,554 miles of rural and urban highway. State Route 99 is the primary north-south highway and State Routes 168 and 137 are the primary east-west highways running through the Kaweah RCIS Area (Figure 1-1).

Planned Caltrans projects in the 2020 to 2026 timeframe in Tulare County include the following (Tulare County Association of Governments 2018).

- Tulare Six-Lane Widening
- Tagus Six-Lane Widening
- Tulare City Widening
- Caldwell Avenue Interchange Improvements
- South Tulare Interchange Project
- Bridge Replacement on Routes 99 and 245
- Culvert Replacement along Routes 63, 99, 137, and 190
- Construction of Safety Roadside Rest Area Facilities

Caltrans' Office of State Highway Operations and Protection Program[2] (SHOPP) Management has primary responsibility for planning, developing, managing, and reporting the four-year SHOPP portfolio of projects, among other tasks. SHOPP projects address maintenance, safety, operation, and rehabilitation of the state highway system and do not add new capacity to the system. Caltrans identifies future projects in the regularly updated State Highway System Management Plan.[3] Caltrans also identifies projects on highway and passenger rail corridors of strategic importance in their Interregional Transportation Improvement Program (ITIP).[4] Other agencies in the Kaweah RCIS Area eligible for State Transportation Improvement Program (STIP) funding include the Tulare County Association of Governments and the Kings County Association of Governments.

Caltrans District 6 completed the Great Valley Ecoregion Section Regional Advance Mitigation Needs Assessment (RAMNA) in 2020 (California Department of Transportation 2020). In the RAMNA, District 6 forecasted its need for wildlife, plant, and aquatic resource compensatory mitigation within the Great Valley Ecoregion Section, located in the San Joaquin Valley, for a 10-year planning horizon (fiscal years 2018 to 2027). This planning horizon matches the time period and projects addressed by the SHOPP *Ten-Year Book* (California Department of Transportation 2018). The RAMNA assessed potential impacts from 129 SHOPP- and 17 STIP-eligible transportation projects, including projects within the Kaweah RCIS Area. While the RAMNA forecasts impacts on hundreds of species' habitat, the RAMNA focused the mitigation needs assessment on five species and subspecies: California tiger salamander, San Joaquin kit fox, giant kangaroo rat, and two subspecies of San Joaquin kangaroo rat: the Tipton kangaroo rat and Fresno kangaroo rat.

Impacts from 129 SHOPP transportation projects are forecasted to potentially affect 39 of the 141 special-status species evaluated, and potentially affect a total of 1,405 acres of habitat. Forecasted impacts on the mitigation focus species include 72.5 acres of California tiger salamander habitat, 177.6 acres of San Joaquin kit fox habitat, and 160 acres of Tipton and Fresno kangaroo rat habitat (the RAMNA was not able to differentiate impacts between the two subspecies of San Joaquin kangaroo rat).

[2] https://dot.ca.gov/programs/transportation-programming/state-highway-operation-protection-program-shopp-minor-program-shopp

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

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

SHOPP projects are also forecast to potentially impact wetland and non-wetland waters.[5] A total of 27 SHOPP transportation projects are forecast to potentially affect 10.4 acres of wetlands; 114 SHOPP transportation projects are forecast to potentially affect 85.8 acres of non-wetland waters. Impacts are forecast to occur within the three Hydrologic Unit Code-8 (HUC-8) watersheds overlapping the Kaweah RCIS Area (Section 2.3.6, *Watersheds*).

Caltrans is authorized by California Streets and Highways Code (SHC) Section 800.6(a) to use Caltrans advance mitigation account funds for purchasing compensatory mitigation credits from, or paying fees to, a conservation or mitigation bank, HCP, NCCP, in-lieu fee program, or mitigation credit agreement developed in accordance with a CDFW-approved RCIS.

County Association of Governments

The Tulare County Association of Governments (TCAG) is a collaboration of regional governments within Tulare County. TCAG is a JPA of the eight Tulare County incorporated cities and the County of Tulare. TCAG creates regional plans for coordinating local transit programs, as well as building regional projects and fostering partnerships to build multi-family housing. TCAG, under the role of Regional Transportation Planning Agency administers the adoption of the Regional Transportation Plan, which provides a long-range, fiscally constrained guide for the future of Tulare County's transportation system. The long range plan extends to the year 2042 in its scope.

The Kings County Association of Governments (KCAG) is a metropolitan planning organization for the Kings County Region. KCAG is a JPA whose member agencies include the County of Kings and the cities of Avenal, Corcoran, Hanford, and Lemoore. KCAG prepared its Regional Transportation Plan in 2018 (Kings County Association of Governments 2018), which extends to the year 2042 in its scope.

TCAG and KCAG are responsible for developing the Federal Transportation Improvement Program (FTIP) for submittal to Caltrans and the federal funding agencies for their respective governments. The FTIP is a federally mandated four year program of all surface transportation projects that will receive federal funding or are subject to a federally required action. The TCAG 2021 FTIP (Tulare County Association of Governments 2021) and KCAG 2021 FTIP (Kings County Association of Governments 2021) identify planned transportation projects such as road and bridge widenings, interchange construction, and road improvements.

Railroads

There are three primary railroad companies that provide freight service in Tulare County (County of Tulare 2012). There are two long-haul railroads: Union Pacific and Burlington Northern & Santa Fe, and one short-haul railroad: the San Joaquin Valley Railroad. The railroads connect Tulare County to all major west coast markets and destinations.

California High-Speed Rail

A small section of the California High-Speed Rail (CHSR) is planned to cross a small portion of the RCIS Area (California High-Speed Rail Authority 2014). The Fresno to Bakersfield Segment of the CHSR passes through the westernmost section of the RCIS Area in Kings County. This segment is currently under construction.

[5] "Non-wetland waters" is a general term used in the RAMNA that can apply to waters of the United States, waters of the state, or both, and does not include wetlands.

Airports

Tulare County's airport system can be divided into three components: publicly owned and operated airports; privately owned airports open to public general aviation use; and private special use airfields and airstrips (Aries Consultants Ltd. 2012). There are five public airports in operation countywide. Three airports are located in the Kaweah RCIS Area; they are operated by the Cities of Tulare (Mefford Field), Woodlake, and Visalia. The two privately owned public use airports are Eckert and Thunderhawk Fields. Other airstrips in the RCIS Area are used for agricultural or other private aviation activities.

2.2.3.3 Renewable Energy Projects

Renewable energy projects in the RCIS Area are limited to the 20-megawatt (MW) Terminus Hydroelectric Project operated by the Kaweah River Power Authority on Lake Kaweah, and solar energy projects (California Energy Commission 2021, Energy Justice Network 2021). There are currently six solar facilities within the RCIS Area (Table 2-10).

Table 2-10. Solar Facilities in the RCIS Area

Solar Facility	Capacity in Megawatts (MW)
Lindsay Solar	4.0
Tulare 1 and 2	3.0
Ivanhoe Solar	3.5
Farmersville	4.5
Exeter Solar	3.5
City of Tulare Water Facility	1.5

Additional solar energy projects are proposed within and adjacent to the RCIS Area. The proposed Glover Solar project is a 150-acre facility located 6 miles south of the City of Tulare within the RCIS Area. This facility will provide approximately 20 MW of renewable energy annually (County of Tulare, Resource Management Agency 2019). The recently approved Rexford Solar Farm will be the largest solar facility in the state, constructed on approximately 3,614 acres in the community of Ducor. This facility is anticipated to produce approximately 700 MW of renewable energy (HDR Engineering, Inc. 2020). Although the facility will be located approximately 15 miles south of the RCIS Area, it will be sited on land that was historically used for agricultural uses similar to lands within the RCIS Area.

Solar energy projects could be an important land use for agricultural land that is repurposed. A multitude of factors should be considered when siting solar energy projects. These factors include climate, solar radiation, terrain, surrounding land use, impacts to farmland, and impacts to natural resources and endangered and threatened species. The Conservation Biology Institute; Berkeley Law's Center for Law, Energy and the Environment; and Terrell Watt Planning Associates, with input from the Governor's Office of Planning and Research, led a stakeholder-driven process to identify locations in the San Joaquin Valley suitable for solar energy project development with the least land use conflict (Pearce et al. 2016). The outcome of this process was a mapping tool[6] that can be used to depict areas of least conflict between agricultural and natural resource values. The data for this

[6] https://sjvp.databasin.org/galleries/3b9ed1d995424b1e94fa4ae3fb2502a6/

mapping tool were developed in 2015 via a stakeholder-led process called the Solar and the San Joaquin Valley Identification of Least-Conflict Lands Project. From an environmental conservation stakeholder's perspective, development of renewable energy projects is encouraged in areas with low environmental value that are near existing transmission corridors (Figure 2-5). Agricultural farmland stakeholders promoted renewable energy development on lands that are fallow and are no longer agriculturally productive (Figure 2-6). Figure 2-7 shows areas of least conflict agreement between both stakeholder groups.

A similar analysis was done to identify areas of least-conflict between solar energy development and endangered species in the San Joaquin Valley (Phillips and Cypher 2019). Approximately 2,084,581 acres of land in the San Joaquin Valley has a moderate to high potential for solar energy development but no or low-quality habitat for rare species. These studies indicate that, when planned properly, conflicts between solar development, agriculture, and natural resources can be minimized.

2.2.3.4 Transmission

Transmission lines in the RCIS Area include those supporting distribution of natural gas and electricity. Southern California Edison (SCE) owns and operates electrical transmission lines within the Kaweah RCIS Area. Three major transmission lines (i.e., 60 kilovolts [kV] and above) traverse the Kaweah RCIS Area along a north-south axis. Locations of SCE transmission lines can be found by using the SCE Power Site Search Tool.[7] SCE has no projects currently planned in Kings or Tulare Counties.[8]

[7] https://www.arcgis.com/apps/webappviewer/index.html?id=05a84ec9d19f43ac93b451939c330888
[8] https://www.sce.com/about-us/reliability/upgrading-transmission

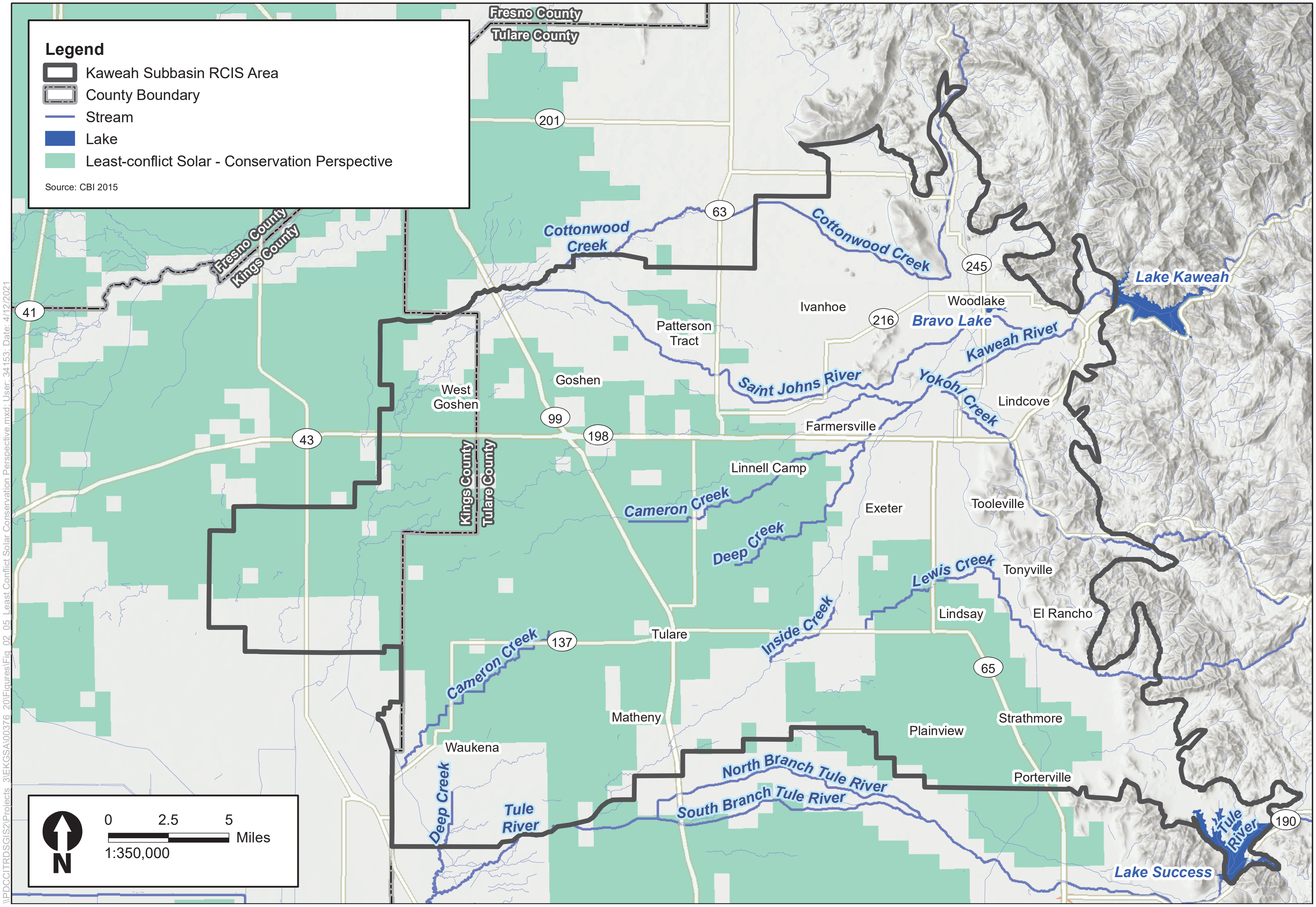


Figure 2-5
Least-conflict Solar - Conservation Perspective

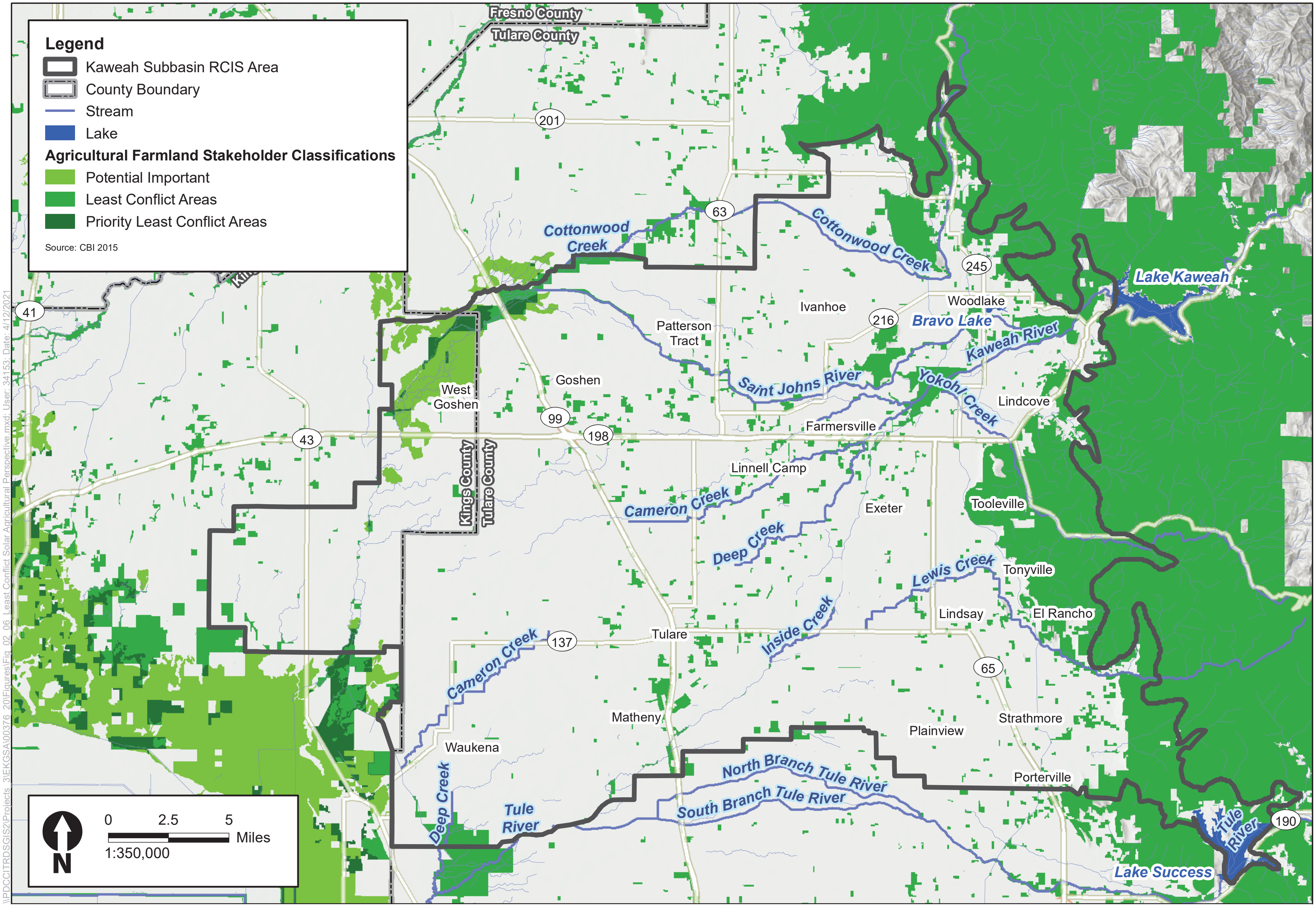


Figure 2-6
Least-conflict Solar- Agricultural Perspective

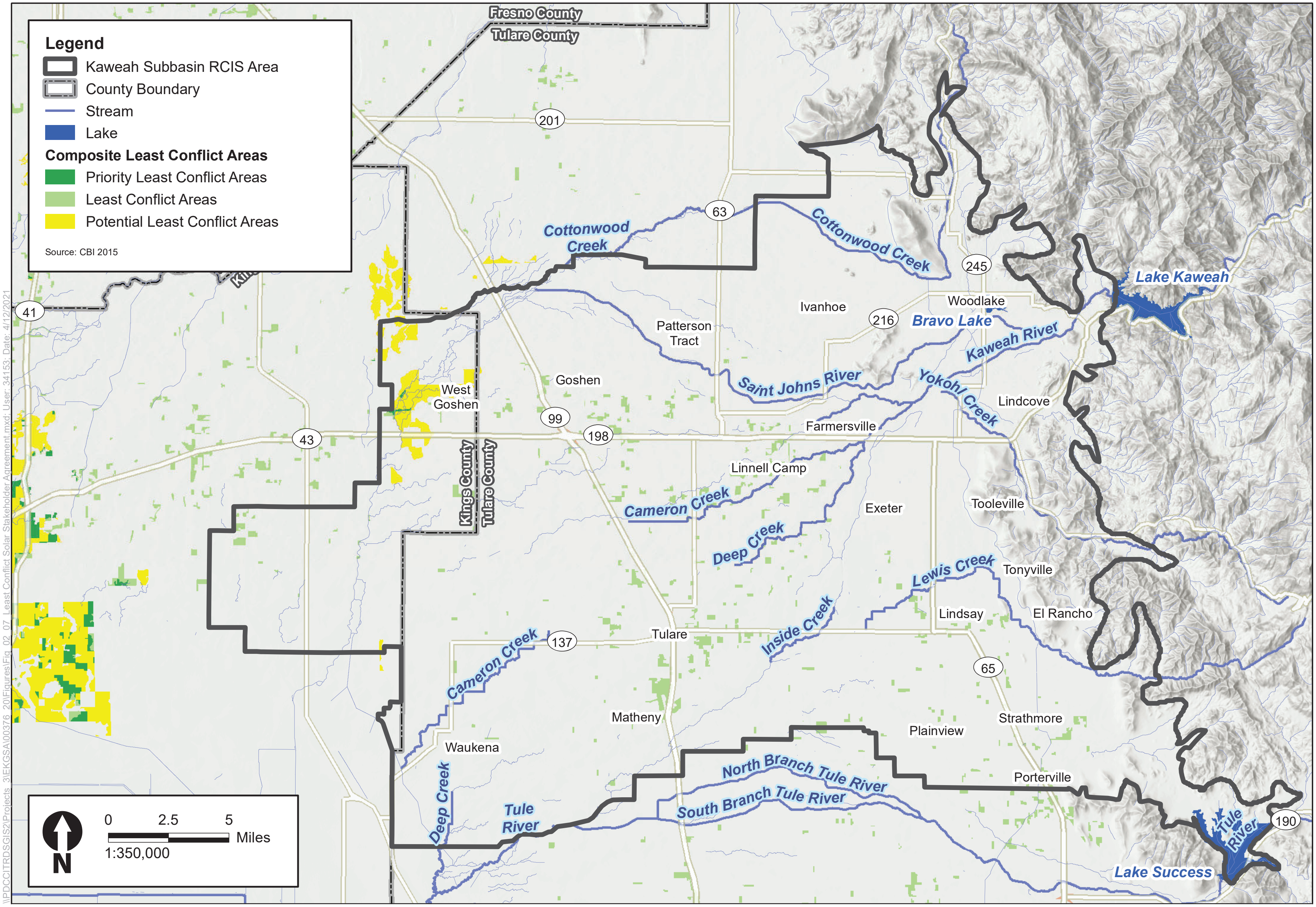


Figure 2-7
Least-conflict Solar - Stakeholder Agreement

ICF

2.3 Natural Environment

2.3.1 Protected Areas

The RCIS Area includes existing *protected areas*, which are public or private lands protected from development through legal or other effective means, where the primary intent of land management is to manage the land for open space use or habitat. Protected areas include preserves and open spaces that are managed primarily for their ecological functions and values.

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

- GreenInfo Network, California Conservation Easement Database (CCED) (2020)
- GreenInfo Network, California Protected Area Database (CPAD) (2020)
- Protected Areas Database of the United States (PAD-US) (U.S. Geological Survey, Gap Analysis Program 2020)
- National Conservation Easement Database (NCED) (2020)
- Sequoia Riverlands Trust Preserve Lands
- CDFW Owned and Operated Lands and Conservation Easements (California Department of Fish and Wildlife 2016a)

The CCED, CPAD, PAD-US, and NCED data were clipped to the Kaweah RCIS Area to create the GIS protected areas data layer. The CPAD and PAD-US include a large number of areas broadly classified as protected for open space uses. All of these areas have a U.S. Geological Survey (USGS) Gap Status Code of 4, indicating that there is no known mandate for biodiversity or habitat protection.[9] These areas were not included in the Kaweah RCIS protected area dataset. These areas include small city parks, golf courses, cemeteries, and other urban protected areas owned by cities, counties, and special districts. Small urban parks are frequently dominated by landscaped vegetation, recreation infrastructure (e.g., ball fields), and hardscape, which provides limited ecological value for the focal species.

There are 7,643 acres of protected areas in the RCIS Area (1.6% of the RCIS Area), comprising land owned in fee title (5,153 acres), or through conservation easement (2,490 acres) (Figure 2-8).

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

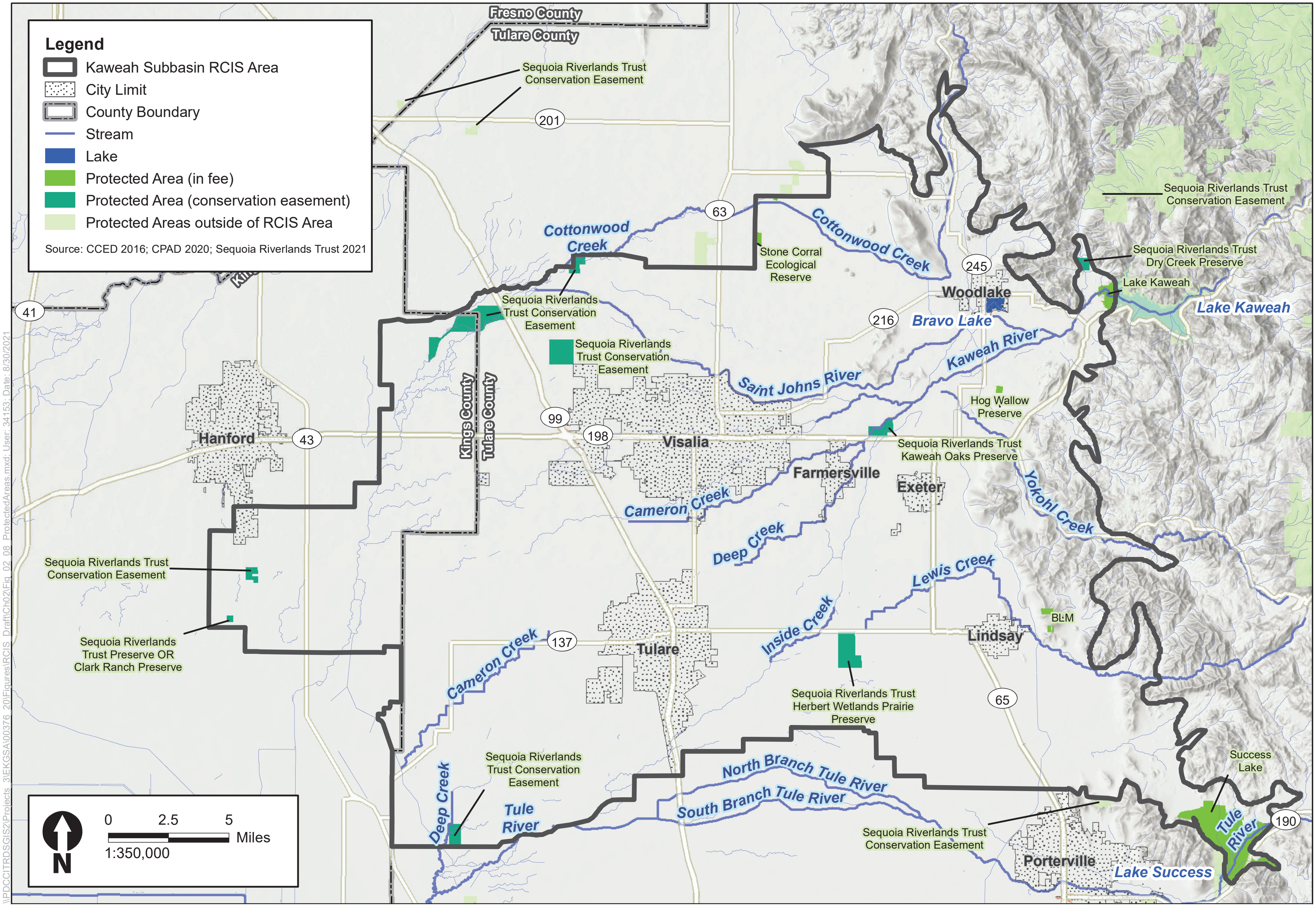


Figure 2-8
Protected Areas

There are small scatterings of protected areas near the Kaweah RCIS Area to the southwest, to the east, and to the northeast (Figure 2-8). Southwest of the Kaweah RCIS Area is a patchwork of CDFW owned and operated lands and conservation easements and the Pixley National Wildlife Refuge (NWR). The Pixley NWR extends outside of Tulare County into northwestern Kern County and is managed as part of the Kern NWR Complex. The Pixley NWR provides some of the last significant southern San Joaquin Valley grassland habitat, and nesting, foraging, and cover habitat for a variety of threatened and endangered San Joaquin Valley species, including Tipton kangaroo rat, blunt-nosed leopard lizard, San Joaquin kit fox, and sandhill cranes. East of the Kaweah RCIS Area is the Blue Ridge NWR. The Blue Ridge NWR provides connectivity to the southern Sierra Nevada and provides habitat for the endangered California condor. There are a series of protected lands east of the RCIS Area including the Moses Wilderness Study Area and Golden Trout Wilderness (east of Lindsay), the Milk Ranch–Case Mountain Wilderness Study Area and John Krebs Wilderness (east of Lake Kaweah), and the Sheep Range Wilderness Study Area (northwest of Woodlake).

2.3.2 Conservation and Mitigation Banks

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

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

A total of 11 conservation banks and mitigation banks with available credits as of the date of this RCIS (or credits that may be available in the future) are either located in, or have service areas that overlap with, the RCIS Area (Table 2-11).[10]

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

Table 2-11. Conservation and Mitigation Banks with Available Credits and Service Areas Overlapping the Kaweah RCIS Area

Bank	Location (County)	Available Credits with Service Area Overlapping RCIS Area
Alkali Sink Conservation Bank	Fresno	Vernal pool fairy shrimp, longhorn fairy shrimp, San Joaquin kit fox, Swainson's hawk, and burrowing owl
Big Gun Conservation Bank	Placer	California red-legged frog
Deadman Creek Conservation Bank	Merced	Conservancy fairy shrimp, vernal pool fairy shrimp and vernal pool tadpole shrimp, San Joaquin kit fox, California tiger salamander
Drayer Ranch Conservation Bank	Merced	San Joaquin kit fox and vernal pool ecosystem preservation for Greene's tuctoria, San Joaquin Orcutt grass, succulent owl's clover, vernal pool fairy shrimp, and vernal pool tadpole shrimp
Dutchman Creek Conservation Bank	Merced	San Joaquin kit fox, and vernal pool ecosystem preservation, including vernal pool fairy shrimp, vernal pool tadpole shrimp, and Conservancy fairy shrimp
French Camp Conservation Bank	San Joaquin	Valley elderberry longhorn beetle
Grasslands Mitigation Bank	Merced	Giant garter snake, seasonal wetlands
Great Valley Conservation Bank at Flynn Ranch	Merced	San Joaquin kit fox and vernal pool ecosystem preservation, including vernal pool fairy shrimp and vernal pool tadpole shrimp
Kern Water Bank	Kern	San Joaquin kit fox, Tipton kangaroo rat, blunt-nosed leopard lizard, bald eagle, willow flycatcher, bank swallow, Swainson's hawk, and San Joaquin wholly threads
River Ranch Conservation Bank	Yolo	Valley elderberry longhorn beetle
Sand Creek Conservation Bank	Tulare	San Joaquin kit fox and California tiger salamander
SSF 1 – Flying M Ranch	Merced	Vernal pools
Vieira-Sandy Mush Road Conservation Bank	Merced	San Joaquin kit fox, and vernal pool ecosystem preservation including Conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp

2.3.3 In-Lieu Fee Programs

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

> …the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for DA permits. Similar to a mitigation bank, an in-lieu fee program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the in-lieu program sponsor.

However, the rules governing the operation and use of in-lieu fee programs are somewhat different from the rules governing operation and use of mitigation banks. The operation and use of an in-lieu fee program are governed by an in-lieu fee program instrument.

No mitigation lands associated with an in-lieu fee program exist in the RCIS Area. However, the Kern River Watershed Meadows and Stream Restoration In-Lieu Fee Program and the Sacramento District California In-Lieu Fee Program have service areas that overlap with the RCIS Area under the jurisdiction of USACE's Sacramento District.

2.3.4 Ecoregions

This section provides a description of the ecoregions that overlap and surround the RCIS Area, according to the U.S. Department of Agriculture (USDA) classification (McNab et al. 2007).

Ecoregions are areas of general similarity in ecosystems based on major terrain features such as a valley, foothills, mountain range, or a combination thereof as defined by USDA. Ecoregions are hierarchical and identified based on patterns of biotic and abiotic phenomena, including geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. North America is divided into different ecological units from coarsest to finest (e.g., provinces, sections, subsections). The RCIS Area overlaps with two provinces (Figure 1-2). The provinces, sections, and subsections that overlap the RCIS Area are described below. Descriptions of provinces and sections are based on the descriptions provided by USDA (Cleland et al. 2007, McNab et al. 2007); descriptions of subsections are supplemented with information from USGS (Griffith et al. 2016).

2.3.4.1 Sierran Steppe-Mixed Forest-Coniferous Forest-Alpine Meadow Province

The Sierran Steppe-Mixed Forest-Coniferous Forest-Alpine Meadow Province overlaps a small portion in the eastern section of the RCIS Area. This province covers much of California from the northern border with Oregon south to just south of Bakersfield. The province has a Mediterranean climate of hot dry summers and cold winters. Precipitation occurs primarily in the winter as snow and is strongly influenced by altitude and direction of mountain ranges. Associated vegetative cover occurs in elevation-delineated zones, ranging from broadleaf-needle leaf woodland and shrublands at lower elevations, to needle leaf evergreen forests at higher elevations.

Sierra Nevada Foothills Section

The Sierra Nevada Foothills Section is comprised of low-elevation crests of similar heights. Geologic formations are a mixture of sedimentary, granitic, volcanic, and ultramafic rocks. Vegetation is mostly comprised of western hardwoods, annual grasslands, and chaparral-mountain shrub cover types.

Lower Granitic Foothills Subsection

The Lower Granitic Foothills Subsection is on moderately steep to steep mountains and hills. Ridges are more commonly aligned toward the southwest, parallel to major rivers that flow off the western slope of the Sierra Nevada. The subsection does not have extensive alluvial fans, floodplains, and terraces. The elevation range is about 400 to 4000 feet. Common vegetation includes annual grasslands, chamise, manzanita, interior live oak, ceanothus, blue oak, and foothill pine.

The San Joaquin, Kings, Kaweah, and Tule Rivers cross this subsection. Runoff is rapid to these rivers and their tributaries. All, with the exception of the larger streams, are generally dry during the summer months. Many reservoirs occur within the subsection, but there are no natural lakes.

2.3.4.2 California Dry Steppe Province

The California Dry Steppe Province overlaps the northeastern corner of the RCIS Area. This province covers California's Central Valley from Redding to Bakersfield. The province has a Mediterranean climate of hot dry summers and mild winters, and most precipitation occurs as rain during the winter. The landscape includes broad, level valleys bordered by sloping alluvial fans and low hills. Associated vegetative cover historically was herbaceous grasslands, but now is largely irrigated agricultural crops.

Great Valley Section

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

Granitic Alluvial Fans and Terraces Subsection

The Granitic Alluvial Fans and Terraces Subsection is nearly level to very gently sloping alluvial fans and basins. The subsection occurs on alluvial fans that are below older fans or terraces on the east side of the San Joaquin Valley. This subsection contains granitic rock from sources in the southern Sierra Nevada. The subsection ranges in elevation from 150 to about 400 feet. The predominant natural vegetation included grasslands and valley oak (*Quercus lobata*) on the fans, Fremont cottonwood (*Populus fremontii*) and willow (*Salix* spp.) along streams, and freshwater emergent wetland species in basins. Most of the region has been converted to cropland, hay and pastureland, and some urban and suburban uses.

There are small areas of floodplain along streams that flow from the Sierra Nevada to reach basins in the San Joaquin Valley. Streams in this subsection drain to basins at the toes of the alluvial fans. All, with the exception of the larger streams, are generally dry during the summer months and there are no permanent lakes.

Hardpan Terraces Subsection

The Hardpan Terraces Subsection is located on terraces along the eastern edge of the Sacramento and San Joaquin Valleys. In the Kaweah Subbasin RCIS Area, this subsection is on gently sloping terraces, floodplains, and alluvial fans of the eastern edge of the San Joaquin Valley. The terraces consist of very gentle to gently sloping terrain and small areas of floodplain and alluvial fans along streams that flow from the Sierra Nevada to reach the Sacramento and San Joaquin Rivers. The subsection elevation range is from 100 to about 400 feet. Common vegetation includes annual grasslands, ceanothus (*Ceanothus* spp.) brushlands, blue oak (*Quercus douglasii*) savannas, and scattered foothill pines (*Pinus sabiniana*) in the draws and protected slopes, and northern hardpan vernal pools.

Streams in this subsection drain to the Sacramento or San Joaquin Rivers or to closed basins in the San Joaquin Valley. All, with the exception of the larger streams, are generally dry during the summer months. There are no lakes, but there is temporary ponding in vernal pools on terraces.

Tulare Basin Subsection

The Tulare Basin Subsection is in the historical Tulare Lake basin near the southern end of the San Joaquin Valley. This subsection abuts the southwestern corner of the Kaweah Subbasin RCIS Area and contains fine-grained deposits derived from the southern Sierra Nevada and the southern Coast Ranges. This subsection is on a level lake basin and is covered by water in wet years, although it was previously covered by a permanent lake before tributary water was diverted for irrigation. Elevation ranges from 180 to 200 feet. Natural vegetation was predominantly freshwater marshes and interconnecting sloughs.

2.3.5 Soils

The wide diversity of soil series across the RCIS Area are a result of the variety of geologic, climatic, and topographic features across the landscape (Figure 2-9a–2-9e). The RCIS Area is bordered to the east by the crystalline bedrock of the Sierra Nevada foothills. The sediments on the east side of the Subbasin consist of arkosic (a sedimentary sandstone) material derived from the Sierra Nevada and are deeply weathered, poorly permeable, reddish-brown sandy silt and clay with well-developed soil profiles (California Department of Water Resources 2004). Moderately to highly permeable alluvial deposits extend across the subsurface to the west side of the RCIS Area and form the major aquifer in the subbasin. Lacustrine and marsh deposits of silty clay and fine sand below the alluvium form aquitards that control the vertical and lateral movement of ground water. The most prominent clay bed is the Corcoran clay which underlies the western half of the Kaweah Subbasin at depths ranging from about 200 to 500 feet (California Department of Water Resources 2004).

Soils in the Subbasin were categorized by the NRCS, which indicates that the soils are mostly fine-loamy to coarse-loamy in texture (Table 2-12). The soils along the Lower Kaweah and St. Johns Rivers, as well as those along Cottonwood, Yokohl, and Lewis Creeks are the coarsest, whereas most of the remainder of the Subbasin is comprised of fine to fine-loamy soils (Provost and Pritchard Consulting Group 2020). Soils with limited distribution that create unique habitat types in the RCIS Area include the clay soils in foothills to the east and the alkaline and saline soils in the west. The well-drained, rich, alluvial soils that comprise the majority of the RCIS Area support the agricultural abundance of the region, as well as providing suitable habitat for a diversity of focal and non-focal species.

Table 2-12. Soil Texture and Permeability in the RCIS Area

Soil Texture Drainage Class	Amount (acres)	Percent in the RCIS Area
Coarse-loamy		
Well drained	114,262	24%
Moderately well drained	10,165	2%
Somewhat poorly drained	23,845	5%
Unknown	20,991	4%
Total	*169,263*	*36%*
Fine		
Well drained	34,321	7%
Moderately well drained	43,550	9%
Somewhat poorly drained	242	0%

Soil Texture Drainage Class	Amount (acres)	Percent in the RCIS Area
Poorly drained	519	0%
Unknown	3,721	1%
Total	*82,353*	*17%*
Fine-loamy		
Well drained	32,402	7%
Moderately well drained	86,612	18%
Somewhat poorly drained	10,987	2%
Poorly drained	15,376	3%
Unknown	12,050	3%
Total	*157,428*	*33%*
Fine-silty		
Moderately well drained	1,685	0%
Somewhat poorly drained	3,356	1%
Total	*5,041*	*1%*
Loamy		
Somewhat excessively drained	846	0%
Well drained	540	0%
Somewhat poorly drained	6,376	1%
Unknown	94	0%
Total	*7,856*	*2%*
Unclassified Texture		
Somewhat excessively drained	4,777	1%
Poorly drained	26	0%
Unknown	49,190	10%
Total	*53,993*	*11%*
Grand Total	**475,935**	**100%**

Source: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. SSURGO Database.

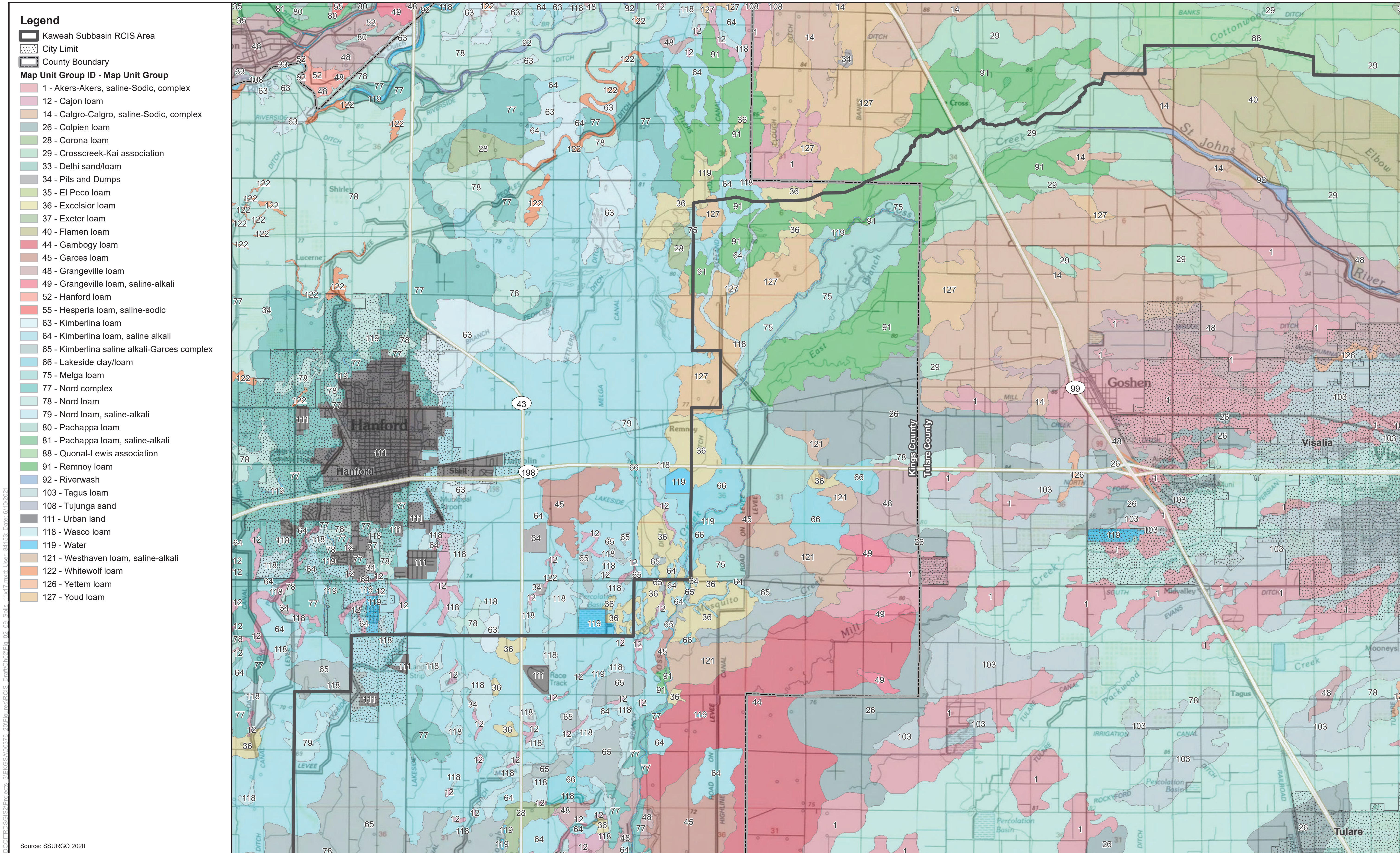


Figure 2-9a
Soil Map Unit Groups

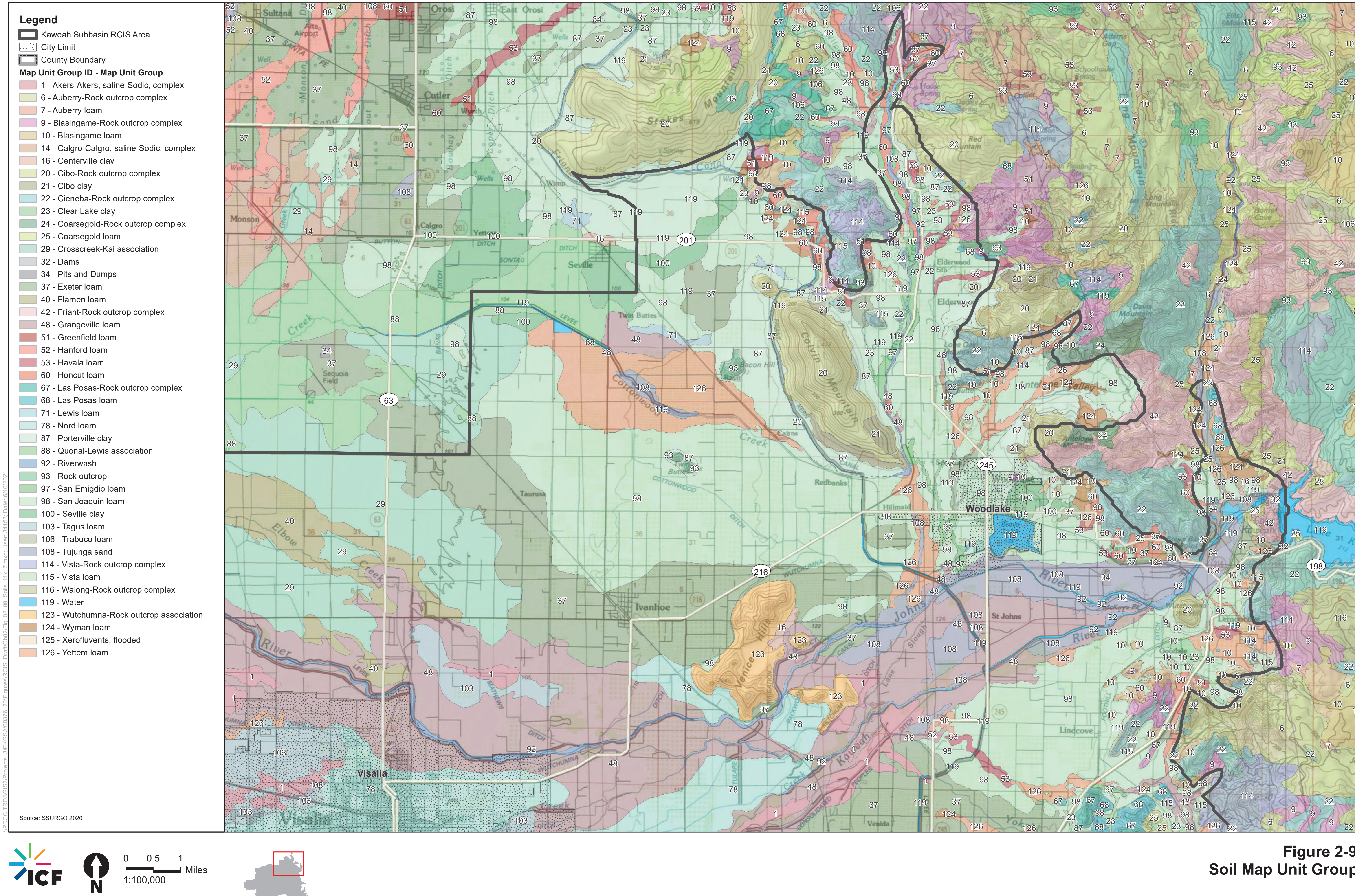


Figure 2-9b
Soil Map Unit Groups

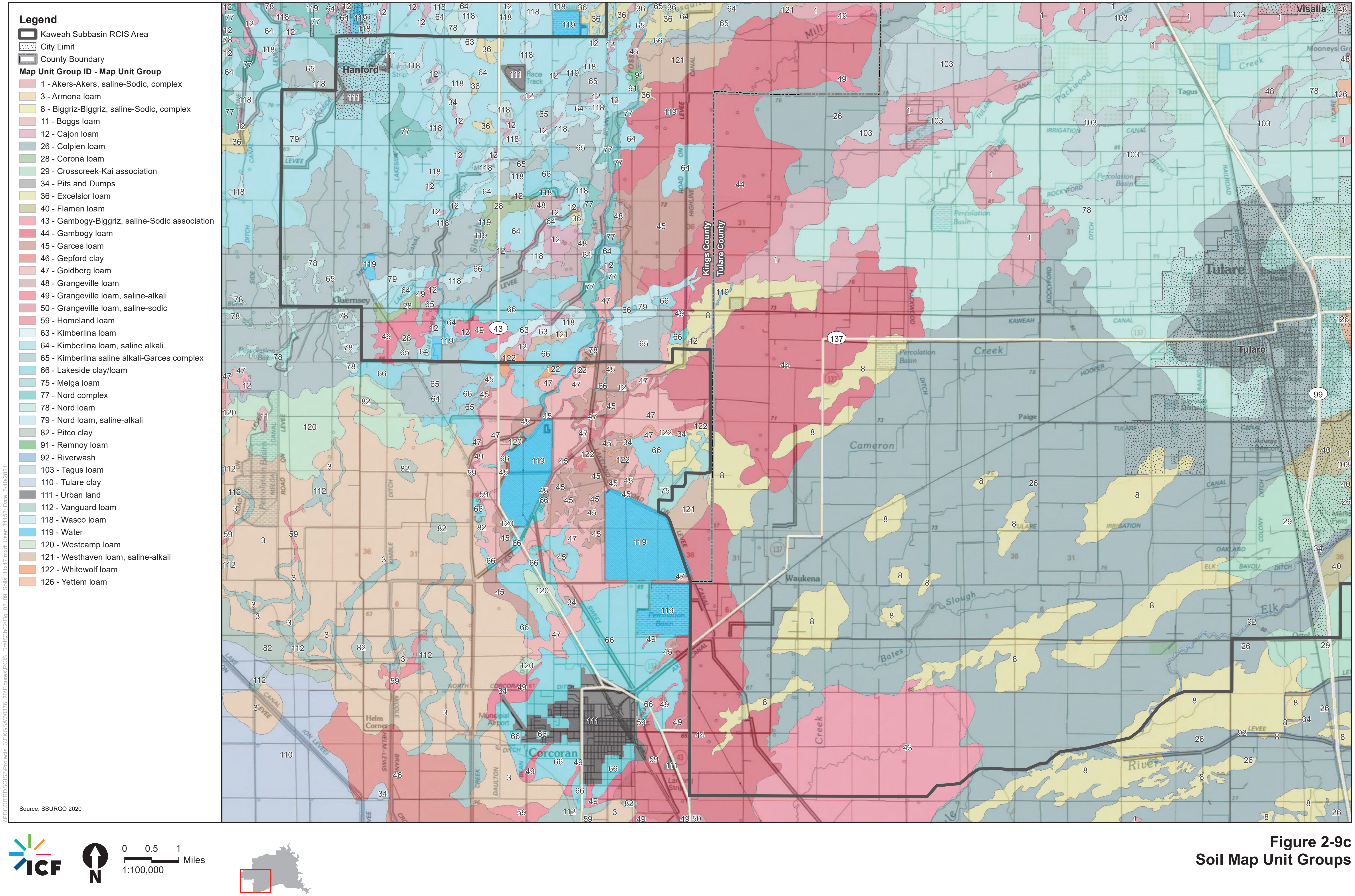


Figure 2-9c
Soil Map Unit Groups

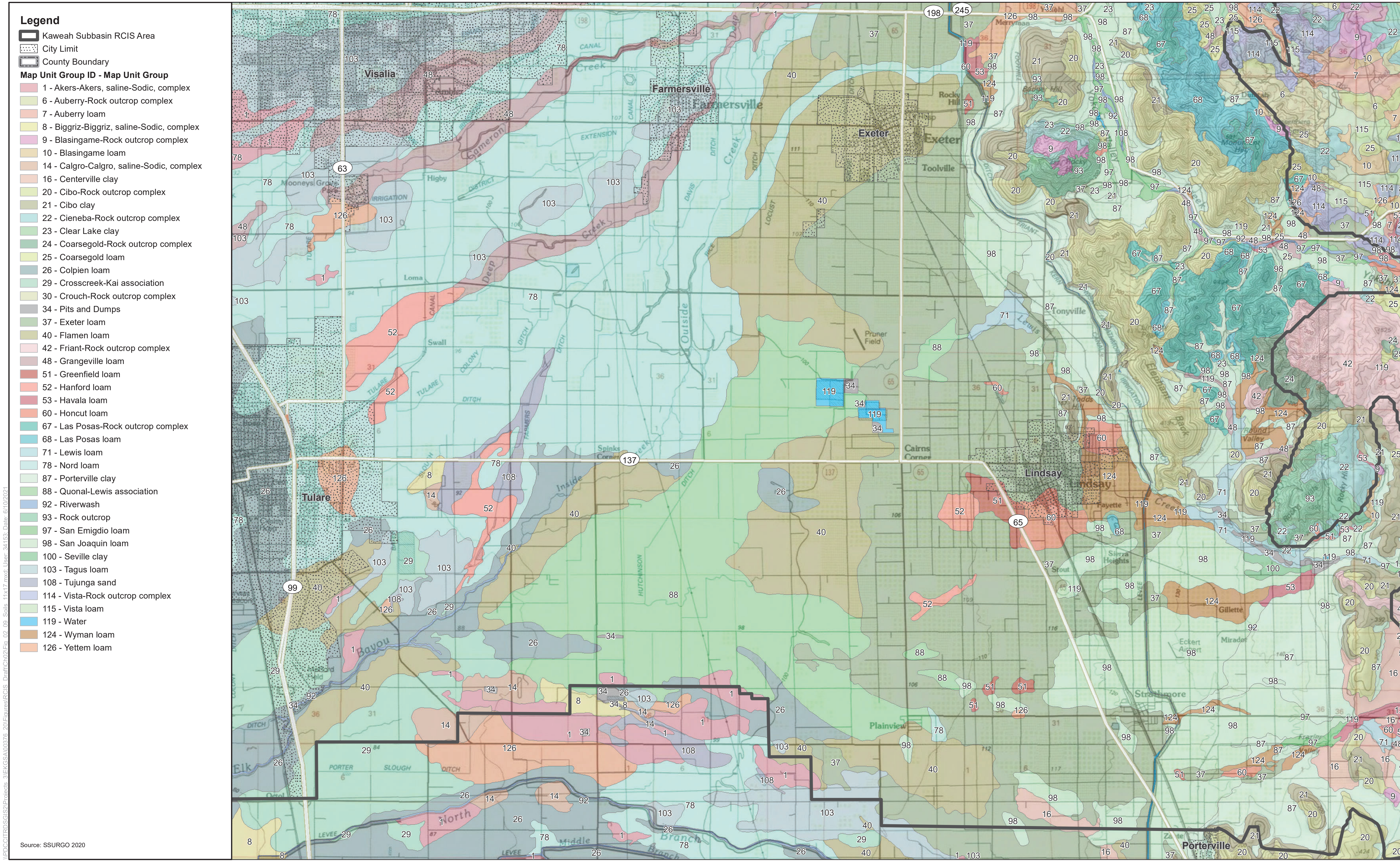


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Figure 2-9d
Soil Map Unit Groups

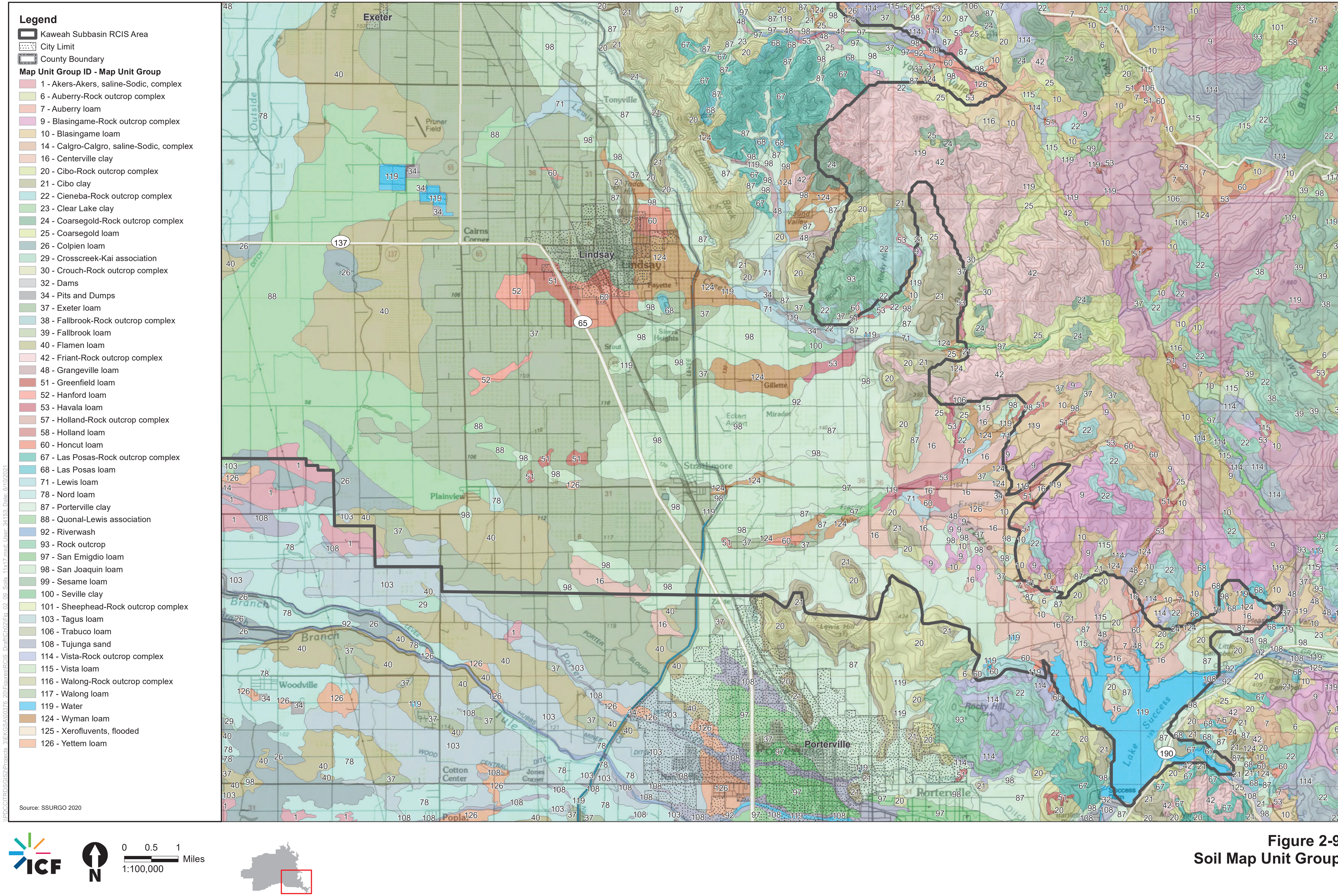


Figure 2-9e
Soil Map Unit Groups

2.3.6 Watersheds

USGS divides and subdivides the United States into successively smaller hydrological units, identified by Hydrologic Unit Code (HUC); watersheds become progressively smaller as the HUC code number increases. Three HUC-8 watersheds overlap the RCIS Area, and 17 HUC-10 watersheds[11] overlap with or occur completely within the RCIS Area (Figure 1-3). Table 2-13 summarizes the HUC-8 watersheds overlapping the RCIS Area. Table 2-14 summarizes the acres and major streams within each HUC-10 watershed that overlaps with the RCIS Area.

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

Table 2-13. HUC-8 Watersheds Overlapping the RCIS Area (Acres)

Watershed	Total Size of Watershed	Size of Watershed in RCIS Area	Percent of Watershed in RCIS Area
Tulare Lake Bed	2,423,854	21,659	0.9
Upper Kaweah	974,463	251,409	25.8
Upper Tule	604,506	202,868	33.6
Total	**4,002,823**	**475,935**	**11.9**

Table 2-14. HUC-10 Watersheds Overlapping the RCIS Area (Acres)

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed	Area of Watershed in RCIS Area (Percent)	Major Creeks in Watershed (Length in Miles)	Ecoregion Section
Tulare Lake Bed	Jacobs Slough-Frontal Tulare Lake Bed	146,665	21,659 (4.6)	Cross Creek (0.9) Empire Canal (< 0.1) Guernsey Slough (3.7) Jacobs Slough (2.6) Kings River (<0.1) Last Chance Ditch (2.6) Lemoore Canal (1.6) Lower Kings River Ditch (1.3) Mussel Slough (2.4) Stratford Canal (0.7) Tulare Lake Canal (0.2)	Great Valley

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed	Area of Watershed in RCIS Area (Percent)	Major Creeks in Watershed (Length in Miles)	Ecoregion Section
Upper Kaweah	Dry Creek	52,265	1,038 (0.2)	Badger Creek (5.3) Bear Creek (7.7) Cedar Creek (5.1) Dry Creek (27.2) East Fork Dry Creek (4.5) Fly Creek (2.0) Fridley Creek (0.7) Hog Spring Creek (.6) Oat Knob Creek (0.7) Ridenhour Creek (3.6) Shadley Creek (1.1) Wagonshed Creek (1.9)	Great Valley, Sierra Nevada Foothills
	Horse Creek-Kaweah River	43,487	8,639 (1.8)	Dry Creek (<0.1) Friant-Kern Canal (1.8) Greasy Creek (5.1) Horse Creek (5.1) Jim Gray Creek (5.1) Kaweah River (23.7) Lane Slough (2.5) Lemoncove Ditch (0.2) Mill Creek (<0.1) North Fork Kaweah River (<0.1) Packwood Creek (<0.1) Saint Johns River (<0.1) South Fork Kaweah River (0.1) Wells Creek (3.6)	Great Valley, Sierra Nevada Foothills

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed	Area of Watershed in RCIS Area (Percent)	Major Creeks in Watershed (Length in Miles)	Ecoregion Section
	Lower Cottonwood Creek	82,648	47,652 (10.0)	Cottonwood Creek (6.4) Elbow Creek (6.8) Friant-Kern Canal (17.2) Long Creek (6.7) Sontag Ditch (<0.1) Story Creek (2.9)	Great Valley, Sierra Nevada Foothills
	Lower Cross Creek	63,770	62,368 (13.1)	Cross Creek (18.6) East Branch Cross Creek (1.2) Mill Creek (17.5) Mosquito Creek (4.3)	Great Valley
	Middle Branch Cross Creek	113,560	71,984 (15.1)	Ax Canal (<0.1) Cameron Creek (9.4) Cross Creek (0.4) Daulton Ditch (<0.1) East Branch Cross Creek (6.5) Guiberson Canal (<0.1) Helm-Lewis Ditch (0.1) Highline Canal (<0.1) Middle Branch Cross Creek (6.4) Packwood Creek (13.6) West Branch Cross Creek (<0.1)	Great Valley

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed	Area of Watershed in RCIS Area (Percent)	Major Creeks in Watershed (Length in Miles)	Ecoregion Section
	Middle Cross Creek	139,885	29,093 (6.1)	A H Smith Ditch (1.0) Alta East Branch Canal (9.3) Cross Creek (8.8) East Branch Cross Creek (5.3) Friant-Kern Canal (9.0) Kennedy Wasteway (0.1) Miller Ditch (<0.1) Saint Johns River (0.2) Smith Mountain Ditch (<0.1) Travers Creek (11.5) West Gould Ditch (<0.1) Willow Creek (3.0) Wooten Creek (7.4)	Great Valley, Sierra Nevada Foothills
	Upper Cottonwood Creek	56,706	5,879 (1.2)	Buckeye Creek (0.8) Bull Creek (8.0) Cottonwood Creek (16.4) Grapevine Creek (4.8) Indian Creek (4.5) Minnehaha Creek (3.1) Moore Creek (4.1) Murry Creek (6.8) Persian Creek (4.2) Rattlesnake Creek (3.7) Wilcox Creek (4.2)	Great Valley, Sierra Nevada Foothills

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed	Area of Watershed in RCIS Area (Percent)	Major Creeks in Watershed (Length in Miles)	Ecoregion Section
	Upper Cross Creek	54,813	24,756 (5.2)	Alta East Branch Canal (0.1) Antelope Creek (10.3) Cottonwood Creek (1.5) Cross Creek (1.6) Friant-Kern Canal (2.3) Mathews Ditch (<0.1) Packwood Canal (<0.1) Saint Johns River (26.1)	Great Valley, Sierra Nevada Foothills
Upper Tule	Deep Creek	50,402	48,523 (10.2)	Bates Slough (5.5) Bates Slough Ditch (0.3) Cameron Creek (<0.1) Deep Creek (11.4) Deep Creek Cut (<0.1) Kaweah River (<0.1) North Fork Deep Creek (1.1) Oakland Colony Ditch (0.2) South Fork Deep Creek (2.4)	Great Valley
	Elk Bayou	116,802	76,439 (16.1)	Elk Bayou (12.9) Frazier Creek (7.9) Friant-Kern Canal (10.7) Inside Creek (0.1) North Branch Tule River (0.2) Outside Creek (0.1) Porter Slough (10.8)	Great Valley, Sierra Nevada Foothills
	Foothill Ditch-Outside Creek	41,058	31,352 (6.6)	Dry Creek (7.3) Friant-Kern Canal (3.5) Gray Ditch (0.1) Inside Creek (3.7) Johnson Slough (2.0) Outside Creek (8.6)	Great Valley, Sierra Nevada Foothills

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed	Area of Watershed in RCIS Area (Percent)	Major Creeks in Watershed (Length in Miles)	Ecoregion Section
	Lewis Creek	40,262	26,205 (5.5)	Friant-Kern Canal (9.2) Lewis Creek (22.1)	Great Valley, Sierra Nevada Foothills
	Lower Tule River	44,277	1,375 (0.3)	Deep Creek (<0.1) East Branch Cross Creek (<0.1) Elk Bayou (0.5) Friant-Kern Canal (0.7) Middle Branch Cross Creek (<0.1) Middle Branch South Branch Tule River (3.4) Mitchell Slough (4.4) North Branch Tule River (12.7) Porter Slough (<0.1) South Branch Tule River (11.7) Taylor Canal (<0.1) Tulare Lake Canal (<0.1) Tule River (28.8) Wilbur Ditch (<0.1) Wood Central Ditch (<0.1)	Great Valley

HUC-8 Watershed	HUC-10 Watershed	Area of Entire HUC-10 Watershed	Area of Watershed in RCIS Area (Percent)	Major Creeks in Watershed (Length in Miles)	Ecoregion Section
	South Fork Tule River	79,150	485 (0.1)	Bear Creek (4.1) Blue Creek (3.6) Bond Creek (7.4) Cedar Creek (4.2) Cow Mountain Creek (1.7) Crawford Creek (1.5) Crew Creek (4.1) Eagle Creek (3.8) Gibbon Creek (5.2) Kessing Creek (6.1) Long Branch (5.9) Miner Creek (2.3) Pigeon Creek (4.9) Redwood Creek (1.6) Rocky Creek (7.2) South Fork Tule River (25.0) Windy Creek (1.5)	Great Valley, Sierra Nevada Foothills
	Upper Tule River	52,385	5,260 (1.1)	Campbell Creek (7.2) Friant-Kern Canal (0.1) Graham Creek (6.0) North Branch Tule River (<0.1) Pioneer Ditch (<0.1) Poplar Ditch (<0.1) Porter Slough (<0.1) South Branch Tule River (0.1) Tule River (25.9)	Great Valley, Sierra Nevada Foothills
	Yokohl Creek	47,176	13,229 (2.8)	Friant-Kern Canal (0.5) Van Gordon Creek (5.8) Yokohl Creek (21.9)	Great Valley, Sierra Nevada Foothills
	Total	**1,225,311**	**475,935**		

2.3.7 Groundwater Sustainability

The Kaweah Subbasin covers 696 square miles within the Tulare Lake Hydrologic Region of the San Joaquin Valley Groundwater Basin. The area is characterized by low topographic relief, rarely exceeding 10 feet except in stream channels, and the elevation ranges from around 800 feet in the east decreasing to around 200 feet at the western boundary. The granitic and metamorphic bedrock of the Sierra Nevada foothills defines the eastern boundary of the Subbasin, forming an almost impermeable boundary for groundwater and channeling it towards the valley. The other three sides of the Subbasin are bounded by the Kings Subbasin to the north, Tule Subbasin to the south, and Tulare Lake Subbasin to the west. These Subbasin boundaries do not coincide with any natural features that affect groundwater flow. Groundwater generally flows from natural recharge at higher elevations in the Sierra Nevada from northeast to southwest through the Kaweah Subbasin to the Tulare Lake Subbasin. However, there are some areas in the northern and southern portions of the Kaweah Subbasin where the flow direction is more directly east to west, indicating that there is some amount of subsurface inflow and outflow between Kaweah, Kings, and Tule Subbasins.

Major rivers and streams in the subbasin include the Kaweah and St. Johns Rivers, and Cottonwood, Mill, Yokohl, and Lewis Creeks. These surface waters also generally flow from the Sierra Nevada and drain toward the Tulare Lake Subbasin. Additional surface water is supplied by the Friant Unit of the CVP. The long-term average annual rainfall in the Subbasin is 10.1 inches; however, the southern San Joaquin Valley has a highly variable climactic cycle that consists of prolonged periods of modest drought interspersed with short bursts of intense wet periods (GEI Consultants, Inc. 2020). Groundwater levels typically follow a pattern of stable to slightly increasing in wet periods and declining in dry periods. Drought conditions in recent years have been prolonged and more severe than those experienced historically. From 2007 to 2016, the Subbasin received 30% less rainfall than the long-term average. Between 2013 and 2015, CVP water deliveries became unavailable in the Subbasin. As a result, groundwater pumping during this period increased substantially to meet local water demands, leading to significant declines in groundwater levels throughout the Subbasin.

Groundwater in the Kaweah Subbasin occurs primarily in an alluvial aquifer system that is present throughout the area. In the central and western parts of the Subbasin, the alluvial aquifer system consists of an upper unconfined zone underlain by an aquitard of Corcoran Clay at depths from 200 to 500 feet, and a lower confined zone below the Corcoran Clay. In the eastern portions of the Subbasin, the Corcoran Clay is not present, and the aquifer system consists of a single merged aquifer zone that is unconfined or semi-confined. The depth to the effective base of the alluvial aquifer systems varies within the Subbasin from 1,100 feet below sea level in the west near Corcoran, to 50 feet below sea level in the east, coinciding with the uplift of bedrock from the Rocky Hill fault. The significant distances separating surface and groundwater throughout much of the Subbasin indicates that surface waters are largely disconnected from groundwater. The majority of natural streams and manmade ditches within the Subbasin are classified as losing channels (i.e., they lose streamflow to groundwater). However, streams in the portion of the Subbasin generally east of the Friant Kern Canal to McKay Point, and the Kaweah River east of McKay Point, are more likely to be neutral to gaining reaches (i.e., groundwater infiltrates surface flow) for short periods of the year (GEI Consultants, Inc. 2020). An area of approximately 850 acres in the eastern portion of the Subbasin where groundwater comes within 50 feet of the ground surface along the Kaweah River south of the City of Woodlake in the GKGSA is considered a potential groundwater dependent ecosystem (GDE). This area includes around 500 acres of tree vegetation, 220 acres of wetlands, and nearly 140 acres of mixed tree/wetland (GEI Consultants, Inc., and GSI Water Solutions, Inc. 2020). Other potential GDEs occur in the north EKGSA between the Friant-Kern Canal and Cottonwood

Creek, and in the southeast EKGSA around Lewis Creek and Frazier Creek southeast of the City of Lindsay, east of the Friant-Kern Canal. Based on groundwater elevations as of spring 2017, no areas have been identified in the MKGSA that could be considered potential GDEs. In general, additional groundwater elevation monitoring in areas with shallower depth to groundwater is necessary throughout the Kaweah Subbasin to determine if interconnected surface waters are present, and if plant communities in identified potential GDEs are groundwater dependent or riparian and thus reliant on surface flows and bank seepage.

Natural groundwater recharge in the Subbasin is primarily from seepage from the Kaweah and St. Johns Rivers and intermittent streams, with direct precipitation contributing a small quantity to the aquifers. Additional seepage from irrigation canals and irrigation water applied in excess of soil-moisture needs are also principal sources of groundwater recharge. A total of 42 artificial recharge basins covering approximately 1,916 acres occur throughout the GKGSA and the MKGSA, receiving surface water flows and allowing them to percolate to groundwater (GEI Consultants, Inc. 2020). There are some tailwater basins located in some IDs in the EKGSA, but recharge basin diversions have not been quantified to date and this source of groundwater inflow has not been considered as a component of the EKGSA water budget. To understand the natural recharge system, and identify locations for additional potential artificial recharge projects, a thorough understanding of soil recharge characteristics in the Subbasin is necessary. Several tools that utilize this information have been developed to help assess the potential for various recharge activities and locations. In addition, the three GSAs and Stanford University are jointly funding a pilot geophysical program for hydrogeological subsurface data collection using airborne electromagnetic survey methods. These data are expected to be incorporated in the respective GSPs in the first 5-year update.

The University of California (UC) Davis and UC Division of Agriculture and Natural Resources have developed the Soil Agricultural Groundwater Banking Index (SAGBI) as a composite evaluation of groundwater recharge feasibility on agricultural land according to risk of crop damage at the recharge site (O'Geen et al. 2015). The index uses a set of weighted factors of agricultural importance (i.e., deep percolation, root zone residence time, topography, chemical limitations, and soil surface conditions) adjusted for soil modification by deep tillage as an initial screening to identify areas of the Subbasin that are favorable for recharge. The Land IQ[12] recharge suitability index built upon SAGBI and developed a groundwater recharge suitability index for the Central Valley and surrounding areas by closely evaluating subsurface soil suitability for percolation and storage of recharge waters. Both suitability indices help to inform other tools such as the Groundwater Recharge Assessment Tool (GRAT)[13] developed by Sustainable Conservation and The Earth Genome in collaboration with the Tulare and Madera IDs. GRAT criteria include access to conveyance facilities, volume of water that can be applied, deep percolation potential, and retention of deep percolation water in the GSA. Researchers and students at the UC Santa Barbara Bren School of Environmental Science and Management developed a customizable multi-benefit groundwater recharge decision support tool that can be applied to any groundwater basin in the Central Valley.[14] This tool considers surface conditions (such as those considered with SAGBI) and subsurface conditions (such as impermeable Corcoran Clay layers) combined with historic fertilizer application to identify areas suitable for recharge that will not introduce new nitrogen contamination into groundwater. The user can then further customize the decision support tool output by assigning weighted priorities to additional benefit and feasibility considerations to identify potential multi-

[12] https://www.landiq.com/water-resources
[13] https://suscon.org/GRAT/
[14] https://waterresilience.wixsite.com/waterresilienceca

benefit recharge locations. These various recharge suitability indices and mapping tools are helpful in providing a regional assessment of recharge potential, but it should be noted that land availability remains a limiting factor in selecting recharge sites and can inhibit the actual recharge potential of a specific GSA.

In a study by UC Davis to evaluate the potential of using fallow agricultural land as temporary percolation basins during periods when excess surface water is available, the modified SAGBI was applied to the Kaweah Subbasin (O'Geen et al. 2015) (Figure 2-10). Using the modified SAGBI, the EKGSA conservatively estimates that 10,000 acres of farmland within the GSA could effectively participate in an on-farm recharge program spreading excess surface water on operational agricultural fields. The MKGSA is using GRAT to target and prioritize optimal lands for on-farm recharge, fallowing, and recharge basins, and projects up to 600 acres of farmland within the GSA may be voluntarily enrolled in an on-farm recharge program depending on level of need and surplus flow availability. On-farm recharge projects targeting approximately 500 acres of farmland are also projected in the GKGSA. Areas that have relatively good groundwater recharge capabilities that do not overlap with Prime Farmland are generally concentrated in the northern and eastern portions of the RCIS Area (Figure 2-11). Using these areas for recharge and habitat co-benefits, particularly where natural communities and habitat remain, could reduce conflicts between competing land uses (Figure 2-12). However, given the extent to which recharge areas overlap Prime Farmland, groundwater recharge and conservation projects and management actions to meet groundwater sustainability plan goals will likely occur on Prime Farmland.

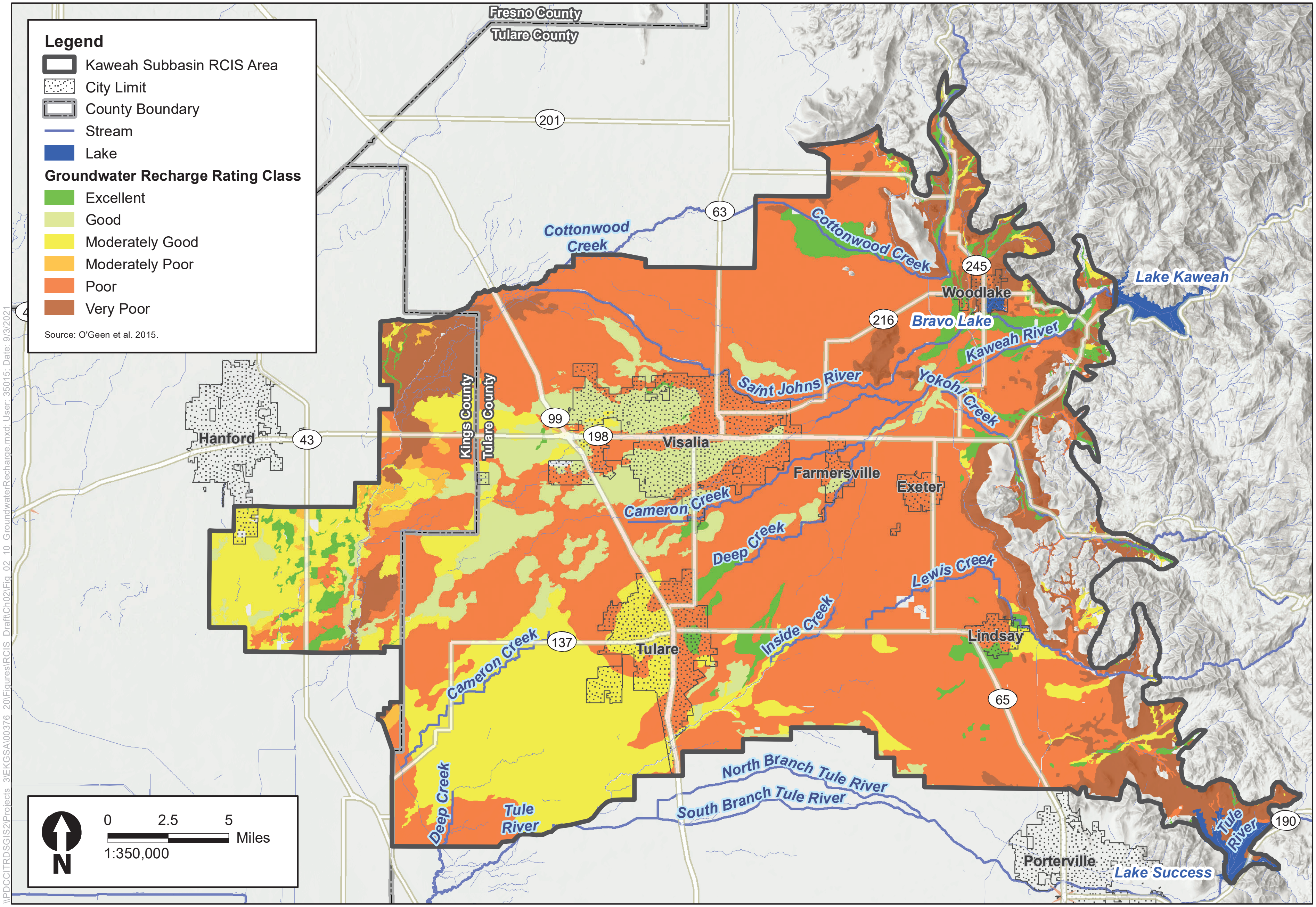


Figure 2-10
Groundwater Recharge

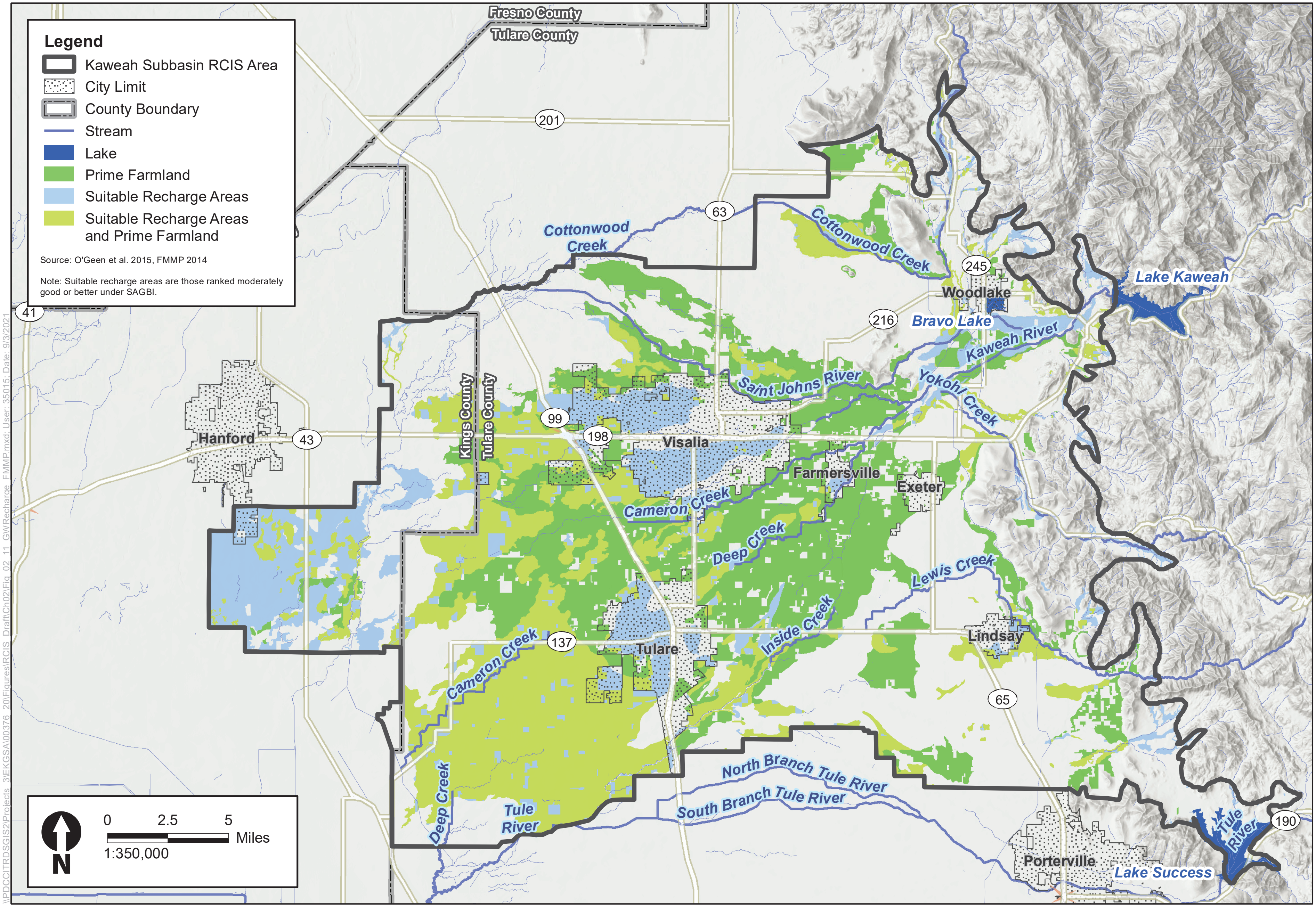


Figure 2-11
Groundwater Recharge and Prime Farmland

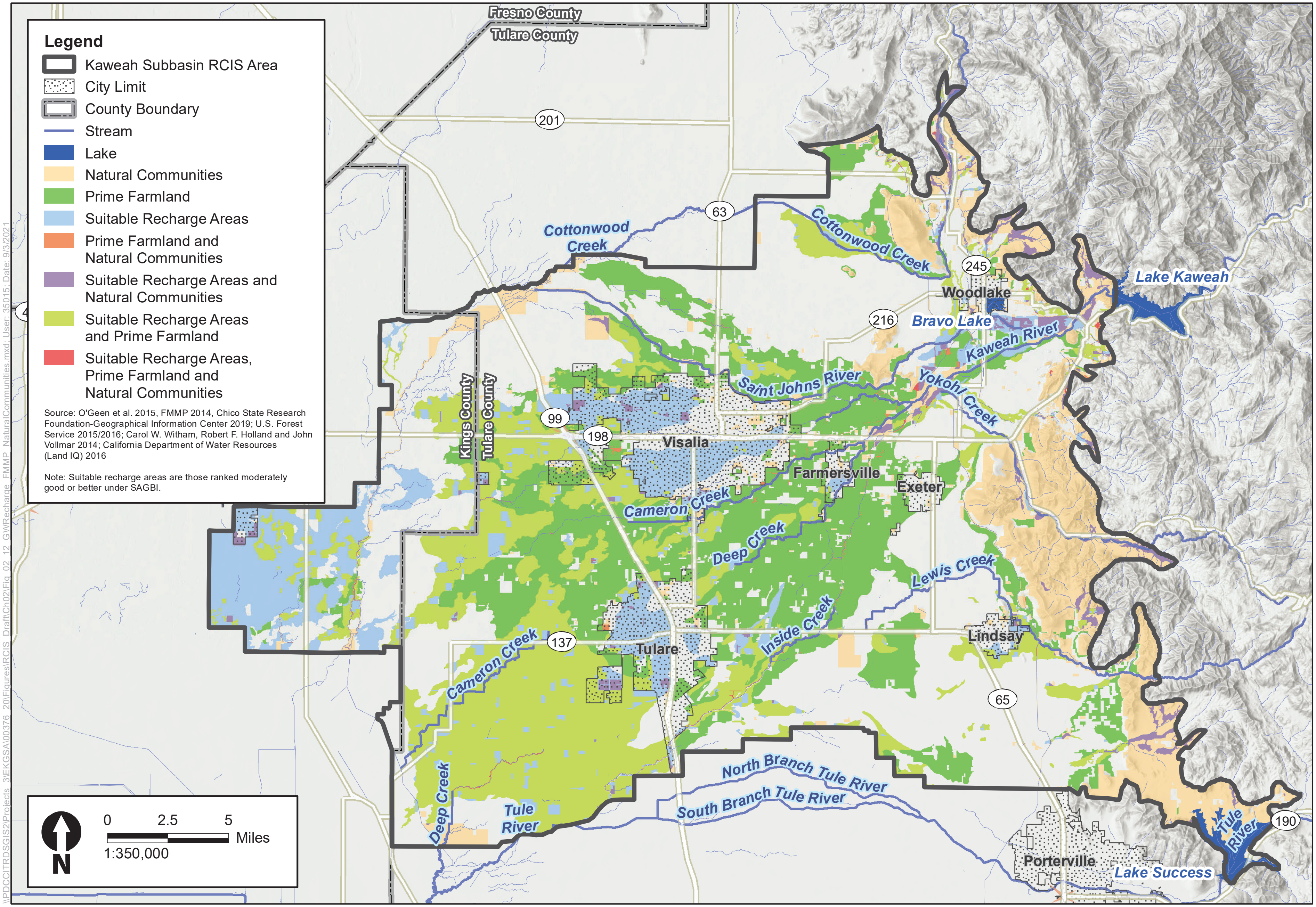


Figure 2-12
Groundwater Recharge, Prime Farmland, and Natural Communities

2.3.8 Natural Communities

2.3.8.1 Historical Vegetation

Prior to European settlement in the late 1840s, the Tulare Basin and the Kaweah Subbasin within it was comprised of a network of desert scrub, wetlands, riparian, grasslands, and valley oak woodland (Figure 2-13). Rivers fed six freshwater lakes in the Tulare Basin, including Tulare Lake, with snowmelt from the Sierra Nevada. A network of sloughs and wetlands connected the lakes (California State University, Chico, Department of Geography and Planning and Geographic Information Center 2003).

The Tulare Basin is the traditional home of the Southern Valley Yokut tribes, and once supported one of the oldest and densest Native American populations in North America, with estimates of at least 19,000 Yokuts in the region. By the 1850s, the U.S. Government had forced most of the Yokuts onto reservations (Tulare Basin Wildlife Partners 2010). Around this time, settlers initiated irrigated agriculture, building levees and diverting water into irrigation canals (Figure 2-14). Much of this water was diverted from Tulare Lake, and by 1900, the lake was dry. By 1945, much of the historical vegetation was converted to irrigated agriculture (Kelly et al. 2005), with urban development replacing some agriculture by 2004 (Figure 2-15).

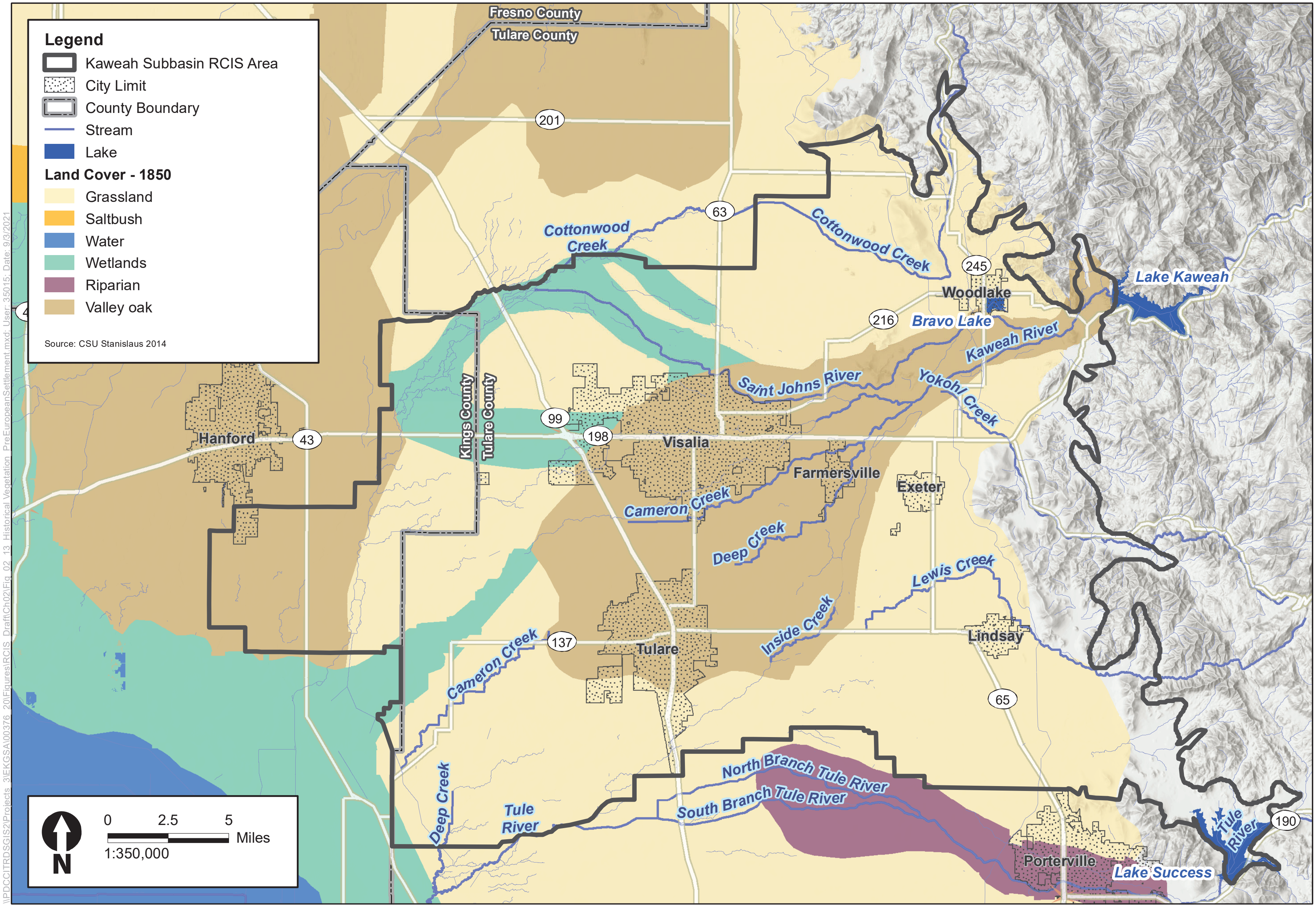
2.3.8.2 Current Natural Communities and Land Cover

This Kaweah RCIS uses a detailed GIS-based map of land cover types within the RCIS Area to spatially characterize the distribution of existing natural communities and habitat.

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

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

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



ICF

Figure 2-13
Historical Vegetation - Pre-European Settlement

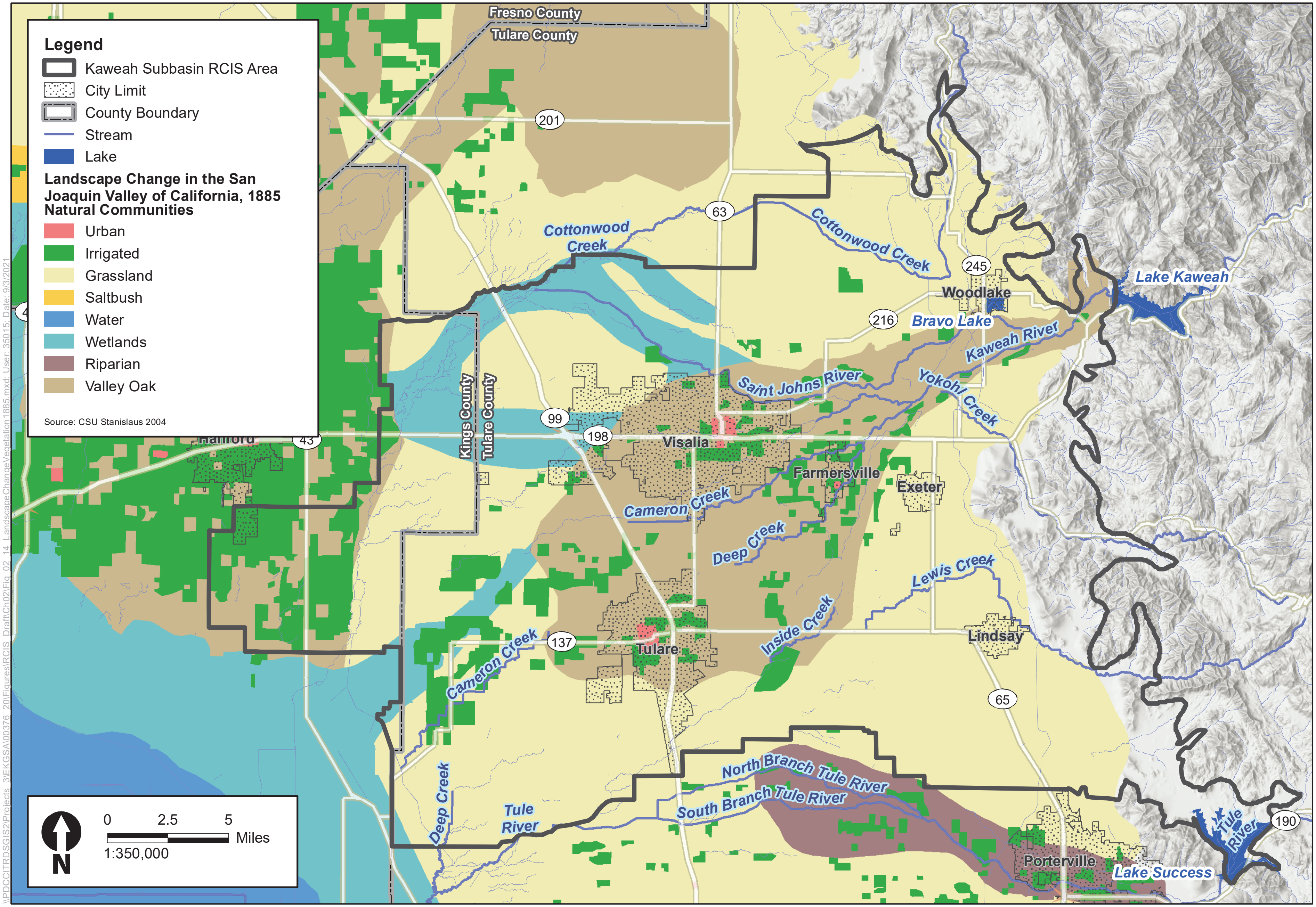


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Figure 2-14
Landscape Change in Vegetation – 1885

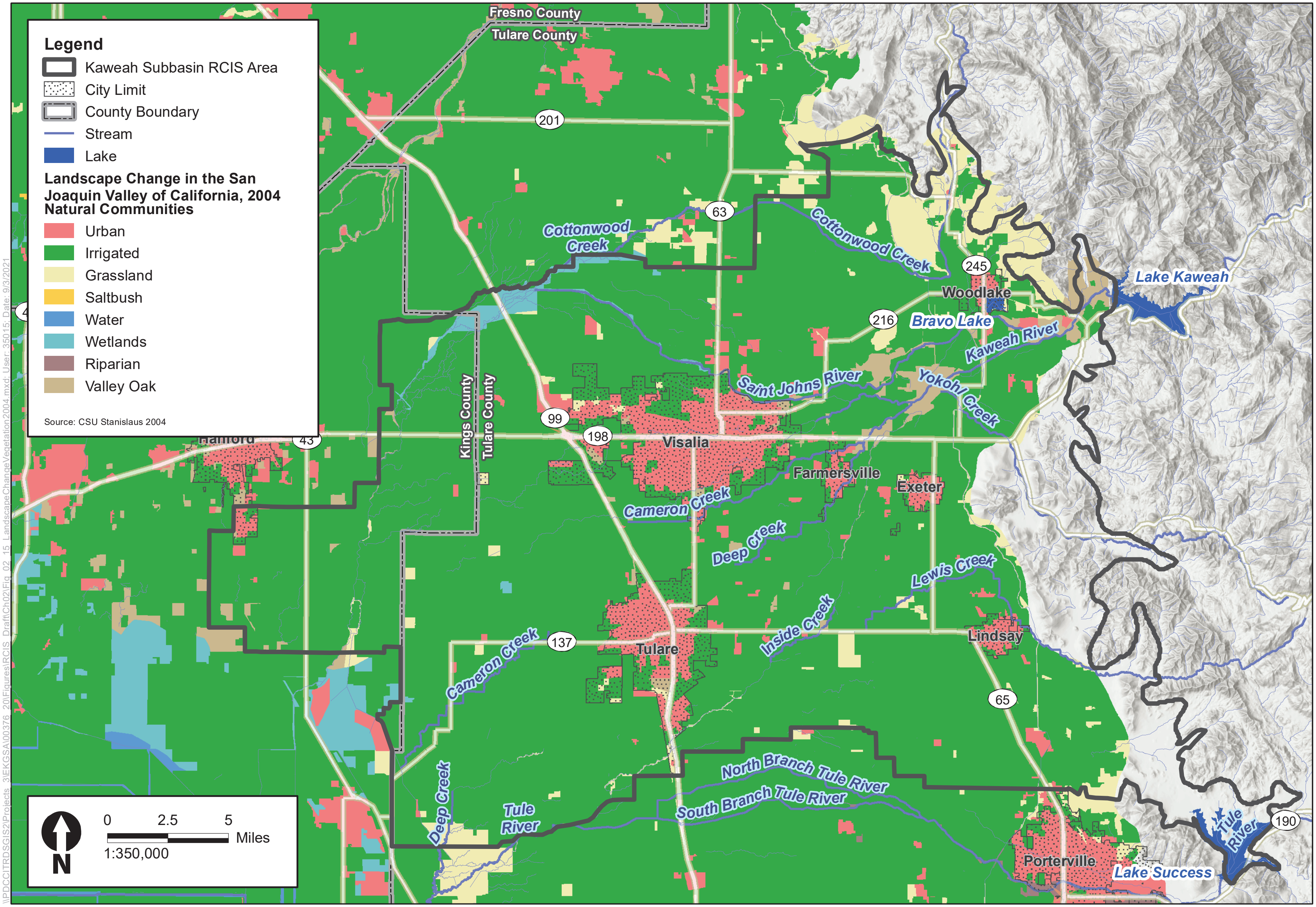

Figure 2-15
Landscape Change in Vegetation – 2004

The land cover dataset used in this RCIS was assembled using the following existing land cover data.

- Great Valley Ecoregion (California Department of Fish and Wildlife 2018b)
- Vernal Pool Distribution, California's Great Central Valley (Witham et al. 2014)
- Existing Vegetation Central Valley (U.S. Department of Agriculture 2014)
- Existing Vegetation South Sierran (U.S. Department of Agriculture 2014)
- California Statewide Agricultural Land Use, 2016 (California Department of Water Resources 2020)

The land cover dataset is intended for planning purposes. Areas identified for potential conservation investments or mitigation will need to be verified with on-the-ground surveys before conservation actions or habitat enhancement actions are implemented.

CDFW Great Valley Ecoregion Vegetation land cover data provided the foundation for the Kaweah RCIS land cover dataset, as this dataset covered almost all of the RCIS Area. A small portion of the eastern edge of the RCIS Area is not covered by the Great Valley Ecoregion Vegetation land cover data. Those portions were filled in with the Existing Vegetation Central Valley and South Sierran land cover datasets (U.S. Department of Agriculture 2014).[15] Refer to Table 2-15 for more information about the relationship between the Existing Vegetation Central Valley and South Sierran land cover types and the Kaweah RCIS land cover types. The Great Valley Ecoregion Vegetation dataset incorporated vernal pool mapping from Witham et al. (2014). However, not all of Witham et al. vernal pool mapping data were incorporated into the Great Valley Ecoregion Vegetation dataset in the Subbasin. The remaining areas mapped by Witham et al. were incorporated into the Kaweah RCIS land cover dataset by overwriting the other land cover types in the same location. The Great Valley Ecoregion, Vernal Pool Distribution, and Existing Vegetation South Sierran datasets were also used to map the wetland land cover types in the vernal pool, wetland, and open water natural communities (Table 2-15).

High-resolution flowlines from the National Hydrography Dataset (U.S. Geological Survey 2016) were used to represent hydro lines in the RCIS Area.

The Great Valley Ecoregion Vegetation dataset identifies agricultural lands, but generally does not distinguish the types of crops planted. Because agriculture is the primary land use in the RCIS Area (Section 2.2.2, *Land Use*), and some focal species are selective in their use of agricultural crops as habitat, California Department of Water Resources (DWR) Statewide Agricultural Land Use 2016 (California Department of Water Resources 2020) data were incorporated into this RCIS's land cover dataset to represent crop types grown in the RCIS Area.

The agricultural land cover data are intended to provide a snapshot of the agricultural composition representative of the RCIS Area at the time this RCIS was developed. Because cropping patterns and type change over time due to market demand, climatic variables, and other factors, the extent and spatial distribution of each agriculture type mapped in this RCIS are expected to change.

[15] The Program Guidelines require that vegetation maps use the vegetation classification system based on *A Manual of California Vegetation*, Second Edition (Sawyer et al. 2009) and follow the *Survey of California Vegetation Standards* (California Department of Fish and Wildlife 2018c). CDFW's Vegetation Classification and Mapping Program was contacted to confirm that the vegetation data used for this RCIS are the best readily available vegetation maps and are appropriate for use for the RCIS (D. Hickson, pers. comm.).

Table 2-15. Crosswalk of Kaweah Subbasin RCIS Land Cover Type Classification to Other State and Local Classification Systems

Kaweah RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	U.S. Forest Service Calveg, Existing Vegetation South Sierran	California Wildlife Habitat Relationships
Grassland			
California annual and perennial grassland	California annual and perennial grassland macrogroup	Annual grasses and forbs, nonnative/ornamental grasses	Annual grassland
Vernal Pool			
Vernal pool complex	Californian mixed annual/perennial freshwater vernal pool/swale bottomland group	Vernal pool	Annual grassland, barren, alkali desert scrub
Scrub			
Bush seepweed scrub	*Suaeda moquinii* alliance	Alkaline mixed scrub	Alkali desert scrub
Fourwing saltbush scrub	*Atriplex canescens* alliance	Saltbush	Alkali desert scrub
Quailbush scrub	*Atriplex lentiformis* alliance	Saltbush	Alkali desert scrub
Silver bush lupine scrub	*Lotus scoparius – Lupinus albifrons – Eriodictyon* spp. alliance	North coastal scrub	Coastal scrub
Woodland			
Blue oak woodland	*Quercus douglasii* alliance	Blue oak	Blue oak-foothill pine, blue oak woodland
California buckeye groves	*Aesculus californica* alliance	California buckeye	Montane hardwood
Interior live oak woodland	*Quercus wislizeni* (tree) alliance	Interior live oak	Montane hardwood
Nonnative groves	Introduced North American Mediterranean woodland and forest group	Nonnative/ornamental hardwood	Urban
Chaparral			
Tucker oak chaparral	*Quercus john-tuckeri* alliance	Semi-desert chaparral	Mixed chaparral
Cliff/scree/rock vegetation	North American warm semi-desert cliff, scree, and other rock vegetation macrogroup	Barren	Barren

Kaweah RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	U.S. Forest Service Calveg, Existing Vegetation South Sierran	California Wildlife Habitat Relationships
Riparian			
Valley oak woodland	*Quercus lobata* Riparian alliance	Valley oak	Valley foothill riparian
Fremont cottonwood woodland	*Populus fremontii – Fraxinus velutina – Salix gooddingii* alliance	Fremont cottonwood	Valley foothill riparian
California sycamore woodland	*Platanus racemosa* alliance	California sycamore	Valley foothill riparian
California coffee berry–western azalea scrub–Brewer's willow	*Frangula californica – Rhododendron occidentale–Salix breweri* shrubland alliance	Lower montane mixed chaparral	Mixed chaparral
Goodding's willow–red willow riparian woodland	*Salix gooddingii – Salix laevigata* forest and woodland alliance	Riparian mixed hardwood, willow	Valley foothill riparian
Sandbar willow thickets	*Salix exigua* alliance	Willow (shrub)	Valley foothill riparian, desert riparian
Blue elderberry stands	*Rhus trilobata – Crataegus rivularis – Forestiera pubescens* alliance	Riparian mixed shrub	Valley foothill riparian
Riparian woodland (alliance unspecified)	Southwestern North American riparian evergreen and deciduous woodland group	Riparian mixed hardwood	Valley foothill riparian
Mulefat thickets	*Baccharis salicifolia* alliance	Baccharis (riparian)	Fresh emergent wetland
Tamarisk thickets	*Tamarix* spp. semi-natural alliance	Tamarisk	Valley foothill riparian, desert riparian
Himalayan blackberry–rattlebox–edible fig riparian scrub	*Rubus armeniacus–Sesbania punicea–Ficus carica* semi-natural alliance	Riparian mixed scrub	Coastal scrub, valley foothill riparian
Wetland			
Baltic and Mexican rush marshes	*Juncus arcticus* (var. *balticus*, *mexicanus*) alliance	Perennial grasses and forbs	Fresh emergent wetland
Californian warm temperate marsh/seep	Californian warm temperate marsh/seep group	Wet meadows, perennial grasses and forbs	Fresh emergent wetland

Kaweah RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	U.S. Forest Service Calveg, Existing Vegetation South Sierran	California Wildlife Habitat Relationships
Cattail marshes	*Typha* (*angustifolia*, *domingensis*, *latifolia*) alliance	Tule–cattail	Fresh emergent wetland
Common and giant reed marshes	*Phragmites australis–Arundo donax* herbaceous semi-natural alliance	Giant reed/pampas grass	Fresh emergent wetland
Duckweed blooms	*Lemna* (*minor*) and relatives provisional herbaceous alliance	Water	Fresh emergent wetland
Hardstem and California bulrush marshes	*Schoenoplectus* (*acutus*, *californicus*) herbaceous alliance	Tule–cattail	Fresh emergent wetland
Mosquito fern mats	*Azolla* (*filiculoides*, *microphylla*) herbaceous alliance	Water	Fresh emergent wetland
Water primrose wetlands	*Ludwigia* (*hexapetala*, *peploides*) provisional herbaceous semi-natural alliance	Water	Fresh emergent wetland
Wet meadow	N/A	Wet meadow	N/A
Naturalized warm-temperate riparian and wetland	Naturalized warm-temperate riparian and wetland group	Wet meadows, nonnative/ornamental grass	Fresh emergent wetland, urban
Open water			
Lacustrine/riverine	N/A	Reservoirs, perennial lakes and ponds, water	Lacustrine, riverine
Agriculture			
Alfalfa	N/A	Orchard agriculture, vineyard-shrub agriculture, pasture and crop agriculture	Deciduous orchard, evergreen orchard, vineyard, irrigated row and field crops
Field crops	N/A	Orchard agriculture, vineyard-shrub agriculture, pasture and crop agriculture	Deciduous orchard, evergreen orchard, vineyard, irrigated row and field crops
Grain and hay	N/A	Orchard agriculture, vineyard-shrub agriculture, pasture and crop agriculture	Deciduous orchard, evergreen orchard, vineyard, irrigated row and field crops

Kaweah RCIS Land Cover Type	California Department of Fish and Wildlife Natural Communities List[a, b]	U.S. Forest Service Calveg, Existing Vegetation South Sierran	California Wildlife Habitat Relationships
Pasture	N/A	Orchard agriculture, vineyard-shrub agriculture, pasture and crop agriculture	Deciduous orchard, evergreen orchard, vineyard, irrigated row and field crops
Fallow	N/A	Orchard agriculture, vineyard-shrub agriculture, pasture and crop agriculture	Deciduous orchard, evergreen orchard, vineyard, irrigated row and field crops
Orchards and vineyards	N/A	Orchard agriculture, vineyard-shrub agriculture, pasture and crop agriculture	Deciduous orchard, evergreen orchard, vineyard, irrigated row and field crops
Developed agriculture	N/A	N/A	N/A
Urban/Barren			
Urban	N/A	Urban/future urban/landfill/ ruderal/turf	Urban
Barren	N/A	Barren	Barren

Notes:

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

[a] California Department of Fish and Wildlife 2020a.

[b] CDFW Natural Communities List complies with the National Vegetation Classification Standard (NVCS) (Federal Geographic Data Committee 2008). NVCS is a hierarchical classification consisting of eight levels. Table 2-15 includes three CDFW natural community levels: macrogroup, group, and alliance. Macrogroup is the broadest of the three and is defined by moderate sets of diagnostic plant species and growth forms that reflect biogeographic differences in composition. Groups are grouped into macrogroups. Groups are defined by relatively narrow sets of diagnostic plant species, broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition. Alliances are grouped into groups. Alliances are the lowest, most granular of the three levels. Alliances are defined by diagnostic plant species and moderately similar composition that reflects regional to subregional environmental factors such as climate, hydrology and disturbance regimes (Federal Geographic Data Committee 2008).

DWR Statewide Agricultural Land Use 2016 data were incorporated into the Kaweah RCIS land cover dataset by overwriting areas mapped by the Great Valley Ecoregion dataset as agriculture. DWR did not map areas between agricultural lands that are otherwise part of the working land landscape, such as areas between fields, roads within agricultural lands, and agricultural infrastructure. For the purposes of this Kaweah RCIS, these areas within the agricultural landscape were mapped as developed agriculture so that land cover was mapped for the entire Kaweah RCIS Area.

DWR Statewide Agricultural Land Use 2016 data include a large number of crop types. Similar crop types were organized into groups to streamline the number the agricultural land cover types. Table 2-16 shows the relationships between DWR Statewide Agricultural Land Use 2016 crop type data and the resulting Kaweah RCIS land cover type.

Table 2-16. Crosswalk of Statewide Agricultural Land Use, 2016 Crop Types to Kaweah RCIS Land Cover Type

Statewide Agricultural Land Use 2016 Crop Type	Kaweah RCIS Crop Type
Alfalfa and alfalfa mixtures	Alfalfa
Almonds	Orchards and vineyards
Apples	Orchards and vineyards
Avocado	Orchards and vineyards
Beans (dry)	Field crops
Bush berries	Orchards and vineyards
Cherries	Orchards and vineyards
Citrus	Orchards and vineyards
Cole crops	Field crops
Corn, sorghum, and Sudan	Field crops
Cotton	Field crops
Flowers, nursery, and Christmas tree farms	Developed agriculture
Grapes	Orchards and vineyards
Greenhouse	Developed agriculture
Idle	Fallow
Kiwis	Orchards and vineyards
Lettuce/leafy greens	Field crops
Managed wetland	Developed agriculture
Melons, squash, and cucumbers	Field crops
Miscellaneous deciduous	Orchards and vineyards
Miscellaneous grain and hay	Grain and hay
Miscellaneous grasses	Grain and hay
Miscellaneous subtropical fruits	Orchards and vineyards
Miscellaneous truck crops	Field crops
Mixed pasture	Pasture
Olives	Orchards and vineyards
Onions and garlic	Field crops
Peaches/nectarines	Orchards and vineyards
Pears	Orchards and vineyards
Peppers	Field crops

Statewide Agricultural Land Use 2016 Crop Type	Kaweah RCIS Crop Type
Pistachios	Orchards and vineyards
Plums, prunes and apricots	Orchards and vineyards
Pomegranates	Orchards and vineyards
Safflower	Field crops
Strawberries	Field crops
Tomatoes	Field crops
Urban	Urban
Walnuts	Orchards and vineyards
Wheat	Grain and hay
Young perennials	Orchards and vineyards

A total of 25 natural communities, or alliances, were mapped within the RCIS Area. *Alliances* are a category of vegetation classification which describes repeating patterns of plants across a landscape based on plant species composition, and the effects of local climate, soil, water, disturbance, and other environmental factors (California Native Plant Society 2021). In addition to these alliances, the RCIS Area also includes 19 other natural and non-natural land cover types.

Table 2-17 presents the extent of natural communities and land cover types in the RCIS Area. Figure 2-16 shows the natural communities in the RCIS Area and Figure 2-17 shows the land cover types in the RCIS Area.

Table 2-17. Extent of Natural Communities and Land Cover Types in the RCIS Area

Kaweah RCIS Land Cover Type	Acres in RCIS Area	Percent of RCIS Area
Grassland	**55,557.6**	**11.7%**
California annual and perennial grassland	55,557.6	11.7%
Vernal pool complex	**8,613.1**	**1.8%**
Vernal pool complex	8,613.1	1.8%
Scrub	**41.5**	**<0.1%**
Bush seepweed scrub	0.1	<0.1%
Fourwing saltbush scrub	28.1	<0.1%
Quailbush scrub	2.9	<0.1%
Silver bush lupine scrub	10.5	<0.1%
Woodland	**1,418.3**	**0.3%**
Blue oak woodland	1039.6	0.2%
California buckeye groves	8.9	<0.1%
Interior live oak	2.7	<0.1%
Nonnative groves	367.2	0.1%
Chaparral	**20.8**	**<0.1%**
Tucker oak chaparral	9.9	<0.1%
Cliff/scree/rock vegetation	10.9	<0.1%
Riparian	**3,311.7**	**0.7%**
Valley oak woodland	1,733.7	0.4%

Kaweah RCIS Land Cover Type	Acres in RCIS Area	Percent of RCIS Area
Fremont cottonwood woodland	559.7	0.1%
California sycamore woodland	125.8	<0.1%
California coffee berry–western azalea scrub–Brewer's willow	6.6	<0.1%
Goodding's willow–red willow riparian woodland	704.2	0.1%
Sandbar willow thickets	11.0	<0.1%
Blue elderberry stands	28.5	<0.1%
Riparian woodland (alliance unspecified)	131.7	<0.1%
Mulefat thickets	<0.1	<0.1%
Tamarisk thickets	4.1	<0.1%
Himalayan blackberry–rattlebox–edible fig riparian scrub	6.4	<0.1%
Wetland	**161.8**	**<0.1%**
Baltic and Mexican rush marshes	9.5	<0.1%
Californian warm temperate marsh/seep	14.1	<0.1%
Cattail marshes	38.8	<0.1%
Common and giant reed marshes	9.0	<0.1%
Duckweed blooms	2.7	<0.1%
Hardstem and California bulrush marshes	11.7	<0.1%
Mosquito fern mats	3.9	<0.1%
Water primrose wetlands	1.3	<0.1%
Wet meadow	9.7	<0.1%
Naturalized warm-temperate riparian and wetland group	61.1	<0.1%
Open Water	**3,580.1**	**0.8%**
Lacustrine/riverine	3,580.1	0.8%
Agriculture	**355,650.7**	**74.7%**
Alfalfa	29,858.4	6.3%
Field crop	96,557.8	20.3%
Grain and hay	11,105.0	2.3%
Pasture	1,081.6	0.2%
Fallow	12,129.8	2.5%
Orchard and vineyard	154,871.2	32.5%
Developed agriculture	50,046.9	10.5%
Barren	**256.6**	**0.1%**
Barren	256.6	0.1%
Urban	**47,323.0**	**9.9%**
Urban	47,323.0	9.9%
GRAND TOTAL	**475,935.1**	**100.0%**

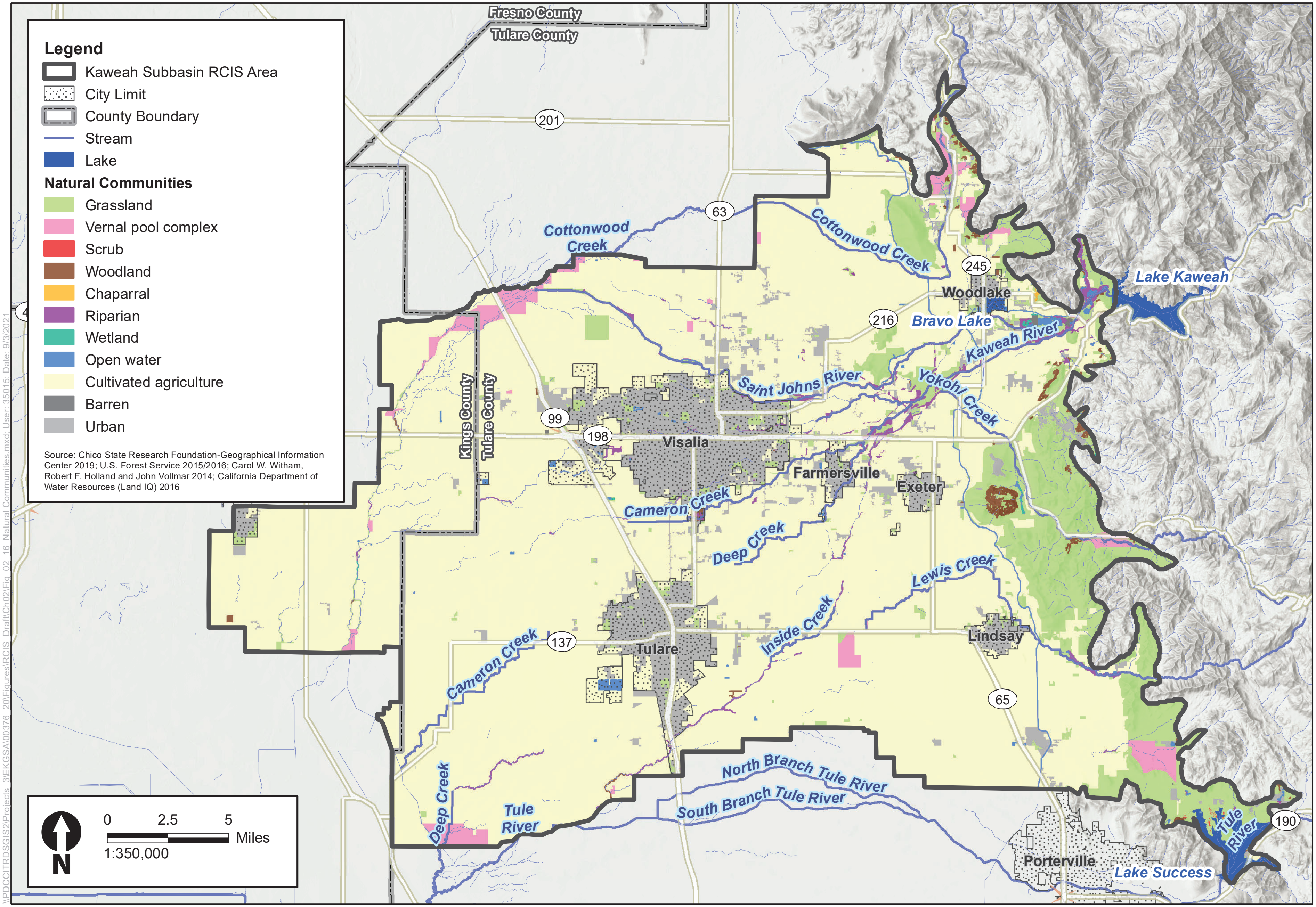

Figure 2-16
Natural Communities

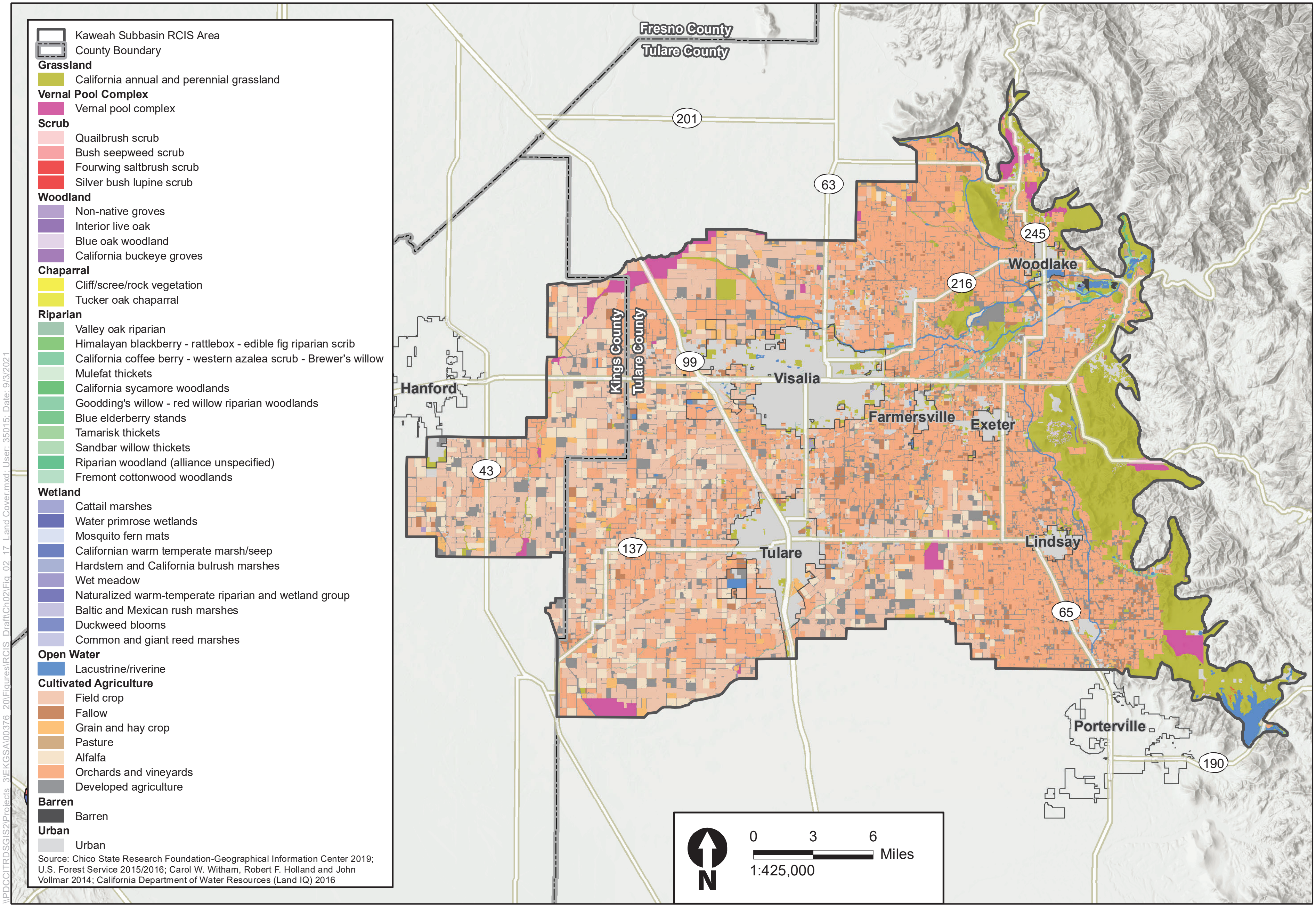

Figure 2-17
Land Cover

The Kaweah RCIS land cover types and CDFW Natural Communities List in Table 2-15 are considered other conservation elements (Section 1.4.4, *Other Conservation Elements*) by this Kaweah RCIS. Table 2-18 describes the natural communities and land cover types within the RCIS Area, including characteristic species of the land cover type and habitats where the land cover type is found. The alliance descriptions for the RCIS Area are summarized from the Manual of California Vegetation Online (California Native Plant Society 2021) unless otherwise noted. Figure 2-18 shows land cover types for grassland and vernal pool complex natural communities; Figure 2-19 shows land cover types for scrub and chaparral natural communities; Figure 2-20 shows land cover types for woodland natural communities; Figure 2-21 shows land cover types for riparian and open water communities; Figure 2-22 shows land cover types for wetland natural communities; and Figure 2-23 shows agricultural land cover types.

Table 2-18. Description Natural Communities and Land Cover Types in the RCIS Area

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Grassland				
California Annual and Perennial Grassland	**State Rarity:** None **Global Rarity:** None	This macrogroup includes the now relictual native perennial grasslands, native annual grasslands and native annual forb meadows of California. Characteristic native plant species include a dominance by native, cool-season bunchgrasses *Agoseris heterophylla, Aristida* spp., *Bromus carinatus, Elymus glaucus, Festuca californica, Festuca idahoensis, Leymus condensatus, Melica californica, Nassella cernua, Nassella lepida, Nassella pulchra*, and *Poa secunda*. Native annual species include *Amsinckia* spp., *Eschscholzia* spp., *Lotus unifoliolatus, Lupinus* spp., *Plagiobothrys nothofulvus, Trifolium variegatum,* and *Vulpia microstachys.* Occurrences often have high native species richness, though many now have significant abundance of nonnative species. No alliances were mapped for the Great Valley Ecoregion Vegetation in the RCIS Area. Mapping was done to the level of the California Annual and Perennial Grassland macrogroup. The *Nassella* spp. - *Melica* spp. (needle grass – melic grass) (G3, S3) Sensitive Alliance, however, may occur in the RCIS Area include the following (Buck-Diaz et al. 2012; California Native Plant Society 2021).	Vegetation is herbaceous.	These communities are best represented on xeric to mesic ultramafic sites where alien annual grasses are less well-adapted. This macrogroup occurs in Mediterranean California from 10-1200 m elevation, with cool, wet winters and hot, dry summers, receiving on average 50 cm (range 25-100 cm) of precipitation per year, mainly as winter rain.
Vernal pool complex				
Vernal pool complex	**State Rarity:** S2 **Global Rarity:** G2	The Kaweah Subbasin is located within the San Joaquin Valley Vernal Pool Region (Keeler-Wolf et al. 1998, U.S. Fish and Wildlife Service 2005). Soils in the vernal pool region are alkaline. Vernal pools are primarily the Northern Claypan type, and generally exist as small mima mount types or larger alkali pools. The vernal pool region includes sensitive plants such as Colusa grass, Greene's tuctoria, Hoover's spurge, heartscale (*Atriplex cordulata*), brittlescale (*Atriplex depressa*), and recurved larkspur (*Delphinium recurvatum*), among others.	Vegetation is herbaceous.	Vernal pools may occur in isolation or in complexes. A complex is a group of pools in close proximity. Intervening non-pool upland often includes wetland or partially wetland swales that can interconnect pools within the complex. Vernal pools typically occur in depressions which are underlain by a subsurface layer, which limits drainage (Holland 1976).

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Scrub				
Bush seepweed scrub	**State Rarity:** S3 **Global Rarity:** G4	*Isocoma acradenia* or *Suaeda nigra* is dominant or co-dominant in the shrub layer with *Allenrolfea occidentalis*, *Atriplex canescens, Atriplex polycarpa, Kochia californica* and *Sarcobatus vermiculatus*. Herbs may include *Frankenia salina, Schismus* spp. or *Sporobolus airoides*.	Shrubs < 1.5 m; canopy is open to continuous. Herbaceous layer is sparse to intermittent.	Flat to gently sloping valley bottoms, playas, toe slopes adjacent to alluvial fans, and bajadas. Soils are deep; saline or alkaline. The *U.S. Army Corp of Engineers Wetland Inventory* (U.S. Army Corps of Engineers 2018) recognizes *Suaeda nigra* as an obligate plant and *Isocoma acradenia* as a facultative upland plant. Elevation: 5–1300 m.
Fourwing saltbush scrub	**State Rarity:** S4 **Global Rarity:** G5	*Atriplex canescens* is dominant or co-dominant in the shrub canopy with *Ambrosia dumosa, Ambrosia salsola, Atriplex confertifolia, Atriplex polycarpa, Chrysothamnus viscidiflorus, Cleome isomeris, Ephedra viridis, Grayia spinosa, Larrea tridentata* and *Suaeda moquinii*. Emergent trees may be present at low cover, including *Prosopis glandulosa*.	Shrubs < 3 m; canopy is open or intermittent. Herbaceous layer is variable with seasonal herbs and nonnative grasses.	Playas, old beach and shores, lake deposits, dissected alluvial fans, rolling hills or channel beds. Soils are carbonate rich, alkaline, sandy, or sandy clay loams. The USFWS Wetland Inventory (1996 national list) recognizes *Atriplex canescens* as a facultative upland plant. Elevation: 75–1500 m.
Quailbush scrub	**State Rarity:** S4 **Global Rarity:** G4	*Atriplex lentiformis* or *Atriplex torreyi* is dominant in the shrub canopy with *Artemisia californica, Atriplex canescens, Baccharis pilularis, Baccharis salicifolia, Distichlis spicata, Encelia californica, Kochia americana, Malosma laurina, Pluchea sericea, Rhus integrifolia, Sporobolus airoides, Suaeda taxifolia* and *Tamarix* spp. Emergent trees may be present at low cover, including *Myoporum laetum* or *Prosopis glandulosa.*	Shrubs < 5 m; canopy is open to intermittent. Herbaceous layer is variable.	Gentle to steep southeast- and southwest-facing slopes. Soils are clays. The USFWS Wetland Inventory (1996 national list) recognizes *Atriplex lentiformis* as a facultative plant. Elevation: 0–170 m.
Silver bush lupine scrub	**State Rarity:** S4 **Global Rarity:** G4	*Lupinus albif*rons is dominant or co-dominant in the shrub canopy *with Eriodictyon californicum, Eriogonum fasciculatum, Eriophyllum confertiflorum, Senecio flaccidus*, and *Toxicodendron diversilobum*.	Shrubs < 2 m; canopy open. Herbaceous layer is open to intermittent with seasonal annuals.	Steep, dry slopes; rocky alluvial sites. Elevation: 0–1500 m.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Woodland				
Blue oak woodland and forest	**State Rarity:** S4 **Global Rarity:** G4	*Quercus douglasii* or *Quercus ×eplingii* (douglasii x garryana) hybrid oak is dominant or co-dominant in the tree canopy with *Aesculus californica, Juniperus californica, Pinus sabiniana, Quercus agrifolia, Quercus lobata* and *Quercus wislizeni*.	Trees < 20 m; with conifers < 35 m; canopy is intermittent to continuous, or savanna-like; it may be one or two tiered. Shrub layer is sparse to intermittent. Herbaceous layer is sparse or grassy, and forbs are present seasonally.	Valley bottoms, foothills, rocky outcrops. Soils are shallow, low in fertility, moderately to excessively drained with extensive rock fragments. Elevation: 30–1900 m.
California buckeye groves	**State Rarity:** S3 **Global Rarity:** G3	*Aesculus californica* is dominant or co-dominant in the tree canopy with *Fraxinus dipetala, Heteromeles arbutifolia, Pinus sabiniana, Prunus ilicifolia, Quercus wislizeni* and *Umbellularia californica*.	Trees < 10 m; canopy is open to continuous, one- or two-tiered. Shrubs are common. Herbaceous layer is sparse or grassy.	Varied slopes and topography. Soils are shallow and moderately to excessively drained. Elevation: 100–1500 m.
Interior live oak	**State Rarity:** S4 **Global Rarity:** G4	*Quercus wislizeni* var. *wislizen*i is dominant or co-dominant in the tree canopy with *Aesculus californica, Arbutus menziesii, Notholithocarpus densiflorus, Pinus sabiniana, Quercus chrysolepis, Quercus douglasii* and *Quercus kelloggii*.	Trees < 20 m; canopy is intermittent or savanna-like. Shrub layer is open to intermittent. Herbaceous layer is sparse or grassy.	Upland slopes, valley bottoms, terraces. Soils are shallow and moderately to excessively drained. Elevation: 500–4500 m.
Nonnative groves	**State Rarity:** None **Global Rarity:** None	Small stands comprised of nonnative dominants in the tree canopy such as *Ailanthus altissima*, *Eucalyptus* spp., and *Robinia pseudoacacia*.	Trees < 60 m; canopy is open to continuous. Shrub and herbaceous layer is sparse to intermittent.	Planted as trees, groves, and windbreaks. Naturalized on uplands or bottomlands and adjacent to streams, lakes, or levees.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Chaparral				
Tucker oak chaparral	**State Rarity:** S4 **Global Rarity:** G4	*Quercus john-tuckeri* is dominant or co-dominant in the shrub canopy with *Adenostoma fasciculatum, Arctostaphylos glauca, Ceanothus cuneatus, Cercocarpus montanus, Ericameria linearifolia, Ericameria nauseosa, Eriogonum fasciculatum, Fraxinus dipetala, Garrya flavescens, Juniperus californica, Quercus wislizeni* and *Symphoricarpos mollis*. Emergent trees may be present at low cover, including *Pinus monophylla, Pinus sabiniana, Quercus chrysolepis* or *Quercus douglasii*.	Shrubs < 6 m; canopy is open to continuous. Herbaceous layer is intermittent to sparse	Upper slopes and ridge tops. Soils are well to extensively drained over bedrock or colluvium. Elevation: 300–1500 m.[a]
Cliff/scree/rock vegetation	No rank	This group is characterized by scattered vegetation that may include woody vegetation such as *Ceanothus* spp. and herbaceous species such as *Dudleya cymosa*, *Eriogonum* spp. and *Dudleya* spp. (Hall and Evans 2014).	Patchy trees or woody vegetation; broadleaf deciduous shrubs; herbaceous layer is intermittent to sparse (Hall and Evans 2014).	Barren and sparsely vegetated areas of steep cliff faces, narrow canyons, smaller rock outcrops of various igneous, sedimentary, serpentinite, and metamorphic bedrock. This group also includes unstable scree and talus slopes typically occurring below cliff faces (Hall and Evans 2014).
Riparian				
Valley oak woodland	**State Rarity:** S3 **Global Rarity:** G3	*Quercus lobata* is dominant or co-dominant in the tree canopy *with Acer negundo, Alnus rhombifolia, Fraxinus latifolia, Juglans hindsii, Juglans hindsii × regia, Platanus racemosa, Populus fremontii, Quercus agrifolia, Quercus douglasii, Quercus kelloggii, Quercus wislizeni, Salix gooddingii* and *Salix lasiolepis*. Shrubs and lianas may include *Vitis californica.*	Trees < 30 m tall; canopy is open to continuous. Shrub layer is open to intermittent. Herbaceous layer may be grassy.	Valley bottoms, lower slopes, summit valleys. Soils are alluvial or residual. The USFWS Wetland Inventory (2012 national list) recognizes *Quercus lobata* as a facultative upland plant. Elevation: 0–775 m.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Fremont cottonwood woodland	**State Rarity:** S3.2 **Global Rarity:** G4	*Populus fremontii* is dominant or co-dominant in the tree canopy with *Acer negundo, Baccharis sergiloides, Fraxinus latifolia, Fraxinus velutina, Juglans hindsii, Juglans hindsii × regia, Platanus racemosa, Quercus agrifolia, Salix exigua, Salix gooddingii, Salix laevigata, Salix lasiolepis, Salix lucida* ssp. *lasiandra* and *Salix lutea*.	Trees < 25 m; canopy is continuous to open. Shrub layer is intermittent to open. Herbaceous layer is variable.	On floodplains, along low-gradient rivers, perennial or seasonally intermittent streams, springs, in alluvial fans, and in valleys with a dependable subsurface water supply that varies considerably during the year. The USFWS Wetland Inventory (1996 national list) recognizes *Populus fremontii* as a facultative wetland plant. Elevation: 0–2400 m.
California sycamore woodland	**State Rarity:** S3 **Global Rarity:** G3	*Platanus racemosa* and/or *Quercus agrifolia* is dominant or co-dominant in the tree canopy in riparian habitats with *Alnus rhombifolia*, *Juglans californica, Populus fremontii, Quercus lobata, Salix exigua, Salix gooddingii, Salix laevigata, Salix lasiolepis, Salix lutea, Schinus molle* and *Umbellularia californica*.	Trees < 35 m; canopy is open to intermittent. Shrub layer is open to intermittent. Herbaceous layer is sparse or grassy.	Gullies, intermittent streams, springs, seeps, stream banks, and terraces adjacent to floodplains that are subject to high-intensity flooding. Soils are rocky or cobbly alluvium with permanent moisture at depth. The USFWS Wetland Inventory (1996) recognizes *Platanus racemosa* as a facultative wetland plant. Elevation: 0–2400 m.
California coffee berry – western azalea scrub – Brewer's willow	**State Rarity:** S3 **Global Rarity:** G3	*Frangula californica, Rhododendron occidentale* and/or *Salix breweri* is dominant or co-dominant in the shrub canopy with *Baccharis pilularis, Calycanthus occidentalis, Corylus cornuta, Frangula purshiana, Garrya veatchii, Heteromeles arbutifolia, Hoita macrostachya, Malus fusca, Oemleria cerasiformis, Prunus virginiana, Quercus durata, Rubus parviflorus* and/or *Tamarix* spp. Emergent trees may be present at low cover, including *Abies grandis, Alnus rubra, Hesperocyparis sargentii, Picea sitchensis, Pseudotsuga menziesii, Quercus agrifolia, Quercus chrysolepis,* or *Umbellularia californica*.	Shrubs < 6 m; canopy is intermittent to continuous and one or two tiered. Herbaceous layer is sparse to abundant.	Seeps, springs, concave slopes, drainages, hill slopes with high water tables. Soils are moist or seasonally saturated sedimentary and serpentine substrates. The USFWS Wetland Inventory (1996 national list) recognizes *Rhododendron occidentale* and *Salix breweri* as facultative plants. Elevation: 0–2700 m.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Goodding's willow – red willow riparian woodland	**State Rarity:** S3 **Global Rarity:** G4	*Salix gooddingii* and/or *Salix laevigata* is dominant or co-dominant in the tree or shrub canopy with *Acer negundo, Aesculus californica, Alnus rhombifolia, Calocedrus decurrens, Fraxinus latifolia, Pinus sabiniana, Platanus racemosa, Populus fremontii, Quercus agrifolia, Quercus chrysolepis, Quercus lobata, Salix lucida* var. *lasiandra* or *Washingtonia filifera.* Shrubs include *Baccharis salicifolia, Cornus sericea, Rosa californica, Rubus armeniacus, Salix exigua, Salix lasiolepis* or *Sambucus nigra*.	Trees < 30 m; canopy is open to continuous. Shrub layer is sparse to continuous. Herbaceous layer is variable.	Terraces along large rivers, canyons, along floodplains of streams, seeps, springs, ditches, floodplains, lake edges, low-gradient depositions. The USFWS Wetland Inventory (1996 national list) recognizes *Salix gooddingii* as a facultative wetland plant and does not list *Salix laevigata*. The 2012 national list *Salix gooddingii* as a facultative wetland, obligate plant and *Salix laevigata* as a facultative wetland plant. Elevation 0-2000 m.
Sandbar willow thickets	**State Rarity:** S4.2 **Global Rarity:** G5	*Salix exigua* is dominant or co-dominant in the shrub canopy with *Baccharis* spp., *Brickellia californica, Rosa californica, Rubus armeniacus, Rubus ursinus, Salix lasiolepis* and *Salix melanopsis*. Emergent trees of many different species may be present at low cover.	Shrubs < 7 m; canopy is intermittent to continuous. Herbaceous layer is variable.	Temporarily flooded floodplains, depositions along rivers and streams, and at springs. The USFWS Wetland Inventory (1996 national list) recognizes *Salix exigua* as a facultative wetland plant. Elevation: 0–2700 m.
Blue elderberry stands	**State Rarity:** S3 **Global Rarity:** G3	*Sambucus nigra* is dominant in the shrub canopy, often occurring with R*ubus armeniacus, R. ursinus, Rosa californica*, and *Salix exigua*. Emergent *Fraxinus latifolia* may be present (Buck-Diaz et al. 2012).	The shrub canopy is open to continuous, and the herbaceous layer is variable and usually grassy.	Stands are often found in riparian areas, including banks and terraces along streams. Elevation: 0–155 m.
Riparian woodland (alliance unspecified)	**State Rarity:** N/A **Global Rarity:** N/A	This type of riparian woodland was not mapped to alliance. Characteristics of riparian woodland (alliance unspecified) are likely represented by one or more of the riparian alliances mapped in the RCIS Area and described in this table.	N/A	N/A
Mulefat thickets	**State Rarity:** S4 **Global Rarity:** G4	*Baccharis salicifolia* is dominant or co-dominant in the shrub canopy with *Artemisia californica, Baccharis emoryi, Baccharis pilularis, Malosma laurina, Nicotiana glauca, Pluchea sericea, Rubus* spp., *Salix exigua, Salix lasiolepis, Sambucus nigra* and *Tamarix* spp. Emergent trees may be present at low cover, including *Platanus racemosa, Populus fremontii, Quercus* spp. or *Salix* spp.	Shrubs < 5 m; canopy is continuous with two tiers at < 2 and at < 5 m. Herbaceous layer is sparse.	Floodplains, irrigation ditches, lake margins, stream channels. Soils are mixed alluvium. The USFWS Wetland Inventory (1996 national list) recognizes *Baccharis salicifolia* as a facultative wetland plant. Elevation: 0–1250 m.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Tamarisk thickets	**State Rarity:** SNA **Global Rarity:** GNA	*Tamarix ramosissima* or another *Tamarix* species is dominant in the shrub canopy. Emergent trees may be present at low cover, including *Populus fremontii* or *Salix* spp.	Shrubs < 8 m; canopy is continuous or open. Herbaceous layer is sparse.	Arroyo margins, lake margins, ditches, washes, rivers, and other watercourses. The USFWS Wetland Inventory (1996 national list) recognizes *Tamarix parviflora* and *T. ramosissima* as a facultative plant. Elevation: 75–800 m.
Himalayan blackberry - rattlebox - edible fig riparian scrub	**State Rarity:** SNR **Global Rarity:** GNR	*Ficus carica* or *Rubus armeniacus* is dominant or co-dominant in the shrub canopy. Emergent trees may be present at low cover, including *Alnus rhombifolia*, *Populus fremontii*, *Quercus lobata*, *Quercus wislizeni*, or *Salix laevigata*.	Shrubs to small trees < 10 m; canopy is intermittent to continuous. Herbaceous layer is open to intermittent.	Pastures, forest plantations, roadsides, streamsides, river flats, floodplains, fence lines, mesic disturbed areas, and right-of-way corridors. The USFWS Wetland Inventory (2012 national list) recognizes *Rubus armeniacus* as a facultative+ plant and *Ficus carica* as a facultative upland plant. Elevation: 0–1600 m.
Wetland				
Baltic and Mexican rush marshes	**State Rarity:** S4 **Global Rarity:** G5	*Juncus balticus* is dominant or co-dominant in the herbaceous layer with *Achillea millefolium*, *Bromus diandrus*, *Carex* spp., *Conium maculatum*, *Deschampsia cespitosa*, *Distichlis spicata*, *Lepidium latifolium*, *Sporobolus airoides*, and *Taraxacum officinale*. Emergent trees and shrubs may be present at low cover.	Herbs < 1 m; cover is intermittent to continuous.	Wet and mesic meadows; along stream banks, rivers, lakes, ponds, fens, and sloughs; and freshwater, brackish, and alkaline marshes. Soils are poorly drained, often with a thick, organic layer. The USFWS Wetland Inventory (2012 national list) recognizes *Juncus balticus* as facultative wetland plants. Elevation: 0–2200 m.
Californian warm temperate marsh/seep	**State Rarity:** N/A **Global Rarity:** N/A	This wetland group was not mapped to alliance. Characteristics of California warm temperate marsh/seep are likely represented by one or more of the wetland alliances mapped in the RCIS Area and described in this table. This group also includes alliances such as *Equisetum* (*arvense*, *variegatum*, *hyemale*), *Leymus cinereus - Leymus triticoides Mimulus* (*guttaus*), and *Muhlenbergia rigens*		Characteristics of California warm temperate marsh/seep are likely represented by one or more of the wetland alliances mapped in the RCIS Area and described in this table.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Cattail marshes	**State Rarity:** S5 **Global Rarity:** G5	*Typha angustifolia, Typha domingensis* or *Typha latifolia* is dominant or co-dominant in the herbaceous layer with *Agrostis stolonifera, Argentina egedii, Cyperus* spp., *Distichlis spicata, Echinochloa crus-galli, Eleocharis macrostachya, Equisetum telmateia, Juncus* spp., *Lemna minuta, Lepidium latifolium, Oenanthe sarmentosa, Persicaria lapathifolia, Persicaria punctata, Phragmites australis, Schoenoplectus americanus, Schoenoplectus californicus*, *Typha ×glauca* and *Xanthium strumarium*. Emergent trees may be present at low cover, including *Salix* spp.	Herbs < 1.5 m; cover is intermittent to continuous.	Semi-permanently flooded freshwater or brackish marshes. Soils are clayey or silty. The USFWS Wetland Inventory (1996 national list) recognizes *Typha angustifolia, T. domingensis*, and *T. latifolia* as obligate plants. Elevation: 0–350 m.
Common and giant reed marshes	**State Rarity:** SNR **Global Rarity:** GNR	*Arundo donax* or *Phragmites australis* is dominant in the herbaceous layer with *Ambrosia psilostachya, Anemopsis californica, Distichlis spicata, Juncus arcticus, Juncus cooperi, Lepidium latifolium, Schoenoplectus acutus, Schoenoplectus americanus, Schoenoplectus californicus, Typha* spp. and *Xanthium strumarium*. Emergent trees may be present at low cover, including *Populus fremontii* or *Salix* spp. Emergent shrubs may be present, including *Baccharis douglasii, Baccharis salicifolia* or *Cephalanthus occidentalis*.	Herbs < 8 m; cover is continuous.	Riparian areas, along low-gradient streams and ditches. Semi-permanently flooded and slightly brackish marshes, impoundments. The USFWS Wetland Inventory (2012 national list) recognizes Phragmites australis and *Arundo donax* as facultative wetland plants. Elevation: 0–1600 m.
Duckweed blooms	**State Rarity:** S4? **Global Rarity:** G5	*Lemna* spp., *Spirodela* spp., *Wolffia* spp. or *Wolffiella* spp. are dominant herbs on the water surface or characteristically present in the herbaceous layer *with Azolla filiculoides, Azolla mexicana* and *Egeria densa*. Emergent plants may be present at low cover, *including Myriophyllum aquaticum* or *Scirpus* spp.	Herbs 0.3-8mm in size; cover is intermittent to continuous	Seasonal and perennial freshwater habitats with still water or on ground surfaces after water levels have dropped. The USFWS Wetland Inventory (1996 national list) recognizes *Lemna aequinoctialis, L. minor, L. trisulca, Spirodela polyrrhiza, S. punctata, Wolffia globosa, Wolffiella lingulata2-83*, and *W. oblonga* as obligate plants. Elevation: 0–2300 m.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Hardstem and California bulrush marshes	**State Rarity:** S3 **Global Rarity:** GNR	*Schoenoplectus acutus* and/or *Schoenoplectus californicus* is dominant or co-dominant in the herbaceous layer with *Apocynum cannabinum, Azolla filiculoides, Bolboschoenus maritimus, Calystegia sepium, Eichhornia crassipes, Euthamia occidentalis, Hibiscus lasiocarpos, Hoita macrostachya, Hydrocotyle ranunculoides, Leersia oryzoides, Ludwigia peploides, Lycopus americanus, Persicaria punctata, Phragmites australis, Sparganium eurycarpum, Triglochin* spp., *Typha angustifolia, Typha domingensis, Typha latifolia* and *Urtica dioica*. Emergent trees and shrubs may be present at low cover, including trees *Alnus rhombifolia, Populus fremontii* or *Salix gooddingii* and shrubs: *Cephalanthus occidentalis, Rosa californica, Rubus armeniacus, Salix exigua* and *Salix lasiolepis.*	Herbs < 4 m; cover is intermittent to continuous.	Brackish to freshwater marshes; along stream shores, bars, and channels of river mouth estuaries; around ponds and lakes; in sloughs, swamps, and roadside ditches. Soils have a high organic content and are poorly aerated. The USFWS Wetland Inventory (2012 national list) recognizes *Schoenoplectus acutus* and *Schoenoplectus californicus* as obligate plants. Elevation: 0–2500 m.
Mosquito fern mats	**State Rarity:** S5 **Global Rarity:** G5	*Azolla filiculoides* or *Azolla microphylla* is dominant floating on the water surface or characteristically present in the herbaceous layer with *Egeria densa, Lemna minor, Spirodela polyrrhiza, Wolffia borealis* and *Wolffiella lingulata*. Emergent plants may be present at low to high cover, including *Ludwigia peploides* or *Myriophyllum aquaticum*.	Herbs 0.3-8 mm in size; cover is open to continuous.	Seasonal and perennial freshwater habitats with still or slow-moving water or on ground surfaces after water levels have dropped. The USFWS Wetland Inventory (1996 national list) recognizes *Azolla filiculoides and A. microphylla* as obligate plants. Elevation: 0–2300 m.
Water primrose wetlands	**State Rarity:** SNR **Global Rarity:** GNR	*Eichhornia crassipes, Ludwigia hexapetala, Ludwigia peploides* ssp. *montevidensis* or other Ludwigia species are dominant as emergent or floating plants on the water surface. *Azolla filiculoides.*	Herbs < 3 m; cover is open to continuous.	Permanently and seasonally flooded freshwater habitats with still water or on ground surfaces after water levels have dropped. The USFWS Wetland Inventory (1996 national list) recognizes *Ludwigia peploides* ssp. *montevidensis, L. palustris, and L. repens* as obligate plants. Elevation: 0-150 m.

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Wet meadow	**State Rarity: N/A** **Global Rarity: N/A**	*Carex,Danthonia, Juncus, Salix*, and/or *Scirpus* are dominant. Important grass and grass-like species *include Agrostis pallens, Carex abrupta, Carex utriculate, Carex nebrascensis, Deschampsia cespitosa, Eleocharis acicularis, Eleocharis quinqueflora, Eleocharis* spp., *Juncus balticus, Juncus nevadensis, Juncus xiphioides, Muhlenbergia filiformis,* and *Scirpus microcarpus*. Important forbs include *Oreostemma alpigenum, Primula jeffreyi, Marsilea vestita, Oenothera* spp., *Mimulus* spp, *Oxypolis occidentalis, Bistorta bistortoides, Trifolium wormskioldii*, and *Viola macloskeyi*. *Salix sp.* is the only shrub found in much abundance (Ratliff 1988).	Shrub or tree layers are usually absent or very sparse; they may, however, be an important feature of the meadow edge. Within the herbaceous plant community, a microstructure is frequently present. Some species reach heights of only a few centimeters while others may grow a meter or more tall. Except where broken by boulders, canopy cover is dense (60–100%) (Ratliff 1988).	Occur where water is at or near the surface most of the growing season, following spring runoff. Elevation above 1200 m (Ratliff 1988).
Naturalized warm-temperate riparian and wetland	**State Rarity: N/A** **Global Rarity: N/A**	This naturalized wetland group was not mapped to alliance. *Lepidium latifolium* dominates in the herbaceous layer. *Distichlis spicata* is commonly present and may be classified as Lepidium latifolium semi-natural alliance or *Distichlis spicata* alliance, respectively.	Herbaceous layer, generally < 2 m. Emergent trees and shrubs may be present at low cover.	Intermittently and seasonally flooded freshwater and brackish marshes and riparian corridors. In alkaline or saline settings.
Open water				
Lacustrine/ riverine	**State Rarity: N/A** **Global Rarity: N/A**	Submerged plants such as algae and pondweeds. As sedimentation and accumulation of organic matter increases toward the shore, floating rooted aquatics such as water lilies and smartweeds often appear. Water moss and heavily branched filamentous algae are held to rocks by strong holdfasts and align with the current. Emergent vegetation grows along riverbanks, and duckweed floats on the surface (Grenfell 1988).	Emergent vegetation may be present in shallow areas (Grenfell 1988).	Lacustrine habitats may occur in association with any terrestrial habitats, Riverine and Fresh Emergent Wetlands. Riverine habitats can occur in association with riparian habitats, which are found adjacent to many rivers and streams. Riverine habitats are also found contiguous to lacustrine and fresh emergent wetland habitats (Grenfell 1988).

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat
Agriculture				
Alfalfa	**N/A**	Comprised of fields grown in alfalfa and alfalfa mixtures.	N/A	N/A
Field crop	**N/A**	Comprised of beans, cole crops, corn, sorghum, Sudan, cotton, lettuce/leafy greens, melons, squash, cucumbers, onions, garlic, peppers, safflower, strawberries, tomatoes, and other truck crops.	N/A	N/A
Grain and hay	**N/A**	Comprised of wheat and miscellaneous grain, hay, grasses.	N/A	N/A
Pasture	**N/A**	Comprised of mixed pasture.	N/A	N/A
Fallow	**N/A**	Land not cropped during the 2016 crop season.	N/A	N/A
Orchard and vineyard	**N/A**	Comprised of almonds, applies, avocado, bush berries, cherries, citrus, grapes, kiwis, olives, peaches/nectarines, pears, pistachios, plums, prunes, apricots, pomegranates, walnuts, young perennials, and miscellaneous deciduous and subtropical fruits.	N/A	N/A
Developed agriculture	**N/A**	Developed lands within the agricultural landscape not mapped in the Statewide Agricultural Land Use, 2016 dataset, including areas between fields, agricultural infrastructure, and roads within agricultural lands.	N/A	N/A
Barren				
Barren	**N/A**	Barren gravel, sand, bare ground, ground covered by riverwash such as cobbles, gravels, or sand bars.	N/A	N/A
Urban				
Urban	**N/A**	Ground covered by urban landscapes such as houses, other buildings, roads.	N/A	N/A

Kaweah RCIS Land Cover Types	Status	Characteristic Species	Vegetation Layers	Habitat

State Ranking

S1 — Critically Imperiled - Critically imperiled in the state because of extreme rarity (often 5 or fewer populations) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.

S2 — Imperiled - Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.

S3 — Vulnerable - Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the state.

S4 — Apparently Secure - Uncommon but not rare in the state; some cause for long-term concern due to declines or other factors.

S5 — Secure - Common, widespread, and abundant in the state.

SNR — Unranked - State conservation status not yet assessed.

Threat Ranks

.1 – Seriously endangered in California.
.2 – Fairly endangered in California.
.3 – Not very endangered in California.
* Presumed extirpated.
? Uncertain about distribution or identity.
?* Uncertain about distribution but presumed extirpated if once present.
(?) Occurrence confirmed, but possibly extirpated.

Global Ranking

G1 — Critically Imperiled: At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2 — Imperiled: At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 — Vulnerable: At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

G4 — Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 — Demonstrably Secure: Common; widespread and abundant.

GNR — Unranked – Global conservation status not yet assessed.

Notes

[a] Tucker oak chaparral is generally distributed in the foothills and mountains of the interior Coast Ranges, the Transverse Ranges, and Tehachapi Mountains between 300–1500 m elevation (California Native Plant Society 2021). The small patch mapped as Tucker oak chaparral may be incorrectly mapped by the Great Valley Ecoregion Vegetation dataset; its presence should be confirmed by on-the-ground surveys.

Plant Species Indicator Category Definitions

Category	Definition
Obligate	Plants that almost always occur in wetlands (estimated probability > 99%) under natural conditions.
Facultative Wetland	Plants that usually occur in wetlands (estimated probability 67 to 99%) but are occasionally found in non-wetland areas.
Facultative	Plants that are equally likely to occur in wetlands or non-wetlands (estimated probability 33 to 67%).
Facultative Upland	Plants that usually occur in non-wetlands (estimated probability 67 to 99%).
Upland	Plants that almost always occur in non-wetlands (estimated probability > 99%) under natural conditions.

Source: California Native Plant Society (2021).

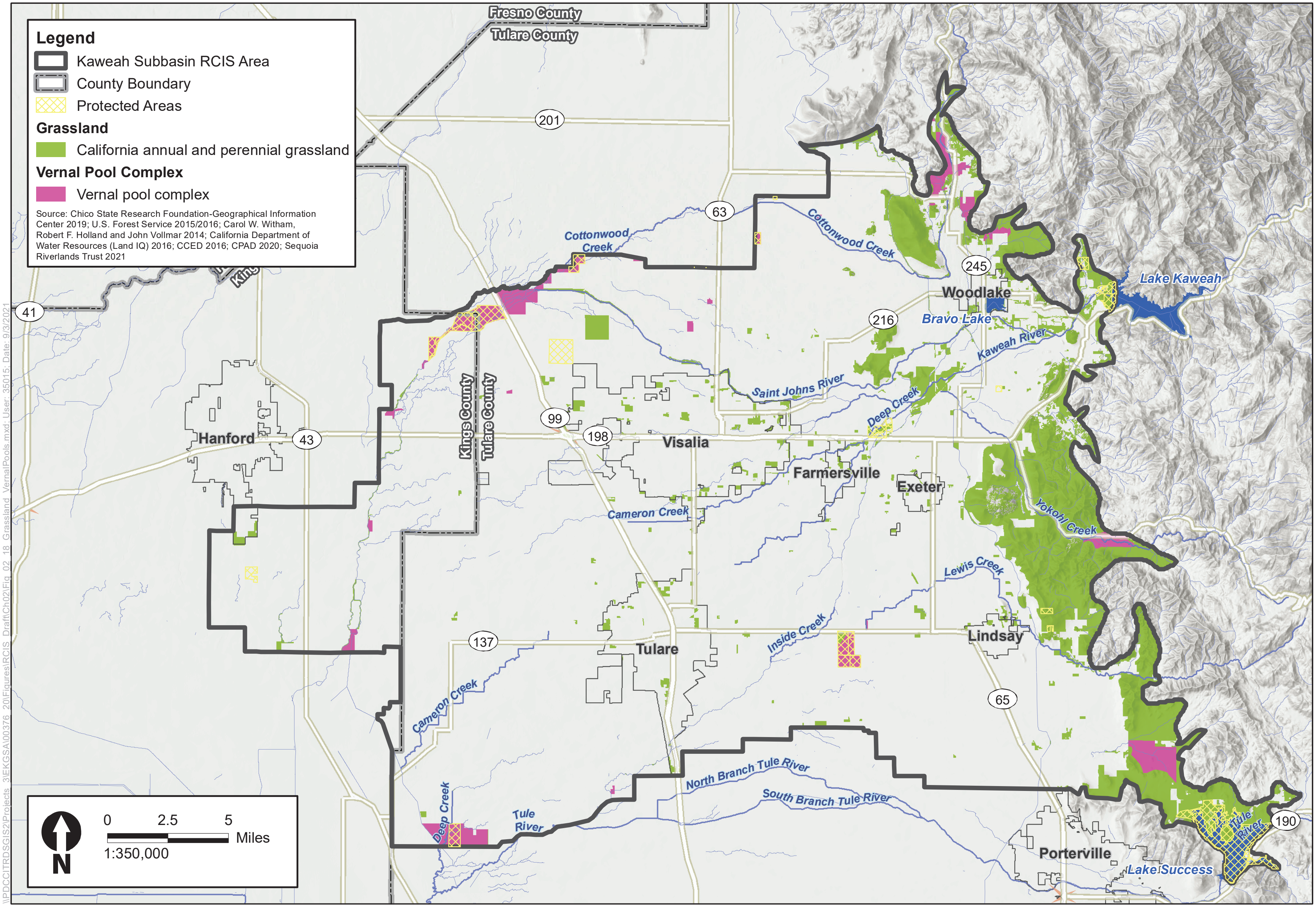

Figure 2-18
Grasslands and Vernal Pool Complex Communities

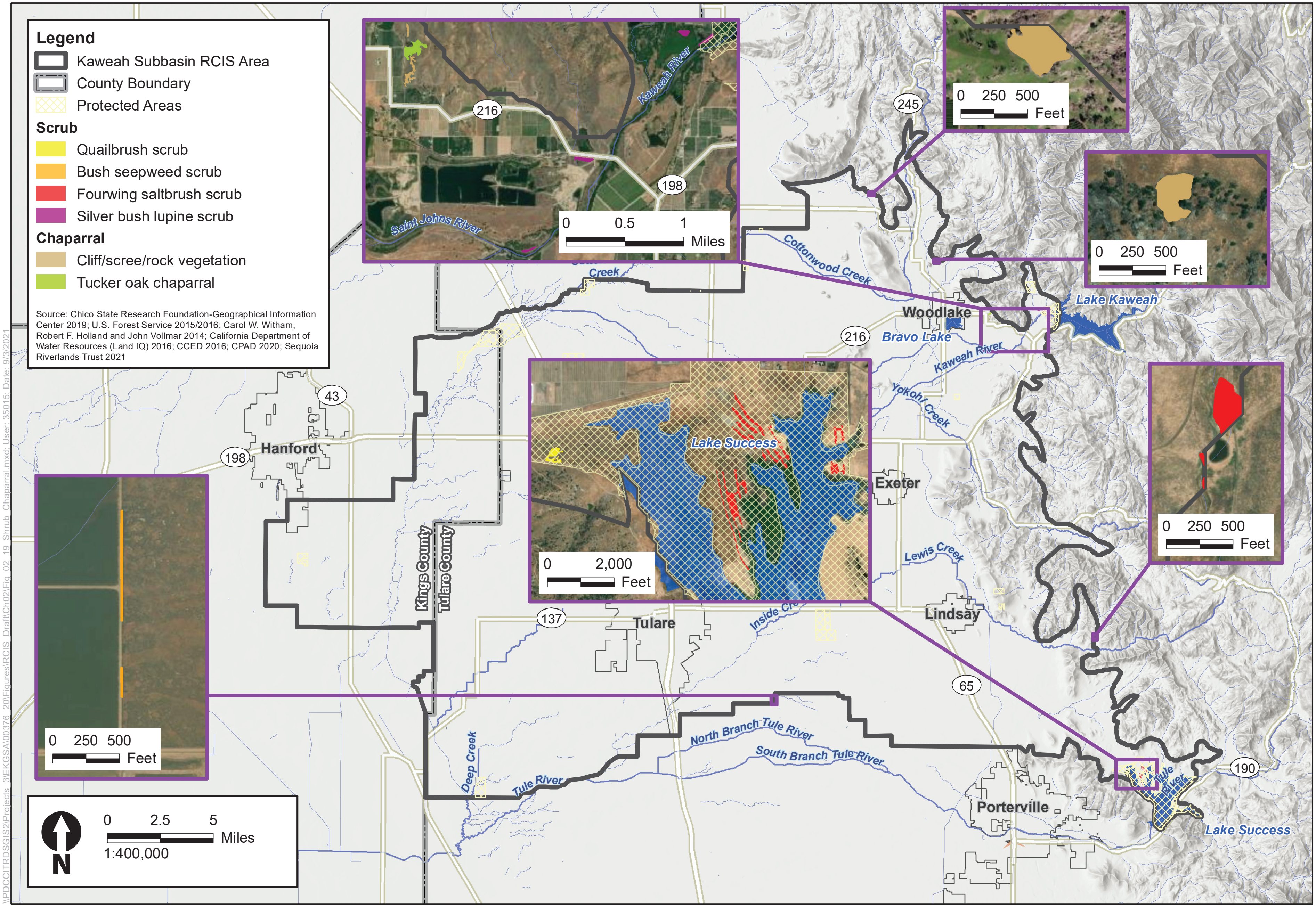

Figure 2-19
Scrub and Chaparral Communities

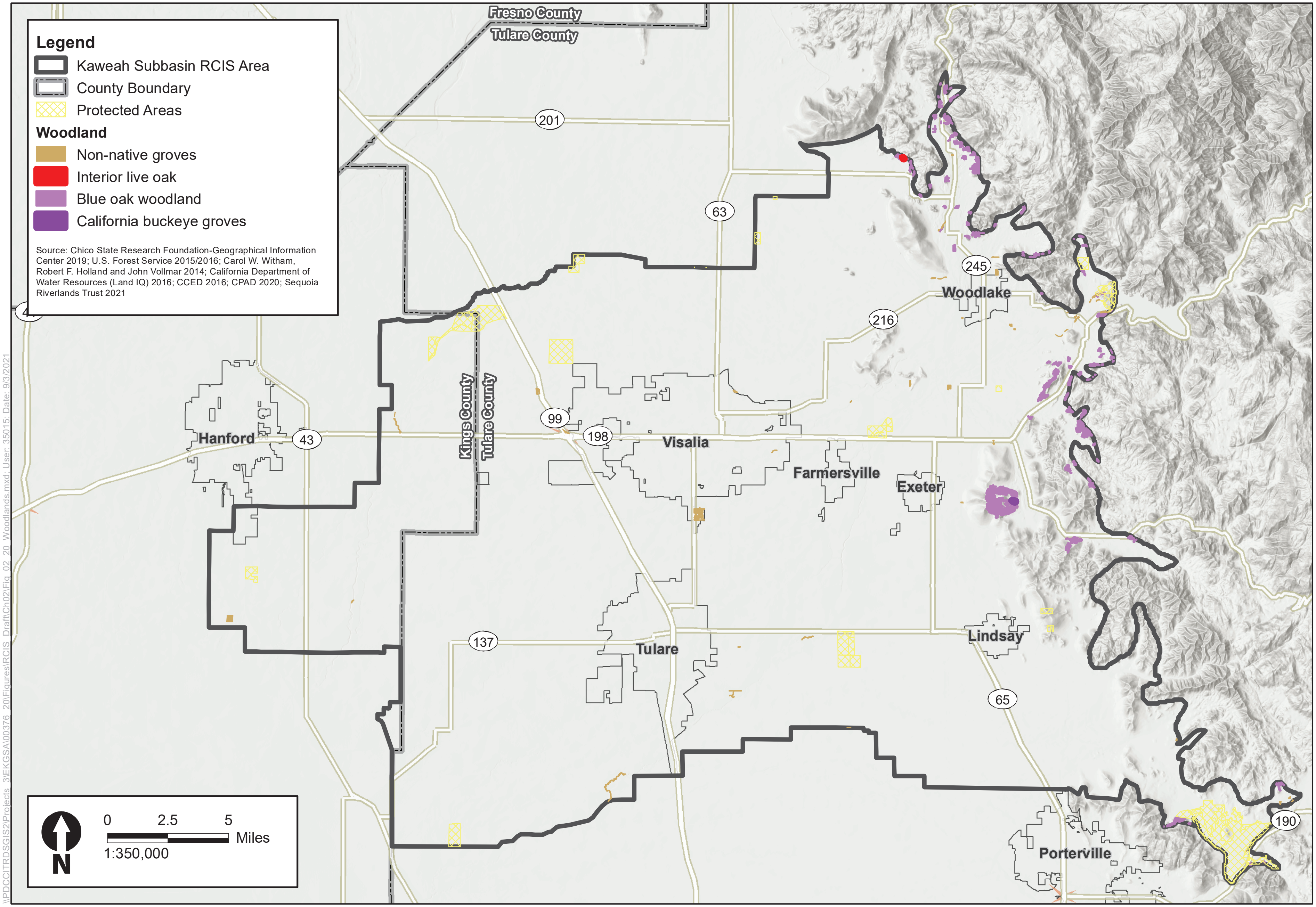

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Figure 2-20
Woodland Communities

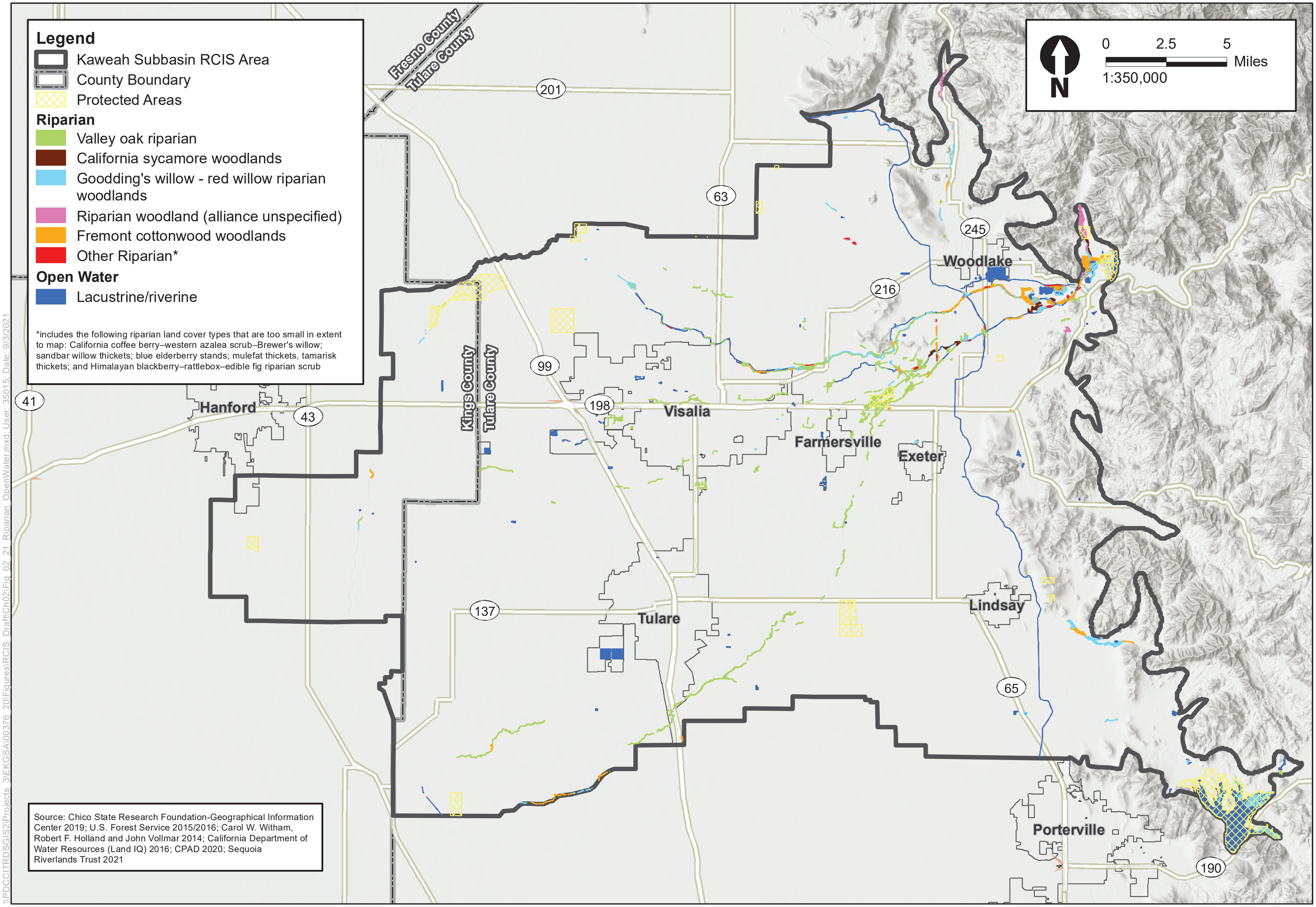


Figure 2-21
Riparian and Open Water Communities

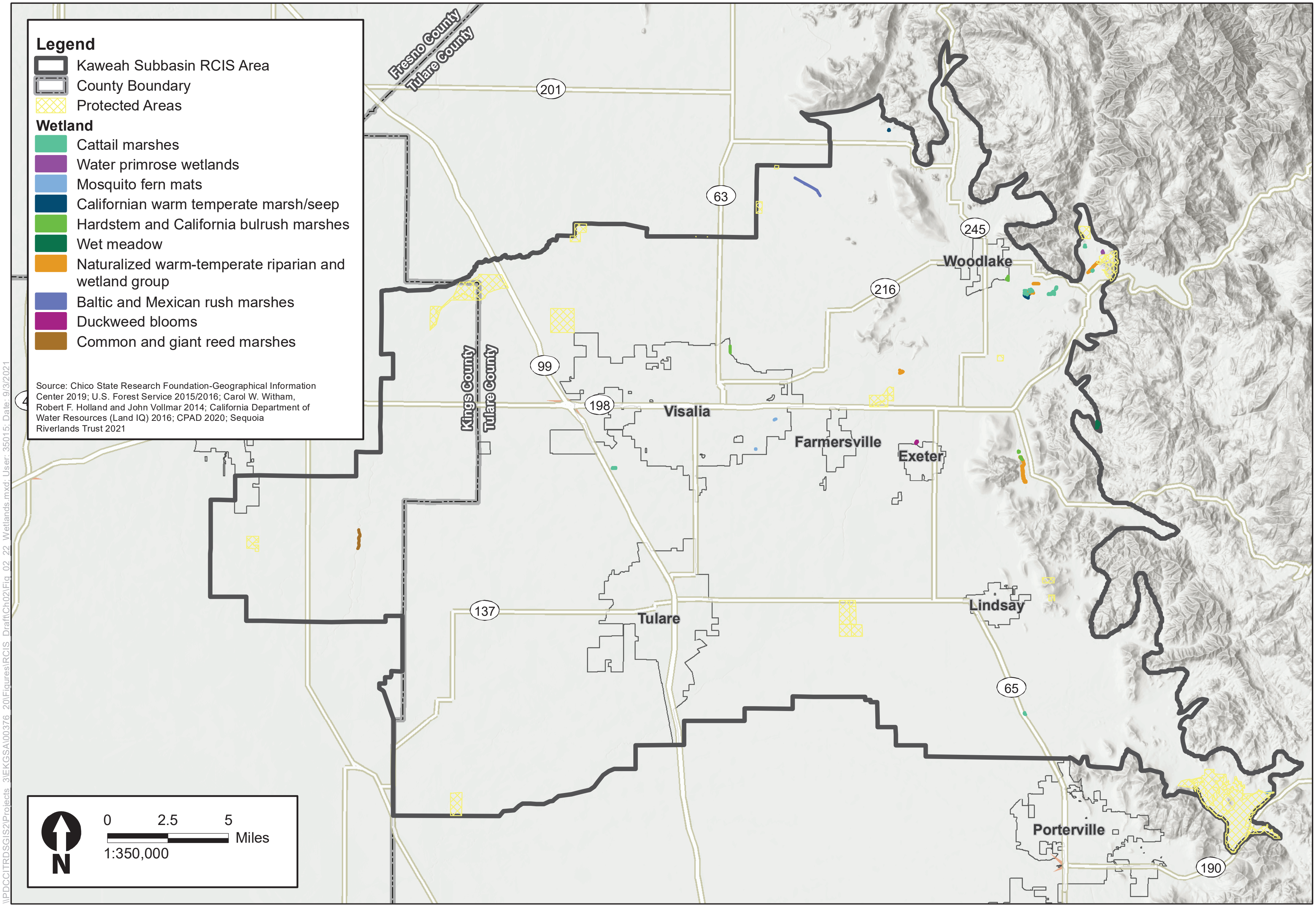


Figure 2-22
Wetland Communities

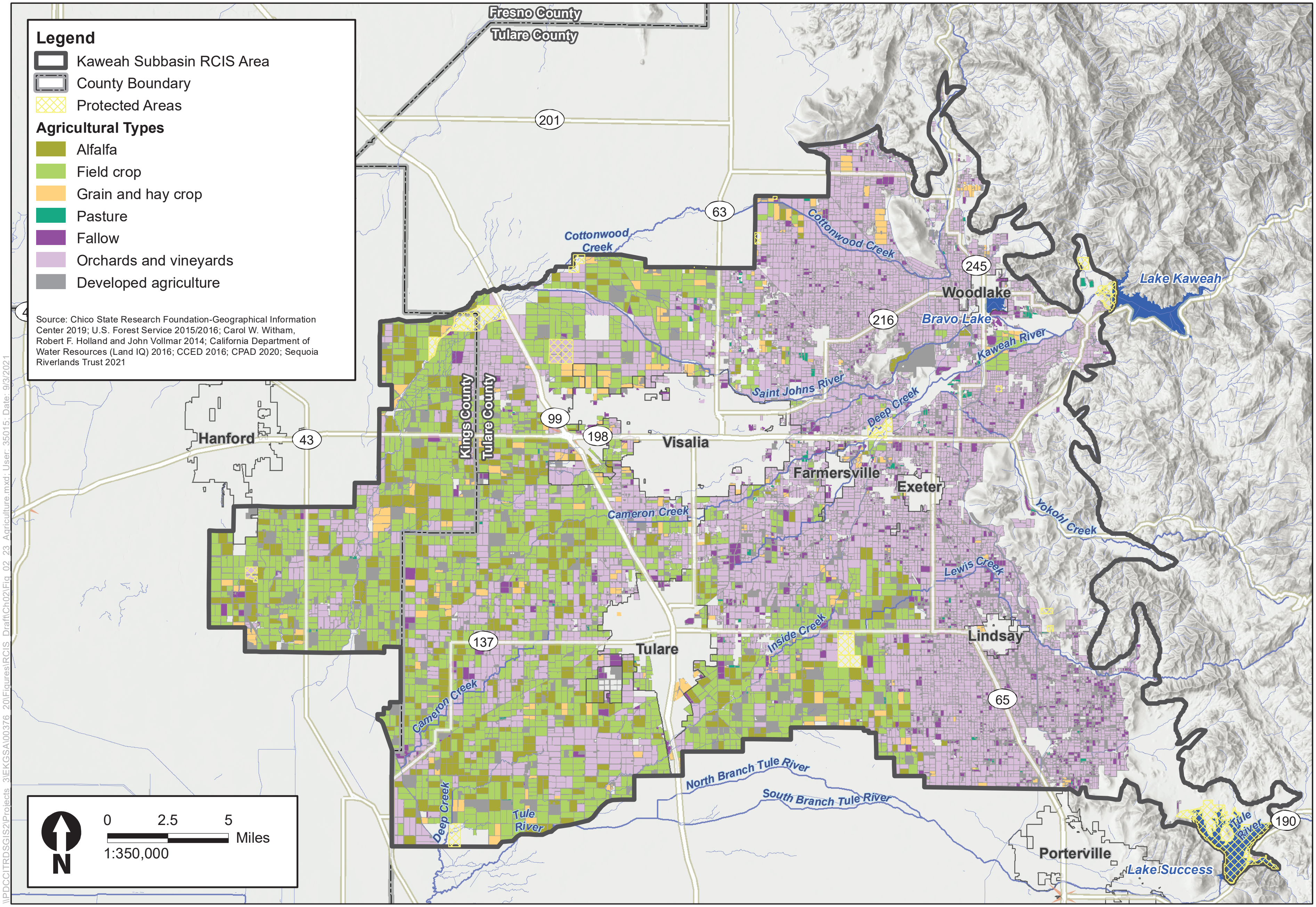


Figure 2-23
Agricultural Types

2.3.9 Working Landscapes

Farmland

Agriculture is the major land use in the Kaweah RCIS Area and an important part of the cultural and scenic landscape. Agricultural lands provide Tulare County's most visible source of open space lands. As such, the Tulare County General Plan 2030 Update envisions the protection of agricultural lands and continued growth and production of agriculture industries as essential to all Tulare County residents (County of Tulare 2012). Similarly, the 2035 Kings County General Plan Land Use Objective B1.1 is to "preserve the integrity of the County's agricultural land resources through agricultural land use designations and other long-term preservation policies" (County of Kings 2010).

Approximately 355,651acres of land in the RCIS Area (75%) is utilized for cultivated, irrigated, agricultural production; 67% of the RCIS Area is designated as Prime Farmland and Farmland of Statewide Importance (Table 2-9; Figure 2-4). Water is supplied to agriculture via diversion of Subbasin surface water, by groundwater pumping, and through import from other regions via Friant CVP supplies. Small areas in the western portion of the RCIS Area may get water from Pine Flat via the Kings River or possibly State Water Project supplies.

Tulare County is ranked as the 3rd leading agricultural production county in California (California Department of Food and Agriculture 2020), providing food and fiber to more than 96 countries throughout the world. In 2019, the total gross value of Tulare County's agricultural production from harvested cropland was $7,505,352,100 (Tulare County 2020). Tulare County's agricultural strength is based on a diversity of crops, with more than 120 different commodities produced in 2019 (Tulare County 2019). Leading commodities in 2019, in dollar value, were milk, navel oranges, table grapes, and cattle and calves (California Department of Food and Agriculture 2020).

Kings County is ranked as the 8th leading agricultural production county in California (California Department of Food and Agriculture 2020). Approximately 11% of the RCIS Area is in Kings County, and most of this area is under agricultural production (i.e., approximately 49,770 acres or 95% of the land in Kings County in the RCIS Area) (Figures 2-4 and 2-23). Field crops comprise most of the farmland landscape (24,661 acres), followed by alfalfa (8,495 acres), and orchards and vineyards (6,705 acres). In Kings County as a whole, the gross value of agricultural production in 2019 was $2,187,693,000. Leading commodities in 2019, in dollar value, were milk, almonds, cotton (Pima), and pistachios (California Department of Food and Agriculture 2020).

San Joaquin Valley working lands, including those within the RCIS Area, provide important habitat for native birds and other wildlife. Some native bird species utilize agricultural lands for cover, forage, reproduction, and dispersal, including focal species such as Swainson's hawk and tricolored blackbird (Central Valley Joint Venture 2006, Golet et al. 2018, Reynolds et al. 2017). Farmland can provide movement corridors for wildlife species such as black-tailed deer, bobcat, San Joaquin kit fox, and American badger depending on crop type and farming practices (i.e., if farms are fenced, wildlife-friendly fences can be used to reduce barriers to wildlife movement through farmland), where it abuts natural open spaces. Farmland is often bisected by streams and creeks, which can provide riparian habitat for a variety of songbirds, raptors, amphibians, and reptiles (Section 2.3.10, *Habitat Connectivity*). Wildlife also use these aquatic features and adjacent upland habitat as movement corridors.

Working landscapes provide several ecosystem services, including water supply, groundwater recharge, regulation of soil and water quality, carbon sequestration, and climate change stabilization (Power 2010, Shaffer and Thompson 2015, U.S. Department of Agriculture 2018). Working landscapes maintain water supply in the RCIS Area through human-made infrastructure, such as dams, reservoirs, and canals, as well as through functioning watersheds and managed aquifers. Typically, small aquatic channels on farmlands provide little benefit to native wildlife; however, if vegetation is allowed to grow in these systems (such as freshwater emergent vegetation), there may be some potential benefits to species that might occur or use these channels.

Working lands also sequester carbon. In contrast to developed lands, for example, the per-acre emission for California's farms are an average of 58 times lower than those from its urban areas (Shaffer and Thompson 2015). The amount of carbon sequestered depends on crop types grown and land management actions (e.g., rangeland soil amendments), among other factors (Kroodsma and Field 2006, Silver et al. 2018).

Rangeland

Rangeland, as mapped as grazing land by the California Department of Conservation FMMP[16] (California Department of Conservation 2018) is predominantly located in the eastern portion of the RCIS Area, particularly north and northeast of Woodlake, southeast of Ivanhoe, west of Lemon Cove, east of Exeter and Lindsay, and east and southeast of Strathmore (Figure 2-4). Smaller patches of rangeland are also located in Kings County, north of Highway 198.

Within the RCIS Area in Tulare County, rangeland makes up 33,170 acres (California Department of Conservation 2018). Non-prime farmland in the valley floor of Tulare County is generally grazing land (County of Tulare 2012). In Tulare County in 2019, 111,000 acres of irrigated pasture and rangeland, 615,000 acres of native pasture, and 54,400 acres of other classified pasture generated an annual income of approximately $58,267,000 (County of Tulare 2020). As of 2019, in Kings County, there are 337,568 acres of rangeland (pasture range), which generated an annual income of $4,338,000 (County of Kings 2020). Within the RCIS Area in Kings County, there are 1,982 acres of rangeland (California Department of Conservation 2018). Rangelands can provide ecosystem services such as habitat and movement corridors for wildlife (Hunting 2003, Jantz et al. 2007, Hobbs et al. 2008), carbon sequestration (Schuman et al. 2002, Derner and Schuman 2007), nutrient cycling, groundwater recharge (Havstad et al. 2007), and food production (Jones and Donnelly 2004, Murray et al. 2012). Rangelands provide habitat for grassland and vernal pool species such as vernal pool fairy shrimp and western spadefoot. Furthermore, the economic viability of rangelands helps to secure the ecosystem services provided by livestock grazing and prevents rangeland conversion to land uses with lower ecological values (e.g., urban development) (Huntsinger and Oviedo 2014, Byrd et al. 2015). The annual grasslands and oak woodlands used as rangelands in the RCIS Area evolved under the influence of prehistoric herbivores—including herds of deer, elk, pronghorn, and other grazing animals—and without competition from nonnative annuals, which currently dominate much of the region. In the absence of these large native herbivores, appropriate livestock grazing of cattle, sheep, and goats is a valuable range management tool, used to manage infestations of invasive plants, promote populations of native plants and animals, and reduce wildfire fuel loads (Marty 2005, Pyke and Marty 2005, Bartolome et al. 2014).

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

Livestock grazing is the most widespread land management practice in the world, affecting 70% of the land surface of the western United States (Krausman et al. 2009). Grazing reduces the amount of accumulated plant litter, thereby favoring native plant establishment and growth and enhancing the overall composition of native plant communities. Nonnative annual grasses and herbs tend to rapidly monopolize landscapes and can inhibit the germination of seeds and growth of native species through the capture of water and mineral resources and the physical and chemical effects of accumulated plant litter (Bartolome et al. 2014). Moderate levels of grazing are generally ideal for maintaining and enhancing native vegetation by reducing competition from more aggressive, nonnative annual plants. Moderate grazing can also improve conditions for focal species by reducing dense ground cover, which can impede movement and decrease populations of burrowing rodents, which create burrows used by other species and also serve as a prey source for some focal species (e.g., burrowing owl, San Joaquin kit fox, and Swainson's hawk) (Ford et al. 2013, Bartolome et al. 2014). Specific grazing practices in any given location should be selected based on site-specific goals.

Williamson Act Lands

Williamson Act contracts are voluntary contracts between landowners and local governments to restrict development on parcels used for agriculture and related open space functions for a minimum term of 10 years, or 20 years if the land is enrolled in a Farmland Security Zone contract. Williamson Act contract terms automatically renew on the anniversary date, meaning the actual term can be indefinite. However, they may be cancelled by either the landowner or local government entity at the end of each term by filing a Notice of Non-Renewal, thus phasing out the contract over a 9-year (or 19-year for Farmland Security Zone contracts) period; contracts can also be cancelled immediately at any time with payment of a substantial fee.

After withdrawal of the state's funding support for Williamson Act contracts, Tulare County enacted a moratorium on new Williamson Act contracts in 2009 and also halted the automatic renewal of contracts on non-prime agricultural land. Assembly Bill 1265 provided a temporary funding stream to support the Williamson Act program between 2011-2016 and allowed counties to recoup some of the lost property tax revenue from existing contracts. In July 2020, the Tulare County Board of Supervisors passed a resolution reinstating the program and began accepting applications for new Williamson Act contracts. Williamson Act contracts provide temporary protection over 244,569 acres of land in Tulare County, and 49,445 acres of land in Kings County in the RCIS Area (Figure 2-24).[17]

The future status of funding for the Williamson Act program remains uncertain after the sunsetting of Assembly Bill 1265 although Tulare County is currently accepting new contracts. The Kings County Board of Supervisors determines on an annual basis if the County will continue the program.

[17] Sources: Tulare County parcel data (County of Tulare 2019) and Kings County parcel data (County of Kings 2018).

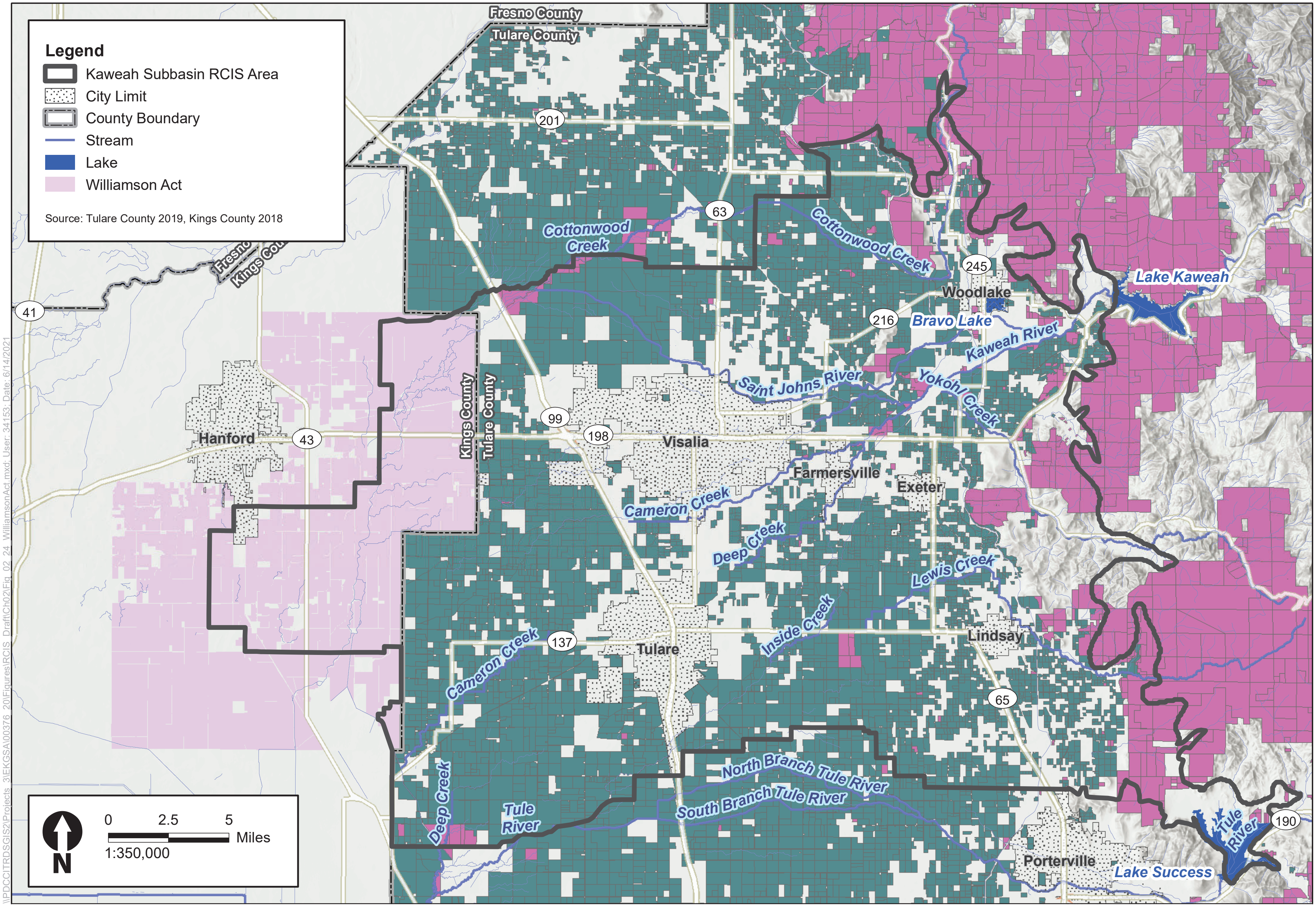


Figure 2-24
Williamson Act Lands

2.3.10 Habitat Connectivity

Habitat connectivity is the capacity of habitat to facilitate the movement of species and ecological functions. Movement is essential for wildlife to find mates, seasonal habitat, shelter, and food, and can facilitate adaption to climate change by allowing access to new areas as habitats shift with changing climatic conditions. Many species also need to be able to move beyond their natal ranges to find and establish new territories. An interconnected landscape can help to maintain ecosystem services such as pollination of crops and the flow of genes that helps to maintain biodiversity (Mitchell et al. 2013). Movement is essential to gene flow and increases the likelihood of long-term persistence of plant and wildlife populations. When populations are isolated in habitat patches, and individuals are unable to move through the landscape to other habitat patches and populations, populations are more susceptible to reduced genetic diversity (and associated deleterious effects), localized loss of habitat, disease, and ultimately extirpation.

Although effects will vary for different species, landscape features can influence the ability of plants and wildlife to move at a range of scales. Human development and associated barriers, land cover types, and rugged topography can all limit movement through an area. Furthermore, as climate change alters habitats, animals and plants will be under increasing pressure to disperse to new areas to adapt to the changing environment. In fragmented habitats such as the RCIS Area, wildlife is at higher risk of being struck by vehicles, getting stuck in fences, or coming into conflict with humans as animals attempt to cross roads and other anthropogenic barriers to reach suitable habitat. The ability of wildlife to move across the landscape will become increasingly threatened without concerted efforts to maintain habitat connectivity and increase permeability across the landscape.

California Essential Habitat Connectivity Project

The California Essential Habitat Connectivity Project (CEHCP) (Spencer et al. 2010) is a statewide assessment of large, intact blocks of natural habitat or natural landscape that support native biodiversity and modeled linkages or essential connections between them that need to be maintained as corridors for wildlife. CEHCP is intended to inform infrastructure planning and conservation investments statewide, as a means to improve connectivity for ecosystems and organisms. CEHCP can be used to inform location of conservation actions to improve landscape connectivity.

The CEHCP used a GIS-based modeling approach to create a statewide wildlife habitat connectivity map and to identify the biological value of connectivity areas. CEHCP identified natural landscape blocks, which include a combination of protected areas and other areas with intact natural communities at low risk of conversion to non-natural communities over time. Essential connectivity areas connect natural landscape blocks; small natural areas tend to be more isolated in the landscape. Natural landscape blocks (> 2,000 acres in the Great Central Valley ecoregion and > 10,000 in the Southern Sierra Nevada) are expected to provide opportunities for focal species and non-focal species to respond to climate change stress by preserving large blocks of habitat and habitat linkage areas that will allow movement and dispersal toward more suitable habitat as the climate changes over time. Habitat connectivity provides protection for ecological processes that support natural communities and species' habitat.

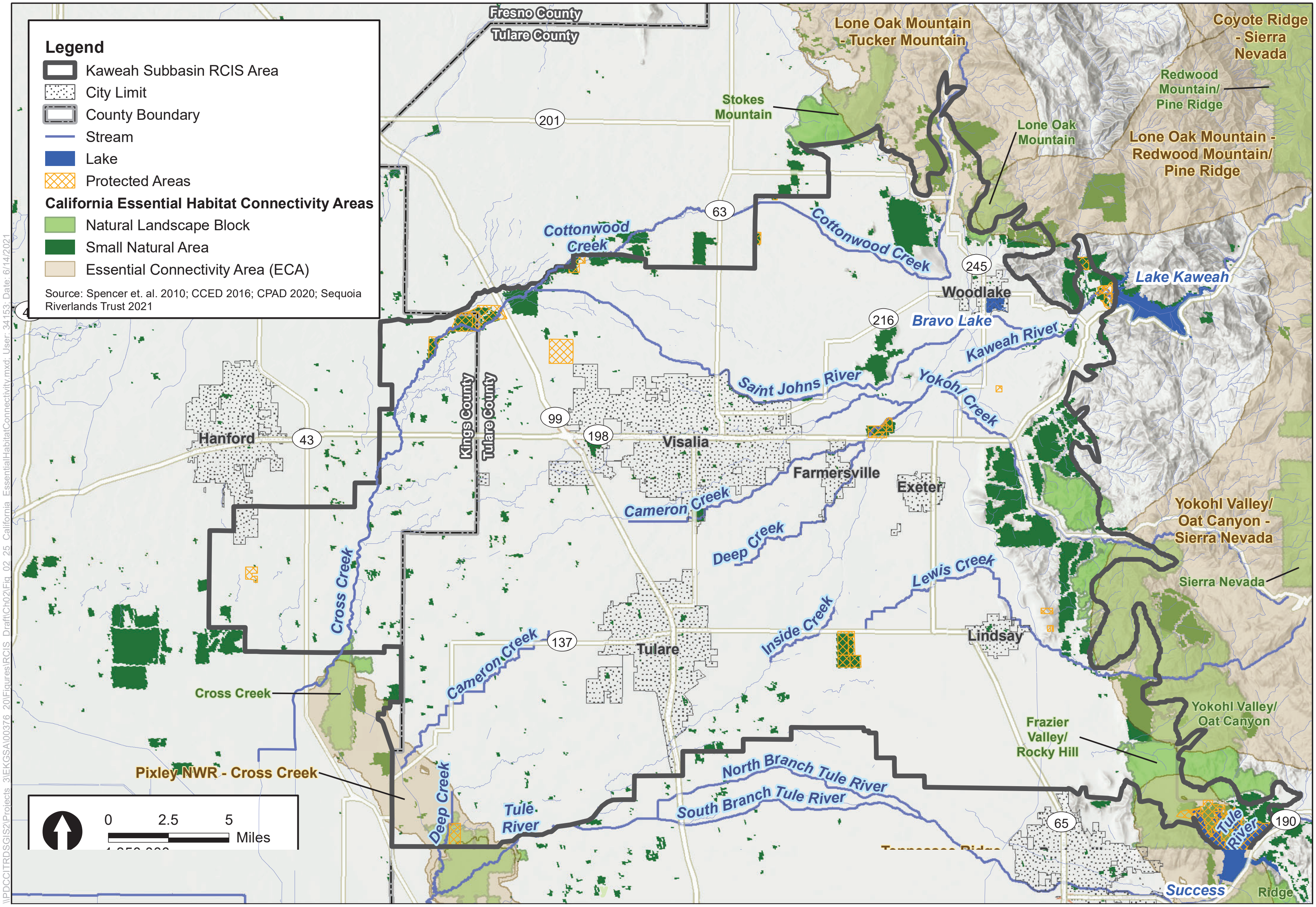
Natural landscape blocks in the RCIS Area are mostly restricted to the foothill margins of the Central Valley and tend to be isolated on hillside slopes and terraces (Spencer et al. 2010) (Figure 2-25). The foothill margins are dominated by annual grasslands and are of modest ecological value due to extensive cover of nonnative vegetation (Spencer et al. 2010). Small natural areas are interspersed throughout the RCIS Area, often associated with, or near to waterways. These small natural areas are isolated due to habitat conversion and fragmentation.

Permeability refers to the ease with which wildlife can move across landscapes. For example, wildlife is assumed by CEHCP to move more easily through natural lands and across protected habitats managed for ecological values than human-modified lands (e.g., major highways or developed residential areas). Although CEHCP assumes that natural lands are more permeable than human-modified lands, agricultural landscapes are comparatively more permeable than developed areas, and provide some level of connectivity to natural landscape blocks within the RCIS Area. Figure 2-26 shows the permeability of the essential connectivity areas, as modeled by CEHCP (Spencer et al. 2010).

CDFW's Areas of Conservation Emphasis (ACE) v.3 terrestrial connectivity dataset (California Department of Fish and Wildlife 2020b). builds upon the CEHCP by mapping corridors and linkages in relation to the blocks of natural habitat, includes regional scale linkage information, and incorporates species-specific information, where available. The analysis determined which natural landscape blocks to connect and modeled least-cost-path corridors to identify essential connectivity areas (Figure 2-27). ACE v.3 developed a scoring system to rank the connectivity potential of an area. Rankings are as follows.

1. **Limited Connectivity Opportunities.** These are areas where current land use may limit options for providing connectivity or no connectivity importance has been identified in models.
2. **Large Natural Habitat Areas**. These are areas where large blocks of natural habitat (greater than 2,000 acres) exist, and their connectivity is generally intact.
3. **Connections with Implementation Flexibility.** These are areas that have connectivity importance, but at this time have not been identified as species corridors or habitat linkages; this rank is fluid and may change depending on changes in the surrounding land use or regional specific information that is developed.
4. **Conservation Planning Linkages.** These are the habitat connectivity linkages mapped in the CEHCP and in fine-scale regional connectivity studies.
5. **Irreplaceable and Essential Corridors.** These are areas identified as priority species movement corridors and includes channelized areas (i.e., areas where surrounding land use and barriers are expected to funnel, or concentrate, animal movement); channelized areas may represent connections between two areas, making them high priority for conservation.

CDFW's ACE v.3 terrestrial connectivity dataset generally identifies the majority of the RCIS Area west of the foothills as having limited terrestrial connectivity opportunities (Figure 2-27) (California Department of Fish and Wildlife 2020b). Terrestrial connectivity improves in the eastern portion of the RCIS Area; these areas are identified as conservation planning linkages due to the presence of nearby large, contiguous natural areas and wildlife movement corridors. In the southwestern corner of the RCIS Area, riparian areas provide some terrestrial connectivity and are ranked as connections with implementation flexibility and potential conservation planning linkages to areas outside of the RCIS boundary.



ICF

Figure 2-25
California Essential Habitat Connectivity Areas

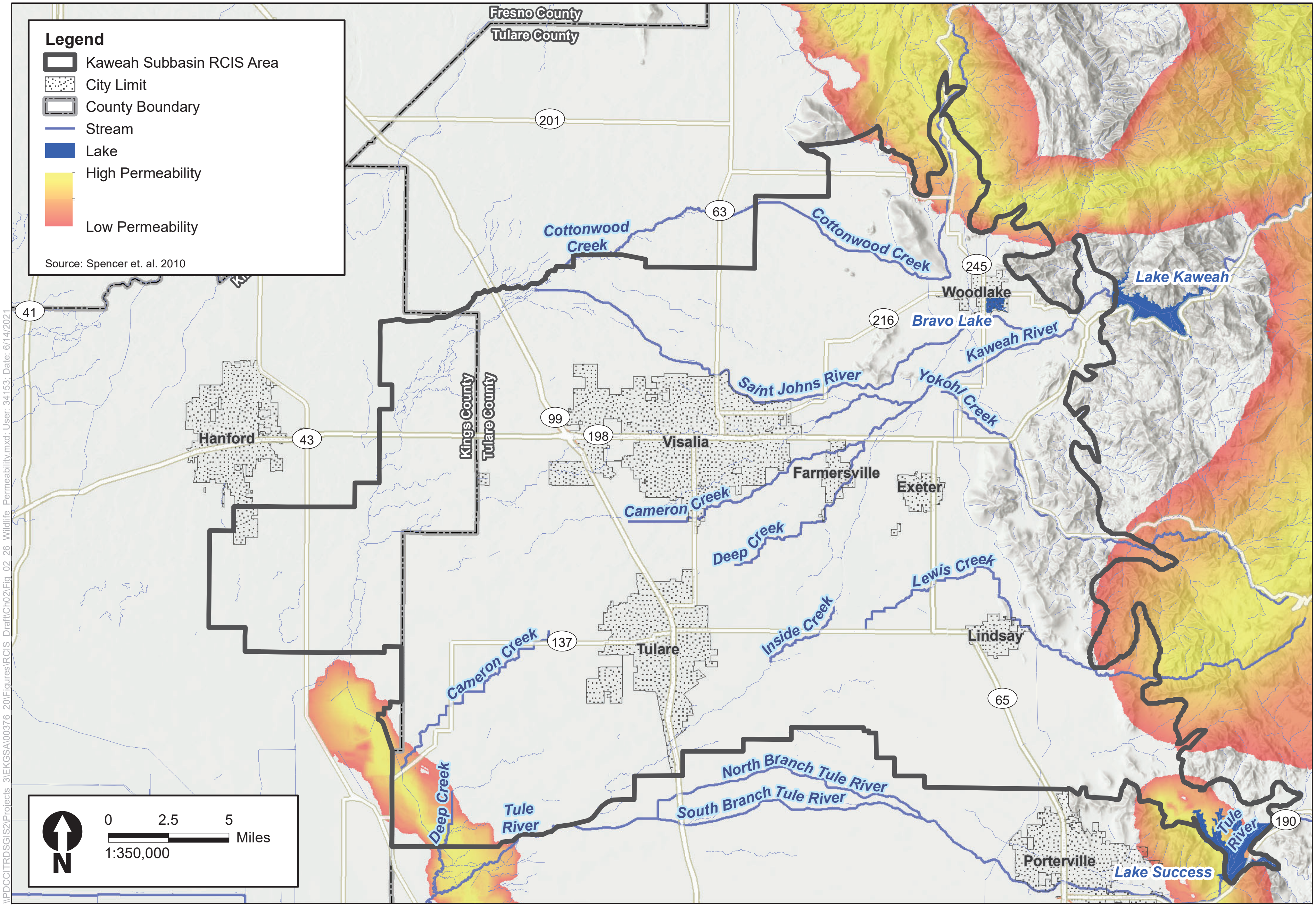


Figure 2-26
Wildlife Permeability within Essential Connectivitiy Areas

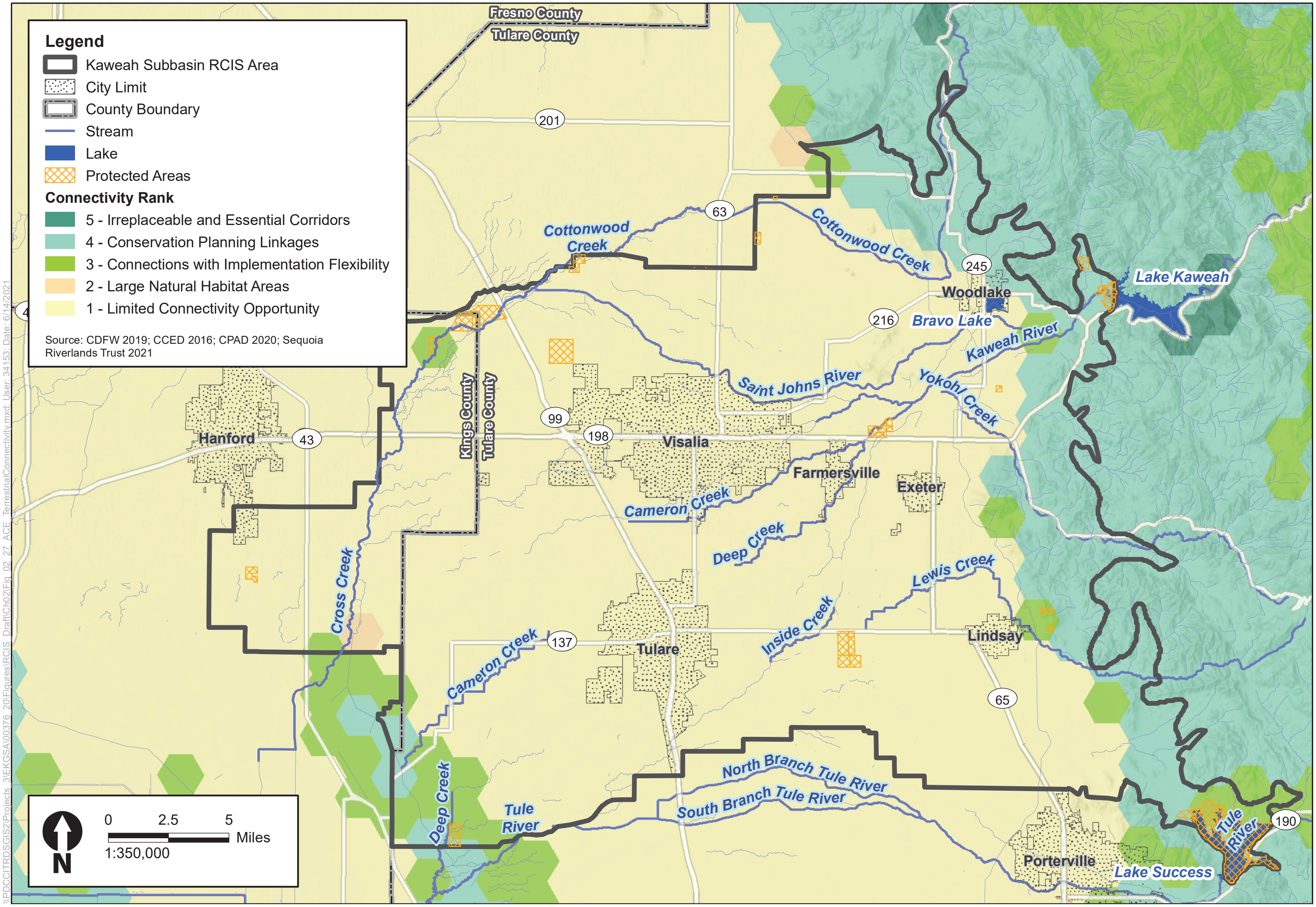


Figure 2-27
Areas of Conservation Emphasis v.3 Terrestrial Connectivity

Stream and Riparian Connectivity

Large expanses of the Central Valley, including the RCIS Area, lack significant natural blocks or Essential Connectivity Areas, limiting the opportunities for maintaining or enhancing cross-valley connectivity using natural upland vegetation (Spencer et al. 2010). Thus, the remaining stream and riparian corridors, in addition to Essential Connectivity Areas, are critical in connecting remaining natural areas in the Central Valley and the RCIS Area.

Streams and associated riparian habitat play important roles as corridors connecting terrestrial and aquatic habitats within and beyond the RCIS Area, connecting aquatic habitats upstream and downstream, and as transition zones between stream channels, floodplains, and upland habitats. Stream and riparian corridors of the RCIS Area provide connectivity that spans elevation gradients and can provide corridors for wildlife to move upslope in response to a changing climate and shifting habitat conditions. Stream and riparian ecosystems also promote ecological processes, including transport of water, groundwater recharge, and sediment and nutrient transport (Spencer et al. 2010). Streams and riparian areas are biodiverse ecosystems, and provide habitat for a number of focal species, including habitat for western pond turtle and nesting habitat for Swainson's hawk. As such, the CEHCP considers riparian corridors as critical in connecting natural areas and stresses the importance of riparian and riverine restoration projects to restore lost connections (Spencer et al. 2010).

The Tulare Basin Watershed Partnership (TBWP) visited accessible land along riparian corridors within the Tulare Basin to assess which corridors are most important to wildlife and provide the greatest array of compatible land uses (Tulare Basin Watershed Partnership 2019). TBWP selected 16 riparian and wildlife corridors for detailed analysis and identified conservation opportunities and provided conservation recommendations. Three of the riparian and wildlife corridors evaluated in the report intersect or partially intersect with the RCIS Area. The following is adapted from TBWP's *Tulare Basin Conservation Report Summary: Tulare Basin Riparian and Wildlife Corridors* (Tulare Basin Watershed Partnership 2019).

- **Cottonwood Creek–Cross Creek Riparian Corridor** is located along the northwestern edge of the RCIS Area. This 41-mile-long creek corridor flows from northwest of Woodlake to southwest of Corcoran where the creek ends. The nearly contiguous corridor of relatively unaltered natural lands extends from the Sierra Nevada foothills to the Tulare Lakebed. This corridor includes an important complex of vernal pools, grassland, and alkali sink.
    - ***Opportunities and Recommendations***. Protect a regionally significant expanse of open space just northwest of Visalia. There is an opportunity to maintain a portion of the landscape as it appeared prior to European settlement. Grassland and vernal pools could be conserved or used as mitigation lands for development elsewhere.
- **Oaks to Tule Riparian Corridor** bisects the middle portion of the RCIS Area. The corridor extends 40 miles from Terminus Dam on the Kaweah Reservoir in the Sierra Nevada foothills to Creighton Ranch in the Tulare Basin. This corridor includes protected land in the upstream portion of the corridor; high-quality riparian habitat near Terminus Dam; and several stretches of protected land along the corridor. Riparian vegetation is nearly continuous along the entire corridor from the Kaweah Reservoir to the Kings County line.
    - ***Opportunities and Recommendations.*** This corridor provides groundwater recharge, flood control, and wetland and riparian habitat. The corridor provides recreation opportunities

such as hiking, bicycling, and an equestrian trail with a rural experience close to urban areas.

- **Lewis Creek Riparian Corridor** runs 8 miles from the headwaters in the Sierra Nevada foothills to the eastern outskirts of Lindsay. The lower 4 miles contain the most valuable riparian habitat of the corridor. This stretch of riparian habitat supports a high percentage of native vegetation, extensive riparian understory, and low proportion of invasive weeds. This corridor contains some of the highest quality Fremont cottonwood-willow habitat in Tulare County. The lower portion of the watershed is bordered primarily by citrus orchards, pasture, and farms.
    - ***Opportunities and Recommendations.*** Protect riparian habitat. Riparian habitat could be conserved or used as mitigation lands for development elsewhere. Provide access to the public to take advantage of the excellent opportunities for recreation, education, and wildlife viewing.

Other analyses highlight the importance of the creek and riparian ecosystems of the RCIS Area. CDFW's ACE v.3 Aquatic Irreplaceability ranking scale (California Department of Fish and Wildlife 2020c) is a measure of uniqueness of habitat areas for aquatic species in the landscape and represents the relative importance of each watershed based on the uniqueness of the habitat for rare and endemic aquatic species. Aquatic Irreplaceability rankings range on a scale from 1 to 5, from least to most irreplaceable. Watersheds with high irreplaceability (i.e., a ranking of 5) contain species or habitat conditions that occur in few places in the landscape and thus are of high conservation value. Within the RCIS Area, Cottonwood Creek has an Aquatic Irreplaceability ranking of 4 (Figure 2-28). Portions of the Saint Johns and Kaweah Rivers in the GKGSA are also ranked a 4. Smaller creeks that flow southwest from Woodlake through Visalia toward the MKGSA and Cameron Creek are ranked slightly lower, as a 3.

Using existing information about wildlife corridors, including datasets from the Endangered Species Recovery Program and the Information Center for the Environment, CDFW, Caltrans, and the California Department of Parks and Recreation identified potential wildlife corridors in the San Joaquin Valley (California Natural Resources Agency 2015). Similar to CEHCP, the potential wildlife corridors that were identified are primarily along riparian areas and connect conservation opportunity areas (California Department of Transportation 2020). Within the RCIS Area a potential wildlife corridor is identified north of Visalia at Cottonwood Creek, southwest along Cross Creek, Mosquito Creek, portions of Highline and Lakewind Canals. A smaller corridor in the north-south axis starts from Bates Slough (southwest of Tulare), bisects Cameron Creek Packwood Creek, and Mill Creek, and crosses Saint Johns River (California Department of Fish and Wildlife 2020d).

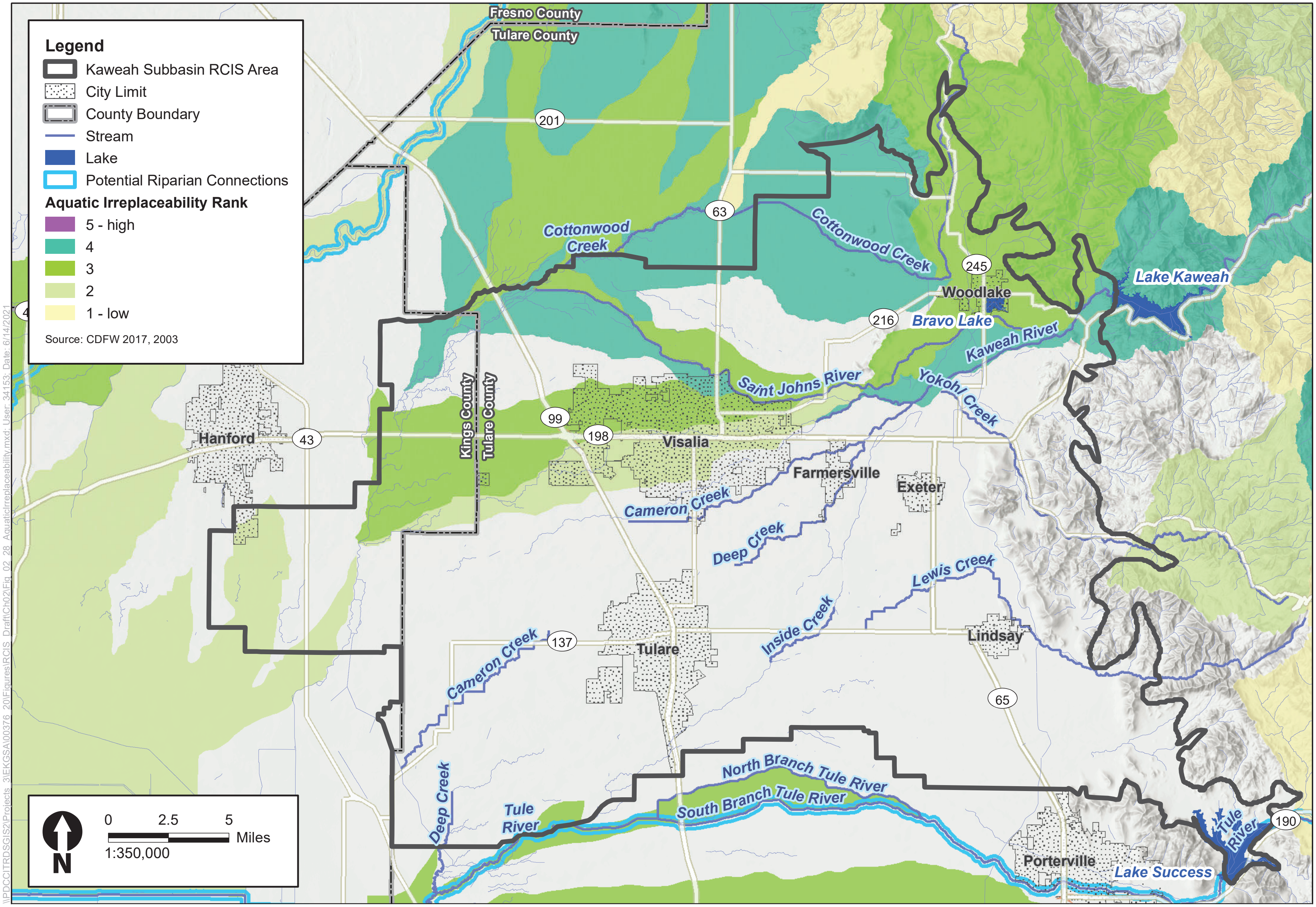


Figure 2-28
Aquatic Irreplaceability

Wildlife Movement and Habitat Connectivity

The California Wildlife Barriers 2020 dataset and report (California Department of Fish and Wildlife 2020e) represents CDFW's initial effort to identify priority wildlife movement barriers across the state. CDFW identified 61 individual priority linear infrastructure segments as barriers to wildlife movement statewide. Of the top priorities, 58 involve the State Highway System (e.g., interstate, highway or state route). One road, one railway, and one canal location were also identified, collectively representing 610 linear miles total.

No high-priority wildlife movement barriers were identified in the RCIS Area; however, a significant movement barrier was identified in southwest Tulare County, east of Alpaugh and west of Highway 43. The barrier (ID W035) is identified as the CHSR Alpaugh segment and is a wildlife movement barrier for San Joaquin kit fox, blunt-nosed leopard lizard, Tipton kangaroo rat, and San Joaquin antelope squirrel. This barrier could affect regional wildlife movement within the Tulare Basin, including the RCIS Area.

2.3.11 Focal Species

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

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

The Steering Committee selected focal species and non-focal species within the context of how the Kaweah RCIS conservation strategy is structured. The conservation actions and priorities of the RCIS, including land protection, enhancement, and restoration, are described and addressed hierarchically. At the highest level, the RCIS addresses groundwater sustainability, natural communities, working landscapes, and habitat connectivity.

Focal species and non-focal species are addressed at the level below groundwater sustainability, natural communities, working landscapes, and habitat connectivity. The Kaweah RCIS conservation strategy is designed so that focal species would benefit from multibenefit groundwater sustainability projects; conservation or habitat enhancement actions that protect, enhance or restore natural communities or working lands; and conservation or habitat enhancement actions that improve landscape connectivity .

Non-focal species are typically included in an RCIS if a species has potential mitigation needs (i.e., CESA or federal ESA listed species) in the RCIS Area and the species' conservation needs would be addressed by implementing conservation or habitat enhancement actions for focal species, natural communities, landscape connectivity, or other conservation elements addressed in an RCIS.

The hierarchical structure of the conservation strategy is intended to provide for the conservation needs of the native biodiversity representative of the Kaweah Subbasin, so that species not included as focal species will benefit from the conservation strategies for focal species and the other conservation elements.

2.3.11.1 Selection Process

The Program Guidelines require that the focal species list "consist of a range of species with conservation needs within the RCIS Area and should include federal- and state-listed species, wide-ranging species (e.g., species that move across landscapes), climate-vulnerable species, and species representative of major taxonomic groups." Focal species must also be native to the region.

For a species to be considered for credits in an MCA, it must be included in an RCIS. Focal species do not need to be restricted to species with anticipated mitigation needs, however, and can be common species in order to expand the breadth of an RCIS to address conservation needs in the RCIS Area more comprehensively. Types of species are summarized below.

- **Listed species** include federal- or state-listed species, candidates for listing, and California Fully-Protected species. The Program Guidelines recommend that the focal species list include listed species that are most representative of the major and unique natural community types in the RCIS Area.
- **Wide-ranging species** are those that require contiguous blocks of habitat and represent the general wildlife and habitat connectivity needs in the RCIS Area.
- **Climate-vulnerable species** are those listed in CDFW's State Wildlife Action Plan (SWAP) as climate-vulnerable Species of Greatest Conservation Need (California Department of Fish and Wildlife 2015).
- **Taxonomic group representatives** are species that represent the following major taxonomic groups: plants, invertebrates, amphibians, reptiles, birds, and mammals.

A two-step process was used to select the focal and non-focal species for this Kaweah RCIS to be consistent with Program Guideline requirements and to identify species that the Steering Committee considered important to address in this RCIS: (1) identify potential focal species, and (2) apply screening criteria. Each step is described in more detail below.

Step 1. Identify Potential Focal Species

A comprehensive list was compiled of native species that occur or may occur in the RCIS Area that qualify as listed species, wide-ranging species, climate-vulnerable species, and are representative of the major taxonomic groups, as described above.

This potential focal species list (Appendix D, *Evaluation of Species for Inclusion as Focal Species*) was compiled by consulting publicly available sources to identify species that could occur in the RCIS Area and might be in need of conservation investments and advance mitigation. The list includes those taxa identified by the Tulare Basin Watershed Partnership as special-status species in the Tulare Basin (Tulare Basin Wildlife Partners 2010); taxa identified as Species of Greatest Conservation Need in the SWAP (California Department of Fish and Wildlife 2015); species that have documented occurrences in the California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife, California Natural Diversity Database 2021a); and species listed as threatened or endangered under CESA or the federal ESA. Other sources that were consulted when identifying potential species to be addressed in this RCIS included the following.

- *The Complete List of Amphibian, Reptile, Bird, and Mammal Species in California* (California Department of Fish and Wildlife 2016b).

- A list of federally listed endangered and threatened species obtained from USFWS for the RCIS Area (Information for Planning and Consultation tool[18]).
- CNDDB Special Animals List (California Department of Fish and Wildlife, California Natural Diversity Database 2021b).
- CNDDB Special Vascular Plants, Bryophytes, and Lichens List (California Department of Fish and Wildlife, California Natural Diversity Database 2021c).
- CNPS Inventory of Rare and Endangered Plants of California (California Native Plant Society, Rare Plant Program 2020).
- Caltrans Advance Mitigation Program, Great Valley Ecoregion Section, RAMNA (California Department of Transportation 2020).

Step 2. Apply Screening Criteria to Select Focal Species

Two criteria were applied to each potential focal species identified in Step 1 to determine whether it should be further considered. To be included as a focal species, the species must be known to occur within, or the species' historical range must overlap, the Kaweah RCIS Area. There must also be sufficient data and information to assess stressors and to develop a conservation strategy for that species. Species that did not meet these two required screening criteria were not included as focal species.

Many species met the two required screening criteria. Additional criteria were then used to pare the list of potential focal species to a manageable number.

Species with conservation needs that are expected to be addressed well by the landscape or natural community strategies, have similar habitats and ecological needs to another focal species, and are not expected to have mitigation needs were not included as focal species.

State and federal listed species that occur in the RCIS Area but were excluded as focal species were considered for inclusion as non-focal species if mitigation needs are anticipated, based on best professional judgment of Steering Committee members.

Required Screening Criteria

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

Additional Screening Criteria

- **Taxonomic group.** The focal species list should include at least one representative of each of the following taxonomic groups: plants, invertebrates, amphibians, reptiles, birds, and mammals.

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

- **Listing Status.** The species is listed by state or federal resource agencies as threatened or endangered, or is a candidate for such listing, or is reasonably expected to be considered for listing within 10 years of RCIS approval; or, the species is identified as a CDFW animal Species of Special Concern; or, the species is described as a Species of Greatest Conservation Need or Climate Vulnerable (CV) in the SWAP; or, the species is recognized by CNPS as Rare, Threatened, or Endangered in California and elsewhere (1B), or Rare, Threatened or Endangered in California, but more common elsewhere (2B).
- **Natural Community Indicator Species.** A species whose habitat associations are indicative of a particular natural community (at least one indicator species should be selected for each natural community).
- **Wide-Ranging Species.** Species that require large, contiguous, or connected blocks of habitat, whereby these species could effectively inform habitat enhancement actions involving habitat connectivity and other important ecological processes within the RCIS Area. At least one wide-ranging species should be included on the focal species list.
- **Potential Mitigation Needs.** Species that would attain the greatest benefit from implementation of mitigation actions and could potentially be served by the development of MCAs in the near term, based on best professional judgement of the Steering Committee. These are species that are listed under CESA or the federal ESA, CNPS 1B.1 or 1B.2 plant species, or other species that commonly require mitigation (e.g., burrowing owl).

A total of 79 wildlife species (including subspecies, evolutionary significant units, and distinct population segments) and 56 plant species (including subspecies and varieties) were assessed for inclusion as focal species in this Kaweah Subbasin RCIS (Appendix D). Table D-1 in Appendix D shows the species assessed, the criteria used to evaluate these species, and the rationale for inclusion as focal species and non-focal species for this Kaweah RCIS. Focal species are listed in Table 2-19.

2.3.11.2 Kaweah RCIS Focal Species

Table 2-19. Kaweah Subbasin RCIS Focal Species

		Status[a]			
Scientific Name	**Common Name**	**Federal**	**State**	**CRPR[b]**	**Global[c]**
Invertebrates					
Bombus crotchii	Crotch bumble bee	–	CE	–	G3G4
Branchinecta lynchi	Vernal pool fairy shrimp	T	–	–	G3
Amphibians					
Ambystoma californiense	California tiger salamander	T	T	–	G2G3
Spea hammondii	Western spadefoot	UR	SSC	–	G3
Reptiles					
Gambelia sila	Blunt-nosed leopard lizard	E	FP, E	–	G1
Birds					
Buteo swainsoni	Swainson’s hawk	–	T	–	G5
Athene cunicularia	Burrowing owl	–	SSC	–	G4
Agelaius tricolor	Tricolored blackbird	–	T	–	G2G3

Scientific Name	Common Name	Status[a] Federal	Status[a] State	CRPR[b]	Global[c]
Mammals					
Sorex ornatus relictus	Buena Vista Lake ornate shrew	E	SSC	–	G5T1
Antrozous pallidus	Pallid bat	–	SSC	–	G5
Dipodomys nitratoides nitratoides	Tipton kangaroo rat	E	E	–	G3T1T2
Vulpes macrotis mutica	San Joaquin kit fox	E	T	–	G4T2
Plants					
Brodiaea insignis	Kaweah brodiaea	–	E	1B.2	G1
Fritillaria striata	Striped adobe-lily	–	T	1B.1	G1
Quercus lobata	Valley oak	–	–	CBR	–

[a] Status

Federal

E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
UR = under review for listing under the federal Endangered Species Act.
– = no listing.

State

E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
C = a candidate for listing under the California Endangered Species Act.
SSC = listed as a California special of special concern by the California Department of Fish and Wildlife
FP = listed as a fully protected by the California Department of Fish and Wildlife
– = no listing.

[b] California Rare Plant Rank (CRPR) (California Native Plant Society, Rare Plant Program 2020).
1B = plants rare, threatened or endangered in California and elsewhere.
0.1 - seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)
0.2 - moderately threatened in California (20-80% of occurrences threatened/moderate degree of immediacy of threat)
CBR = considered but rejected
– = listing for plants only.

[c] Global Conservation Status (NatureServe 2020)
G1 = critically imperiled- high risk of extinction due to extreme rarity (often 5 or fewer populations)
G2 = imperiled- high risk of extinction due to very restricted range, very few populations (often 20 or fewer populations)
G3 = vulnerable- moderate risk of extinction due to restricted range and very few populations (often 80 or fewer populations)
G4 = apparently secure- uncommon but not rare
G5 = secure- common, widespread and abundant
G#G# = Range rank; numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community.
T# = Infraspecific taxon; the status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.
Rules for assigning T-ranks follow the same principles outlined above for global conservation.

Summaries of the distribution, occurrence, ecology, and habitat associations of focal species are provided in Appendix E, *Focal Species Profiles*. These summaries include range maps and maps of modeled distribution from publicly available models.

The data used to identify locations of occurrence of focal species come primarily from CNDDB (California Department of Fish and Wildlife, Natural Diversity Database 2021a). Only CNDDB occurrences presumed extant were used. Calflora (2020) observation data records were used for plants. Records from 1980 and later were used.

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

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

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

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

2.3.12 Non-Focal Species

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

Some species that were not selected as focal species for this Kaweah RCIS (i.e., non-focal species) have conservation needs similar to the focal species and may also be addressed through the conservation strategy for natural communities and working landscapes (Section 3.7, *Conservation Strategy for Natural Communities* and Section 3.8, *Working Landscapes*) or habitat connectivity (Section 3.9, *Conservation Strategy for Habitat Connectivity*). The Kaweah RCIS Steering Committee selected 10 species to be included in this RCIS as non-focal species based on the potential need for mitigation credits for these species. Non-focal species are listed in Table 2-20.

Table 2-20. Kaweah Subbasin RCIS Non-Focal Species

		Status[a]			
Scientific Name	**Common Name**	**Federal**	**State**	**CRPR[b]**	**Global[c]**
Invertebrates					
Branchinecta lynchi	Vernal pool tadpole shrimp	E	–	–	G4
Reptiles					
Emys marmorata	Western pond turtle	UR	SSC	–	G3G4T3Q
Anniella pulchra	Northern California legless lizard	–	SSC	–	G3
Mammals					
Taxidea taxus	American badger	–	SSC	–	G5
Plants					
Clarkia springvillensis	Springville clarkia	T	E	1B.2	G2
Euphorbia hooveri	Hoover's spurge	T	–	1B.2	G1
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	T	E	1B.1	G1
Pseudobahia peirsonii	San Joaquin adobe sunburst	T	E	1B.1	G1
Sidalcea keckii	Keck's checkerbloom	E	–	1B.1	G2
Tuctoria greenei	Greene's tuctoria	E	R	1B1	G1

[a] Status
Federal
E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
UR = Under review for listing under the federal Endangered Species Act.
– = no listing.
State
E = listed as endangered under the California Endangered Species Act.
SSC = listed as a California special of special concern by the California Department of Fish and Wildlife.
R = listed as rare by California Department of Fish and Wildlife.
– = no listing.

[b] California Rare Plant Rank (CRPR) (California Native Plant Society, Rare Plant Program 2020).
1B = plants rare, threatened or endangered in California and elsewhere.
0.1 - seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)
0.2 - moderately threatened in California (20-80% of occurrences threatened/moderate degree of immediacy of threat)
– = listing for plants only.

[c] Global Conservation Status (NatureServe 2020)
G1 = critically imperiled- high risk of extinction due to extreme rarity (often 5 or fewer populations)
G2 = imperiled- high risk of extinction due to very restricted range, very few populations (often 20 or fewer populations)
G3 = vulnerable- moderate risk of extinction due to restricted range and very few populations (often 80 or fewer populations)
G4 = apparently secure- uncommon but not rare
G5 = secure- common, widespread and abundant
G# = Range rank; numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community.
Q = Questionable taxonomy; taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid.
T# = Infraspecific taxon; the status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.
Rules for assigning T-ranks follow the same principles outlined above for global conservation.

Appendix F, *Non-Focal Species Summaries*, includes brief descriptions of the habitat requirements for the 10 non-focal species and how conservation strategies for focal species and other conservation elements would benefit each non-focal species. Table F-1 and F-1 in Appendix F shows the habitat associations between non-focal species and this RCIS's land cover types, and Table F-2 highlight the general similarities in habitat use and overlap between non-focal species and focal species, identified by similarities in use of land cover types. As such, this RCIS contemplates the conservation needs of the focal species and non-focal species with similar habitat needs. It is assumed that MCAs that memorialize protection and habitat improvements for land cover types that support focal and non-focal species alike, could result in mitigation credits for both focal and non-focal species.

2.4 Pressures and Stressors on Conservation Elements

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

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

This Kaweah Subbasin RCIS identifies the following general categories of pressures and stressors from the SWAP.

- Urban development
- Agriculture
- Habitat loss and fragmentation
- Climate change

- Dams and water management/use
- Invasive plants and animals
- Fire and fire suppression
- Renewable energy, mining, and quarrying

Each of these pressures is summarized below and includes a general discussion of how each type of pressure can affect the focal species and other conservation elements. A detailed discussion about the pressures and stressors on each focal species is provided in Appendix E. While the Kaweah Subbasin RCIS organizes this discussion of pressures and stressors by type of pressure as described in the SWAP, these pressures and stressors interact, often with compounding effects. Some of these interactions are briefly discussed within the context of each type of pressure.

2.4.1 Urban Development

Economic and population growth is a driver of development, leading to an increased demand for housing, commercial development, services, water, transportation, and other infrastructure, which in turn puts increasing pressure on agricultural lands, natural communities, habitats, water, and other natural resources. Urban and suburban development is limited primarily to the cities and communities, comprising approximately 10% of the RCIS Area in terms of land cover (Table 2-17). Focal species differ in their tolerance of urban development, with many unable to adapt to more intensive land uses. Beyond direct habitat loss, converting land to more intensive land uses create additional stressors, including an increase in the spread of invasive species, human disturbance, demand for water, wildfire suppression, and insect control, that further degrade ecosystem health and wildlife viability.

Urban development includes the following pressures that could impact focal species and other conservation elements (California Department of Fish and Wildlife 2015).

- Housing and urban areas
- Commercial and industrial areas
- Household sewage and urban wastewater
- Utility and service lines

Urban and suburban development, including commercial and industrial development, infrastructure projects, the conversion of natural communities and habitats, and conversion of agricultural land to development are primary pathways of land conversion. Urban development has resulted in the loss, degradation, and fragmentation of natural habitats and agricultural land in the RCIS Area.

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

2.4.1.1 Effects on Focal Species and Habitats

All of the focal species are impacted by housing and urban development. Population growth that leads to increased land conversion for housing, commercial, industrial, and other infrastructure has the potential to affect focal species, including, but not limited to the following pathways.

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

Focal species may lose foraging, breeding, nesting, or migration habitats that support various stages of their life cycle, resulting in a decline in population sizes. Growth and development fragment habitats into small patches, isolating individuals with limited dispersal ability, and altering the remaining fragments. These smaller fragments often become dominated by species more tolerant of habitat disturbance, while less-tolerant species decline. Populations of less-mobile species often decline in smaller habitat patches due to reduced habitat quality, extreme weather events, or normal population fluctuations. Natural recovery following such declines is difficult for mobility-limited species. Such fragmentation also disrupts or alters important ecosystem functions, such as predator-prey relationships, competitive interactions, seed dispersal, plant pollination, and nutrient cycling (Bennett 1999, Environmental Law Institute 2003, as cited in California Department of Fish and Wildlife 2015). Habitat fragmentation and degradation also has additional consequences, including the introduction and spread of invasive species, noise, and light pollution.

Increased pollutants and pathogens resulting from increased commercialization, industrialization, and population, can directly impact species and their habitats. Roads and traffic can result in direct mortality of species. According to Caltrans and California Highway Patrol statistics, there are about 1,000 reported accidents each year on state highways involving deer, other wildlife, and livestock (Shilling 2015, as cited in California Department of Fish and Wildlife 2015).

Wildlife may alter their behavior, such as their feeding, breeding, and migration strategies, in response to increased noise, light, vibration, and movement. Increased urbanization, including increased roadways and construction, increase these effects.

2.4.1.2 Effects on Other Conservation Elements

All of the other conservation elements in the RCIS Area could be affected by land conversion for urban development, and the effects are similar to those described above for focal species (e.g., loss of habitat, fragmentation, exposure to pollution, direct mortality, and changes in behavior). Conversion to impervious surfaces (e.g., concrete or asphalt) can increase polluted runoff into streams and wetlands. Groundwater is the main source of water for municipal and industrial uses and urban development has increased demand on this important water source. Groundwater extraction for urban uses contributes to land subsidence and concentration of groundwater pollutants.

Habitat conversion may further isolate areas of remaining natural habitat, increasing the edge (i.e., boundary) and the distance between habitats, limiting habitat connectivity and wildlife linkages. For example, habitat fragmentation may disconnect streams and their tributaries, change hydrologic regimes, and limit or obstruct natural interactions between wetland systems.

Urban development converts farmland and rangeland to urban uses, resulting in loss of habitat for species that use working lands, and also loss of livelihoods and cultures associated with working lands. For the period from 2014 to 2016, the San Joaquin Valley region had the largest area of agricultural land developed (21,276 acres) in California, primarily for urban, solar, and other non-agricultural uses, surpassing Southern California for the first time (California Department of Conservation 2018). Tulare and Kings Counties were in the top 10 counties in California in the net acres of agricultural land lost to urbanization. In Kings County, the loss was primarily due to solar development. Subdividing and developing parcels may result in the remaining, nearby undeveloped lands being too fragmented to be economically viable for larger scale operations. Small and fragmented working lands also provide less habitat value for the species supported by these habitats, as described above.

2.4.2 Agriculture

As described in Section 2.3.9, *Working Landscapes*, agriculture is an essential component of the economy and culture in the RCIS Area. Although cultivated agricultural lands no longer support native vegetation, they can provide valuable habitat for native species (e.g., field crops such as alfalfa provide foraging habitat for Swainson's hawk and tricolored blackbirds) and facilitate wildlife movement between habitats that might not otherwise happen in a developed landscape. Land maintained and zoned for agricultural production also precludes conversion of agricultural land to developed lands, which provides considerably fewer habitat values for focal species and other conservation elements than agricultural lands. Agriculture includes the following pressure that could impact focal species and other conservation elements in the RCIS Area (California Department of Fish and Wildlife 2015).

- Agricultural effluents and effects on water quality and hydrology
- Annual and perennial non-timber crops
- Livestock, farming, and ranching

Conversion of native habitat to cultivated agriculture across the San Joaquin Valley has transformed much of the historical landscape (Section 2.3.8.1, *Historical Vegetation*). Conversion of natural lands, including rangelands used for grazing, into intensively managed cultivated agricultural uses such as orchards, vineyards, and row crops eliminates and fragments natural habitats (e.g., Dudley and Alexander 2017). Conversion of cultivated agricultural types (e.g., alfalfa, row crops) to more intensive uses (e.g., orchards and vineyards) further reduces and eliminates the remaining or replacement habitat values provided by agricultural lands. Agricultural water diversions and certain farming practices can alter hydrologic regimes while sediment and nutrient laden runoff can degrade aquatic habitats. Specifically, deep ripping to mechanically break up compacted soil layers can drain wetlands and impact impermeable layers beneath vernal pools. Similar soil preparation activities can degrade essential upland habitats for species such as the California tiger salamander (U.S. Fish and Wildlife Service 2017). Further, the use of chemical fertilizers, herbicides, and rodenticides may have unintended negative consequences that adversely affect focal species.

2.4.2.1 Effects on Focal Species and Habitats

All of the focal species are impacted to some extent by agriculture. Agricultural practices can have a range of direct and indirect consequences to focal species and native biodiversity, positive or negative, based on timing, duration, and intensity. Different cropping systems (e.g., organic versus conventional farming, or highly diversified fields versus large monocultures) can have different levels of impacts to natural ecosystems across the landscape. Agricultural land uses have the potential to affect focal species both positively and negatively via the following pathways.

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

Herbicides and pesticides can have toxic effects on aquatic plants and animals (e.g., Crotch bumble bee [Hatfield et al. 2018]), and chemical contaminants can alter the ecological composition and chemistry of aquatic systems. For example, fertilizer runoff can increase growth of aquatic plants and algae, resulting in lowered oxygen levels when excessive plant matter decomposes. Sedimentation in aquatic habitats can cause increased temperature, decreased visibility, and reduced oxygen when the sediment contains additional nutrients from fertilizers, all of which can negatively affect aquatic ecosystems. Application of rodenticides affects important keystone species such as ground squirrels, as well as predators that consume affected rodents. Activities that remove ground squirrels also negatively affect species that depend on the burrows they create, such as burrowing owl and California tiger salamander.

The Irrigated Lands Regulatory Program (ILRP),[19] administered by the Central Valley Regional Water Quality Control Board, was initiated in 2003 to prevent agricultural runoff from impairing surface waters and in 2021, groundwater regulations were added to the program. Growers implement ILRP requirements by working to prevent sediment, fertilizer, pesticides, manure and other materials used in farming from leaving their field in irrigation or storm water and entering surface waters, or from leaching below the root zone to groundwater. Growers are also required to develop and implement on-farm plans and submit reports to their coalition; these reports are then summarized and reported to the Central Valley Water Board (Central Valley Regional Water Quality Control Board 2021).

Historical conversion of natural communities to cultivated agriculture is a leading cause of habitat loss and fragmentation in California and the San Joaquin Valley (California Department of Fish and Wildlife 2015, Stewart et al. 2019). Land conversion from one type of agriculture to another, including conversion of field and row crops or grazing lands to orchards or vineyards, can also affect focal species and native wildlife that use the existing crop. For example, conversion of field crops to orchards and vineyards dramatically reduces the quality of foraging habitat for Swainson's hawk and tricolored blackbird (California Department of Fish and Wildlife 2015). Farming practices can also affect wildlife movement, particularly where crops such as vineyards, are fenced to prevent access by wildlife.

[19] https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/

2.4.2.2 Effects on Other Conservation Elements

Working lands, which include farming, are identified as an important conservation element, and their value for conservation is described in Section 2.3.9.

Agriculture is an important user of surface and groundwater. Agricultural water demand helps to maintain reliable imports of CVP water to the Kaweah Subbasin and helps to maintain investments in the infrastructure that conveys and stores water. Water imports from outside the basin help to maintain the agricultural economies in the RCIS Area. However, agricultural water demand, along with urban development, has contributed to depletion of groundwater reserves, increased pumping costs, deteriorated water quality and aquatic ecosystems, and resulting land subsidence (Konikow and Kendy 2005).

Between 2014 and 2016, there was a statewide net decrease in irrigated farmland. Land idling has been a major contributing factor to that reduction, particularly in Kings, Fresno, and Kern Counties. Kings County's net decrease of irrigated farmland was the largest, at 27,644 acres (California Department of Conservation 2018). Land idling to achieve groundwater recharge goals, when done strategically, can provide and restore habitats for native wildlife and plants while reducing erosion and impacts to air quality. The economic costs of idling land to achieve groundwater recharge and habitat goals can be substantial. Economic incentives and supportive policies are necessary to offset economic costs (Bourque et al. 2019). Some counties, however, had a net-increase in irrigated farmland during this time period. Many of the counties with the largest land increases were in the San Joaquin Valley, including Tulare, Stanislaus, Madera, and San Joaquin Counties, primarily due to orchard planting (California Department of Conservation 2018).

Agricultural runoff with fertilizers and pesticides can pollute aquatic habitat. Rain and irrigation runoff carry silt and agricultural chemicals, degrading surface water quality and reaching groundwater. Significant amounts of nitrogen fertilizers applied for agricultural use have been shown to contaminate the underlying groundwater in agricultural areas throughout the state (Viers et al. 2012). Herbicides and pesticides can have toxic effects on focal species. Nutrients from fertilizer in agricultural runoff increase plant and algal growth in receiving waterbodies. When the plants and algae die, the process of their decomposition can drastically reduce the levels of dissolved oxygen in the system, which can negatively impact aquatic focal species. Elevated nutrient levels have been shown to favor parasitic flat worms that cause deformities in many frog species, indicating that increases in nutrients would also have negative effects on amphibians. California tiger salamanders have been shown to be less competitive in areas with pesticide drift (Ryan et al. 2012). Silt and sediment degrade aquatic systems by increasing turbidity and temperature and shading out aquatic vegetation.

Livestock grazing is an essential conservation tool in California rangelands. Well-managed livestock grazing can benefit sensitive plant and animal species, particularly by controlling invasive annual grasses and forbs as well as wildfire fuels in grasslands and other natural communities where these have become established. Well-managed livestock grazing is essential to conserving and managing focal species' habitats and natural communities, as well as diversity and cover of native forbs and grasses, though livestock grazing can also result in an increase in the cover of exotic grasses and forbs if not properly managed (Hayes and Holl 2003, Marty 2005, Stahlheber and D'Antonio 2013, Bartolome et al. 2014, Larson et al. 2015). Properly managed grazing is also a vital tool for maintaining hydrological conditions and native plant and animal diversity in vernal pools. Conversely, a lack, or cessation of grazing can result in buildup of thatch and a reduction in native plant species diversity (Marty 2005, Pyke and Marty 2005). High levels of cattle waste (i.e., feces and urine) in vernal pools can cause a reduction in plant cover and species richness through increased nutrient loading (Croel and Kneitel 2011). Populations of ground squirrels tend to increase in grazed areas (ground squirrels are another conservation element in this RCIS), which in turn creates upland habitat for California tiger salamander and burrowing owl (Ford et al. 2013, Bartolome et al. 2014).

When livestock grazing is poorly managed it can negatively affect water quality and aquatic focal species through erosion and sediment transport, nutrient loading, introduction of pathogens from urine and feces, and alteration of stream flows, channel morphology, riparian zone soils, and in-stream and streambank vegetation (e.g., Belsky et al. 1999, George et al. 2004, Hubbard et al. 2004). Even with moderate grazing, if cattle are allowed to remain in the riparian area and move along the stream, they can have a serious impact on native fish, amphibians, and aquatic macroinvertebrates and can contribute to erosion, affecting groundwater levels and surface vegetation. Livestock can consume and trample riparian plants, which decreases shade and can increase water temperatures. Some of these impacts, such as effects to riparian vegetation can be reduced or eliminated by separating the riparian zone as a "special use riparian pasture," timing grazing to the least vulnerable seasons (Kauffman and Krueger 1984) and providing off-channel water sources (California Department of Fish and Wildlife 2015). The alternative of exclusionary fencing is usually not necessary, except in high-impact or sensitive areas, and can cause other problems, such as pest plant infestations and cattle trailing in worse locations (L. Ford, pers. comm. in ICF 2021). In arid areas where extreme flows from exceptional winter storms are necessary to establish riparian seedlings after many years or decades of drier conditions, grazing can severely diminish or even eliminate the next generation of riparian trees by destroying the saplings before they can grow beyond grazing height. Elimination of grazing can have detrimental effects, such as excess buildup of litter, an increase in fuel load and fire risk, and an increase in invasive plant species. These issues can be reduced with intermittent or periodic grazing of riparian areas and must be balanced depending on whether sensitive resources are present (Miller et al. 2018).

2.4.3 Habitat Loss and Fragmentation

This RCIS identifies habitat connectivity as a conservation element (Section 2.3.10). The loss of habitat connectivity, including habitat fragmentation, can occur via the following.

- Conversion of natural habitat to urban, suburban and agricultural uses
- Loss of habitat connection through climate change events, such as changes to natural habitats due to drought
- Construction of linear structures like roads, canals, and power lines that impede movement

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

Urban development, along with associated reservoirs and linear structures like roads, canals, fencing, and power lines impede or prevent movement of a variety of animals. Loss or reduction of habitat connectivity makes it more difficult for wildlife to move across habitats and landscapes in search of food, shelter, and breeding or rearing habitat and to escape competitors and predators.

Animals restricted to the ground, like mammals, reptiles, and amphibians, face obstacles such as roads, canals, and urban/suburban development. Attempts to cross these obstacles can be deadly, depending on the species and the nature of the gap (e.g., four-lane highways with concrete median barriers compared to narrow, rural two-lane roads).

Wildlife-vehicle collisions are a large and growing concern among public transportation departments, conservation organizations and agencies, and the driving public. Wildlife-vehicle collisions are a safety concern for drivers and a conservation concern for most animal species. Recently, Loss et al. (2014) estimated that between 89 and 340 million birds may die per year in the United States from collisions with vehicles. Many public transportation departments are trying different methods of reducing wildlife-vehicle collisions, including fencing roadways and providing crossing structures across the right-of-way to allow safe animal passage (California Department of Transportation 2020).

The UC Davis Road Ecology Center records the locations of roadkill observations on major highways and freeways using observations from the California Roadkill Observation System,[20] California Highway Patrol, and other sources. Data from the system are used to identify stretches of California highways that are likely to be hotspots (i.e., stretches of highway that are statistically different from other stretches) for wildlife-vehicle collisions. The system accounts for both observed animal carcasses and traffic incidents, which can range from wildlife sightings on the roadway to wildlife-vehicle collisions. In the RCIS Area, hotspots are primarily located along State Highway 99. Most of the hotspots have a modest level of incidents (0.3 incidents/mile-year).

2.4.3.1 Effects on Focal Species and Habitat

Loss of habitat connectivity affects all of the focal species. Effects include the following.

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

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

Habitat connectivity is also important for the focal plant species to be able to migrate in response to climate change. The loss of habitat connectivity would also restrict the focal plant and wildlife species from colonizing new areas of suitable habitat.

Roads pose a threat to species that are more susceptible to road-related impacts, such as road mortality and habitat fragmentation from infrastructure (Brehme et al. 2018). Amphibians and

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

reptiles are particularly susceptible to the negative effects of infrastructure, due to their small body size (thus making them less visible to drivers), reduced mobility (e.g., speed), and lack of behavioral avoidance of roads. Species such as western pond turtle and California tiger salamander are at very high risk from the negative effects of roads (Brehme et al. 2018).

2.4.3.2 Effects on Other Conservation Elements

Loss of habitat connectivity affects wildlife linkages and natural communities. Loss of habitat connectivity further isolates populations in the increasingly fragmented RCIS Area. The loss of connectivity between patches of native land cover types could result in isolation of small, fragmented patches of habitat with reduced biodiversity and limited ability to adapt to changing conditions.

2.4.4 Climate Change

Climate change is a major challenge to the conservation of natural resources in California and the RCIS Area.[21] Climate models overall predict warmer average annual temperatures, with slightly more precipitation for the RCIS Area. Table 2-21 shows modeled predicted change in annual average maximum and minimum temperature, and precipitation in 2050 and 2099 relative to historical average values for two different emission modeling scenarios: representative concentration pathway (RCP) 4.5, a medium emissions modeling scenario, and RCP 8.5, a high emissions modeling scenario.[22] Maximum and minimum annual average temperatures are predicted to increase under all scenarios above the observed average historical temperatures. Projected change in precipitation varies between models: the warmer/drier model projects less precipitation, whereas the cooler/wetter model projects more precipitation.

Table 2-21. Modeled Projections of Annual Average Maximum and Minimum Temperature and Precipitation for the RCIS Area

Parameter	Emissions Scenario	Historical Average (1960–2000)	Warmer/ Drier[a] 2059-2099 (% Change from Historical)	Cooler/ Wetter[b] 2059–2099 (% Change from Historical)
Average annual maximum temperature (F°)	RCP 4.5	75.5	82.2 (8.9%)	80.6 (6.8%)
	RCP 8.5	75.5	85.7 (13.5%)	83.6 (10.7%)
Average annual minimum temperature (F°)	RCP 4.5	50.5	55.8 (10.5%)	54.8 (8.5%)
	RCP 8.5	50.5	59.0 (16.8%)	58.0 (14.9%)
Average annual precipitation (inches)	RCP 4.5	10.5	9.5 (-9.5%)	11.6 (10.5%)
	RCP 8.5	10.5	9.4 (-10.5%)	12.0 (14.3%)

Data from Cal-adapt (2021)
[a] HadGEM2-ES climate simulation model
[b] CNRM-CM5 climate simulation model

[21] A number of websites provide valuable tools and resources to project change in climatic variables, assess impacts, and plan for change, including: http://www.adaptingtorisingtides.org/; https://cal-adapt.org/; http://data.pointblue.org/apps/ocof/cms/; https://www.wildlife.ca.gov/Conservation/Climate-Science/Resources
[22] Change in annual average minimum and maximum temperatures and precipitation were projected using climate tools available at Cal-adapt: https://cal-adapt.org/tools/.

Climatic changes are already occurring in the state and have resulted in observed changes in natural systems. For example, small mammal distributions were found to shift upwards along an elevational gradient in Yosemite National Park, consistent with an increase in minimum changes in temperature over the last century (Moritz et al. 2008).

2.4.4.1 Drought

Seasonal dry periods are a natural part of a Mediterranean climate system to which the species and natural communities of the RCIS Area have adapted. However, a prolonged drought could cause serious impacts on focal species and their habitats. Extended drought models predict warmer average annual temperatures during the early 21st century (i.e., a projected annual average from 2023 to 2042) and late 21st century (i.e., a projected annual average from 2051 to 2070) for the RCIS Area.[23] Both models predict the maximum and minimum daily temperatures will increase relative to historical (1961–1990) maximum and minimum annual average temperatures. Models for both the early and late 21st century time periods project a decrease in average annual precipitation relative to historical average precipitation over the same time periods. Table 2-22 shows the extended drought scenarios for the early and late 21st century time periods.

Table 2-22. Extended Drought Scenario for Early and Late 21st Century Time Periods by Water Year (October–September) [a]

Parameter	Observed Historical Average (1961-1900)	Drought Scenario 2023–2042 (% Change from Historic)	Drought Scenario 2051–2070 (% Change from Historic)
Average daily maximum temperature (F°)	75.6	80.3 (6.2%)	80.4 (6.3%)
Average daily minimum temperature (F°)	50.1	54.1 (8.0%)	57.4 (14.6%)
Average daily precipitation (inches)	10.0	7.4 (-26.0%)	7.4 (-26.0%)

Data from Cal-adapt (2021)
[a] Drought scenarios simulated using HadGEM2-ES climate simulation model and the RCP 8.5 modeling scenario.

Whether drought causes a species or population to decline toward extinction depends on a number of factors, including how widely distributed the species or population is relative to extreme drought conditions, the degree to which microhabitats remain available to serve as refugia, and the ability of populations to migrate to shifting habitats. With adequate behavioral or genetic diversity and enough time, some organisms can adapt to or evolve with changing conditions.

2.4.4.2 Wildfire

Climate change is expected to contribute to significant changes in fire regimes, including shifts in the timing, frequency, and intensity of wildfire events. Fire is a natural component of many ecosystems and natural community types, including grassland, chaparral, scrub, and woodland. Under controlled conditions, prescribed fire is a valuable tool for managing fuel load, invasive species, and vegetation community structure. For each of these natural communities, fire frequency and intensity influence community regeneration, composition, and extent. Although wildfire can provide beneficial ecosystem services, more frequent, intense fires could have grave effects on human development, particularly at the urban-wildlands interface. Wildfire can also negatively affect

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

vegetative community composition by favoring early successional species. Frequent, intense fires could cause type conversion, increasing the extent of certain natural communities, such as grassland, at the expense of others, such as chaparral or woodlands (refer to Section 2.4.7, *Fire and Fire Suppression* for further discussion).

The majority of the RCIS Area is developed or cultivated agricultural land, with low risk of wildfire due to limited fuel sources. Wildfires are expected to occur within the foothills of the Sierra Nevada. This area is dominated by grassland and woodland vegetation communities. Table 2-23 shows the modeled historical annual average area burned from 1961 to 1990, and the projected annual average area burned from 2035 to 2064 for three approximately 6-kilometer model grid areas within the eastern portion of the RCIS Area. The average annual area projected to burn is expected to increase, with the size of the increase dependent on location and emissions scenario.

Table 2-23. Modeled Annual Area (Acres) Burned for Three Grid Cells in the Eastern Portion of the RCIS Area

Grid Cell (Coordinates of Center of Grid)	Scenario	Warmer/Drier[a] Modeled Historical Average (1961-1990)	Warmer/Drier[a] 2035 -2064
36.32.3211, -119.0968	RCP 4.5	10.9	11.2
	RCP 8.5	10.8	10.9
36.2459, -119.0968	RCP 4.5	10.9	18.4
	RCP 8.5	11.6	17.2
36.0078, -119.0273	RCP 4.5	12.2	13.9
	RCP 8.5	11.8	13.4

Data from Cal-adapt (2021)

[a] Model results are the same under a warmer/drier and cooler/wetter scenario. Projections made under a medium population growth scenario.

2.4.4.3 Nonnative Species and Disease

Climate change can cause a change in the distribution and abundance of nonnative species within a region, with novel species invading new regions or populations of resident nonnative species increasing (Clark et al. 2003, Hijmans and Graham 2006, Kurz et al. 2008, Willis et al. 2010, Smith et al. 2012). Climate change may allow nonnative species to persist in areas where they previously were unable due to climatic tolerances and physiological constraints (Zerebecki and Sorte 2011). Climate change may allow niches to be invaded by nonnative species as populations of native species shift geographically or decline in numbers (McNeely 2000). Refer to Section 2.4.6, *Invasive Plants and Animals* for more discussion on the pressures and stressors related to invasive, nonnative species.

2.4.4.4 Effects on Focal Species and Habitat

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

- Extirpation or reduced population size due to habitat loss and fragmentation
- Habitat loss, fragmentation, and decrease of habitat quality due to change in precipitation and temperature regimes
- Exposure to extreme weather
- Change in behavior or distribution of populations in response to shifts in seasonal timing
- Change of distribution of species in response to an increase in disturbance events and intensity of disturbance events such as wildfire or drought
- Increase in the distribution and abundance of invasive nonnative species and pathogens

Species that are particularly vulnerable to the effects of climate change often occur within a limited geographic range, exist in small populations, have specialized habitat requirements, and have low dispersal ability, making it difficult for populations to migrate to more suitable areas as habitats shift with climate change.

Focal species in the RCIS Area could be impacted by temporal changes that cause a mismatch in events that need to occur together or in a specified order. The timing of seasonal events, such as migration, flowering, and egg laying, may shift earlier or later. Such shifts may affect the timing and synchrony of events that must occur together, such as crotch bumble bee emergence and nectar and pollen availability.

Extended drought could have significant effects on the focal species and their habitats in the RCIS Area, affecting habitat features such as vegetation, soil availability (for plants), and food resources, among other factors (PRBO Conservation Science 2011, Thorne et al. 2016). Climatic changes may be outside the range of historical variability or outside the range of suitable conditions for plants and animals, limiting their available habitat and resources through changes in temperature, precipitation, and disturbance events such as wildfire and drought. Thorne et al. (2016) conducted a climate change vulnerability analysis on California's terrestrial vegetation communities to evaluate the vulnerability of vegetation communities to environmental conditions projected by four different climate change models (agricultural and urban areas were not evaluated). The analysis identified areas where existing vegetation will be increasingly stressed under the influences of climate change. The vegetation communities in the RCIS Area received a mid-high climate vulnerability ranking (the second most-vulnerable ranking).

Range and distribution of focal species may potentially shift across landscapes as they have done historically (Walther et al. 2002). Today, however, urban and rural development create barriers to movement across the landscape.

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

2.4.4.5 Effects on Other Conservation Elements

Climate change will affect all other conservation elements. Working landscapes will experience a variety of direct and indirect effects. Rising levels of carbon dioxide may affect plant water use efficiency and could enhance the productivity of certain crops such as alfalfa or pasture lands. However, increased temperatures that increase evapotranspiration rates and heat stress are more likely to decrease the yield of the majority of annual and perennial crop types. The shift to warmer night- and daytime temperatures will result in fewer frost days, affecting crops that require chill hours and potentially changing the viability of the RCIS Area for certain crop types. Cropping patterns will also shift in response to water supply conditions.

Agricultural production is responsible for significant releases of each of the three main greenhouse gasses (carbon dioxide, methane, and nitrous oxide), and so adaptation to climate change will likely require changes in agricultural practices that will have impacts on the landscape. For example, practices such as reducing tillage can reduce releases of carbon dioxide from the soil and reduce the use of fuels for powering agricultural equipment. Planting cover crops and trees can help sequester carbon from the atmosphere. Cover cropping can also increase soil moisture retention, soil fertility, and help maintain soil structure which will become increasingly important as growing seasons become hotter and soils become drier. Even with these adaptations, irrigated land area in California as a whole is predicted to decrease by around 26% by 2050 due to climate change (Howitt 2014).

Some natural communities may be severely reduced in range and distribution or even extirpated with prolonged or extreme climate-driven events, such as a severe drought, severe storms with extreme rainfall and flooding, or increased fire frequency. Climatic conditions in the RCIS Area are expected to be unsuitable by the end of the century for California annual and perennial grassland and California forest and woodland macrogroups (Thorne et al. 2016) as well as valley oak (Matzner et al. 2003, Kueppers et al. 2005, McLaughlin and Zavaleta 2012). These natural communities and valley oak are projected to migrate upslope in elevation in the Sierra Nevada foothills.

Climate change is expected to impact precipitation timing and variability, more so than precipitation amounts (Joyce et al. 2009). Droughts will become more frequent, more intense, and longer lasting, and rainfall will be more extreme when it does occur, disrupting the natural recharge of groundwater that typically occurs annually during the wet season. When rates of direct runoff exceed the soil infiltration capacity, groundwater recharge is negatively impacted. Warmer temperatures will mean a reduction in snowpack since a greater percentage of winter precipitation is likely to fall as rain rather than snow, and snowmelt will occur earlier and faster. Reduction in snowpack water storage and earlier snowmelt combined will affect streamflow timing and downstream flood risk. Water will be delivered downstream earlier in the year and at higher flows. The reduced snowpack will no longer be able to maintain streamflows throughout the summer months leading to lack of available surface waters that will increase reliance on, and overexploitation of, groundwater supplies.

Hotter, drier summers, combined with lower river flows, will further stress water resources available to people, wildlife, and vegetation. This is likely to translate into less water for wildlife, especially fish and wetland species. Lower river flows will result in warmer water and degraded water quality, disrupting the complex food web of aquatic systems. As freshwater aquatic systems in the RCIS Area become stressed, the ecological functioning of upland habitats is also likely to be disrupted as individual species respond differently to climate change.

2.4.4.6 Areas of Resilience to Effects of Climate Change

CDFW's ACE v.3 identifies areas that are expected to be relatively buffered from the impacts of climate. The Terrestrial Climate Change Resilience dataset (California Department of Fish and Wildlife 2020f) is based primarily on the California Vegetation Climate Vulnerability Assessment (Thorne et al. 2016). Thorne et al. used spatially explicit models of exposure of vegetation to eight future climate change scenarios under different combinations of global climate models, emissions scenarios, and time horizons to identify areas that are relatively buffered from the impacts of climate change. The models provide probabilities that a given location (displayed as hexagons) will provide refugia from effects of climate change, where refugia is defined as an area with low exposure to the effects of climate change. Climate resilience ranks were given for each hexagon and range from 1 to 5, where 1 is low and 5 is high (California Department of Fish and Wildlife 2020f). A high score indicates that that the climatic conditions will likely remains suitable for the current array of plants and wildlife that reside in that hexagon.

Overall, the RCIS area is not expected to provide significant resilience to the effects of climate change (Figure 2-29). Most of the RCIS Area modeled for this assessment received the lowest climate resiliency rank (Rank 1, low), indicating that climatic conditions will likely become unsuitable for the current array of plants and wildlife in the RCIS Area. Some hexagons are anticipated to provide slightly better resilience (Rank 2, moderately low) in the Lower Cross Creek and Tule Lakebed watersheds in the western part of the RCIS Area. A large portion of the RCIS Area was not included in this analysis; these areas are indicated has having no data in Figure 2-29. Landscapes become increasingly resilient to the effects of climate change upslope and east of the RCIS Area in the Sierra Nevada. It will be critical to restore and maintain habitat corridors between remaining and restored habitats in the Valley and the Sierra Nevada to provide pathways for wildlife and plants to migrate upslope in step with suitable habitat conditions.

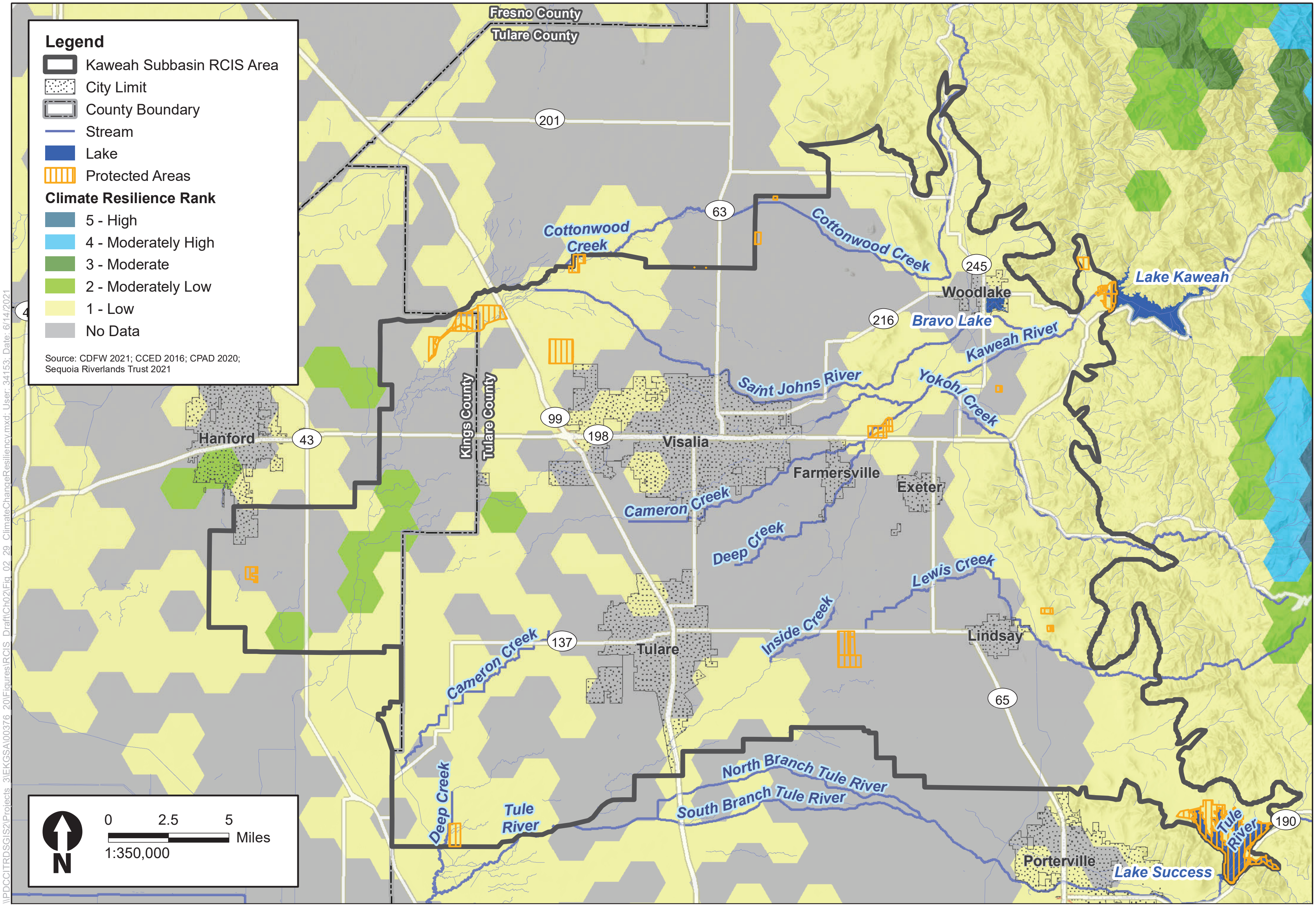


Figure 2-29
Climate Change Resiliency

2.4.5 Dams and Water Management/Water Use

Water resources are managed to meet the needs of urban communities, agricultural production, and flood control. Water infrastructure within the RCIS Area is described in Section 2.2.3.1, *Water*. Water management pressures in the RCIS Area include water diversions, dams, flood control structures (e.g., levees and bank protection, concrete channels), groundwater pumping, and artificial marshes.

Terminus Dam and Reservoir, located about 20 miles east of Visalia, was completed in 1962 and provides seasonal storage of Kaweah River flows for flood protection and irrigation demand. A minimum pool is maintained for recreation, but no carryover storage is provided in the reservoir, which produces about 95 percent of the total runoff of the Kaweah River watershed. At McKay Point located southeast of the City of Woodlake, the Kaweah River is diverted equally into the St. Johns River and Lower Kaweah River branches, originally by weirs constructed in the 1920s and 1930s. These weirs have now been operationally replaced by new water control structures located immediately downstream on both the St. Johns and Lower Kaweah Rivers. Water is then diverted from these rivers and distributed throughout the Subbasin through a complex system of natural and constructed channels and canals owned or operated by numerous agencies and entitlement holders. The Friant-Kern Canal flows from north to south through the RCIS Area along the eastern edge of the valley floor, providing imported irrigation water for several federal water contractors in Tulare and Kings Counties.

Rivers and streams in the RCIS Area are subject to ongoing conversion of tributary waterways into constructed irrigation diversion and stormwater control infrastructure. For example, Lewis Creek enters the valley floor in the Lindsay area. The natural channel of the creek has been eliminated and replaced with a man-made channel that travels mainly along property lines to the northwest before turning west-southwest and eventually entering the distribution system of the Farmers Ditch Company in the area of the Herbert Wetland Prairie Preserve maintained by the Sequoia Riverlands Trust. Some water from Lewis Creek is diverted across the Preserve lands to maintain a restored 83-acre seasonal wetland.

Water is supplied to agriculture by diversion of Subbasin surface water, by groundwater pumping, and through import from other regions via the CVP. In contrast, almost all urban communities, large animal farms, and residences in unincorporated areas of the Subbasin rely exclusively on groundwater. The RCIS Area contains a network of thousands (i.e., more than 7,500) of domestic supply, public supply, and industrial production wells. A portion of the wells are also used by a variety of local, state, and federal agencies to monitor groundwater levels and water quality. Groundwater declines between 70 and 100 feet have been documented throughout the Subbasin, which severely impacts domestic water supplies when groundwater drops below well depth and is no longer available to domestic wells. Groundwater sustainability plans developed by the three Kaweah Subbasin GSAs under SGMA are discussed in Section 2.1.1., *Groundwater Sustainability Plans*.

2.4.5.1 Effects on Focal Species and Habitats

Dams and water management/water use primarily affect riparian and aquatic species and groundwater sustainability in the RCIS Area; however, the construction and expansion of dams and water systems can also affect upland species and plants. These effects include the following.

- Conversion of upstream habitat due to construction or expansion of dams
- Alteration of natural hydrology
- Barriers to aquatic and terrestrial wildlife movement through both dams and linear water infrastructure (Section 2.3.10, *Habitat Connectivity*)

Additional water storage for surface waters could aid in the protection and recharge of groundwater, provide flood control benefits, and create habitat. However, construction of dams and large water storage projects can be economically, politically, and environmentally challenging. In 2005, USACE completed an enlargement project for Lake Kaweah that added over 42,000 acre-feet of storage in Terminus Reservoir and took over 20 years to complete. The Paregien Basin Project, recently completed by the Kaweah Delta Water Conservation District, created two flood control and recharge basins on the Deep Creek channel that also provide protection for native oak savannah habitat.

When dams are constructed or expanded, upstream habitat is flooded as the reservoir area behind the dam is inundated. Wildlife may migrate to other areas, if suitable habitat is available and within the species' dispersal range. Plant populations are unlikely to adapt to the new reservoir footprint and typically are lost when the new areas are flooded. Once in operation, dams alter natural hydrology, potentially reducing the amount of water in streams that is needed by fish at critical times, such as during the spawning season when rainwater is captured behind the dam. Dam operations, including the amount and timing of water release, influence the temperature, depth, and velocity of water downstream, as well as the capacity of the stream to transport sediment and alter channel morphology, potentially constraining breeding opportunities for amphibians and other aquatic species present in downstream environments. Dams can also be managed to benefit species by storing water and then releasing it at times when water is scarce, such as in the summer when rivers start to dry.

Stormwater conveyances are managed to convey urban runoff and floodwater and can alter the hydrologic processes that are important to ecosystem function, such as sediment deposition, water filtration, support of riparian vegetation and wildlife movement corridors. Reservoirs can serve as a barrier to terrestrial wildlife, such as San Joaquin kit fox that could potentially cross low flowing rivers but are unable to cross the expanse of a reservoir. Similarly, infrastructure, such as water canals, can limit other terrestrial wildlife.

The replacement of natural creek channels with constructed channels and canals to divert water for irrigation alters natural hydrologic regimes and impacts habitats dependent on those aquatic resources such as vernal pool complexes. While groundwater in the RCIS Area is largely disconnected from surface water, in areas with shallower groundwater (i.e., less than 50 feet) that have potential to support GDEs, depletion of groundwater to levels below the root zone can functionally disrupt these habitats and cause conversion to non-GDEs.

2.4.5.2 Effects on Other Conservation Elements

Surface waters in the RCIS Area are heavily managed to prevent destructive surface flooding and to provide irrigation water for working lands, including importing water from outside the Subbasin to meet the demand for agricultural water. Conflicting water rights can lead to unreliable supplies, especially of imported water. In addition, the water management infrastructure may not have the capacity to store and divert natural water supplies under the altered conditions of climate change. Working lands can be adapted somewhat to changing water supplies by making shifts in crop choice, but this can be a costly exercise for established perennial crops. Without dependable water supplies, it is likely that some working lands will need to be taken out of agricultural production and repurposed, particularly to achieve SGMA sustainability goals (refer to Section 1.2.2, *Purpose and Need* and Section 2.1.1, *Groundwater Sustainability Plans*).

Weirs, levees, and bank-protection structures on rivers and streams in the RCIS Area prevent flood flows from entering historical floodplains and eliminate or alter the character of floodplain habitats, such as shaded riverine habitat, and floodplain ecosystem processes. This also leads to reduced natural groundwater recharge that would occur during natural seasonal flooding, and the need for the construction of artificial recharge basins to compensate. Constrained flood-level flows increase scouring and incision of river channels and reduce or halt the formation of riparian habitat, channel meanders, and river oxbow channels (California Department of Fish and Wildlife 2015).

Increased pumping of groundwater and groundwater declines are linked to an increase in the concentration of groundwater contaminants (Ortiz-Partida et al. 2020). There are localized areas of high nitrate pollution on the eastern side of the Subbasin, high salinity water between Lindsay and Exeter, and arsenic levels above drinking water standards primarily in the western portion of the Subbasin (California Department of Water Resources 2004, GEI Consultants, Inc. 2020). Poor groundwater quality impairs drinking water supplies, reduces long-term agricultural prosperity, and degrades ecosystems. Effects are magnified in the disadvantaged rural communities that make up a large percentage of the RCIS Area.

2.4.6 Invasive Plants and Animals

Nonnative invasive plants can be found throughout the natural communities and habitats within the RCIS Area. The California Invasive Plant Council (Cal-IPC) evaluates species' impacts to wildland habitats and provides ecological impact ratings. They maintain a watch list of species that are anticipated to become a problem for natural habitats.[24] Not all nonnative plants are problematic for habitats but those that are considered ecologically-damaging are given a rating showing their ability to disrupt and permanently alter the habitat they are invading.

Disease may be broadly defined as a physiological disturbance that compromises health. If applied on a wildlife population or ecosystem scale, it can be defined as a physiological disturbance resulting in disruption of demographic functions that compromise population or ecological health. If affected substantially by disease, wildlife and plant populations can become unhealthy, losing resilience and self-sustainability (California Department of Fish and Wildlife 2015).

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

2.4.6.1 Effects on Focal Species

Nonnative species, native nuisance species, and diseases can affect focal species in the RCIS Area. These effects include the following, among others.

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

A number of diseases have the potential to affect wildlife; the degree to which disease affects a focal species and populations of that species varies between species, population, and disease. Species-specific diseases and the effects on those species are discussed in Appendix E. Some examples of diseases include rabies, canine parvovirus, and canine distemper, which could cause mortality or contribute to reduced fertility in female kit foxes. Severe outbreaks of these diseases in San Joaquin kit fox are not known from the RCIS Area, though rabies and sarcoptic mange outbreaks have occurred in Camp Roberts and Bakersfield populations of San Joaquin kit fox, respectively (White et al. 2000, Miller et al. 2000).

Examples of other diseases that could potentially affect amphibians include Chytridiomycosis and ranavirus. Chytrid fungus (*Batachochytrium dendrobatidis*), which causes the disease Chytridiomycosis, is one cause for large, global declines in amphibian populations (Stuart et al. 2004, Wake and Vredenburg 2008). *B. dendrobatidis* is found in water or soil and infects individual frogs or salamanders when their skin comes into contact with water containing chytrid spores. The fungus kills infected animals by disrupting normal function of the skin (California Center for Amphibian Disease Control 2007). In some populations, the disease can cause 100% mortality while in others it causes only some deaths.

Ranavirus is an infectious disease of amphibians, reptiles, and fish caused by viruses from the genus *Ranavirus*. Ranaviruses are capable of infecting amphibians from at least 14 families and over 70 individual species (Miller et al. 2011). There are several different species of ranavirus that cause varying levels of disease in affected animals. Ranavirus is believed to be the cause of several recent massive mortality events in amphibian populations across the globe. With a mortality rate of 90 to 100%, the disease has the potential to eliminate entire species if not controlled. Ranavirus outbreaks can affect multiple species at the same time (Northeast Wildlife Disease Cooperative n.d.). Translocation of infected amphibians through commercial trade (e.g., food, fish bait, pet industry) contributes to the spread of ranaviruses (Miller et al. 2011).

2.4.6.2 Effects on Other Conservation Elements

Invasive plants and animals outcompete and displace native species. Invasive, nonnative vegetation affects many of the natural communities in the RCIS Area, particularly grasslands, which are dominated by nonnative annual grasses. For example, the replacement of native grasses and herbs by fast-growing nonnative annual grasses and forbs in grasslands have a profound effect on ecosystem functions. Exotic annual grasses grow faster, deplete soils of nutrients, and reduce light availability. Similarly, feral pigs can degrade unique land cover types from excessive use and rooting, which can lead to loss of emergent vegetation, erosion, and flooding. In oak woodlands, feral pigs can inhibit the germination and growth of young oaks by eating acorns and oak seedlings and removing leaf litter, causing soils to dry out (California Department of Fish and Game 2005).

2.4.7 Fire and Fire Suppression

The majority of the RCIS Area is developed or cultivated agricultural land, with low risk of wildfire due to limited fuel sources (CalFire Fire and Resource Assessment Program 2018). Wildfires are generally limited to the foothills of the Sierra Nevada. This area is dominated by grassland and woodland vegetation communities.

Fire is a natural component of the grasslands and woodlands in the foothills of the RCIS Area (CalFire Fire and Resource Assessment Program 2020) (Figures 2-30 and 2-31). Generally, fire frequency is low within the RCIS Area, with Elephant Back, northeast of Lindsay, experiencing the highest fire frequency. The area experienced multiples fires from 1990 to 1999, from 2000 to 2009, and again from 2010 to 2019 (Figure 2-30).

2.4.7.1 Effects on Focal Species and Habitats

Fire and/or fire-suppression policies may pose a threat to the focal species occurring in the remaining natural communities. Focal species could be affected through the following.

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

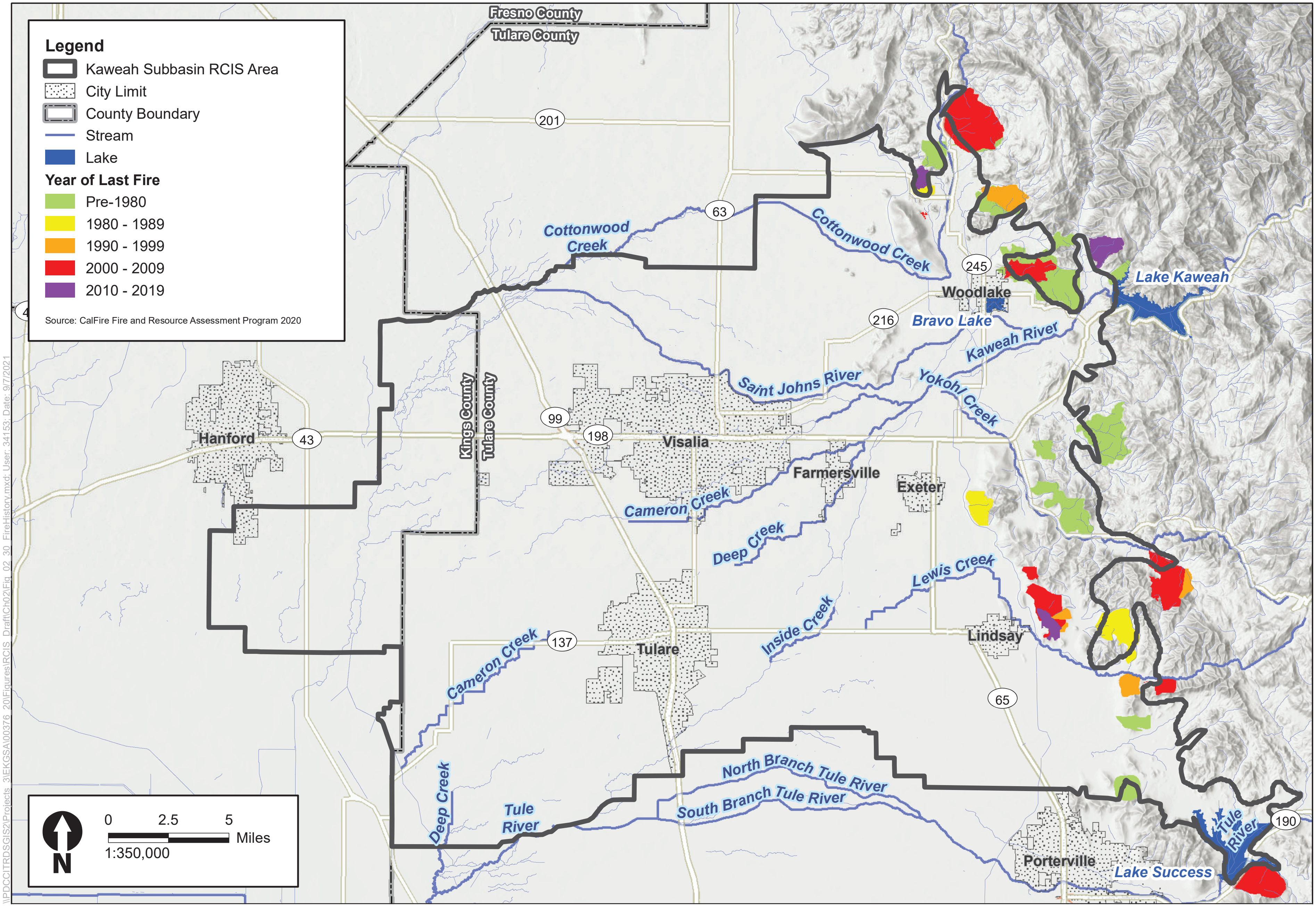


Figure 2-30
Fire History

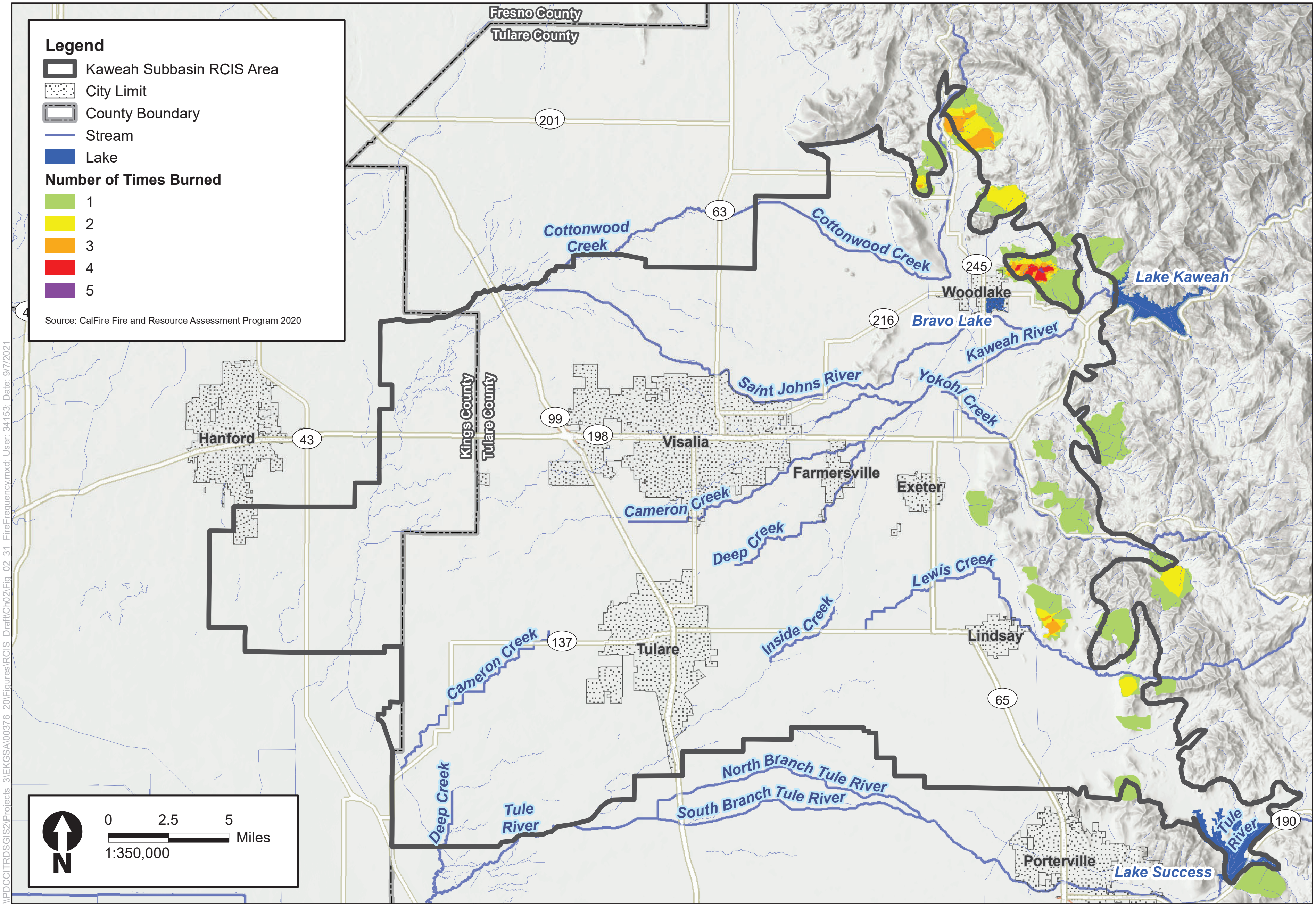


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Figure 2-31
Fire Frequency

2.4.7.2 Effects on Other Conservation Elements

Periodic fire and fire suppression are an important influence on grassland and woodland natural communities. Historically and prehistorically, fires caused by lightning strikes and human ignition, along with drought and native grazers, kept woody vegetation from invading grassland where the soil conditions were appropriate and converting it to shrubland or woodland (Paysen et al. 2000).

Fire suppression allows thatch and woody fuels to build up to higher levels than it would when periodic, low-intensity fires occurred more frequently, particularly if vegetation is not otherwise managed to control fuels. Native American burning declined as Native American populations declined, and was replaced with burning by Spanish, Mexican, and United States ranchers (Bartolome et al. 2007). Starting the early 1900s, widespread fire suppression reduced fire frequency in most grasslands. Once regular anthropogenic burning ceased, nonnative grasses rapidly established dominance and species richness decreased.

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

2.4.8 Renewable Energy, Mining, and Quarrying

Solar energy development accounts for the majority of the renewable energy-related pressures in the RCIS Area. There has been an increase in solar facilities statewide (Phillips and Cypher 2019) and demand will likely continue to increase. The California State legislature passed Senate Bill (SB) 350[25] in 2015 requiring all energy-supplying utilities to obtain at least 50% of their electricity from renewable energy sources by 2030 . The California State legislature followed up SB 350 by passing SB 100[26] in 2018, that mandated reaching the 50% target by 2026 and reaching a 60% target by 2030, with 100% of retail sales of electricity from renewable and zero-carbon sources by 2045.

There is a high potential for solar energy generation in the San Joaquin Valley, though comparatively less so in the RCIS Area than in the south and southwestern San Joaquin Valley (Phillips and Cypher 2019). The flat terrain and high insolation rates, coupled with relatively low land prices and proximity to transmission corridors make the San Joaquin Valley particularly attractive for solar facilities (Phillips and Cypher 2019, Pearce et al. 2016). Solar energy development may be a valuable land use alternative for landowners who need to repurpose land.

The SWAP includes mines and quarries in this category of pressures and stressors. There are few mines and quarries in the RCIS Area. Much of the RCIS Area in Tulare County is zoned for intensive agriculture to preclude the intrusion of uses which conflict with agriculture, including resource extraction-oriented uses such as quarries. Mineral Resource Zones in Tulare County are generally restricted to a narrow area east of Visalia and south of Woodlake. The portion of Kings County in the RCIS Area is zoned for exclusive agriculture which precludes surface mining.

2.4.8.1 Effects on Focal Species and Habitats

Solar energy installations can have significant effects on focal species and their habitats depending on the size of the project and the species. Some species, such as San Joaquin kit fox, may benefit from the increased protection from larger terrestrial predators afforded by the security fencing around solar installations, and the solar panels themselves may protect against avian predators (Cypher et

[25] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350
[26] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB100

al. 2019). However, projects need to be sited in ways to minimize negative effects on species and their habitats such as disrupted migration pathways and landscape linkages. Focal species and other sensitive species are rare or uncommon in the RCIS Area and region, limited to small, fragmented patches of habitat. Solar projects on remaining natural habitats will further degrade or eliminate habitat and further fragment remaining habitats and populations (Moore-O'Leary et al. 2017, Phillips and Cypher 2019).

2.4.8.2 Effects on Other Conservation Elements

As described above in Section 2.4.1, *Urban Development*, solar projects are an important contributor to the conversion of agricultural land (California Department of Conservation 2018) and could reduce the amount of land in agricultural production. Solar projects on natural communities can degrade or eliminate those natural communities, and further fragment the landscape. However, if implemented strategically, solar installations could be sited on lands identified for repurposing to achieve groundwater sustainability goals, while minimizing impacts to sensitive species (Pearce et al. 2016, Phillips and Cypher 2019) (Figures 2-5 through 2-7). Such multibenefit projects would reduce water use while potentially providing an alternate source of revenue for landowners.

Mining and quarrying can convert or degrade habitat. Within the limited scale in the RCIS Area, however, loss of natural communities and habitats are relatively small. Mining activities in aquatic habitats such as streams can affect aquatic conditions. Suction dredge mining can cause siltation and create deep holes in streams which provide habitat for nonnative predatory fish. Gravel mining in streams can affect the development of soil conditions necessary to support riparian vegetation (U.S. Fish and Wildlife Service 2002).

Chapter 3
Conservation Strategy

3.1 Overview

This chapter identifies and prioritizes the conservation opportunities in the Kaweah Groundwater Subbasin (Kaweah Subbasin) Regional Conservation Investment Strategy (RCIS) Area to guide conservation investments and advance mitigation. This Kaweah RCIS uses the best available science to identify *conservation goals* and *objectives* (Section 3.2.2, *Conservation Goals and Objectives*), and *actions* and *conservation priorities* (Section 3.2.3, *Actions and Priorities*) to achieve the conservation goals and objectives by protecting, restoring, and enhancing habitat and other conservation elements.

This conservation strategy is intended to support the implementation of Kaweah Subbasin Groundwater Sustainability Plans (GSPs) by identifying conservation and habitat enhancement actions that can be implemented as components of multibenefit projects to provide habitat values for *focal species* and other *conservation elements*; direct financial compensation to landowners; improve community drinking water reliability; and provide increased access to open space and recreation for community members. An important goal of this Kaweah RCIS is to provide a tool that could be used to provide financial incentives to working landowners who voluntarily participate in groundwater sustainability projects and management actions that also provide habitat values for focal species and other conservation elements addressed by this RCIS. This goal may be achieved by landowners participating in multibenefit compensatory mitigation projects for infrastructure or other development projects, as well as conservation investments. Agriculture plays a central role in the economy, environment, and culture of the region; this Kaweah RCIS emphasizes continued economically-viable stewardship of working lands in ways that benefit native biodiversity and ecosystem processes.

This Kaweah RCIS encourages the application of a multibenefit approach to achieving groundwater sustainability goals. This includes implementation of multibenefit groundwater sustainability projects and management actions, which are designed to do the following.

- Incorporate Kaweah RCIS conservation and habitat enhancement actions and create habitat values for focal species, non-focal species, and other conservation elements
- Direct financial compensation to landowners
- Contribute toward achieving sustainable groundwater use
- Improve community drinking water reliability
- Provide increased access to open space and recreation for community members

3.2 Framework

This conservation strategy was designed to meet the requirements of the California Department of Fish and Wildlife (CDFW) *Regional Conservation Investment Strategies Program Guidelines* (Program Guidelines) (California Department of Fish and Wildlife 2018a) to address groundwater sustainability, natural communities and working landscapes, focal species, and habitat connectivity. The most efficient way to achieve the conservation goals and objectives is to strategically implement voluntary multibenefit actions that provide the most benefit for a diverse group of stakeholders. Collaboration among all stakeholders will be necessary to achieve this outcome. Implementing this strategy will contribute to achieving groundwater sustainability; help sustain and enhance focal species and their habitats, and help populations adapt to climate change; reduce effects of other stressors on focal species and other conservation elements; and provide new opportunities for financial compensation to landowners who repurpose land.

This conservation strategy comprises four elements: conservation goals, conservation objectives, actions, and conservation priorities. This conservation strategy provides actions and priorities to accomplish the conservation goals and objectives through the following general concepts.

- Retain the diversity of land uses in the RCIS Area to support agricultural uses, focal and other native species, human communities, and sustainable groundwater use.
- Protect and restore the diversity of natural communities in the RCIS Area to maintain habitats for native flora and fauna that depend on these habitats.
- Protect populations of focal and other native species and their habitats to enable these species to persist in the RCIS Area and adapt to a changing climate.
- Manage and enhance focal and other native species' habitats to maintain and improve habitat quality for focal species and native biodiversity.
- Protect, enhance, and restore landscape linkages to facilitate movement through the landscape by wildlife and plants (e.g., as seeds are dispersed).
- Implement multibenefit projects that improve drinking water reliability and provide access to open space and recreation.

This chapter also presents an adaptive management and monitoring strategy (Section 3.12, *Adaptive Management and Monitoring Strategy*), which can be used to inform the development of adaptive management and monitoring plans for mitigation credit agreements (MCAs) under this RCIS (Section 4.3.1, *Mitigation Credit Agreements*).

3.2.1 Consideration of Development of Major Infrastructure Facilities

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

The Steering Committee primarily considered water infrastructure, urban development, transportation infrastructure, and solar facilities in the development of this RCIS's conservation goals, objectives, actions, and priorities. As an RCIS focused on multibenefit groundwater sustainability projects, this RCIS inherently considers water infrastructure that provides irrigation to agriculture and drinking water to the Subbasin's communities.

Land repurposing will likely be necessary to achieve the goals of the three Kaweah Subbasin GSPs. This RCIS considers strategically repurposing land for solar energy production as a means to provide an alternative source of income to landowners while minimizing the effects to focal species and other conservation elements, and where feasible, integrating habitat values into solar project design.

The California Department of Transportation (Caltrans) has a number of projects planned for the region. Conservation strategies for focal species, natural communities, and habitat connectivity were informed by the anticipated mitigation needs of these projects (Section 2.2.3.2, *Transportation*) (California Department of Transportation 2020).

3.2.2 Conservation Goals and Objectives

This Kaweah RCIS's *conservation goals* reflect the broad, desired outcomes for the focal species and other conservation elements in the RCIS Area. Each conservation goal is supported by several conservation objectives. An *objective* is a concise, measurable statement of what is to be achieved in support of a conservation goal. Each conservation objective was developed to be fully or partially-achievable through implementation of conservation actions and habitat enhancement actions within the next 10 years, which is the maximum duration of CDFW's RCIS approval period. Implementation of this Kaweah RCIS is voluntary, so there is no deadline or requirement to achieve these objectives. Resources available to the conservation community and others to invest in conservation actions are limited and variable, and there is no expectation that all of the conservation goals and objectives will be fully or partially achieved within the next 10 years.

The conservation goals and objectives are organized hierarchically so that multibenefit conservation and habitat enhancement actions implemented for groundwater recharge, natural communities, working landscapes, and habitat connectivity will benefit focal species and non-focal species. For example, the natural community conservation goals and objectives focus on protecting, enhancing, and restoring natural community ecological functions and values. Achieving these goals and objectives will provide for the conservation of habitats of associated focal species and other native species.

Species-specific conservation goals and objectives address stressors and habitat needs specific to individual focal species that are not addressed under the natural community, working landscapes, or habitat connectivity goals and objectives.

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

As required by California Fish and Game Code (FGC) Section 1852(c)(9), an RCIS shall include "[c]onservation actions, including a description of the general amounts and types of habitat that, if preserved or restored and permanently protected, could achieve the conservation goals and objectives…"

Each natural community objective in this RCIS that will be achieved through permanent protection or restoration includes a general amount (*Conservation Target* in Table 3-1) that would contribute to achieving the corresponding conservation goal. Some focal species objectives include conservation targets to protect a certain number of occurrences or protect or restore habitat. The general amounts of natural communities and numbers of occurrences of focal species to protect are based on the best professional judgement of ecologists on the Planning Team, regional conservation planning by the Sequoia Riverlands Trust, and conservation opportunities identified by local conservation partners.

Many habitat connectivity objectives that will be achieved through permanent protection or restoration will be achieved largely by implementing natural community and focal species conservation actions and habitat enhancement actions in targeted ways to improve groundwater sustainability and habitat connectivity. For example, actions to protect or restore grasslands can also be implemented to achieve objectives to improve habitat connectivity if grasslands are protected or restored within important connectivity areas (Section 3.9, *Conservation Strategy for Habitat Connectivity*).

This RCIS's objectives each include a metric to measure the net change resulting from the implementation of conservation and habitat enhancement actions, as required by FGC Section 1854(e). Examples include accounting for acres protected, restored, or managed to provide habitat for a focal species, or acre-feet of groundwater recharge capacity. The metrics provided in this RCIS may be refined through an RCIS amendment (as described in the Program Guidelines and Section 4.4, *Amending the Regional Conservation Investment Strategy*) as new metrics and techniques to measure the outcomes of conservation and habitat enhancement actions are developed.

3.2.3 Actions and Priorities

This Kaweah RCIS's *actions and priorities* are actions that will accomplish this RCIS's conservation goals and objectives. Actions include both conservation actions and habitat enhancement actions and are defined in the Program Guidelines as follows.

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

> MCA would create habitat enhancement credits intended for use as compensatory mitigation for temporary impacts.[1]

Actions described in the conservation strategies in this chapter are not identified as either conservation actions or habitat enhancement actions to retain flexibility in how the action may be implemented under an MCA, as many of the actions can be implemented on land permanently protected under a conservation easement (i.e., conservation action), or on land protected under a species- or habitat-appropriate durability agreement that is not permanently protected (i.e., habitat enhancement action). For example, an action to fallow fields or grow crops that provide foraging habitat for Swainson's hawk may be implemented on permanently protected land, with the land managed in perpetuity to provide foraging habitat for Swainson's hawk, or on land protected under an appropriate durability agreement that is not permanently protected. MCAs may include habitat enhancement actions on lands that are already protected, as well as lands that the MCA commits to protect. Conservation actions and habitat enhancement actions are intended to achieve conservation goals and objectives through multiple-implementation efforts, across the RCIS Area landscapes, rather than as part of a single conservation project (refer to the CDFW MCA Guidelines[2] for more details).

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

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

Conservation priorities are used to highlight important conservation actions and habitat enhancement actions that should be implemented within the next 10 years.

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

3.2.3.1 Criteria for Identifying Conservation Priorities

Development of this Kaweah RCIS conservation strategy was informed by U.S. Fish and Wildlife (USFWS) recovery plans, 5-year reviews, and species status assessments for focal species and communities (i.e., grassland–vernal pool complex) and the best available science, as summarized in the focal species profiles and Chapter 2, *Environmental Setting and the Built Environment*. Conservation priorities were refined for the conditions and ecosystems in the Subbasin based on conservation strategies developed locally by the Sequoia Riverlands Trust and input from the Planning Team and Steering Committee. Other factors considered when identifying conservation priorities include the following.

[1] FGC Section 1856(d) states that "…the habitat enhancement action shall remain in effect at least until the site of the environmental impact is returned to pre-impact ecological conditions."

[2] https://www.wildlife.ca.gov/conservation/planning/regional-conservation

- Locations of natural communities using this RCIS's land cover dataset (Section 2.3.8, *Natural Communities*; Figure 2-16), to identify where in the RCIS Area these conservation elements occur
- Documented recent species occurrences (Appendix E, *Focal Species Profiles*), as this RCIS prioritizes the protection of habitat occupied by focal species
- Designated critical habitat for focal species that have designated critical habitat in the RCIS Area (Figure 2-1), to inform where priority actions should be implemented
- Important locations for habitat connectivity (Section 2.3.10, *Habitat Connectivity*) to identify where priority actions should be implemented to improve habitat connectivity
- Adjacency to protected areas (Figure 2-8), to expand and connect protected areas
- Locations that would, or are expected to, promote climate resilience (Section 2.4.4.6, *Areas of Resilience to Effects of Climate Chang*e; Figure 2-29), to facilitate adaptations by supporting native biodiversity to better respond to a changing climate
- Areas that are suitable for multibenefit groundwater recharge activities

3.3 Adaptations Against the Effects of Climate Change

FGC Section 1852(c)(13) states that an RCIS shall include "a description of how the strategy's conservation goals and objectives provide for adaptation opportunities against the effects of climate change for the strategy's focal species." The effects of climate change are expected to result in increased temperature and drought, changes in precipitation patterns, and increased area burned by wildfire (Section 2.4.4, *Climate Change*). Using various tools such as CDFW's Areas of Conservation Emphasis (ACE) Terrestrial Climate Change Resilience dataset (California Department of Fish and Wildlife 2020a), this conservation strategy's conservation goals and objectives were designed to provide opportunities to adapt to the effects of climate change, specifically focusing on this RCIS's focal species. This RCIS also incorporates strategies for encouraging resilience against the effects of climate change by recommending protection of large blocks of interconnected habitat that support focal species and managing the landscape matrix to increase habitat values within it. Increasing the amount of protected habitat and land managed will in turn provide habitat for focal species, retain wildlife corridors, retain linear stretches of habitat that connect larger patches of habitat, and will facilitate focal species movement to future, shifting habitats. This RCIS also identifies actions to simulate historical disturbance regimes (e.g., grazing, wildfire) that can be used to create a diversity of microhabitats across landscapes. Diverse native plant and animal communities that retain important ecological functions have a greater chance for persistence and change in response to climate shifts. In turn, these persistent communities will allow focal species to move to favorable habitats if their current locations become unsuitable (Beller et al. 2015).

3.4 Gap Analysis

A gap analysis was conducted to estimate the extent of natural communities and focal species' habitat already protected in the RCIS Area, and the amount that would need to be protected or restored to achieve the conservation targets for protection and restoration.

The gap analysis serves as a baseline to assess progress toward achieving the quantitative protection and restoration objectives for natural communities through implementation of conservation actions and habitat enhancement actions identified in this RCIS (Section 4.2.2, *Assessing Progress*). For example, the East Kaweah Groundwater Sustainability Agency (EKGSA), who is the RCIS proponent, or other users of this RCIS can assess the progress toward achieving this RCIS's goals and objectives by comparing current levels of protection of natural communities and focal species' habitat to the baseline estimated by the gap analysis.

The following Kaweah RCIS geographic information system (GIS) data layers were used to identify gaps in protection for the natural communities and focal species habitat in the RCIS Area.

- Natural communities and land cover (Section 2.3.8.2, *Current Natural Communities and Land Cover*; Figures 2-16 and 2-16)
- Focal species predicted habitat for species with habitat models (Appendix E).
- Kaweah RCIS protected lands dataset (Section 2.3.1, *Protected Areas*; Figure 2-8)

3.4.1 Natural Community Gap Analysis

Table 3-1 shows the following, from left to right.

- Total amount of each natural community, agricultural land, and land cover type in the RCIS Area.
- Amount and percent of each natural community, agricultural land, and land cover type protected for open space or habitat values.
- Amount and percent of unprotected land for each natural community, agricultural land, and land cover type.
- Conservation target for natural communities and the percent the conservation target comprises of the total amount of that natural community. Conservation targets are general amounts of a natural community that should be protected or restored and would contribute toward achieving the conservation goal for the corresponding natural community. The conservation targets are based on the best professional judgment of ecologists on the Planning Team, regional conservation planning by the Sequoia Riverlands Trust, and conservation opportunities identified by local conservation partners. Conservation targets can be achieved by protecting or restoring any of the land cover types.
- Conservation gap, or the amount of the natural community that needs to be protected or restored to meet the conservation target, and the percent of the conservation target that is currently protected. Natural community objectives are designed to close the conservation gap. Conservation targets are incorporated into natural community objectives to create quantitative objectives.

Table 3-1. Natural Community Gap Analysis (All Area Values in Acres)

Natural Community and Land Cover Type	Total Land Cover	Protected		Unprotected		Conservation Target (Protect or Restore)		Conservation Gap	
	Area	Area	%	Area	%	Area	%	Area	%
Grassland (total)	**55,558**	**2,029**	**4**	**53,528**	**96**	**13,900**	**25**	**11,871**	**15**
California annual and perennial grassland	55,558	2,029	3.65	53,528	96	–	–	–	–
Vernal Pool Complex (total)	**8,613**	**2,492**	**29**	**6,121**	**71**	**4,310**	**50**	**1,881**	**56**
Vernal pool complex	8,613	2,492	29	6,121	71	–	–	–	–
Scrub (total)	**42**	**31**	**74**	**11**	**26**	**1,220**	**–**	**1,190**	**3**
Bush seepweed scrub	0	0	0	0	100	–	–	–	–
Fourwing saltbush scrub	28	27	96	1	4	–	–	–	–
Quailbush scrub	3	3	100	0	0	–	–	–	–
Silver bush lupine scrub	11	1	10	10	90	–	–	–	–
Chaparral (total)	**21**	**0**	**0**	**21**	**100**	**–**	**–**	**–**	**–**
Tucker oak chaparral	10	0	0	10	100	–	–	–	–
Cliff/scree/rock vegetation	11	0	0	11	100	–	–	–	–
Woodland (total)	**1,418**	**58**	**4**	**1,360**	**96**	**500**	**35**	**442**	**12**
Blue oak woodland	1,040	14	1	1,026	99	–	–	–	–
California buckeye groves	9	0	0	9	100	–	–	–	–
Interior live oak	3	0	0	3	100	–	–	–	–
Nonnative groves	367	44	12	323	88	–	–	–	–
Riparian (total)	**3,312**	**475**	**14**	**2,837**	**86**	**960**	**29**	**486**	**49**
Valley oak woodland	1,734	208	12	1,526	88	454	26	246	14
Fremont cottonwood woodland	560	35	6	525	94	–	–	–	–
California sycamore woodland	126	1	1	125	99	–	–	–	–
California coffee berry–western azalea scrub–Brewer's willow	7	0	0	7	100	–	–	–	–
Goodding's willow–red willow–riparian woodland	704	197	28	507	72	–	–	–	–
Sandbar willow thickets	11	0	0	11	100	–	–	–	–
Blue elderberry stands	29	4	14	25	86	–	–	–	–
Riparian woodland (alliance unspecified)	132	30	23	102	77	–	–	–	–

Natural Community and Land Cover Type	Total Land Cover	Protected		Unprotected		Conservation Target (Protect or Restore)		Conservation Gap	
	Area	Area	%	Area	%	Area	%	Area	%
Mulefat thickets	<0.1	0	0	<0.1	0	–	–	–	–
Tamarisk thickets	4	0	0	4	100	–	–	–	–
Himalayan blackberry–rattlebox–edible fig riparian scrub	6	0	0	6	100	–	–	–	–
Wetland (total)	**162**	**2**	**1**	**160**	**99**	**4**	**3**	**2**	**50**
Baltic and Mexican rush marshes	10	0	0	10	100	–	–	–	–
Californian warm temperate marsh/seep	14	0	0	14	100	–	–	–	–
Cattail marshes	39	0	0	39	100	–	–	–	–
Common and giant reed marshes	9	0	0	9	100	–	–	–	–
Duckweed blooms	3	0	0	3	100	–	–	–	–
Hardstem and California bulrush marshes	12	0	0	12	100	–	–	–	–
Mosquito fern mats	4	1	26	3	74	–	–	–	–
Water primrose wetlands	1	0	0	1	100	–	–	–	–
Wet meadow	10	0	0	10	100	–	–	–	–
Naturalized warm-temperate riparian and wetland group	61	1	2	60	98	–	–	–	–
Open Water (total)	**3,580**	**1,768**	**49**	**1,813**	**51**	**–**	**–**	**–**	**–**
Lacustrine/riverine	3,580	1,768	49	1,813	51	–	–	–	–
Agriculture (total)	**355,651**	**842**	**0**	**354,809**	**100**	**–**	**–**	**–**	**–**
Alfalfa	29,858	1	0	29,857	100	–	–	–	–
Field crop	96,558	1	0	96,557	100	–	–	–	–
Grain and hay	11,105	1	0	11,104	100	–	–	–	–
Pasture	1,082	0	0	1,082	100	–	–	–	–
Fallow	12,130	13	0	12,117	100	–	–	–	–
Orchard and vineyard	154,871	773	0	154,098	100	–	–	–	–
Developed agriculture	50,047	53	0	49,994	100	–	–	–	–

3.4.2 Focal Species Gap Analysis

Table 3-2 shows the following, from left to right.

- Total amount of predicted habitat class for each focal species with a habitat model (Appendix E)
- Amount and percent of each predicted habitat class protected for open space or habitat values
- Amount and percent of unprotected land for each predicted habitat class

Table 3-2. Focal Species Gap Analysis (All Area Values in Acres)

	Total Predicted Habitat	Protected Predicted Habitat		Unprotected Predicted Habitat	
Predicted Habitat Class for Focal Species	**Area**	**Area**	**%**	**Area**	**%**
Vernal Pool Fairy Shrimp[a]	**8,613**	**2,491**	**29**	**6,121**	**71**
California tiger salamander	**18,283**	**2,563**	**14**	**15,720**	**86**
High	16,262	2,430	15	13,832	85
Moderate	268	98	37	170	63
Low	1,754	35	2	1,719	98
Western Spadefoot	**369,574**	**7,191**	**2**	**362,382**	**98**
High	58,289	5,955	10	52,335	90
Moderate	1,530	32	2	1,498	98
Low	309,754	1,205	<1	308,550	99
Blunt-nosed Leopard Lizard	**2,076**	**273**	**13**	**1,803**	**87**
Moderate	1,288	273	21	1,014	79
Low	788	0	0	788	100
Swainson's Hawk	**127,181**	**2,928**	**2**	**124,253**	**98**
High	76,212	1,865	2	74,347	98
Moderate	2,521	158	6	2,363	94
Low	48,448	905	2	47,543	98
Burrowing Owl	**134,851**	**2,981**	**2**	**131,870**	**98**
High	134,517	2,900	2	131,617	98
Moderate	12	0	0	12	100
Low	322	81	25	241	75
Tricolored Blackbird	**383,872**	**5,169**	**1**	**378,703**	**99**
High	67	31	46	36	54
Moderate	749	157	21	592	79
Low	383,056	4,981	1	378,075	99
Pallid Bat	**471,089**	**5,374**	**1**	**465,715**	**99**
High	2,302	5	<1	2,297	100
Moderate	34,078	88	<1	33,990	100
Low	434,709	5,281	1	429,428	99

Predicted Habitat Class for Focal Species	Total Predicted Habitat	Protected Predicted Habitat		Unprotected Predicted Habitat	
	Area	Area	%	Area	%
Tipton Kangaroo	**3,488**	**575**	**16**	**2,913**	**84**
Moderately High	12	0	0	12	100
Moderate	1,200	465	39	735	61
Low	2,276	110	5	2,166	95
San Joaquin Kit Fox	**473,498**	**7,561**	**2**	**465,937**	**98**
High	2,277	100	4	2,177	96
Moderate	14,411	1,597	11	12,814	89
Low	456,810	5,864	1	450,946	99

[a] Vernal pool complex land cover is used as vernal pool fairy shrimp habitat.

3.5 Guiding Principles for Implementing Conservation and Habitat Enhancement Actions

While this RCIS includes conservation priorities specific to the focal species and other conservation elements, this section provides guiding principles to assist users of this RCIS in further prioritizing compatible land use and implementing the conservation and habitat enhancement actions in this RCIS. These guidelines identify preferred characteristics of conservation and mitigation sites for permanent protection and restoration, guiding principles for restoration and enhancement, and the appropriate use of transplantation and translocation of plant material and wildlife.

3.5.1 Guidelines for Prioritizing Sites for Protection

When identifying areas to protect for focal species, users of this RCIS should consider the following guidelines for prioritizing sites for permanent protection.

- **Multibenefit projects.** Protect sites that provide groundwater sustainability benefits while providing habitat for focal species and other conservation elements, direct financial compensation to landowners, improve drinking water and reliability, and provide increased access to open space and recreation for community members. Multibenefit projects could include recharge projects, land repurposing, or change in crop type or pattern while protecting existing habitat or growing crops that might be used by focal species as habitat. Multibenefit projects could also include solar projects on re-purposed land (i.e., re-purposed for groundwater benefits) that are sited to minimize impacts on focal species and other conservation elements. Solar energy projects should be designed to provide habitat values for focal species and other conservation elements, for example, by using wildlife-friendly fencing that allows wildlife to move through solar energy project areas. Siting and design of multibenefit projects should consider groundwater savings potential and revenue lost from repurposing working lands.
- **Focal species and habitat.** Protect sites occupied by multiple focal species and other conservation elements (e.g., rare/unique natural communities), including those that are within riparian wildlife corridors and Essential Connectivity Areas, Natural Landscape Blocks, and Small Natural Areas (Section 2.3.10, *Habitat Connectivity*; Figure 2-25). Prioritize sites with comparatively abundant, robust occurrences of multiple focal species (e.g., sites with multiple, large populations/subpopulations of focal plant species) that support high-quality habitat for important phases of a species' lifecycle (e.g., ponds used for breeding amphibians) over smaller sites with relatively marginal habitat that is not occupied by the target focal species.
- **Size and configuration of site.** Protect large sites with a low ratio of edge to interior (i.e., large convex parcels) to minimize potentially negative effects of adjacent land uses (e.g., development and the spread of invasive plants, and increases in numbers of predators commonly associated with human development). The size and shape of the site should provide for the ecological needs of the target species. For example, sites should be large enough to sustain a population, subpopulation, or multiple territories or nest sites of the target focal species. Sites should have the ecological features necessary for target focal species to complete their life cycles, or the phase or phases of the life cycle that the target focal species needs to complete while in the RCIS Area. For example, a site protected for tricolored blackbird should include an active nest colony

site and high-quality foraging habitat, particularly if high-quality foraging habitat is not available in close proximity.

- **Proximity to protected habitat.** Protect sites adjacent or close to existing protected areas to expand and connect protected habitats.
- **Consideration of adjacent land uses.** Prioritize sites that are buffered by adjacent land uses or prioritize sites that will serve to buffer existing protected areas from adjacent land uses. Buffers should provide opportunities for access to open space and passive recreation when compatible with the focal species and habitats being buffered.
- **Climate resilience.** When ecologically appropriate, prioritize sites that may be more resilient to the effects of climate change (Section 2.4.4.6, *Areas of Resilience to Effects of Climate Change*), and provide refugia from the effects of climate change, as identified in Figure 2-29.

3.5.2 Guidelines for Prioritizing Sites for Restoration

When considering sites for restoration, users of this RCIS should consider the following guidelines.

- **Multibenefit projects.** The guidelines for multibenefit habitat protection projects apply similarly for prioritizing sites for restoration. Where feasible, restoration projects should be sited and implemented to provide multiple benefits, maximize groundwater demand reduction and recharge, and minimize economic impacts.
- **Compensation to landowners.** Prioritize sites for restoration that would direct financial compensation, when available, to landowners repurposing land to achieve GSP goals.
- **Site characteristics.** Prioritize sites with the biological, physical (particularly soils), and chemical characteristics and processes that will support the ecological community to be restored and have a high likelihood for successful restoration.
- **Species occupancy.** Prioritize sites that are occupied by target species, but are of low quality, and may currently be population sinks.
- **Likelihood of colonization.** Prioritize sites that have a high likelihood of being colonized by target species. For example, the site could be adjacent to, or near to, a population of the target species, or it could be ecologically connected to occupied sites. The level of connectedness will depend on the target species and its ability to disperse through landscapes to colonize habitat patches.
- **Proximity to high-quality habitat.** Prioritize degraded sites adjacent to higher-quality habitats to expand the extent and interconnectedness of high-quality habitat.

3.5.3 Guiding Principles for Habitat Restoration and Management

All sites that are permanently protected will be managed to improve ecological conditions for focal species, conservation elements, and ecological functions. In this RCIS, techniques for enhancing habitat (which can also be applied to restoring habitat) are briefly described in the conservation strategies for focal species and the other conservation elements. The following broad recommendations should apply to all enhancement and restoration actions.

- **Manage at multiple scales.** Biological processes occur at a wide variety of spatial scales across landscapes. Restoration and enhancement activities should be planned and executed with these multiple scales in mind. For example, restoration of plant occurrences may occur within a relatively small area around the occurrence, and could require specific, intensive management actions to restore an occurrence, such as planting and protecting seedlings from herbivores, or irrigating plantings to improve survivorship. The methods used to restore and enhance plant occurrences may depend on the microhabitat features the species relies upon, such as soil texture, soil depth, rockiness, and distance to the nearest occurrence of the same species. However, other processes such as the spread of invasive species generally occur at larger spatial scales than an occupied patch of habitat. Management of invasive species may therefore be better addressed at a larger spatial scale, such as grazing a protected area to manage invasive vegetation. Wildlife lifecycle phases may also occur at more than one spatial scale. For example, breeding habitat may require a relatively small area but highly specific conditions (e.g., vernal pool hydroperiods for amphibian breeding), while estivation (for amphibians) and migration/dispersal (for birds/mammals) habitat must be larger but may be more varied.
- **Maintain or mimic natural processes.** This is a management technique that recognizes that natural processes (e.g., hydrologic regimes in vernal pool systems to maintain seasonal hydroperiod, wildfire) are the fundamental forces that shape natural systems and create and maintain habitats. Management actions should focus on defining, maintaining or restoring, and enhancing these natural processes (e.g., herbivory via livestock grazing or prescribed burning to manage vegetation). If not feasible, then the effects of those processes can be duplicated by alternative management actions (e.g., mowing or other mechanical or chemical treatments to control invasive vegetation).
- **Create natural land features.** Create microtopographic features such as mounds or vernal pool basins to provide habitat for focal species and other native species, particularly where past land uses have leveled or plowed the land. For example, blunt-nosed leopard lizards use minor topographical changes as perches for surveying the environment and for thermoregulation (U.S. Fish and Wildlife Service 2020a).
- **Account for inherent variability.** It is important to acknowledge that stochastic or chance events can often exert strong effects on natural systems and populations of species that comprise those systems. The most common of these chance events are weather-related factors such as flooding, temperature extremes, and drought; native or invasive pest outbreaks are also common. Other chance events are associated with populations themselves; these may include variation in rates of reproduction and mortality. Such inherently uncontrollable variables and their effects on target focal species are best offset by enhancing and restoring a diversity of microsites and environmental gradients. This ensures that target focal species can take advantage of suitable habitat during years with favorable conditions (e.g., adequate rainfall), and find refugia in years with unfavorable conditions (e.g., drought).

3.5.3.1 Transplantation and Translocation to Aid in Species Recovery

Transplantation of plant material (e.g., seeds, cuttings, etc.) or translocation of wildlife is one type of action in the RCIS toolkit that would assist in the conservation and recovery of focal species populations. When it is infeasible to permanently protect enough populations of rare plants or wildlife to secure long-term viability of a species or subspecies, transplantation or translocation may be considered as a means to enhance degraded populations or create new populations to increase a species' likelihood of long-term viability. For example, transplantation or translocation may be considered as a means to assist colonization of restored or created habitat, particularly if barriers to movement limits natural colonization of restored or created habitat.

This Kaweah RCIS does not intend for transplantation or translocation to be used to compensate for impacts to rare plants or wildlife, unless a transplanted or translocated occurrence has been documented as well established through long-term monitoring, and with approval by the permitting wildlife agency and consistent with the CDFW Conservation Translocation Policy (California Department of Fish and Wildlife 2017). Transplantation of rare plants is rarely successful in establishing a new occurrence. Because of the low likelihood of successful transplantation of rare plants at a new location, transplantation is opposed by conservation organizations as a primary mitigation tool (Howald 1996, California Native Plant Society 1998). Many of the wildlife focal species or subspecies exist in small fragmented habitat patches throughout their ranges (e.g., blunt-nosed leopard lizard, Buena Vista Lake ornate shrew, Tipton kangaroo rat; U.S. Fish and Wildlife Service 2020a, 2020b, 2020c). Translocation may be necessary for these species to colonize and successfully reproduce in restored or created habitat; however, reliably successful methods for translocation of these species have not been developed (U.S. Fish and Wildlife Service 2020a, 2020c).

Transplantation or translocation to assist in the conservation and recovery of populations of focal plant or wildlife species should only be implemented after developing a thorough plan in coordination with biologists with expertise on the species or subspecies (or closely related taxa) and with CDFW and USFWS, particularly if the plant or wildlife is state or federally listed, or considered rare by the California Native Plant Society (CNPS).

Careful planning for transplantation or translocation should include consideration of the species' or subspecies' biological and environmental requirements, as transplantation and translocation can be extremely stressful. Transplantation of rare plants should not be effected close to an existing population of that species, as measured by the potential for genetic exchange among individuals through pollen or propagule (e.g., seed, fruit) dispersal, unless transplantation propagules are from a local population (i.e., there is genetic exchange between the propagule source and the existing population that will be enhanced through transplantation). Transplantation or seeding receptor sites (i.e., habitat suitable for establishing a new population) should be carefully selected on the basis of physical, biological, and logistical considerations (Fiedler and Laven 1996). It is crucial that the soil and habitat requirements of the species are fully understood before successful establishment can be assured (Fiedler 1991). Both the source location and the receptor site must be carefully prepared to ensure that plants are removed and planted in a manner that provides them with the best chance of reestablishment, including ensuring disease-free soils. Thus, transplantation (and translocation) should only occur on a case-by-case basis using pilot studies and in consultation with CDFW, USFWS, and species experts to ensure that both the species' ecological requirements and site-specific conditions are fully understood.

If transplantation or translocation of a state-listed species is to occur, take coverage via either 2081(a) for recovery actions or 2081(b) for Incidental Take Authorization would be required to comply with CESA. Incidental Take Authorization cannot be issued for fully protected species.

3.6 Conservation Strategy to Provide Groundwater Sustainability Co-Benefits

Irrigated agriculture in the San Joaquin Valley, California's most productive agricultural region, is the primary consumer of water resources. However, local water supplies are limited, particularly in the southern regions of the San Joaquin Valley, and many farmers rely on surface water imported from the Sacramento-San Joaquin Delta (Delta) to irrigate their crops. More frequent and intense droughts, increased demands on surface water, competing water rights, and increased regulations to protect native endangered fish have all affected the availability of reliable surface water supplies in the RCIS Area. In response, both agricultural and urban water users have experienced an increased reliance on groundwater to meet their water needs, resulting in the San Joaquin Valley having the largest groundwater deficit in the state (Hanak et al. 2019) and the Kaweah Subbasin having a designation as critically overdrafted. These conditions affecting surface water availability also reduce the amount of water available for natural groundwater recharge, which is necessary to replenish aquifers.

To counteract the adverse effects of unsustainable groundwater withdrawals, land use changes throughout the San Joaquin Valley including the RCIS Area will be required to meet the Sustainable Groundwater Management Act (SGMA)-mandated requirement for sustainable groundwater use by 2040. The three Kaweah Subbasin GSPs have outlined a suite of projects and management actions to achieve sustainability via water supply augmentation and water demand reduction (Section 2.2.3.1, *Water*). Reducing water demand will require a reduction in irrigated agriculture along with an increase in urban water conservation. Land repurposing strategies should begin by considering groundwater supply and demand reduction objectives, since the need for repurposing will often be driven by GSP implementation. However, collaborative, multibenefit planning can help RCIS Area residents cope with the necessary landscape-scale changes by providing cost-effective adaptation strategies that support the economy while also improving public health and the environment (Bourque et al. 2019, Bryant et al. 2020, Environmental Defense Fund 2021).

Traditional approaches to land conservation usually entail permanent protection that involves purchase or restoration of lands and conversion to land trust, preserve, refuge or public park. This approach can be effective; however, it cannot solely accomplish the large-scale land use changes necessary to provide groundwater sustainability in the RCIS Area. Since the effectiveness of protected areas depend on the surrounding landscape, working agricultural lands that can provide buffer zones and transitions between protected areas can help enhance sustainability and resilience (Kremen and Merenlender 2018). In the context of climate change adaptation, integration of dynamic conservation with permanent protected areas, particularly in highly human-modified and fragmented landscapes such as working agricultural lands, is increasingly being recognized as a crucial strategy to provide temporary or transient protection for migratory or key species and sustain critical ecosystem services (D'Aloia et al. 2019).

Water resource managers throughout the western United States are beginning to incorporate these principles into multibenefit managed aquifer recharge projects. For example, The Nature Conservancy, working in partnership with the Colusa Groundwater Authority, is conducting an on-farm, multibenefit recharge program in a Severely Disadvantaged Community, which works with farmers to create temporary "pop-up" wetlands for migratory shorebirds on farmland by using computer models and bird data to track conditions in real time, and determine when, where, and how much habitat is needed as conditions change from year to year.[3] Farmers are invited to participate in a reverse auction which has them submit bids for the cost of providing habitat in two-week increments in spring or fall. Bids are evaluated by The Nature Conservancy based on price per acre, predicted bird occurrence, and other factors such as distance to refuges and protected areas, and suitability for groundwater recharge, and bids with the best conservation return on investment are selected. This on-farm recharge program requires short-term commitments from growers to irrigate and maintain shallow water depths of 4 inches or less on enrolled fields, and pays for field preparation, irrigation, and water costs. Since inception of the program in 2014, over 100 farmers have participated and have helped create over 58,000 acres of temporary shorebird habitat during critical migration periods, while also receiving financial compensation for their participation.

Wetland conservation and working agriculture have been successfully integrated in other regions of northern California[4] and the Pacific Northwest[5] that have extensive agricultural economies. Farmers typically set aside a portion of their land for conversion to either seasonally flooded or permanently flooded wetlands for short (i.e., 1- to 4-year) cycles before returning the land to active cropping. In return, farmers receive financial compensation for their land, and studies have shown that in addition to the benefits to wildlife, wetland cycles can enhance soil fertility and tilth, reduce soil-borne crop pathogens, reduce farming inputs, and boost quality and quantity of yields after a wetland cycle (Mehlman et al. 2011, Saez 2015).

Municipal and industrial water use represents a small percentage of total groundwater usage in the RCIS Area, but most of these users are wholly dependent on groundwater supplies. Projected population growth and increased demand on municipal water supplies could add to the Kaweah Subbasin groundwater imbalance if it is not coupled with increased water conservation measures. Many communities are already feeling the effects of water shortages and impacted water quality that limits access to safe drinking water. Implementing green infrastructure elements in urban settings has the potential to increase local water supplies while also providing increased flood protection, ameliorating groundwater pollution, reducing the “heat island” effect in urban areas, creating green space, and enhancing community livability (Natural Resource Defense Council 2009, U.S. Environmental Protection Agency 2014).

Soils with high groundwater recharge potential occur within urban boundaries throughout the RCIS Area (Figure 2-10). Practices that emphasize rainwater harvesting, which include infiltration as well as catchment for later use (e.g., permeable pavements, bioswales, rain gardens, and rain barrels) increase groundwater recharge and reduce water demand, they work at the project site-level, and they can be implemented in individual development, redevelopment, or retrofit projects. The addition of native vegetation and greenspace, which frequently are components of these projects, increases urban wildlife habitat and can support habitat connectivity within ecological landscapes and serve as a refuge for species impacted by urbanization (U.S. Forest Service Research and Development 2013). Green infrastructure is an integral component of sustainable communities that need to balance economic assets, natural resources, and social priorities so that residents’ diverse needs can be met now, and into the future (U.S. Environmental Protection Agency 2014).

The goals and objectives for this conservation element are designed to support the implementation of the suite of projects and management actions described by the three Kaweah Subbasin GSPs in a

[3] https://birdreturns.org/multi-benefit-groundwater-recharge/

[4] https://www.fws.gov/refuge/tulelake/walkingwetlands.html

[5] https://www.washingtonnature.org/fieldnotes/farming-for-wildlife-farmers-in-washington

manner that provides the maximum environmental, social, and economic benefits possible at the least cost. These goals are also in alignment with the water management goals and policies of the various General Plans in the Subbasin. Groundwater recharge is intricately tied to agricultural lands and many of the conservation actions presented for working landscapes (Section 3.8 *Working Landscapes*) will also benefit groundwater recharge.

3.6.1 Conservation Goals, Objectives, and Actions

Goal GW-1. Multibenefit groundwater sustainability projects and management actions that (1) incorporate Kaweah RCIS conservation and habitat enhancement actions and create habitat values for focal species, non-focal species, and other conservation elements; (2) direct financial compensation to landowners; (3) improve community drinking water reliability; and (4) provide increased access to open space and recreation for community members.

Objective GW 1-1. Implement groundwater recharge projects. Implement multibenefit flood control and groundwater recharge projects that provide or support habitat values for focal species and other conservation elements. Measure progress toward achieving this objective by acre-feet of recharge capacity, acre-feet of surface water application, and acres of habitat created/enhanced.

- ***Action GW1.1-1.*** Plan and implement multibenefit recharge projects that enhance, restore, or create natural communities and habitats for focal species.
- ***Action GW1.1-2.*** Direct mitigation and conservation opportunities to provide financial compensation to working landowners who choose to participate in multibenefit groundwater sustainability projects or management actions.
- ***Action GW1.1-3.*** Incorporate appropriate groundwater sustainability metrics into MCA monitoring and adaptive management plans to measure groundwater savings and surface water application, including groundwater extraction volumes, surface water application volumes, total water use, and calculated recharge potential.
- ***Action GW1.1-4.*** Work with willing landowners with lands and crops that are compatible with on-farm recharge to flood appropriate fields when excess surface waters are available, providing groundwater recharge and flood control benefits, and increasing available wildlife habitat.
- ***Action GW1.1-5.*** Support development of a rotational wetlands program for the RCIS Area that allows local growers the opportunity to temporarily fallow suitable lands by converting them to multibenefit recharge areas for short cycles (1–4 years) before they are returned to cultivation, providing increased groundwater infiltration, regional benefits for focal species, and economic benefits to growers.
- ***Action GW1.1-6.*** Within the framework of a groundwater trading network, if one is developed for the Subbasin, support financial compensation for landowners who reduce groundwater demand and reallocate limited groundwater supplies to other users within the Kaweah Subbasin for use in multibenefit recharge projects.
- ***Action GW1.1-7.*** Integrate dynamic management principles with water resource management to flexibly respond to the water needs of different users with less water, while potentially yielding more sustainable results with multiple benefits. Dynamic management strategies rely on the integration of real-time data to inform management decisions rapidly in space and time and can

allow working agricultural lands to be used to provide temporary or transient habitat, providing buffer zones and transition between permanently protected areas (Rohde et al. 2020).

- ***Action GW1.1-8.*** When implementing in-stream recharge projects, encourage maintenance of streamflows that support the aquatic component of focal species' life cycle in streams and off-channel pools (e.g., breeding habitat for western spadefoot).

Objective GW1-2. Green infrastructure. Encourage green infrastructure development in urban and rural residential areas, particularly in traditionally underserved and disadvantaged communities, to increase groundwater recharge and deliver environmental, social, and economic benefits that create sustainable communities. Measure progress toward achieving this objective by number of projects implemented, and percentage of projects implemented in disadvantaged communities.

- ***Action GW1.2-1.*** Develop and promote public information programs that foster homeowner awareness of green infrastructure practices such as installation of xeriscaping, rain gardens, and rainwater catchment systems, and the benefits these provide for water conservation, increased property values, and enhancement of urban wildlife habitat.

- ***Action GW1.2-2.*** Establish an incentive program for private developers to incorporate green infrastructure into proposed projects to reduce impermeable surfaces and urban runoff that can affect surface water quality, increase urban groundwater recharge, and increase urban greenspace.

Objective GW 1-3. Community buffers zones and recreational space. Implement multibenefit groundwater projects that improve reliability of community drinking water and air quality, create open space, recreational areas, viewsheds, and buffers from pesticides, and other benefits to local communities. Measure progress toward achieving this objective by number of projects implemented that have water supply (either demand reduction or recharge) and community benefits, and percentage of projects implemented in disadvantaged communities.

- ***Action GW1.3-1.*** Prioritize siting of groundwater recharge basins and injection wells in areas that can provide buffers to natural habitat areas when transitioning from urban to natural habitat. (Groundwater recharge basins and injection wells are generally managed for recharge and would not provide primary habitat for wildlife.)

- ***Action GW1.3-2.*** Use multibenefit recharge tools such as the Groundwater Recharge Assessment Tool (GRAT)[6] or the San Joaquin Valley Decision Support Tool[7] to inform siting of recharge projects. Decision support tools may need to be adapted to incorporate focal species habitats and ecological needs (e.g., habitat connectivity, minimum patch size) for siting recharge projects intended to benefit focal species.

- ***Action GW1.3.-3.*** Work with willing landowners to minimize pesticide application and open agricultural burning on agricultural lands in proximity to community buffer zones and recreational space.

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[6] https://suscon.org/GRAT/

[7] https://recharge-for-resilience.shinyapps.io/SanJoaquinValley/?_ga=2.30571903.175768344.1619452506-511092436.1619452506.

- ***Action GW1.3-4.*** Incorporate habitat features and access to green/open space into the design of surface water storage and groundwater recharge basin projects (including restored upland areas), where safe access is feasible.

Objective GW1-4. Incorporation of Habitat Values into Renewable Energy Development on Repurposed Lands. Strategically site solar energy projects to minimize negative effects to focal species, important working lands, and other conservation elements, and incorporate habitat features (e.g., providing herbaceous ground cover to facilitate movement of wildlife) into solar projects that would benefit the focal species. Measure progress toward achieving this objective in acres.

- ***Action GW1.4-1.*** Prioritize siting of solar energy developments in areas of least conflict with conservation priorities and prime agricultural lands (Figure 2-7) to avoid the fragmentation of important habitat areas. Use previously disturbed sites that have limited economic value or high cost for habitat restoration, where feasible.
- ***Action GW1.4-2.*** Encourage project developers to use the best available science to incorporate site design and security features that reduce potential negative impacts on wildlife; e.g., fencing that allows passage for wildlife or shielded lighting at night to avoid attracting wildlife or disrupting natural behavior.
- ***Action GW1.4-3.*** Encourage the use of pollinator-friendly plants and revegetation of solar facilities with native species to help control dust and reduce the need for water to clean solar panels while increasing available forage and habitat for native pollinators and increasing pollination services for surrounding agricultural lands.
- ***Action GW1.3-4.*** Encourage site preparation, construction practices, and operation of solar developments that incorporate co-location of vegetation suitable to the land use type so that habitats are maintained, and maximum benefits are received by landowners and solar developers. Vegetation should be managed to provide appropriate cover, structure, and habitat features for focal species and other native species.

3.6.2 Conservation Priorities

- Implement groundwater recharge projects that have the greatest potential to provide co-benefits for focal species and habitats in the RCIS Area.
- Implement groundwater recharge projects that have the greatest potential to improve community drinking water reliability and provide increased access to open space and recreation for community members.

3.6.3 Data Gaps

A number of spatial landscape optimization studies for the San Joaquin Valley have been conducted to identify least-conflict agricultural landscapes to improve groundwater recharge while providing co-benefits to other natural resources and human communities (e.g., Bourque et al. 2019, Bryant et al. 2020). A decision support tool should be developed through a local, stakeholder driven process for the Kaweah Subbasin and surrounding region to identify lands for multipurpose groundwater recharge to achieve GSP goals while maximizing habitat conservation and minimizing agricultural costs. A decision support tool should also consider other stakeholder-supported co-benefits, such as siting solar projects. Outcomes of a decision support tool should contribute toward achieving

Kaweah RCIS conservation goals and objectives. Local input is needed to ensure multibenefit strategies work as well as possible for all affected stakeholders.

The Kaweah Subbasin GSPs have generally identified a need to expand the spatial extent and density of the monitoring network for groundwater levels, water quality, and land subsidence. In addition, knowledge of the existing monitoring network including geological/hydrogeological information, well logs, and well construction is incomplete. A complete monitoring network that provides reliable data is necessary to determine how successful recharge actions are at increasing the water supply and remediating water quality issues. It is also a necessary component of a dynamic management strategy that allows water resource managers to respond flexibly to the needs of diverse water users.

Exportation of groundwater from the Kaweah Subbasin could affect the GSAs' ability to achieve groundwater sustainability goals. The Kaweah Subbasin GSAs should monitor and report groundwater exported from the Subbasin to develop a better understanding of the extent of groundwater export and how it affects achievement of groundwater sustainability goals.

3.7 Conservation Strategy for Natural Communities

The conservation strategy for natural communities and working landscapes is designed to protect, enhance, and restore native biodiversity and ecological processes that maintain representative natural communities of the RCIS Area.

3.7.1 Grassland and Vernal Pool Complex

The grassland natural community includes annual grasslands and vernal pool complex land cover types. Grasslands are concentrated in the eastern portion of the RCIS Area, with smaller patches elsewhere. Patches of vernal pool complex are distributed throughout the RCIS Area (Figure 2-18).

Small patches (less than 11 acres; 21 acres total) of chaparral land cover types (Tucker oak chaparral and cliff/scree/rock vegetation) are interspersed within grasslands in the far eastern edge of the RCIS Area. Tucker oak chaparral is generally distributed in the foothills and mountains of the interior coast ranges, the Transverse Ranges, and Tehachapi Mountains between 300 and 1,500 meters elevation (California Native Plant Society 2021). The small patch mapped as Tucker oak chaparral may be incorrectly mapped by the Great Valley Ecoregion vegetation dataset; its presence should be confirmed by on-the-ground surveys. This Kaweah RCIS does not include a conservation objective for chaparral natural communities; rather, patches of chaparral and cliff/scree/rock vegetation should be protected within a grassland matrix to maintain a diversity of habitats within protected areas.

Although dominated by nonnative species, annual grasslands provide important habitat for wildlife and plants, including foraging habitat for focal species such as Swainson's hawk and tricolored blackbird. Vernal pool complexes provide habitat for vernal pool fairy shrimp, California tiger salamander, and western spadefoot. The foothill grasslands are a functional component of the Natural Landscape Blocks, Small Natural Areas, and Essential Connectivity Areas identified by the California Essential Habitat Connectivity Project (CEHCP) (Section 2.3.10, *Habitat Connectivity*; Figure 2-25) (Spencer et al. 2010) and conservation planning linkages identified by the Areas of

Conservation Emphasis (ACE) v.3 Terrestrial Connectivity Analysis (Section 2.3.10; Figure 2-27) (California Department of Fish and Wildlife 2020b).

Colonial (social) burrowing rodents are important engineers in annual grassland ecosystems and are a key component in maintaining the functional capacity and resilience of grasslands (Davidson et al. 2012). Habitat functions provided by social burrowing rodents in grasslands include providing a prey source, thermal refuge, predator cover, and nesting/seasonal habitat for native wildlife species (e.g., insects, including native pollinator species, California tiger salamander, non-burrowing rodents, burrowing owl, and San Joaquin kit fox).

Grazing is the primary tool used to manage grasslands. Grazing can be used to reduce cover of invasive plants, increase native biodiversity, and remove dense thatch in grasslands to maintain their health and function for focal and other native species. Grasslands may have evolved with intense levels of grazing and browsing. In the last 10,000 years, tule elk, black-tailed deer, and pronghorn antelope grazed California grasslands in large numbers. With the decline in native grazers such as tule elk and pronghorn antelope, cattle and sheep now often fulfill the grazing role of native ungulates.

The ability to maintain, reestablish, or mimic natural disturbance is important to maintaining biological diversity and habitat conditions for certain species. Fire, for example, is a potential source of natural disturbance in grasslands. Disagreement over the natural role and frequency of fire is the main impediment to the application of prescribed fire regimes. The use of prescribed fire for ecosystem management is also constrained by the presence of human assets, such as adjacent development, low-density homesteads, and agricultural crops and development, which increase the risk of loss and the cost of protection during prescribed burns. For certain natural communities such as grasslands, prescribed burning may be used as a tool to manage invasive vegetation, to a limited extent.

The Vernal Pool Recovery Plan (U.S. Fish and Wildlife Service 2005) identifies six core areas in the RCIS Area: Cross Creek, Pixley, Cottonwood Creek, Tulare, Kaweah, and Yokohl (Figure E-4); core areas are the specific sites that the recovery plan deems necessary to recover or conserve endangered or threatened vernal pool species addressed by the recovery plan. Preservation and enhancement of each core area is important to maintain and possibly expand the distribution of the vernal pool species range wide. The recovery plan specifies a protection target of 85% for each core area.

3.7.1.1 Conservation Goals, Objectives, and Actions

Goal GL-1. Large contiguous patches of grassland to sustain and enhance the distribution and abundance of associated focal and other native species in the RCIS Area.

Objective GL1-1. Protect and Restore Grassland. Protect and restore (either permanently, or through a term agreement) 11,871 acres of grassland by 2032. Measure progress toward achieving this objective in acres of protected and restored grassland.

- ***Action GL1.1-1.*** Work with willing landowners to protect grasslands and vernal pool complexes.
- ***Action GL1.1-2.*** Restore grassland and vernal pool complexes. Vernal pool complexes should be restored on suitable soil to create hydrologic conditions that support native vernal pool flora

and fauna, using nearby natural vernal pools as reference sites to inform restoration design and restoration success criteria.

- ***Action GL1.1-3.*** Work with willing landowners to adjust grazing regimes to enhance habitat for focal species and other native species, and to maintain grasslands (e.g., reduce encroachment of shrubs such as coyote bush).
- ***Action GL1.1-4.*** Work with willing landowners to protect patches of chaparral and cliff/scree/rock vegetation where present within a grassland matrix to maintain the diversity of habitats and environmental gradients within the grassland matrix.

Objective GL1-2. Appropriate Grazing Regimes. Maintain and enhance grasslands and vernal pool complexes as habitat for focal and other native species by implementing appropriate grazing regimes. Measure progress toward achieving this objective in acres of grassland and vernal pool complexes managed with grazing.

- ***Action GL1.2-1.*** Integrate grazing management into management plans for protected lands.
- ***Action GL1.2-2.*** Apply adaptive management and monitoring to grazing regimes, adjusting grazing as needed to minimize overgrazing, minimize cover of invasive species, maximize cover of native biodiversity, and provide the necessary habitat (e.g., grassland structure, height, biomass, and patches of bare ground) for focal and other native species.

Objective GL1-3. Maintain Habitat for Burrowing Rodents. Maintain and enhance grasslands and vernal pool complexes as habitat for focal and other native species by maintaining areas with burrowing rodents such as ground squirrels, kangaroo rats, and gophers. Measure progress toward achieving this objective in acres of grasslands and vernal pool complexes managed to maintain populations of burrowing rodents (e.g., where land management does not include control of burrowing rodent populations).

- ***Action GL1.3-1.*** Work with willing landowners to identify and implement management practices that support habitat for burrowing rodents.

Objective GL1-4. Appropriate Fire Regimes. Apply fire to benefit focal species and other native species. Prescribed burns may be used, for example, to manage nonnative grass biomass and structure, maintain patches of bare ground, or to clear vegetation to prepare a site for restoration. Measure progress toward achieving this objective in acres of natural communities managed with prescribed fire.

- ***Action GL1.4-1***. Incorporate prescribed fire into management programs in areas where fire is an ecologically appropriate disturbance regime (e.g., grasslands), where feasible. Avoid prescribed fire in saltbush scrub vegetation since these species are fire-intolerant. When scheduling prescribed fires, take into consideration the needs of focal species such as tricolored blackbird (e.g., schedule burns outside of the tricolored blackbird nesting season).

Goal VPC-1. Large, contiguous patches of vernal pool complexes to sustain and enhance the distribution and abundance of native vernal pool species in the RCIS Area.

Objective VPC1-1. Protect Vernal Pool Complexes. Protect (either permanently, or through a term agreement) and restore 1,881 acres of vernal pool complex by 2032. Measure progress toward achieving this objective in acres of protected and restored vernal pool complex.

- Implement actions GL1.1-1 and GL1.1-2 under Objective *GL1-1*, *Grasslands*.

Objective VPC1-2. Enhance Vernal Pool Complexes. Enhance vernal pool complexes by enhancing upland grasslands as described for Objective GL1.2, *Grazing Regimes* and Objective GL1.3, *Burrowing Rodents*. Measure progress toward achieving this objective in acres of enhanced vernal pool complex.

Action VPC1.2-1. Enhance habitat based on the results of site-specific assessments. Enhancement actions may include, but are not limited to, activities such as implementing or adjusting prescribed grazing to manage invasive and native vegetation, prescribed burning of vernal pool grasslands (where feasible), and minor recontouring of basins to improve hydrological conditions (where possible).

Action VPC1.2-2. Develop habitat management plans for all protected lands, informed by the best available science.

Objective VPC1-3. Restore or Create Vernal Pools. Restore or create vernal pools (prioritizing restoration over habitat creation) for vernal pool branchiopods and other vernal pool focal species. Use the best available science to inform restoration design to tailor habitat characteristics for focal species (e.g., pool size, soil substrate, etc.). Measure progress toward achieving this objective in acres of restored or created vernal pool complex.

- ***Action VPC1.3-1.*** Work with willing landowners to restore vernal pool complexes and individual vernal pools on suitable soils within a matrix of upland grasslands to create hydrologic conditions that support native vernal pool flora and fauna, using nearby natural vernal pools as reference sites. Use the best available science to inform restoration design to tailor habitat characteristics for target species (e.g., pool size, soil substrate, etc.).
- ***Action VPC1.3-2.*** Identify sites that have in the past, or could, support vernal pool branchiopods and identify factors limiting occupancy.
- ***Action VPC1.3-3.*** Restore and create alkali wetlands, vernal pools, swales, and other aquatic features that provide suitable habitat for vernal pool branchiopods such that they achieve conditions at reference sites, as identified in restoration/creation-specific success criteria. Restoration and creation actions, such as recontouring basins, will depend on site-specific conditions.
- ***Action VPC1.3-4.*** Inoculate restored and created pools with soils and cysts of vernal pool branchiopods from nearby reference pools, as needed, based on site-specific conditions.
- ***Action VPC1.3-5.*** Adaptively manage restored and created vernal pools and associated vernal pool aquatic features to meet predetermined success criteria, including sustained occupancy by vernal pool branchiopods.
- ***Action VPC1.3-6.*** Identify source populations for potential banking of seed/cysts for use in future introduction/reintroduction to suitable habitat.

3.7.1.2 Conservation Priorities

- Vernal pool complexes are state- and globally ranked as imperiled (State Rarity: S2; Global Rarity: G2). Prioritize the protection of remaining large, contiguous patches of vernal pool complex, particularly those with remnant components of native grasslands within vernal pool fairy shrimp or California tiger salamander critical habitat and Vernal Pool Recovery Plan core areas (Figures E-4 and E-6, respectively). Protection of existing vernal pool complexes should be prioritized over restoration or creation, where feasible (U.S. Fish and Wildlife Service 2005).

- Prioritize the restoration of grassland and vernal pool complexes to expand and connect existing patches of grassland, vernal pool complex, and other natural communities, particularly those with remnant components of native grasslands within vernal pool fairy shrimp or California tiger salamander critical habitat and vernal pool core areas (Figures E-4 and E-6, respectively).
- Prioritize protection of vernal pool complexes occupied by vernal pool fairy shrimp, California tiger salamander, western spadefoot, or a non-focal species.

3.7.1.3 Data Gaps

The Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005) recognizes that vernal pool restoration and creation may be valuable recovery tools for some vernal pool species. Although vernal pool fairy shrimp and vernal pool tadpole shrimp are known to occupy restored and created pools, data on long-term persistence of these species in restored and created pools are lacking. Long-term monitoring of restored and created vernal pools within an adaptive management framework could provide information to improve restoration or creation methods.

3.7.2 Scrub and Chaparral

There is very little scrub (41.5 acres, or less than 0.1% of the RCIS Area) and chaparral (20.8 acres, less than 0.1% of the RCIS Area) (Table 2-17; Figure 2-19). Small, remnant patches of scrub, as mapped for the Great Valley Ecoregion vegetation map (California Department of Fish and Wildlife 2016a) are mostly scattered on the eastern edge of the RCIS Area in the lower foothills.

Given the small amount of remaining scrub, restoration will be necessary to recover scrub habitats on appropriate soils (e.g., saline, sandy, and alkaline) and other conditions and habitats (e.g., playas, alluvial fans). These soils are patchily distributed in the western portion of the RCIS Area and may support existing scrub not mapped by the Great Valley Ecoregion vegetation map (Figure 2-9a–2-9e)

Restoration should be focused in areas that would expand and connect existing patches of scrub to ultimately restore patches of scrub to 1,200 acres or larger (in total) to benefit blunt-nosed leopard lizard (Bailey and Germano 2015, Stewart et al. 2019), Tipton kangaroo rat, and other species that rely on scrub habitats. Patch size is an important predictor of blunt-nosed leopard lizard occupancy (Bailey and Germano 2015). Patch occupancy was positively correlated with patch size, and habitat patches greater than 1,236 acres have a 90.7% chance of being occupied by blunt-nosed leopard lizard. Based on these findings, the USFWS defines a high quality habitat patch as having at least 1,236 acres of contiguous suitable habitat (U.S. Fish and Wildlife Service 2020a). Tipton kangaroo rat populations are at greater risk of local extirpation from smaller habitat patches, particularly due to climatic changes and the ability of small populations to respond adaptively (Cypher pers. comm., as cited in U.S. Fish and Wildlife Service 2020c). The size and type of habitat needed to sustain a large population of Tipton kangaroo rat is not well understood, however (Cypher et al. 2016).

3.7.2.1 Conservation Goals, Objectives, and Actions

Goal SC-1. Scrub habitat to sustain and enhance the distribution and abundance of focal species that rely on this natural community.

Objective SC1-1. Protect or Restore Scrub. Protect or restore (either permanently, or through a term agreement) 1,190 acres of scrub natural communities by 2032. Measure progress toward achieving this objective in acres of protected and restored scrub.

- ***Action SC1.1-1.*** Work with willing landowners to protect existing scrub natural communities.
- ***Action SC1.1-2.*** Identify sites for restoration with suitable soils on lands that will be repurposed and where there will be future opportunities to expand the patch of restored scrub and associated semi-arid grassland to at least 1,220 acres in size.
- ***Action SC1.1-3.*** Restore scrub natural communities. Scrub should be restored on appropriate soils (e.g., sandy and alkaline) for the vegetation that comprises scrub natural community alliances. Restoration treatments may include various combinations of sowing native seeds, burning, invasive vegetation management, irrigation, and microtopographic grading (Laymon et al. 2010, Stewart et al. 2019). Restoration projects should consider the following recommendations for successful habitat restoration as implemented at Atwell Island, south of the RCIS Area, provided by Laymon et al. (2010), and presented here.
    - Always use fresh, locally collected seed in restoration plantings.
    - Do not try to save money by planting at low seeding rates (i.e., under 25 pounds per acre). Use enough seed so the native plants will dominate the site and suppress weed species.
    - Develop planting designs based on soil type; do not try to grow species that are not adapted to site conditions.
    - Plant in fall in October and November, prior to first heavy late-fall rains.
    - Use standard agricultural site preparation and planting techniques. To date, the best restoration success has occurred using these two sequences.
        - If field is fallow, burn it before planting with a range drill.
        - If field is immediately out of production, disk several times and plant using a Trillion broadcast seeder.
    - Irrigate the restoration planting only if the rainfall totals for the year are more than 20% below average. Irrigation may help native plantings but will also encourage weed species.
    - Use existing local reference sites to define success criteria for restoration.
- ***Action SC1.1-4.*** If restoration treatments are not feasible, fields may be fallowed to allow natural ecological processes to restore scrub conditions which could be managed in the future.
- ***Action SC1.1-5.*** Translocate ecosystem engineers such as Heermann's kangaroo rat (*Dipodomys heermanni*) to provide burrows and create soil microtopography (Stewart et al. 2019). Translocation efforts should consider the effects of translocation on other target species such as Tipton kangaroo rat. Heermann's kangaroo rats compete with the smaller Tipton kangaroo rat and it is difficult to establish new populations of Tipton kangaroo rats if Heermann's kangaroo rat is present (Cypher et al. 2020, U.S. Fish and Wildlife Service 2020c).

Objective SC1-2. Appropriate Grazing Regimes. Maintain and enhance scrub as habitat for focal and other native species by implementing appropriate intensity grazing regimes within an adaptive management framework to control invasive, nonnative grasses. Measure progress toward achieving this objective in acres of scrub managed with grazing.

- ***Action SC1.2-1.*** Integrate grazing management into management plans for protected lands.
- ***Action SC1.2-2.*** Apply adaptive management and monitoring to grazing regimes, adjusting grazing as needed to minimize cover of invasive species, maximize cover of native biodiversity, and provide the necessary habitat for focal and other native species.

3.7.2.2 Conservation Priorities

- Protect or restore large patches (i.e., more than 1,220 acres) of scrub. Protection and restoration may happen in multiple phases, as it may not be feasible to protect or restore one large patch in a single project.
- Manage scrub to benefit focal species.

3.7.2.3 Data Gaps

Conduct on-the-ground surveys to identify remnant patches of scrub for protection.

A common opinion among land managers in the Tulare Basin is that restored sites will be reclaimed by nonnative grasses and forbs. Monitoring at Atwell Island indicates that native vegetation can maintain itself over the mid-term (approximately 5 years) (Laymon et al. 2010). Monitoring should be long-term (20–30 years or more) to evaluate long-term viability of restored sites.

3.7.3 Woodland

There are approximately 1,050 acres of native woodland in the RCIS Area, composed primarily of blue oak woodland (Table 2-17). Most of the native woodland is in the lower Sierra Nevada foothills in the eastern portion of the RCIS Area (Figure 2-20). Climate models predict oak woodland will shift northward and upslope in elevation in the Sierra Nevada foothills under most emission scenarios and models (Kueppers et al. 2005, Thorne et al. 2016).

The conservation strategy for woodlands emphasizes protecting and enhancing foothill woodlands to protect the diversity of natural communities and environmental gradients present in the RCIS Area, to protect landscape connectivity, and to provide opportunities for species to migrate into foothill habitats as vegetation changes with a changing climate. The conservation strategy does not emphasize large-scale woodland restoration, as restoration might not be the most cost-effective use of conservation dollars if climate change is expected to make the lower foothills in the RCIS Area unsuitable for woodland.

3.7.3.1 Conservation Goals, Objectives, and Actions

Goal WL-1. Native woodland that sustains habitats for native biodiversity and maintains habitat connectivity between the San Joaquin Valley floor and the Sierra Nevada.

Objective WL1-1. Protect Woodland. Protect 500 acres of woodland by 2032 (either permanently, or through a term agreement). Measure progress toward achieving this objective in acres of protected woodland.

- ***Action WL1.1-1.*** Work with willing landowners to protect woodland.

Objective WL1-2. Maintain and Enhance Woodland. Maintain and enhance oak woodlands by promoting regeneration and recruitment of representative species by managing vegetation, fuels, and invasive plants. Measure progress toward achieving this objective in acres of enhanced woodland.

- ***Action WL1.2-1.*** Integrate grazing management into management plans for protected lands.
- ***Action WL1.2-2.*** Apply adaptive management and monitoring to grazing regimes, adjusting grazing as needed to minimize cover of invasive species, maximize cover of native biodiversity, minimize damage to oak seedlings and saplings from grazing, promote oak recruitment, and provide the necessary habitat for focal and other native species.
- ***Action WL1.2-3.*** Mechanically thin and remove excess vegetation to control nonnative species and wildfire fuels.
- ***Action WL1.2-4.*** Plant acorns and seedlings in suitable microhabitats (e.g., mesic depressions) within or adjacent to existing oak woodlands to support oak woodland regeneration. Protect seedlings with exclosures and irrigate seedlings, where needed.

3.7.3.2 Conservation Priorities

- Protect sites with a diversity of aspects to provide microclimates that may be more resilient to the effects of climate change.
- Encourage management prescriptions that promote oak regeneration and recruitment. Management prescriptions may include one or a combination of the above actions described under Objective WL1-2, Maintain and Enhance Woodland.
- Protect sites with a diversity of habitats in addition to oak woodland (e.g., streams, riparian, grassland).
- Protect sites that will improve habitat connectivity (Section 3.9, *Conservation Strategy for Habitat Connectivity*).

3.7.3.3 Data Gaps

A better understanding of the likelihood of areas presently supporting woodland to support woodland in the future under a changing climate is necessary to inform woodland management strategies. Land managers should consider whether plantings or restoration efforts could be successful long-term, and whether restored woodland could be self-sustaining at the margins of the lower elevational range in the Sierra Nevada foothills.

Guidance for restoration and small-scale plantings generally emphasizes use of local stock (e.g., seeds, seedlings, cuttings) under the assumption that local stock are adapted to local conditions. For long-lived species such as blue oak, local stock may not be adapted to future climatic conditions such as temperature. "Genome-informed assisted gene flow" is a recently introduced concept that matches source population stock for restoration projects that optimally matches individuals to future climates based on genetic-environment associations (Browne et al. 2019). With further research, genome-informed assisted gene flow could be used to identify populations of target plant species from elsewhere in California that may be better adapted to the expected future climatic conditions in the RCIS Area. Future studies are needed to identify potential source populations that would be adapted to current conditions (e.g., soils, drought stress) to enable successful establishment and regeneration, and tolerance of future climatic conditions, to enable long-term persistence (Browne et al. 2019).

3.7.4 Riparian

Many of the streams in the RCIS Area have been channelized or are subject to ongoing conversion of tributary waterways into constructed irrigation diversion and stormwater control infrastructure. Remnant stretches of riparian corridors traverse a handful of the waterways that drain the Sierra Nevada foothills into the San Joaquin Valley. These waterways span the elevational gradients of the RCIS Area. Riparian areas also connect and provide an ecological transition between aquatic and adjacent uplands, supporting a diversity of habitats.

These highly fragmented ecosystems have the potential to support habitats for focal species as well as ecosystem services such as groundwater recharge and serving as corridors for wildlife movement (Section 2.3.10, *Habitat Connectivity*). Riparian stream systems in the RCIS Area also provide excellent opportunities for multibenefit recharge projects that direct surface waters through creeks for in-stream recharge. Surface water released for recharge could also support riparian vegetation and restoration efforts, including restoration of valley oak, a focal species (Section 3.10.15, *Valley Oak*) and iconic species of the Central Valley.

Riparian habitats connected to a channel or floodplain prevent flood flows and surface runoff from moving too quickly over land before they can percolate into soil and recharge groundwater. Riparian vegetation that has roots extending into groundwater extracts groundwater (*phreatophyte extraction*); however, a phreatophyte extraction analysis detailed in the *Kaweah Subbasin Basin Setting Components* (GEI Consultants, Inc. 2020) indicates that this component of outflow constitutes a minor extraction from the groundwater reservoir.

Climate change may further fragment residual habitat values for native species in the Central Valley by altering habitat functions of remnant riparian patches (California Natural Resources Agency 2009). Riparian habitat associated with watercourses is naturally resilient to climate change impacts owing to readily available water, the ecological interactions between the aquatic environment and the terrestrial environment that characterize riparian habitats, and its function as a thermal refugium for wildlife (Seavy et al. 2009). Riparian areas provide a framework for uniting ecosystems at landscape scales, enhancing regional ecological resilience (Fremier et al. 2015).

3.7.4.1 Conservation Goals and Objectives

Goal RR-1. Contiguous stretches of riparian habitat and floodplains providing corridors for wildlife movement and connectivity between the San Joaquin Valley and Sierra Nevada foothills.

Objective RR1-1. Protect and Restore Riparian Habitats. Protect and restore 486 acres of riparian natural communities by 2032 (either permanently, or through a term agreement). Measure progress toward achieving this objective in acres of protected and restored riparian natural communities.

- ***Action RR1.1-1.*** Work with willing landowners to protect riparian habitats and associated uplands.
- ***Action RR1.1-2.*** Work with willing landowners to protect and restore riparian habitat associated with interconnected aquatic areas, including irrigation canals and other water-supply infrastructure and drainage elements, where feasible, to provide habitat, corridors for wildlife movement, and groundwater recharge benefits. Restoration techniques will be site-specific but may include plantings and seedings, contouring land to provide micro-topography, expanding the extent of floodplains, irrigation, and protecting seedlings and saplings.
- ***Action RR1.1-3.*** Provide private landowners with financial incentives to voluntarily maintain and enhance existing riparian areas on private lands, or to allow riparian habitat to naturally establish and be retained on sites with suitable soils and hydrology.
- ***Action RR1.1-4***. If it is infeasible to provide wide areas of riparian habitat along the entire channel, restore areas to provide wide nodes of riparian habitat along the channel.

Objective RR1-2. Maintain or Enhance Riparian Habitat. Maintain or enhance the habitat value of existing riparian habitat by maintaining or increasing the complexity of the riparian vegetation. Measure progress toward achieving this objective in acres of enhanced riparian natural communities.

- ***Action RR1.2-1.*** Introduce tall, broad-canopied tree species like valley oak as well as shorter species such as willows (*Salix* spp.) which increases the structural complexity of riparian habitat, increases the complexity of food webs in the habitat, and provides a cohort of smaller trees to fill canopy gaps as they open over time.
- ***Action RR1.2-2.*** Work with willing landowners to control or eliminate invasive riparian plant species such as giant reed (*Arundo donax*) that would otherwise create large monotypic stands lacking in structural diversity, and that have the capacity to out-compete native riparian species.

Objective RR 1-3. Expand and Connect Riparian Patches and Floodplains. To improve habitat connectivity and groundwater recharge**,** reconnect riparian corridors by reconnecting riparian fragments, and reconnecting floodplains to channels, where feasible. Measure progress toward achieving this objective in miles of streams and acres of adjacent riparian zones managed to provide connectivity corridors.

- ***Action RR1.3-1.*** Strategically site riparian protection and restoration projects to expand, increase the length, and connect existing patches of riparian habitat along watercourses.
- ***Action RR1.3-2.*** Strategically site riparian protection and restoration projects to create or expand floodplains laterally from channels to uplands to provide habitat for focal species and improve groundwater recharge capacity.

3.7.4.2 Conservation Priorities

- Prioritize multibenefit recharge projects that protect or restore riparian habitats.
- Prioritize projects that improve riparian-wildlife habitat corridors in the Cottonwood Creek–Cross Creek, Oaks to Tule, and Lewis Creek riparian corridors (Tulare Basin Watershed Partnership 2019).

- Prioritize sites for restoration that would expand and connect riparian patches and floodplains. For example, restoration projects should be designed, where feasible, to close gaps in vegetation along the length of drainages, widen riparian zones or provide wide riparian nodes adjacent to drainages, provide lateral linkage between drainages and adjacent natural communities, and slow flood water to improve groundwater recharge, where feasible.

3.7.4.3 Data Gaps

Project-specific planning is needed to identify riparian restoration opportunities that can be paired with in-channel recharge projects.

3.7.5 Wetland

There is little extant wetland in the RCIS Area, with limited opportunities for protection (162 acres, or less than 0.1% of the RCIS Area); 38% of the wetland natural community is comprised of the naturalized warm-temperate riparian and wetland group, with the larger patches interspersed within aggregate quarries and riparian communities. Some small areas of wetlands are present in the eastern portion of the RCIS Area at the base of the foothills.

Restoration and creation of wetlands should be opportunistic, taking advantage of groundwater recharge projects to restore or create wetlands that provide habitat values. The type and extent of wetland depends, among other factors, on the design of the recharge basin, the amount of water delivered to the recharge basin, and the duration for which the site remains inundated or provides suitable soil moisture to support wetland vegetation.

3.7.5.1 Conservation Goals and Objectives

Goal FW-1. Wetlands that provide habitat for focal species, groundwater recharge, and other ecosystem functions.

Objective FW1-1. Multibenefit Wetland Projects. Protect, restore, or create (either permanently, or through a term agreement) 2 acres of wetlands by 2032, as part of, but not limited to, multibenefit groundwater recharge projects, to provide habitat for focal species and support native biodiversity. Measure progress toward achieving this objective in acres of protected, restored, and created wetlands, and by acre-feet of recharge capacity and acre-feet of surface water application.

- ***Action FW1.1-1.*** Design groundwater recharge projects to support wetland vegetation, where feasible. Consider habitat needs of focal species when designing recharge projects. For example, patches of dense vegetation or deep leaf litter and moist soil could be integrated into a recharge project to provide potential habitat for Buena Vista Lake ornate shrew.

- ***Action FW1.1-2.*** Work with willing landowners to protect or restore small patches of wetlands with dense vegetation along interconnected waterways such as streams or unlined canals in areas that could be colonized by Buena Vista Lake ornate shrew.

- ***Action FW1.1-3***. Work with willing landowners to apply water (e.g., on a seasonal or annual basis), when available and as needed. to maintain adequate soil moisture in small patches of habitat.

- ***Action FW1.1-4.*** Work with willing landowners and organizations (e.g., Sequoia Riverlands Trust) to conduct restoration projects on protected land.
- ***Action FW1.1-5.*** Work with willing landowners to protect wetlands on working lands.
- ***Action FW1.1-6.*** Maintain water infrastructure to take advantage of high flow or precipitation events to capture water and apply it to wetland areas to achieve groundwater recharge and maintain wetlands.
- ***Action FW1.1-7.*** Minimize or eliminate pesticide use in wetlands, where feasible, to reduce impacts to Buena Vista Lake ornate shrew and other native species.

3.7.5.2 Conservation Priorities

- Prioritize multibenefit recharge projects, particularly in the Yokhol Creek watershed, that restore or create wetlands that provide habitat values for focal species and native biodiversity.

3.7.5.3 Data Gaps

Restored or created wetlands should be monitored within an adaptive management framework to improve habitat values and groundwater recharge benefits provided by multibenefit recharge-wetland projects. Projects should be monitored to determine the amount of water needed to achieve desired recharge and habitat benefits.

3.8 Working Landscapes

With much of the native natural communities and habitats in the Central Valley converted to agriculture, and to a lesser extent urban and suburban development, the habitat values provided by agricultural lands in working landscapes are increasingly important for the conservation of native wildlife. Because agriculture is the dominant land use in the RCIS Area, voluntary partnerships with private landowners to maintain existing land use practices and integrate approaches to managing working lands to benefit focal species and other native wildlife is vital to the success of this RCIS's conservation strategy.

Agricultural land will likely need to be repurposed to achieve Kaweah Subbasin GSP goals. Repurposing land will involve difficult decisions that could result in financial losses for landowners. An important goal of this Kaweah RCIS is to provide a tool that could be used to provide financial incentives to working landowners who voluntarily participate in groundwater sustainability projects and management actions that also provide habitat values for focal species and other conservation elements addressed by this RCIS.

The conservation strategy for working landscapes focuses on (1) enhancing habitat values for focal species and native biodiversity within working landscapes, and (2) strategies to repurpose land to contribute toward achieving GSP goals, to direct financial compensation to landowners, and to provide habitat for focal species and native biodiversity.

3.8.1 Conservation Goals, Objectives, and Actions

Goal WL-1. Multibenefit conservation and groundwater sustainability projects on agricultural lands to increase the habitat values they provide for focal species, native wildlife, and natural communities, and alternative sources of income for repurposed working lands.

Objective WL1-1. Encourage Habitat Values Incorporated with Agricultural Uses. Work with agriculture producers and the ranching community to manage croplands and ranchlands in ways that both maintain economically viable operations (including infrastructure necessary to support well managed working lands operations) and benefit focal species, native biodiversity, and habitat connectivity. Measure progress toward achieving this objective in acres of working lands incorporating habitat values.

- ***Action WL1.1-1.*** Encourage landowners to participate in the Tricolored Blackbird Voluntary Local Program (VLP) when tricolored blackbird colonies are nesting in agricultural lands.
- ***Action WL-1.1-2.*** Work with agencies (e.g., Resource Conservation Districts, Natural Resource Conservation Service, CDFW, and USFWS) to establish programs (e.g., Safe Harbor Agreements) that conserve and enhance habitat for wildlife, native plants, and other conservation elements while protecting working lands from conversion to more intensive land uses (e.g., urban development) not compatible with sustaining focal species and other conservation elements.
- ***Action WL1.1-3.*** Work with willing landowners to provide and enhance habitat values associated with interconnected aquatic areas with wetland or riparian vegetation in the agricultural landscape, including major canals and other water-supply infrastructure elements, and ditches throughout the landscape matrix, creating a regional conservation lattice supporting habitat while also providing corridors for wildlife movement. For example, maintain ditch vegetation to provide cover for sensitive species such as Buena Vista Lake ornate shrew.
- ***Action WL1.1-4.*** Provide information to agriculture producers and the ranching community regarding wildlife-friendly practices such as hedgerows, integrated pest management, stock ponds with wildlife-friendly design features, wildlife-friendly fencing, vegetation conditions that benefit wildlife, and grazing management prescriptions to promote small mammal compatible farm and ranch practices.
- ***Action WL1.1-5.*** Work with willing landowners to improve working land habitats to manage a diversity of cultivated agriculture crop types, as well as cropping patterns, to provide habitat for focal species (e.g., foraging habitat for Swainson's hawk and tricolored blackbird) and other native wildlife.
- ***Action WL1.1-6.*** Create VLPs or Safe Harbor Agreements for private landowners to maintain and enhance habitat for focal species.
- ***Action WL1.1-7.*** Offer financial incentives to landowners to maintain and enhance habitat for focal species and other conservation elements.
- ***Action WL1.1-8.*** Work with willing landowners to manage grazing lands in a manner that sustains habitat for focal species (e.g., vernal pool fairy shrimp, California tiger salamander,

western spadefoot, blunt-nosed leopard lizard, burrowing owl, Tipton kangaroo rat, San Joaquin kit fox).

Objective WL1-2. Pollinators in Working Landscapes. Maintain native pollinators in the agricultural landscape. Measure progress toward achieving this objective in acres managed to maintain and enhance native pollinator habitat.

- ***Action WL1.2-1.*** Work with willing landowners to maintain or enhance existing natural habitat (e.g., grasslands, vernal pool complexes, and riparian areas associated with streams and waterways) that occurs in the vicinity of agricultural areas near wildlands.
- ***Action WL1.2-2.*** Work with willing landowners to maintain or enhance existing pollinator habitat in agricultural landscapes, such as the following.
  - Areas of natural habitat such as riparian areas, wetlands, grasslands, scrub, chaparral, and woodland.
  - Areas supporting floral resources (including species that provide nectar for bees and other pollinators) host plants (e.g., for butterflies), such as buffer areas, hedgerows, roadsides, ditchsides, and fallowed fields. Native milkweeds (*Asclepias* spp.) should be planted to provide habitat for monarch butterflies (*Danaus plexippus*).
  - Potential bee-nesting sites such as areas of untilled bare soil, snags, and pithy-stemmed shrubs.
- ***Action WL1.2-3.*** Work with willing landowners to incorporate management actions that increase pollinator habitat within working lands, such as the following.
  - Plant hedgerows, pollinator meadows ("bee pastures"), orchard understory plantings, perennial forbs, riparian and rangeland revegetation, and flowering cover crops during fallow periods.
  - Use native plants wherever possible.
  - Avoid heavily mulching areas of bare soil that contain nest locations.
  - Create linear habitats along roads and tracks, ditches, riparian areas, ditches, canals, and field margins to increase connectivity across the landscape.
- ***Action WL1.2-4.*** Work with willing landowners to minimize pesticide (herbicide and insecticide) use, especially adjacent to natural areas or known pollinator habitat.
  - *Integrated Pest Management* (IPM) principles should be followed when planning pest management.
  - When pesticides are used, comply with all storage, usage, disposal, and safety information provided on the product label.
  - Select the formulation and application method that will minimize overspray or drift into wildland pollinator habitat. Check the bee precaution database and use the least toxic method available that will achieve pest control goals within an IPM framework.[8]
  - Plan pesticide application timing to avoid the majority of potentially affected pollinator species. This can include avoiding spraying pre-bloom or blooming plants or avoiding times

[8] https://www2.ipm.ucanr.edu/beeprecaution/

of day when pollinators are actively foraging (e.g., applying pesticides at night where allowable and feasible).

- Reduce spraying near field margins and adjacent patches of natural communities, and where feasible, incorporate a buffer area of at least 40 feet from patches of natural communities.

- ***Action WL1.2-5.*** Work with local and state road owners to find opportunities to include pollinator habitat in road landscape areas, such as road verges and shoulders.

Objective WL1-3. *Strategically repurpose working lands, as needed to achieve GSP goals***.** Implement multibenefit repurposing of agricultural lands to provide benefits for groundwater recharge, focal species, and alternative sources of income when landowners choose to repurpose agricultural lands. Measure progress toward achieving this objective in acres of repurposed working lands that benefit multiple conservation targets.

- ***Action WL1.3-1.*** Identify farms on lower quality soils with groundwater recharge and habitat restoration potential for repurposing.
- ***Action WL1.3-2.*** Use decision support tools to help identify lands for repurposing that would benefit multiple objectives (e.g., groundwater recharge, minimize impacts to high-value agricultural lands, focal species habitats, siting solar).
- ***Action WL1.3-3.*** Encourage and direct financial compensation for landowners that convert irrigated farmland to crops compatible with dry-land farming practices such as permanent pasture, grass seed/forage crop mixtures, and rotational fallowing with cover crops to provide wildlife cover, reduce soil erosion, and improve infiltration rates while keeping working lands in production.
- ***Action WL1.3-4.*** Assist willing landowners on lands that are likely to support conversion to non-water intensive crops and dryland farming techniques to develop land management strategies conducive to dryland farming that also provide habitat benefits for focal species.
- ***Action WL1.3-5.*** Direct infrastructure agencies, developers, and other entities that have mitigation needs to landowners willing to participate in MCAs.
- ***Action WL1.3-6.*** Support landowners interested in participating in MCAs or repurposing land for habitat values by providing guidance on habitat restoration techniques and land use management for habitat values.

3.8.2 Conservation Priorities

- Protect working lands from urban development or conversion to other land uses that preclude future farming.
- Direct financial compensation to landowners for implementing voluntary conservation actions and habitat enhancement actions on working lands through mechanisms such as MCAs.
- Work with willing landowners to manage working lands to provide conservation benefits for focal species and other native species.
- Conduct outreach with willing landowners to integrate voluntary conservation and habitat enhancement actions with agricultural practices to benefit focal species and other native species on working lands.

3.8.3 Data Gaps

Decision support tools are needed to assist the complex process of identifying lands for groundwater sustainability repurposing that minimize impacts to valuable and important farmland while providing habitat values that support the ecological needs of focal species.

3.9 Conservation Strategy for Habitat Connectivity

The CEHCP (Spencer et al. 2010) identifies essential connectivity areas between natural landscape blocks and small natural areas between large landscape blocks. CDFW's ACE v.3 terrestrial connectivity dataset builds on the CEHCP by developing a scoring system to rank the connectivity potential of an area (Section 2.3.10, *Habitat Connectivity*). The RCIS Area is dominated by agriculture; natural landscape blocks and small natural areas and the linkages and corridors between them are limited to the Sierra Nevada foothills in the far eastern portion of the RCIS Area and the southwestern portion of the RCIS Area (Figures 2-25 and 2-27). Protection and restoration of natural community habitats, and management of working lands to provide habitat values for focal species and other native wildlife within these essential connectivity areas can improve the permeability of landscapes between natural landscape blocks and small natural areas.

Streams and associated riparian habitat provide corridors for wildlife movement, connecting terrestrial and aquatic habitats within and beyond the RCIS Area. The Tulare Basin Watershed Partnership (2019) identified opportunities to protect and restore habitats in three riparian and wildlife corridors in the RCIS Area: Cottonwood Creek–Cross Creek Riparian Corridor; Oaks to Tule Riparian Corridor; and Lewis Creek Riparian Corridor. The conservation strategy for habitat connectivity emphasizes protecting and restoring habitats in these riparian systems to restore wildlife corridors.

3.9.1 Conservation Goals, Objectives, and Actions

Goal HC-1. Interconnected working landscapes and natural communities in the RCIS Area that provide for movement and genetic interchange among populations of focal species, support adaptive adjustments in focal species distributions in response to climate change, and sustain native biodiversity.

Objective HC1-1. Protect and Restore Riparian and Wildlife Corridors. Implement natural community actions to protect, enhance, and restore (either permanently, or through a term agreement) riparian and other historical natural communities within important corridors that connect the Tulare Basin and San Joaquin Valley to the Sierra Nevada foothills within the Cottonwood Creek–Cross Creek Riparian Corridor, the Oaks to Tule Riparian Corridor, and the Lewis Creek Riparian Corridor. Measure progress toward achieving this objective in acres of habitat protected and restored within each corridor.

- ***Action HC1.1-1.*** Work with willing landowners to protect and restore riparian, grasslands and vernal pool complexes, and other natural communities dependent on site-specific conditions to restore and reconnect corridors on the Cottonwood Creek–Cross Creek, Oaks to Tule, and Lewis Creek riparian corridors.

- ***Action HC1.1-2.*** Work with willing landowners to protect and restore aquatic habitat connectivity and transitional habitats (e.g., between waterways and uplands) along the Kaweah and Saint Johns River, Cottonwood, Cross, Yokohl, and Lewis Creeks.
- ***Action HC1.1-3.*** Work with willing landowners to establish riparian corridors by restoring riparian areas to provide continuous lengths of vegetation along drainages. Riparian areas should be as wide as soil, hydrologic, and human-induced constraints will allow.

Objective HC1-2. Landscape Connectivity. Reestablish landscape connections or increase landscape permeability between natural communities, natural landscape blocks, small natural blocks, and protected areas. Maintain connectivity where it currently exists and avoid fragmentation. Measure progress toward achieving this objective in acres of habitats managed to improve connectivity.

- ***Action HC1.2-1.*** Work with willing landowners to provide and maintain connectivity among natural communities, natural landscape blocks, and small natural blocks in and adjacent to the RCIS Area by implementing natural community actions to protect and restore natural communities.

Objective HC1-3. Heterogeneity within Agricultural Lands. Create and maintain a heterogenous landscape of agricultural and natural lands throughout the RCIS Area, structurally complex patches of native vegetation connected by corridors, and habitat stepping stones within a matrix of agricultural lands. Measure progress toward achieving this objective in acres of corridors and habitat stepping stones within agricultural landscapes.

- ***Action HC1.3-1.*** Work with willing landowners to create or maintain stepping stone patches (i.e., small areas of natural vegetation distributed throughout the landscape. There is no minimal patch size, but larger patches [e.g., > 1 acre] are preferred over smaller patches) and corridors (i.e., elongated strips of native vegetation that link the stepping stone) of natural lands within the agricultural matrix by implementing the actions to achieve Objective WL1-1, *Encourage Habitat Values Incorporated with Agricultural Uses*.
- ***Action HC1.3-2.*** Work with willing landowners to incorporate and maintain structural complexity, including trees, snags, rock outcrops (in the lower foothills) and other structural elements, in the agricultural matrix to provide cover, shade, nesting, perching, and roosting opportunities for native wildlife.

*Objective HC1-4. Wildlife Permeability***.** Enhance wildlife permeability across linear structures (e.g., highways, roads, canals, bridges, railroads etc.) that may impede or prevent wildlife movement. Measure progress toward achieving this objective in the number of barriers modified, remediated, or removed.

- ***Action HC1.4-1***. Identify known or existing wildlife movement information and planned projects potentially affecting wildlife movement and determine, at a local scale, where potential barriers to movement exists or where movement is constrained.
- ***Action HC1.4-2.*** Identify wildlife-vehicle collision hotspots (i.e., areas with high wildlife mortality or other observable measure), conduct further investigation into potential causes, and deploy measures to reduce the incidence of roadkill.
    - Identify areas with suitable habitat on both sides of a linear structure for focal species or other native species and where potential wildlife movement can be facilitated.

  - Modify existing culverts, viaducts, and underpasses to accommodate wildlife movement across linear structures and to improve permeability in the RCIS Area for focal species and other wildlife.
  - Remove or modify barriers to increase or improve wildlife permeability for focal species and other wildlife.
  - Design new culverts, bridges, and roads to allow or improve safe animal passage through, under, or over them.
- ***Action HC1.4-3.*** Improve existing wildlife movement crossing locations by providing vegetative cover adjacent to and near the entrances of crossings to facilitate use by species whose movement and predator avoidance behavior patterns depend on such cover. This vegetation should be heterogeneous and contiguous (where possible) with surrounding native habitat to help facilitate movement to the crossings from surrounding landscapes. This can be especially important for small species, which require cover to move safely through their environment. Additionally, artificial lighting should be avoided in and adjacent to wildlife crossing structures and wildlife corridors as it may deter animal usage or passage.
- ***Action HC1.4-4.*** Install dedicated wildlife underpasses to facilitate wildlife movement in areas where movement is currently constrained.

3.9.2 Conservation Priorities

- Implement projects that improve riparian-wildlife habitat corridors as recommended by the Tulare Basin Watershed Partnership (2019). Specifically target riparian corridors that intersect with the RCISA Area such as Cottonwood Creek – Cross Creek, Oaks to Tule, and Lewis Creek riparian corridors.
- Protect and restore natural communities to improve habitat connectivity within Areas of Conservation Emphasis with terrestrial connectivity rank greater than 2 (Figure 2-27).
- Work with willing landowners to protect habitat and improve landscape permeability and habitat connectivity within Essential Wildlife Connectivity Areas (Spencer et al. 2010) and adjacent to protected areas (e.g., Sequoia Riverlands Trust Conservation Easements, Stone Corral Ecological Reserve, Kaweah Oaks Preserve, James K. Herbert Wetland Prairie Preserve).
- Prioritize projects that improve or incorporate improvements for wildlife permeability (e.g., roadway overpasses, underpasses, or other structural modification) to improve permeability across the landscape.

3.9.3 Data Gaps

Assess the degree to which State Highway 99 is a barrier to movement by mid-sized wildlife such as San Joaquin kit fox.

GIS-based modeling approaches are used to create wildlife habitat connectivity maps. The data input can vary at the spatial scale (e.g., coarse scale—statewide, finer-scale—regional), on which focal species are used in the connectivity study, and on species-specific habitat and movement needs. The connectivity maps that intersect with the RCIS Area may not have considered all the focal species included in the RCIS.

3.10 Conservation Strategy for Focal Species

The conservation strategy for this Kaweah RCIS's focal species prioritizes the protection and management of occupied habitat to protect existing populations of focal species. The natural communities, habitat connectivity, and working landscapes conservation strategies are intended to provide for the conservation, restoration, and enhancement of landscapes and natural communities that will benefit focal species and native biodiversity. This section identifies focal species–specific conservation goals, objectives, actions, and priorities that address species-specific conservation needs that may not be addressed by landscape or working landscapes and natural community actions.

See Table 3-3 for a summary of focal species-natural community relationships. Table 3-3 also identifies the degree to which each focal species requires surface water. This information can be used to assess the feasibility of habitat enhancement or restoration when water available for a project is very limited.

The following general principles of conservation biology (Soule and Wilcox 1980, Soule 1986, Primack 1993, Noss et al. 1997, Margules and Pressey 2000, Groom et al. 2006) should be used to further prioritize habitat protection actions.

- Protect occurrences of focal species
- Integrate habitat management practices that benefit focal species into the management of working lands
- Preserve large blocks of intact habitat
- Focus protection of areas that expand existing protected areas and/or connect existing protected areas within and adjacent to the RCIS Area
- Protect wildlife corridors and linkages

The conservation objectives, actions, and priorities for each focal species are discussed in this section. Each section also identifies critical gaps in data for that species that if filled, would better inform conservation efforts. Data gaps common to most, if not all, focal species include a better understanding of the locations of populations in the RCIS Area and how each species will respond to the effects of climate change.

Table 3-3. Summary of Kaweah Subbasin RCIS Focal Species Natural Community Associations and Surface Water Needs

Species	Natural Community Association and Habitat	Surface Water Needs
Crotch bumble bee	Grasslands, desert scrub. Likely overwinters in soft, disturbed soil, or under leaf litter.	No
Vernal pool fairy shrimp	Vernal pools, seasonal wetlands, generally within a matrix of grasslands. All water provided by rainfall. Seasonality of water, with summer drought, required for persistence of this species. Restoration and management of vernal pools and other temporary pools do not require imported water.	Yes—rainfall only
California tiger salamander	Upland habitat includes grasslands, open woodlands with available burrows. Breeds in aquatic habitats such as vernal pools, seasonal wetlands, and stock ponds. Restoration and management of vernal pools and other temporary pools do not require imported water.	Yes—rainfall only in vernal pools and seasonal wetlands
Western spadefoot	Upland habitat includes grasslands, oak woodlands, scrub, and chaparral vegetation in washes and floodplains. Relies on temporary pools of water only to breed. These include vernal pools, seasonal wetlands, pools in creek channels or off-channel, cattle ponds. Restoration and management of vernal pools and other temporary pools do not require imported water.	Yes—rainfall only in vernal pools and alkali sink playas
Blunt-nosed leopard lizard	Sparsely vegetated grasslands, valley sink scrub, and saltbush scrub habitats, canyon floors, and large washes. Generally flat, semi-arid grasslands, alkali flats, and washes with open spaces. Uses mammal burrows for cover and shelter.	No
Swainson's hawk	Grasslands, riparian. Forages primarily in open, grasslands and areas with relatively sparse shrubs. In agricultural lands, forages in a variety of low-stature field crops and pasture where prey is abundant and accessible (e.g., alfalfa). Rarely forages in orchards and vineyards. Nests in trees, either isolated, lone trees, in riparian areas, windrows, or small groupings.	No
Burrowing owl	Upland, grassland, desert scrub. An upland species primarily found in grasslands with short vegetation with sparse shrubs and taller vegetation. Burrows, generally created by ground squirrels, for nesting and roosting must be present. Also uses agricultural environments, nesting along roadsides and water conveyance structures surrounded by croplands.	No
Tricolored blackbird	Grasslands, wetlands. Protected substrate needed for nesting. This historically includes native wetland habitat with emergent aquatic vegetation such as cattails and bulrushes, willows, thistles, and nettles. Open water provides protection from terrestrial predators in wetland nesting habitat. With much wetland habitat throughout its range lost, tricolored blackbird colonies nest in silage crops and other nonnative vegetation such as large stands of Himalayan blackberry. Forages in upland habitats such as grassland, riparian scrub, and agricultural habitat including cattle feedlots and dairies.	Yes—for nesting, but not required; commonly uses non-wetland habitat for nesting.

Species	Natural Community Association and Habitat	Surface Water Needs
Buena Vista Lake ornate shrew	Riparian, wetland, freshwater marsh, dense riparian wetland vegetation. Within these natural communities, habitats include thick understory vegetation with downed logs and branches, with an abundance of leaf litter and detritus	Yes
Pallid bat	Grasslands, scrub and chaparral, woodlands. Roosts in crevices in rocky outcrops and cliffs, caves, trees, and mines, other structures	Yes—for drinking; can be small water source such as a cattle tank.
Tipton kangaroo rat	Valley saltbush scrub, valley sink scrub, and grassland habitats located on the San Joaquin Valley floor to 300 feet in elevation. Open alkali sinks with alkali scalds (i.e., areas naturally without vegetation). Sparse vegetation and open to moderate shrubs/subshrubs (*Sueada*, *Frankenia*, *Allenrolfea*)	No
San Joaquin kit fox	A variety of upland habitats, including grasslands, scrublands, vernal pool areas, alkali meadows and playas, and an agricultural matrix of row crops, irrigated pastures, orchards, vineyards, and grazed annual grasslands.	No
Kaweah brodiaea	Grassland, oak woodland. This species is strongly associated with granite or clay soils on south-southwest facing slopes.	No
Striped adobe-lily	Grassland and foothill woodland. Edaphically restricted to abode clay soils. Striped adobe-lily are also associated with north-facing slopes most likely for the preference of the cooler, moister soil conditions	No
Valley oak	Oak woodland, riparian.	Yes—periodic, with annual flow in adjacent streams/creeks

Note: Focal species will benefit from implementation of natural community conservation and habitat enhancement actions. See Appendix E for detailed habitat relationships.

3.10.1 Crotch Bumble Bee

Crotch bumble bee inhabits open grassland and scrub habitats, requiring a hotter and drier environment than most bumble bee species (Hatfield et al. 2015, NatureServe 2021). There are no described nests for this species in the scientific literature; however, this species is thought to nest underground in abandoned rodent nests. Crotch bumble bee could also nest above ground in tufts of grass, old bird nests, rock piles, or cavities in dead trees (Williams et al. 2014). Crotch bumble bee was historically common in the Central Valley but now appears to be absent from most of it (Hatfield et al. 2015, 2018). There are four occurrences of Crotch bumble bee within the RCIS area (California Department of Fish and Wildlife, Natural Diversity Database 2021). These occurrences were documented prior to 1980 and are mostly on private land (Figure E-2). The current status of these occurrences is unknown.

The primary source of information used to inform the conservation strategy is *A Petition to the State of California Fish and Game Commission to List the Crotch bumble bee (*Bombus crotchii*), Franklin's bumble bee (*Bombus franklini*), Suckley cuckoo bumble bee (*Bombus suckleyi*), and western bumble bee (*Bombus occidentalis occidentalis*) as Endangered under the California Endangered Species Act* (Hatfield et al. 2018).

3.10.1.1 Conservation Goals, Objectives, and Actions

Goal CBB-1. Sustained populations of crotch bumble bee in the RCIS Area.

Objective CBB1-1. Protect Unprotected Occurrences. Protect (either permanently, or through a term agreement) at least 2 unprotected occurrences of Crotch bumble bee within suitable grassland and scrub habitat by 2032. Measure progress toward achieving this objective in the number of extant occurrences protected.

- ***Action CBB1.1-1.*** Survey suitable habitat, where access is permitted, to locate occurrences of Crotch bumble bee to identify protection and habitat enhancement opportunities.
- ***Action CBB1.1-2.*** Work with willing landowners to protect occurrences of Crotch bumble bee and habitat supporting the occurrences.

Objective CBB1-2. Protect or Restore Suitable Habitat. Protect or restore (either permanently, or through a term agreement) grassland or scrub habitat within dispersal distance (6.2 miles) of currently occupied habitat by implementing actions to achieve grassland and scrub protection and restoration. Measure progress toward achieving this objective in acres of habitat protected and restored.

- ***Action CBB1.2-1.*** Work with willing landowners to protect Crotch bumble bee habitat within the dispersal distance of currently occupied habitat.

Objective CBB1-3. Enhance Suitable Habitat. Enhance Crotch bumble bee habitat. Measure progress toward achieving this objective in the acres of enhanced Crotch bumble bee habitat.

- Implement actions WL1.2-1 through WL1.2-5 under Objective *WL1-2*, *Pollinators in Working Landscapes*.
- ***Action CBB1.3-1.*** Work with willing landowners to promote farming practices that increase the use of nitrogen-fixing fallow field cover crops (legumes) and other pollinator-friendly native

plants along field margins such as peas (*Fabaceae*), milkweed (*Asclepiadaceae*), waterleaf (*Boraginaceae*), sunflower (*Asteraceae*), mint (*Lamiaceae*), dogbane (*Apocynaceae*), plantain (*Plantaginacea*e), and evening primrose (*Onagraceae*) (Hatfield et al. 2018).

- ***Action CBB1.3-2.*** Minimize pesticide use in or near Crotch bumble bee habitat especially while treated plants are in bloom (Hatfield et al. 2018). When pesticides are used, comply with the information on the product label, and where feasible, incorporate a buffer area of at least 40 feet from Crotch bumble bee habitat.
- ***Action CBB1.3-3.*** Develop grazing management plans that enhance habitat for Crotch bumble bee while minimizing effects to Crotch bumble bee and its habitat. Grazing management plans should follow the recommendations provided by the *Guidelines for Creating and Managing Habitat for America's Declining Pollinators* (Hatfield et al. 2012) or other best available science. Recommendations include the following.
    - Grazing a site for a short period of time, with an extended period for recovery, depending on characteristics of the site.
    - Grazing should only occur on approximately one third of the property annually.
    - Establish exclosures and rotate grazing to allow recovery of the vegetation community.

3.10.1.2 Conservation Priorities

- Conduct surveys within the species historic range to locate additional occurrences for protection and habitat enhancement.

3.10.1.3 Data Gaps

There are only four known occurrences of Crotch bumble bee in the RCIS Area (Figure E-2). Surveys of habitat should be conducted, with landowner permission, to identify new occurrences for protection. Surveys should occur on protected lands (e.g., Stone Corral Ecological Reserve) as well as private lands.

Little is known about the overwintering sites used by Crotch bumble bee (Hatfield et al. 2018). Information on where this species overwinters is necessary to improve habitat management.

3.10.2 Vernal Pool Fairy Shrimp

The distribution of vernal pool fairy shrimp in the RCIS Area is limited to the distribution of vernal pool complexes; thus, vernal pool fairy shrimp will benefit from the grassland and vernal pool complex conservation strategy. The actions and priorities for vernal pool branchiopods were informed primarily by the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005).

3.10.2.1 Conservation Goals, Objectives, and Actions

Goal VPFS-1. Sustained populations of vernal pool fairy shrimp in the RCIS Area.

*Objective VPFS1.1***.** *Protect Unprotected Occurrences.* Protect (either permanently, or through a term agreement) 10 vernal pool fairy shrimp occurrences by 2032. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action VPFS1.1-1.*** Work with willing landowners to protect occurrences of vernal pool fairy shrimp and vernal pool complex habitat to support occurrences.
- ***Action VPFS1.1-2.*** Survey suitable habitat, where access is permitted, to locate additional occurrences of vernal pool fairy shrimp.

3.10.2.2 Conservation Priorities

- Implement vernal pool complex natural community conservation priority actions.

3.10.2.3 Data Gaps

Baseline condition of vernal pools occupied by vernal pool fairy shrimp on unprotected lands is unknown. Surveys are needed to inform habitat management actions.

3.10.3 California Tiger Salamander

California tiger salamander breeds in vernal pools and other ephemeral ponds that fill during the rainy season and often dry out by summer. California tiger salamander upland habitat includes grasslands and oak woodland savanna near to breeding sites (generally less than 1.5 miles) with burrowing rodents which create burrows that California tiger salamander use as refuge. California tiger salamander will benefit primarily from the grassland and vernal pool complex conservation strategy. The actions and priorities for California tiger salamander were informed primarily by the *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander* (Ambystoma californiense) (U.S. Fish and Wildlife Service 2017b) and federally designated critical habitat (U.S. Fish and Wildlife Service 2005).

3.10.3.1 Conservation Goals, Objectives, and Actions

Goal CTS-1. Sustained populations of California tiger salamander in the RCIS Area.

Objective CTS1-1. Protect Unprotected Occurrences. Protect (either permanently, or through a term agreement) 5 California tiger salamander extant occurrences by 2032. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action CTS1.1-1.*** Work with willing landowners to protect occurrences of California tiger salamander and grassland and vernal pool complex habitat to support occurrences.
- ***Action CTS1.1-2.*** Survey suitable habitat, where access is permitted, to locate additional occurrences of California tiger salamander.

Objective CTS1-2. Enhance Suitable Habitat. Enhance California tiger salamander breeding and upland habitat. Measure progress toward achieving this objective in acres of occupied and unoccupied habitat enhanced to benefit California tiger salamander.

- ***Action CTS1.2-1.*** Eradicate nonnative wildlife species such as bullfrogs, mosquitofish, crayfish, other nonnative predatory fish, nonnative turtles, and salamanders from breeding ponds. Occasional drying of ponds in late summer-early fall, as guided by best available science (U.S. Fish and Wildlife Service 2017a, 2017b), is a valuable tool for controlling nonnative wildlife species in breeding ponds.

- ***Action CTS1.2-2.*** Improve upland habitat by controlling invasive plant growth and by promoting land management practices that will positively benefit California ground squirrels and other fossorial mammals that create burrows used by California tiger salamander.
- ***Action CTS1.2-3.*** Use livestock grazing to maintain vegetation heights low enough to allow for overland movement by California tiger salamander and encourage ground squirrel colonization. Livestock corrals should be located at least 500 feet away from known and potential breeding sites (U.S. Fish and Wildlife Service 2002).
- ***Action CTS1.2-4.*** Maintain ponds or areas of ponds with no to minimal vegetation by allowing livestock access to ponds or through other means (e.g., mechanical removal, fire) (Ford et al. 2013).
- ***Action CTS1.2-5.*** Cease the use of rodenticides and other small mammal control efforts on protected lands, particularly in vernal pool complex grasslands, to maintain a source of burrows for California tiger salamander.
- ***Action CTS1.2-6.*** Incorporate measures in management and monitoring plans to ensure ranaviruses, chytrid fungus, or other pathogens are not introduced to California tiger salamander. Measures include ensuring that pathogen hosts (i.e., hybrid salamanders, fish species) are not introduced, and protocols for sterilization of field equipment (U.S. Fish and Wildlife Service 2017a).
- ***Action CTS1.2-7.*** Create safe passages across barriers to dispersal, such as tunnels under roadways to improve successful movement between habitats.

3.10.3.2 Conservation Priorities

- Conserving rangeland is a high priority for the Southern San Joaquin Valley Recovery Unit (U.S. Fish and Wildlife Service 2017b) which occurs in the RCIS Area.
- Protect and enhance high suitability habitat for California tiger salamander as identified in Figure E-6.
- Protect, enhance, and restore areas designated as critical habitat along Cottonwood Creek (Figure E-6).

3.10.3.3 Data Gaps

Population data for California tiger salamander are limited due to the fact that the species spends most of its life underground. Monitoring habitats for population status, trends, and threats within the Southern San Joaquin Valley Recovery Unit will help to inform management actions (U.S. Fish and Wildlife Service 2017b).

3.10.4 Western Spadefoot

Western spadefoot spends most of its life in burrows in grasslands adjacent to aquatic breeding sites. Western spadefoot breeds in vernal pools and other ephemeral pools (e.g., pools in creeks) and ponds that fill during the rainy season and often dry out by summer. Western spadefoot will benefit primarily from the grassland and vernal pool complex conservation strategy. The actions and priorities for western spadefoot were informed primarily by the *Recovery Plan for Vernal Pool*

Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005) and *California Amphibian and Reptile Species of Special Concern* (Thomson et al. 2016).

3.10.4.1 Conservation Goals and Objectives

Goal WSF-1. Sustained populations of western spadefoot in the RCIS Area.

Objective WS1-1. Protect Unprotected Occurrences. Protect (either permanently, or through a term agreement) 15 western spadefoot occupied occurrences by 2032. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action WSF1.1-1.*** Work with willing landowners to protect occurrences of western spadefoot and grassland and vernal pool complex habitat to support occurrences.
- ***Action WSF1.1-2.*** Survey suitable habitat, where access is permitted, to locate additional occurrences of western spadefoot.

Objective WSF1-2. Enhance Suitable Habitat. Enhance western spadefoot breeding and upland habitat. Measure progress toward achieving this objective in acres of occupied and unoccupied habitat enhanced to benefit western spadefoot.

- ***Action WSF1.2-1.*** Eradicate nonnative wildlife species such as bullfrogs, mosquitofish, crayfish, other nonnative predatory fish, nonnative turtles, and salamanders from breeding ponds. Occasional drying of ponds in late summer-early fall, as guided by best available science (U.S. Fish and Wildlife Service 2017a, 2017b), is a valuable tool for controlling nonnative wildlife species in breeding ponds.
- ***Action WSF1.2-2.*** Improve upland habitat by controlling invasive plant growth and by promoting land management practices that will positively benefit California ground squirrels and other fossorial mammals that create burrows used by western spadefoot.
- ***Action WSF1.2-3.*** Use livestock grazing to maintain vegetation heights low enough to allow for overland movement by western spadefoot and encourage ground squirrel colonization. Livestock corrals should be located at least 500 feet away from known and potential breeding sites (U.S. Fish and Wildlife Service 2002).
- ***Action WSF1.2-4.*** Maintain ponds or areas of ponds with no to minimal vegetation by allowing livestock access to ponds or through other means (e.g., mechanical removal, fire) (Ford et al. 2013).
- ***Action WSF1.2-5.*** Cease the use of rodenticides and other small mammal control efforts on protected lands, particularly in vernal pool complex grasslands, to maintain a source of burrows for western spadefoot.
- ***Action WSF1.2-6.*** Incorporate measures in management and monitoring plans to ensure ranaviruses, chytrid fungus, or other pathogens are not introduced to western spadefoot habitat. Measures include ensuring that pathogen hosts (i.e., hybrid salamanders, fish species) are not introduced, and protocols for sterilization of field equipment (U.S. Fish and Wildlife Service 2017a).
- ***Action WSF1.2-7.*** Create safe passages across barriers to dispersal, such as tunnels under roadways to improve successful movement between habitats.

- ***Action WSF1.2-8.*** Minimize disturbance around breeding habitat to protect adult western spadefoot (Thomson et al. 2016).

3.10.4.2 Conservation Priorities

- Protect occurrences in multiple regions of the RCIS Area, from Cottonwood Creek in the west to occurrences at the base of the Sierra Nevada foothills to protect a diversity of populations.
- Protect and enhance high suitability habitat for western spadefoot as identified in Figure E-8.

3.10.4.3 Data Gaps

Research is needed on terrestrial habitat use, including importance of rodent burrows and distances traveled by dispersing juveniles and migrating adults. This information is needed to inform how much and what types of terrestrial habitat to protect around breeding habitat (Thomson et al. 2016).

3.10.5 Blunt-Nosed Leopard Lizard

There are no blunt-nosed leopard lizard occurrences within the RCIS Area (California Department of Fish and Wildlife, Natural Diversity Database 2021). Suitable habitat occurs in the sparsely vegetated grasslands, vernal pool complexes and scrub along the western edges of the RCIS Area (Figure E-10). The closest known population is about 12 miles south of the RCIS Area on the Pixley National Wildlife Refuge (U.S. Fish and Wildlife Service 2020a).

Patch size of suitable habitat is important for blunt-nosed leopard lizard persistence. Blunt-nosed leopard lizard needs relatively large tracts of suitable habitat to sustain a population (>1,220 acres; Bailey and Germano 2015).

Restoring repurposed land to scrub habitat for blunt-nosed leopard lizard will be necessary to expand and connect large habitat patches in the RCIS Area, where much of the historic habitat has been lost (Stewart et al. 2019). Restoration actions may include active treatments (e.g., seeding, planting, weed management; Section 3.7.2, *Scrub and Chaparral*); however, passive restoration by fallowing fields on sandy and alkali soils may provide habitat after an extended period (e.g., decades). Stewart et al (2019) have observed recolonization by blunt-nosed leopard lizard of dry farmland that has been retired for decades. In general, while passive vegetation restoration and grazing exclusion in agricultural drylands results in net positive restoration outcomes, passive soil restoration does not (Miguel et al. 2020). Further, passive restoration practices are more variable and less effective than active restoration practices (Miguel et al. 2020) which should be considered when developing restoration strategies.

Blunt-nosed leopard lizard will benefit primarily from the scrub and grassland conservation strategy. The actions and priorities for blunt-nosed leopard lizard were informed primarily by the *Probability of Occupancy of Blunt-nosed Leopard Lizard on Habitat Patches of Various Sizes in the San Joaquin Desert of California* (Bailey and Germano 2015), Blunt-nosed Leopard Lizard 5-year Review (U.S. Fish and Wildlife Service 2020), and the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (U.S. Fish and Wildlife Service 1998a).

3.10.5.1 Conservation Goals, Objectives, and Actions

Goal BNLL-1. Restored population of blunt-nosed leopard lizard in the RCIS Area.

Objective BNLL1-1. Protect or Restore Suitable Habitat. Protect or restore (either permanently, or through a term agreement) 1,220 acres of blunt-nosed leopard lizard habitat by implementing actions to achieve grassland and scrub protection and restoration by 2032. Protection and restoration should be configured to expand or connect existing habitat to restore a block of habitat at least 1,220 acres. Restoration of a 1,220-acre block of habitat can be achieved through the combination of multiple smaller projects. Measure progress toward achieving this objective in acres of habitat protected and restored.

- ***Action BNLL1.1-1.*** Work with willing landowners to protect blunt-nosed leopard lizard habitat to expand or connect existing habitat patches to create habitat patches at least 1,220 acres in size or where there will be future opportunities to expand the patch of blunt-nosed leopard lizard habitat to at least 1,220 acres in size.
- ***Action BNLL1.1-2***. Survey potential blunt-nosed leopard lizard habitat, where access is permitted, to identify previously unknown, occupied habitat, and areas for protection or restoration. Occupied habitat should be protected.
- ***Action BNLL1.1-3.*** Restore previously disturbed habitat, particularly alkali sink habitat with sparse shrubs/subshrubs and microtopography for refugia from flooding within the range of blunt-nosed leopard lizard. Parcels near (e.g., within 5 miles) the Pixley National Wildlife Refuge just outside the southwestern corner of the RCIS Area would be of particular importance.
- ***Action BNLL1.1-4.*** Use restoration techniques that include recontouring of microtopography to benefit blunt-nosed leopard lizards.
- ***Action BNLL1.1-5.*** Develop and test restoration strategies within an adaptive management framework (Cypher et al. 2016).
- ***Action BNLL1.1-6.*** If active restoration is not feasible, passively restore fallowed lands that were once saltbush scrub and alkali scrub by letting vegetation naturally reclaim fallowed fields.

Objective BNLL1-2. Enhance Suitable Habitat. Enhance blunt-nosed leopard lizard habitat. Measure progress toward achieving this objective in acres of occupied and unoccupied habitat enhanced to benefit blunt-nosed leopard lizard.

- ***Action BNLL1.2-1.*** Utilize livestock grazing on habitat sites with dense ground cover, particularly where ground cover is dominated by invasive nonnative grasses to maintain low biomass with patches of open bare ground (Cypher et al. 2016).
- ***Action BNLL1.2-2.*** Avoid applying rodenticide in blunt-nosed leopard lizard habitat.
- ***Action BNLL1.2-3.*** Avoid discing blunt-nosed leopard lizard habitat.

Objective BNLL1-3. Restore fallowed lands that were once saltbush scrub and alkali scrub. Measure progress toward achieving this objective in the area of habitat restored.

- ***Action BNLL1.3-1.*** Identify willing landowners who want to repurpose their lands. Acquire those lands through conservation easement or other real estate instrument. Focus on acquiring parcels with sandy and alkaline soils.
- ***Action BNLL1.3-2.*** Utilize restoration techniques that include recontouring of microtopography that benefits blunt-nosed leopard lizards.

3.10.5.2 Conservation Priorities

- Protect saltbush and alkali scrub vegetation and sparsely vegetated grasslands near (e.g., within 5 miles) the Pixley National Wildlife Refuge just outside the southwestern corner of the RCIS Area or adjacent to predicted habitat (Figure E-10).
- Restore scrub habitat on sandy, alkaline soils in areas that expand and connect existing habitat patches, with the ultimate goal to protect or restore patches larger than 1,220 acres (Bailey and Germano 2015, Stewart et al. 2019).
- Protect or restore scrub habitat that encompasses or is near to extant or historical occurrences to improve likelihood of recolonization of protected and restored habitat in the RCIS Area. Areas proximate to historical occurrence records indicate that those areas once provided habitat and have the potential to provide habitat again (Stewart et al. 2019).

3.10.5.3 Data Gaps

Only one study has evaluated restoration of alkali scrub from retired farmland. Restoration efforts should be used as experiments for evaluating the efficacy of restoration methods to improve likelihood of successful restoration of alkali scrub natural communities and blunt-nosed leopard lizard habitat (Stewart et al. 2019).

Translocation may be necessary to reintroduce blunt-nosed leopard lizard to restored areas that are not adjacent to occupied habitat (Tennant et al. 2013, U.S. Fish and Wildlife Service 2020a). Research should be done to inform successful translocation methods (U.S. Fish and Wildlife Service 2010a).

Stewart et al. (2019) suggests that translocating native ecosystem engineers such as Heermann's kangaroo rats could be a low-cost, high-reward restoration technique. Research should be done to assess the efficacy of introducing Heermann's kangaroo rats or other ecosystem engineers.

3.10.6 Swainson's Hawk

Swainson's hawk requires large, open landscapes that include suitable grassland or agricultural foraging habitat and sparsely distributed trees for nesting. As Swainson's hawk commonly exhibit nest fidelity (i.e., the use of the same nest in subsequent years), the protection of nest sites is of high priority. Most CNDDB occurrences of Swainson's hawk are in the agricultural landscapes of the western half of the RCIS Area (Figure E-12) (California Department of Fish and Wildlife, Natural Diversity Database 2021).

Agricultural crops that provide suitable foraging habitat include a mixture of alfalfa and other hay crops, grain, row crops, and lightly grazed pasture with low-lying vegetation that support adequate rodent prey populations (Estep 1989, Bechard et al. 2010). Perennial crop types, such as vineyards, and orchards do not support accessible prey and are considered unsuitable (Estep 1989, Swolgaard et al. 2008).

Swainson's hawk will benefit primarily from the working landscapes, riparian (for nest trees), and grassland and vernal pool complex conservation strategies.

Primary sources of information used to inform the Swainson's hawk conservation strategy include the *5-Year Status Report: Swainson's Hawk* (California Department of Fish and Wildlife 2016b), *Staff Report Regarding Mitigation for Impacts to Swainson's Hawk* (Buteo swainsoni) *in the Central Valley of California* (California Department of Fish and Game 1994), and primary literature on the biology and habitat relationships of Swainson's Hawk in the Central Valley.

3.10.6.1 Conservation Goals and Objectives

Goal SWHA-1. Sustained population of Swainson's hawks in the RCIS Area.

Objective SWHA1-1. Enhance Natural and Agricultural Habitat to Benefit Swainson's Hawk. Work with landowners of protected natural lands and working lands to manage foraging habitat to benefit Swainson's hawk. Measure progress towards achieving this objective in acres of foraging habitat managed for Swainson's hawk.

- ***Action SWHA1.1-1.*** Encourage managers of protected lands and private landowners to manage working lands to support Swainson's hawk foraging habitat (e.g., planting dryland grain, pasture, and low-height row crops that provide foraging habitat) and nest trees**.**
- ***Action SWHA1.1-2.*** Work with willing landowners to reduce the amount of rodenticide used in Swainson's hawk foraging areas. This may include public information campaigns on the negative effects of rodenticide on wildlife.
- ***Action SWHA1.1-3.*** Encourage the use of cover plant types that optimize both prey cover and accessibility (Swolgaard et al. 2008) and maintain cover crops in vineyards and field edges for multiple years to facilitate increasing prey density for Swainson's hawk and to provide refugia for small mammals during crop harvest (Smallwood 1995, Estep and Teresa 2001).

Objective SWHA1-2. Maintain/Enhance the Density of Swainson's Hawk Nest Trees. Maintain or enhance the density of Swainson's hawk nest trees within foraging habitat (high, medium, or low predicted habitat in Figure E-12) to provide a density of one tree or clump of trees suitable for Swainson's hawk nesting per 10 acres of foraging habitat (ICF 2018). Measure progress toward achieving this objective in the number of nest trees planted and acres of foraging habitat within 5 miles of planted nest trees.

- ***Action SWHA1.2-1****.* Plant and maintain suitable nest trees or clumps of nest trees, where feasible (preferably native trees that grow to over 20 feet in height), on and near (e.g., 1-2 miles) foraging habitat in riparian areas and along watercourses.

3.10.6.2 Conservation Priorities

- Prioritize protection of active nest trees (i.e., a nest site used one or more times during the past 5 years [California Department of Fish and Game 1994]) and protect adjacent suitable nest trees (preferably native trees that grow to over twenty feet in height, particularly valley oak, cottonwoods, and other faster growing tree species) where conditions are suitable.

- Plant nest tree species as part of riparian restoration or in-stream recharge projects to take advantage of increased soil moisture, particularly where a riparian restoration or in-stream recharge project is located within or near to (e.g., 1-2 miles) foraging habitat and lands not dominated by orchards and vineyards.

3.10.6.3 Data Gaps

Long-term repeatable breeding/nest surveys are needed to assess population trends, temporal variation, and abundance (California Department of Fish and Wildlife 2016b).

3.10.7 Burrowing Owl

Burrowing owl requires habitats with three basic attributes: open, well-drained terrain; short, sparse vegetation generally lacking trees; and underground burrows (Klute et al. 2003, Gervais et al. 2008).

There are 6 CNDDB occurrences of burrowing owl within the RCIS Area; the four precise CNDDB occurrences are protected on Sequoia Riverlands Trust Conservation Easements (Figure E-14) (California Department of Fish and Wildlife, Natural Diversity Database 2021). Most CNDDB records in the region are in the Valley floor; however, there are considerably more eBird occurrence records, with many occurring in grasslands along the roads that climb into the lower foothills (Cornell Lab of Ornithology 2021).

Burrowing owl will benefit primarily from the grassland and vernal pool complex conservation strategy.

Primary sources of information used to inform the burrowing owl conservation strategy include the *Burrowing Owl Mitigation Staff Report* (California Department of Fish and Game 2012), USFWS's *Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States* (Kluet et al. 2003), as well as published literature on the species' habitat requirements and ecology.

3.10.7.1 Conservation Goals, Objectives, and Actions

Goal BUOW-1. Sustained population of burrowing owls in the RCIS Area.

Objective BUOW1-1. Manage and Enhance Natural and Agricultural Habitat to Benefit Burrowing Owl. Implement management and habitat enhancement practices to encourage burrowing owl occupancy and to increase habitat values for burrowing owl on natural and agricultural habitat. Measure progress toward achieving this objective in acres of occupied and unoccupied habitat enhanced to benefit burrowing owl,

- ***Action BUOW1.1-1.*** Continue or introduce livestock grazing in annual grasslands that will maintain vegetation heights that encourage ground squirrel colonization, and will provide suitable vegetation height, composition, and structure for foraging burrowing owls. Although suitable vegetation structure varies across locations and vegetation types, vegetation between 1.85 and 5.11 inches (4.7 to 13 cm) in height is compatible with burrowing owl (MacCracken et al. 1985, Green and Anthony 1989).

- ***Action BUOW1.1-2.*** Conduct invasive plant species management for species listed with a High or Moderate Rating on the California Invasive Plant Council's Invasive Plant Inventory in California annual grassland habitat to improve habitat for ground squirrel, and plant native vegetation to encourage burrowing owl prey species abundance.

- ***Action BUOW1.1-3.*** Provide elevated perches near potential nest areas, in grasslands with vegetation heights of 1.85 to 5.11 inches, where perches are lacking. Perches may provide hunting advantages to burrowing owl. However, avoid creating small islands of tall vegetation or perches that may act to attract predators near the nest (Rosenberg et al. 2009).
- ***Action BUOW1.1-4.*** Minimize the use of rodenticides and insecticides on protected lands to provide a source for burrow creation (e.g., ground squirrels) and to minimize their effect on nesting birds and their eggs.
- ***Action BUOW1.1-5.*** Implement best management practices for operation and maintenance of agricultural canals that minimize adverse effects on burrowing owl, such as avoiding maintenance activities around active nesting burrows. If maintenance is needed, implement a buffer around active burrows during the burrowing owl nesting season until young have fledged. Utilize recommended setback distances, determined by the level of disturbance, for burrowing owls as outlined in the Burrowing Owl Mitigation Staff Report (California Department of Fish and Game 2012).

3.10.7.2 Conservation Priorities

- Prioritize the protection of occupied habitat.

3.10.7.3 Data Gaps

Survey the eastern grasslands for burrowing owl to identify occupied habitat for potential protection and enhancement.

3.10.8 Tricolored Blackbird

Historically, tricolored blackbird nested primarily in freshwater marshes dominated by cattails (*Typha* spp.) and bulrushes (*Schoenoplectus* [formerly *Scirpus*] spp.), with colony sites occurring to a lesser extent in willows, blackberries (*Rubus* spp.), thistles (*Cirsium* and *Centaurea* spp.), or nettles (*Urtica* spp.) (Neff 1937). With the loss of this natural breeding habitat, tricolored blackbirds have adapted to nesting in other vegetation types such as silage and grain fields near dairies in the San Joaquin Valley, and Himalayan blackberry (*Rubus discolor*) elsewhere (Cook 1996, California Department of Fish and Wildlife 2018b, California Farm Bureau Federation 2019). Silage and grain fields (e.g., triticale) have been reported to contain some of the largest recently documented colonies (Hamilton et al. 1995, Beedy and Hamilton 1997, Hamilton 2000).

In the RCIS Area and surrounding region, tricolored blackbird nest primarily in triticale crops, and to a lesser extent in milk thistle (*Silybum marianum*) in natural habitats, and cattails and bulrush in ponds. Tricolored blackbird has nested in bulrush at the Deer Creek Recharge Basin in Tulare County south of the RCIS Area; however, this site has not been occupied by tricolored blackbird since prior to 2005 and is dry and unsuitable for nesting in most years (University of California, Davis 2021). Nesting in agricultural fields poses a great risk to tricolored blackbird because entire colonies have the potential to be destroyed by agricultural operations (e.g., harvesting and plowing of occupied fields) (Beedy et al. 2020, Beedy and Meese 2015, Meese 2009, Beedy 2008).

Tricolored blackbird will benefit primarily from the grassland and vernal pool complex and working landscapes conservation strategies.

Primary sources of information used to inform the tricolored blackbird conservation strategy include the *Tricolored Blackbird Voluntary Local Program* (California Department of Fish and Wildlife 2019), *Annual Report: Tricolored Blackbird Voluntary Local Program 2019* (California Farm Bureau Federation 2019), *Status Review of Tricolored Blackbird in California* (California Department of Fish and Wildlife 2018b), and *Species Status Assessment for Tricolored Blackbird v1.1* (U.S. Fish and Wildlife Service 2019).

3.10.8.1 Conservation Goals, Objectives, and Actions

Goal TRBL-1. Sustained tricolored blackbird population in the RCIS Area.

Objective TRBL1-1. Protect Nest Colonies in Agricultural Lands. Encourage willing landowners with a tricolored blackbird nest colony in agricultural land on their property to enroll in the Tricolored Blackbird Volunteer Local Program. Measure progress toward achieving this objective in the number of active tricolored blackbird colonies protected.

- ***Action TRBL1.1-1.*** Work with willing landowners to enter into a Cooperative Agreement, via the Tricolored Blackbird VLP with the California Farm Bureau Federation to conserve nesting colonies of tricolored blackbird through implementation of best management practices prescribed by the Tricolored Blackbird VLP. The best management practices incorporate the establishment of a buffer zone around the colony and determination of a harvest day by a designated biologist.
- ***Action TRBL1.1-2.*** Direct financial compensation to landowners participating in the Tricolored Blackbird VLP.
- ***Action TRBL1.1-3.*** Secure and direct additional funding to compensate landowners to help offset the financial cost of silage loss and disruption of timing for planting a secondary crop (e.g., increasing the payment to cover the full cost of silage loss) (Arthur 2015).
- ***Action TRBL1.1-4.*** Perform community outreach and education (e.g., newsletters, social media posts, public meetings etc.), prior to tricolored blackbird nesting season, to encourage participation in tricolored blackbird protection, participation in CDFW's VLP, and to allow landowners time to prepare for potential impacts from tricolored blackbird nesting on agricultural lands (California Farm Bureau Federation 2019). Conduct outreach and coordination with landowners whose grazing lands in the foothills support breeding colonies (Airola et al. 2015).
- ***Action TRBL1.1-5.*** Increase survey efforts to support early detection of nesting colonies to minimize risk to landowners and tricolored blackbirds. Encourage self-reporting of the presence of tricolored blackbird by landowners (California Farm Bureau Federation 2019).

Objective TRBL1-2. Protect Nest Colonies in Non-Agricultural Habitats. Measure progress toward achieving this objective in the number of active tricolored blackbird colonies protected annually.

- ***Action TRBL1.2-1.*** Work with willing landowners to identify suitable nesting habitat and nest colonies in natural or naturalized vegetation, including protected areas.

- ***Action TRBL1.2-2.*** Work with willing landowners with extensive rangelands where the availability of nesting substrate may be limiting reproduction, add nesting substrate where it is lacking, enhance nesting substrate where it is limiting, and protect nesting substrate where necessary and does not conflict with agricultural operations, such as unprotected freshwater wetlands, weedy fields, or blackberry thickets (Meese et al. 2015, Meese 2017).
- ***Action TRBL1.2-3.*** Work with willing landowners to develop management plans to protect and enhance nest colony sites and habitat.

Objective TRBL1-3. Multibenefit Recharge Projects to Benefit Tricolored Blackbird. Restore at least 1 acre (i.e., at least 50% of Objective FW1-1, *Multibenefit Wetland Projects*) of wetland nesting habitat within 3 miles of suitable foraging habitat as part of, but not limited to, multibenefit groundwater recharge projects by 2032. Measure progress toward achieving this objective in acres of restored habitat.

- ***Action TRBL1.3-1.*** Design groundwater recharge projects to restore and maintain cattail or bulrush wetlands in patches large enough to support a nesting colony of tricolored blackbirds, where feasible (e.g., the recharge project is expected to provide and hold enough water to support habitat features for tricolored blackbird, at least during wet years). Cattail or bulrush vegetation should be at least 30 to 45 feet wide to provide adequate space for breeding as well as protection from predators (Kyle 2011). Cattail stands must be at least 50 feet wide to support successful nesting (Meese and Beedy 2015).
- ***Action TRBL1*.3.2.** Site groundwater recharge projects designed to benefit tricolored habitat close to (ideally within 1 mile, but no more than 3 miles) foraging habitat, such as alfalfa or sunflower crops, pasture, or grassland.

Objective TRBL1-4. Manage and Enhance Tricolored Blackbird Habitat. Enhance nesting and foraging tricolored blackbird habitat. Measure progress toward achieving this objective in acres of enhanced nesting and foraging habitat.

- ***Action TRBL1.4-1.*** Nesting habitat: Management and enhancement of tricolored blackbird nesting habitat should be consistent with the recommendations provided by CDFW's VLP (California Department of Fish and Wildlife 2019) and other recent guidance on management of tricolored blackbird habitat (e.g., Kyle 2011, Meese and Beedy 2015). The following recommendations should guide management of various types of nesting substrate to benefit tricolored blackbird. Actual techniques should be implemented based on the best available science for site conditions.
    - Avoid intensive agricultural disturbances (e.g., heavy equipment operation associated with harvesting) or other activities within 100 feet of an active breeding colony. The buffer distance may need to be increased if additional or recurring harvesting or other agricultural activities occur or are likely to occur during sensitive nesting periods (e.g., during nest building, egg laying etc.) (California Department of Fish and Wildlife 2019).
    - Delay harvesting of agricultural crops where a nesting colony has established until the end of the breeding season, usually the end of June in the San Joaquin Valley (Beedy et al. 2020) or work with CDFW and approved Designated Biologists to determine an appropriate harvest date (California Department of Fish and Wildlife 2019).
    - Manage freshwater wetland, particularly marshes with cattail (preferred nesting vegetation by tricolored blackbirds over bulrush) in large, continuous blocks with first or second year

of growth, with vegetation height of 4 feet high and submerged in shallow water 6-18 inches deep (Meese and Beedy 2015).

- Burn, mow, or disc bulrush/cattail vegetation every 2 to 5 years, as needed, to remove dead growth and encourage the development of new vegetative structure (Kyle 2011). Burning is the preferred method to maintain wetland vegetation and is best done in late autumn (Meese and Beedy 2015, U.S. Fish and Wildlife Service 2019). All appropriate permits should be obtained prior to implementing burning as a management action.
- Maintain large continuous stands of bulrush/cattail that are at least 30 to 45 feet wide to provide adequate space for breeding as well as protection from predators (Kyle 2011).
- Provide a 50:50 to 60:40 ratio of bulrush/cattail marsh to open water in areas intended to support tricolored blackbird nesting (Kyle 2011).
- Manage and provide upland nesting substrate habitat (e.g., large patches of Himalayan blackberry, California blackberry, triticale grain fields, stinging nettles [*Urtica dioica*], milk thistles, and California rose [*Rosa californica*]) (Meese and Beedy 2015, Kyle 2011).
- Encourage the vertical growth of patches of blackberry and restrict their horizontal spread to attract nesting tricolored blackbird (Meese and Beedy 2015).
- Maintain "weedy fields" of milk thistle, mustard (*Brassica* spp.), and mallow (*Malva* spp.). Encourage the growth of such field by burning the field or cultivate the soil in autumn and rely upon winter and early spring precipitation to provide the water necessary to germinate seed and sustain weedy growth (Meese and Beedy 2015).

- ***Action TRBL1.4-2.*** Foraging habitat: Work with willing landowners to encourage planting agricultural areas with cover strips and hedgerows to provide habitat to increase prey (insect) abundance for tricolored blackbird. Where possible, plant in high- and very high-value crop types, as defined below. Crop types have foraging habitat values for tricolored blackbird as follows (natural lands are not listed below) (Meese pers. comm. 2013, as cited in the Yolo Habitat Conservation Plan/Natural Community Conservation Plan [ICF 2018]).
  - Very high value: Native pasture.
  - High value: alfalfa, sunflower, mixed pasture.
  - Medium value: Fallow lands cropped within 3 years; new lands prepared for crop production.
  - Low value: Mixed grain and hay crops.
- ***Action TRBL1.4-3.*** Moderately graze annual grassland and pastures outside of agricultural areas to support insect populations and provide accessibility to tricolored blackbirds for foraging. Maintaining grasses to below 15 inches is preferred by foraging tricolored blackbird (Meese and Beedy 2015).

3.10.8.2 Conservation Priorities

- Locate and protect all tricolored blackbird nesting colonies.
- Maintain or enhance foraging habitat within three miles of nest colonies.

3.10.8.3 Data Gaps

Assess the effectiveness of restoring alternate nesting habitat (e.g., fresh emergent wetlands) as a tool to draw birds away from nesting in dairy silage fields (Beedy et al. 2020).

Monitor the effects of predation on colony reproductive success. Where persistent large negative impacts occur, especially due to nonnative or unusually large predator populations, evaluate potential actions to reduce the impacts (California Department of Fish and Wildlife 2018b).

3.10.9 Buena Vista Lake Ornate Shrew

There are no Buena Vista Lake ornate shrew occurrences within the RCIS Area (California Department of Fish and Wildlife, Natural Diversity Database 2021). Buena Vista Lake ornate shrew has most commonly been found in areas with a dense vegetation understory or deep leaf litter near open water (Collins 1998, U.S. Fish and Wildlife Service 2011). The dense vegetation provides cover and protection from predators and supports prey such as insects and other invertebrates (U.S. Fish and Wildlife Service 2017b). Moist soil under vegetation or detritus makes earthworms and other prey burrowed in soil more accessible. The closest known population is about 12 miles south of the RCIS Area on the Pixley National Wildlife Refuge (U.S. Fish and Wildlife Service 2020b).

Buena Vista Lake ornate shrew occurs in groundwater recharge areas (i.e., Bakersfield City/Kern Fan Recharge Area, Goose Lake Critical Habitat; Cypher et al. 2017), demonstrating the feasibility of creating occupied habitat within a recharge area, though habitat quality at these sites is low due in part to unreliable water supplies.

Buena Vista Lake ornate shrew will benefit primarily from the riparian and wetland conservation strategies. The actions and priorities for Buena Vista Lake ornate shrew were informed primarily by the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (U.S. Fish and Wildlife Service 1998a), Buena Vista Lake Ornate Shrew Species Status Assessment (U.S. Fish and Wildlife Service 2020b), and the Buena Vista Lake Orate Shrew 5-year Review (U.S. Fish and Wildlife Service 2020d).

3.10.9.1 Conservation Goals, Objectives, and Actions

Goal BVLOS-1. Restore or create a population of Buena Vista Lake ornate shrew in the RCIS Area.

Objective BVLOS1-1. Restore or Create Buena Vista Lake Ornate Shrew Habitat. Restore or create at least 50 acres of suitable habitat connected (or mostly connected) to occupied habitat by waterways with habitat suitable for dispersal (e.g., dense riparian vegetation), as part of, but not limited to, multibenefit groundwater recharge projects by 2032. Measure progress toward achieving this objective in acres of restored habitat, by acre-feet of recharge capacity and acre-feet of surface water application.

- Implement actions under GOAL RR-1 and GOAL FW-1 to restore riparian and wetland habitat for Buena Vista Lake ornate shrew.
- ***Action BVLOS 1.1-1.*** Introduce tall, broad-canopied tree species like valley oak and shorter species such as toyon (*Heteromeles arbutifolia*) in riparian restoration or enhancement projects to increase the structural complexity of riparian habitat and the complexity of food webs in the habitat.

- ***Action BVLOS 1.1-2.*** Site restoration or protection and enhancement projects along waterways that connect the restored or enhanced habitat to occupied habitat to improve likelihood of dispersal to the restored or enhanced habitat patch.

Objective BLOVS1-2. Maintain and Enhance Suitable Habitat. Maintain and enhance suitable habitat for Buena Vista Lake ornate shrew. Measure progress toward achieving this objective in acres of enhanced habitat.

- ***Action BLOS 1.2-1.*** Implement measures to manage restored or created habitat to benefit shrews, such as slowly lowering or raising water levels, keeping soils moist even if standing water is not present (e.g., by adding dense leaf litter, planting shade trees), and not clearing or disturbing beneficial vegetation, particularly dense patches of rushes or cattails (Cypher et al. 2017).

Objective BVLOS1-3. Establish a Population of Buena Vista Lake Ornate Shrew. Translocate Buena Vista Lake ornate shrews to restored riparian and wetland habitat. Measure progress toward achieving this objective in number of Buena Vista Lake ornate shrews (or index of relative abundance) and duration for which restored habitat remains occupied after translocation.

- ***Action BVLOS1.3-1.*** Create regulatory protection such as a Safe Harbor Agreement to improve willingness of landowners to host introduced Buena Vista Lake ornate shrew populations.
- ***Action BVLOS1.3-2.*** Facilitate a collaboration of species experts and agency biologists to develop a translocation plan for Buena Vista Lake ornate shrew to suitable riparian and wetland habitat within the RCIS Area.
- ***Action BVLOS1.3-3.*** Translocate Buena Vista Lake ornate shrew as determined by the collaboratively developed translocation plan.

3.10.9.2 Conservation Priorities

- Restore or create Buena Vista Lake ornate shrew habitat connected to an existing population of Buena Vista Lake ornate shrew. Translocate individuals to the unoccupied restored habitat if feasible (see data gap, below).

3.10.9.3 Data Gaps

Translocation may be necessary to introduce Buena Vista Lake ornate shrew to unoccupied restored habitat that is not adjacent to occupied habitat or not connected by dispersal corridors to occupied habitat. Research should be done to develop successful translocation methods (Cypher et al. 2017).

Research is needed to better understand optimal habitat conditions for Buena Vista Lake ornate shrew. Greater understanding of optimal habitat conditions in riparian areas, marshes, sloughs, canals and the microhabitat conditions within each habitat type to better inform restoration and habitat enhancement efforts will increase their success.

3.10.10 Pallid Bat

Pallid bat is commonly associated with open, arid habitats with rocky outcrops for roosting, but may utilize a wide variety of habitats including grasslands, shrublands, woodlands, and forests. Pallid bat roosts are most commonly within rocky outcrops and crevices but may also occur within a variety of other structures and substrates including caves, mines, hollow trees, bridges, and buildings. Within the RCIS area, a maternity colony was documented using a bridge northeast of the City of Visalia along the Saint Johns River (Figure E-19) (California Department of Fish and Wildlife, Natural Diversity Database 2021).

The conservation strategy for pallid bat is primarily focused on locating and protecting maternity and hibernacula roosting habitat. Pallid bat will generally benefit from the natural community conservation strategy objectives to protect, enhance, and restore natural habitats by providing natural habitats and areas with low levels of human disturbance.

Primary sources of information used to inform the pallid bat conservation strategy include the *Conservation Assessment for the Pallid Bat* (*Antrozous pallidus*) *in Oregon and Washington* (Gervais 2016), and *California Bat Mitigation Techniques, Solutions and Effectiveness* (H. T. Harvey & Associates 2019).

3.10.10.1 Conservation Goals, Objectives, and Actions

Goal PB-1. Sustained pallid bat population in the RCIS Area.

Objective PB1-1. Protect Pallid Bat Maternity Roosts and Hibernacula. Protect or avoid disturbing pallid bat maternity roosts and hibernation sites and adjacent foraging habitats. Measure progress toward achieving this objective in the number of maternity roosts and hibernacula protected.

- ***Action PB1.1-1.*** Survey potential roost sites to locate pallid bat maternity roosts and hibernacula.
- ***Action PB1.1-2.*** Work with willing landowners to protect land with bat maternity roosts and hibernacula, with a focus on protecting roost sites for pallid bat.
- ***Action PB1.1-3.*** Where possible, fence or otherwise limit access to locations that support active pallid bat maternity roosts and/or hibernacula.
- ***Action PB1-1.4.*** Work with willing landowners to protect natural habitats that provide foraging habitat in close proximity to roosts.
- ***Action PB1.1-5.*** Protect or retain rock outcrops that provide roost sites for pallid bats.

Objective PB1-2. *Enhance Pallid Bat Habitat*. Measure progress toward achieving this objective in acres of enhanced habitat.

- ***Action PB1.2-1.*** Reduce disturbance to occupied roosting sites for pallid bat in man-made structures.
- ***Action PB1.2-2.*** Retrofit or create stock ponds, with pooled water accessible to bats, which drink water on-the-wing, consistent with best available design standards to improve accessibility and safety for bats and other wildlife while improving water quality for livestock (e.g., Taylor and Tuttle 2012).
- ***Action PB1.2-3.*** Coordinate with local agencies and landowners to incorporate habitat for pallid bat into transportation, and enhancement or restoration projects.

3.10.10.2 Conservation Priorities

- Conduct studies to locate maternity and hibernacula roost sites within the region. This would include documentation of roost site structures (bridges, rock outcrops, etc.) to guide protection strategies applicable to each feature.

- Permanently protect pallid bat roost sites and adjacent foraging habitat.

3.10.10.3 Data Gaps

The location of maternity and hibernacula roost sites is needed to protect roosting and nursing bats and to inform strategies to enhance foraging habitat.

3.10.11 Tipton Kangaroo Rat

There are no Tipton kangaroo rat occurrences within the RCIS Area. A Tipton kangaroo rat occurrence documented prior to 1995 is approximately 0.7 miles west of the RCIS Area. Recent occurrences (1995 or later) are documented within 7.5 miles of the RCIS Area (California Department of Fish and Wildlife, Natural Diversity Database 2021).

Restoring repurposed land to scrub habitat for Tipton kangaroo rat will be necessary to expand and connect habitat patches in the RCIS Area. Tipton kangaroo rat was found by Cypher et al. (2016) to have increased likelihood of presence on sites with high quality, intact alkali sink habitat. These sites commonly had large alkali scalds (i.e., playas), sparse ground cover, and seepweed (*Suaeda* spp.), with no evidence of past tilling. Tipton kangaroo rat competes with Heermann's kangaroo rat, and numbers of Tipton kangaroo rats are generally lower when Heermann's kangaroo rats are present (Germano et al. 2013, Cypher et al. 2016, U.S. Fish and Wildlife Service 2020c).

Tipton kangaroo rat will benefit primarily from the scrub and chaparral conservation strategy. The actions and priorities for Tipton kangaroo rat were informed primarily by the *Conservation of Endangered Tipton Kangaroo Rats* (Dipodomys nitratoides nitratoides)*: Status Surveys, Habitat Suitability, and Conservation Strategies* (Cypher et al. 2016) and the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (U.S. Fish and Wildlife Service 1998a).

3.10.11.1 Conservation Goals, Objectives, and Actions

Goal TKR1. Restored population of Tipton kangaroo rat in the RCIS Area.

Objective TKR1-1. Protect or Restore Suitable Habitat. Protect or restore (either permanently, or through a term agreement) 500 acres of Tipton kangaroo rat scrub habitat by implementing actions to achieve scrub protection and restoration (Objective SC1-1, *Protect or Restore Scrub*) by 2032. Protection and restoration should be configured to expand or connect existing suitable habitat. Measure progress toward achieving this objective in acres of habitat protected and restored.

- ***Action TKR1.1-1.*** Work with willing landowners to protect or restore Tipton kangaroo rat habitat.
- ***ActionTKR1.1-2.*** Site restoration projects to expand or connect existing or restored Tipton kangaroo rat habitat.
- ***Action TKR1.1-3.*** Restore previously disturbed habitat, particularly alkali sink habitat with sparse shrubs/subshrubs and microtopography for refugia from flooding within the range of Tipton kangaroo rat. Parcels near (e.g., within 5 miles) the Pixley National Wildlife Refuge just outside the southwestern corner of the RCIS Area would be of particular importance.
- ***Action TKR1.1-4.*** Develop and test restoration strategies within an adaptive management framework (Cypher et al. 2016).

- ***Action TKR1.1-5***. Survey potential Tipton kangaroo rat habitat, where access is permitted, to identify previously unknown, occupied habitat. Occupied habitat should be prioritized for protection.

Objective TKR1-2. Enhance Tipton Kangaroo Rat Habitat. Measure progress toward achieving this objective in acres of habitat enhanced to benefit Tipton kangaroo rat.

- ***Action TKR1.2-1.*** Graze habitat with livestock on sites with dense ground cover, particularly where ground cover is dominated by invasive nonnative grasses to maintain low biomass with patches of open bare ground (Cypher et al. 2016).
- ***Action TKR1.2-2.*** Avoid applying rodenticide or other small mammal control methods in Tipton kangaroo rat habitat.
- ***Action TKR1.2-3.*** Avoid tilling or discing Tipton kangaroo rat habitat.

Objective TKR1-3. Establish a Population of Tipton Kangaroo Rat. Translocate Tipton kangaroo rat to suitable, unoccupied habitat. Measure progress toward achieving this objective in number of Tipton Kangaroo rats (or index of relative abundance) and duration for which habitat remains occupied after translocation.

- ***Action TKR1.3-1.*** Past Tipton kangaroo rat translocations have had a low success rate (Germano 2001, Germano 2010, Germano et al. 2013, Tennant et al. 2013). Research translocation strategies to improve the likelihood of successful translocations and establishment of new Tipton kangaroo rat populations (Cypher et al. 2016).
- ***Action TKR1.3-2.*** Translocate Tipton kangaroo rats salvaged from sites that will be destroyed for development, or individuals from nearby protected populations where appropriate, to suitable unoccupied habitat, once successful methods have been developed (Cypher et al. 2016).

3.10.11.2 Conservation Priorities

- Restore scrub habitat adjacent to existing or restored scrub habitat to begin creating a large block of contiguous habitat (500 acres or more).

3.10.11.3 Data Gaps

Tipton kangaroo rat populations are at greater risk of local extirpation from smaller habitat patches, particularly due to climatic changes and ability of the population to respond (Cypher pers. comm., as cited in U.S. Fish and Wildlife Service 2020c). Habitat patches need to be large enough to support populations large enough to sustain the species during extremely dry or wet climatic conditions and when populations decline to low numbers (U.S. Fish and Wildlife Service 2019, as cited in U.S. and Fish and Wildlife Service 2020c). The size and type of habitat needed to sustain a large population of Tipton kangaroo rat is not well understood, however (Cypher et al. 2016). More information on patch size and habitat quality is needed to better understand how to conserve self-sustaining Tipton kangaroo rat populations (U.S. Fish and Wildlife Service 2020c).

Tipton kangaroo rats are sensitive to local habitat conditions (U.S. Fish and Wildlife Service 1988), but the specific microhabitat characteristics needed to support Tipton kangaroo rat populations are not well understood (U.S. Fish and Wildlife Service 2020c). Further research is needed to understand Tipton kangaroo rat microhabitat characteristics and how to best mange for those characteristics (U.S. Fish and Wildlife Service 2020c).

Restoration of repurposed land will be necessary to provide Tipton kangaroo rat habitat. Tipton kangaroo rat usually occurs on sites with no obvious signs of past tilling (Cypher et al. 2016). Techniques to restore habitat on previously tilled land will improve suitability of restored habitat for Tipton kangaroo rat.

Translocating individual Tipton kangaroo rats may be necessary to establish or augment populations for recovery purposes. To date, translocations have not been very successful. Research is needed to identify new techniques to determine best practices for Tipton kangaroo rat translocations (U.S. Fish and Wildlife Service 2020c).

3.10.12 San Joaquin Kit Fox

San Joaquin kit fox occurs in a variety of habitats, including grasslands, scrublands, vernal pool areas, alkali meadows and playas, and an agricultural matrix of row crops, irrigated pastures, orchards, vineyards, and grazed annual grasslands (U.S. Fish and Wildlife Service 1998a). High and moderately suitable predicted habitat is located in the southeast and southwest corners of the RCIS Area. These patches are part of a USFWS satellite recovery unit (Figure E-23). Satellite areas are more fragmented or of lower quality with kit fox populations that are smaller than core populations.

San Joaquin kit fox will benefit primarily from the grassland and vernal pool complex, and scrub and chaparral conservation strategies, along with the habitat connectivity conservation strategy. Actions and priorities for San Joaquin Kit Fox were informed by the *San Joaquin Kit Fox* (Vulpes macrotis mutica) *5-Year Review: Summary and Evaluation* (U.S. Fish and Wildlife Service 2010b), and the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (U.S. Fish and Wildlife Service 1998a).

3.10.12.1 Conservation Goals, Objectives and Actions

Goal SJKF1. Sustained population of San Joaquin Kit Fox in the RCIS Area.

Objective SJKF1-1. Protect and Restore Suitable Habitat. Protect and restore (either permanently, or through a term agreement) 2,250 acres of San Joaquin kit fox habitat within the Allensworth Ecological Reserve/Creighton Ranch/Pixley National Wildlife Refuge satellite area in the southwest portion of the RCIS Area and nearby highly- and moderately-suitable habitat (Figure E-23) by implementing actions to achieve grassland, vernal pool complex, and scrub protection and restoration by 2032. Measure progress toward achieving this objective in acres of habitat protected or restored.

- ***Action SJKF1.1-1.*** Survey potentially suitable habitat, where access is permitted, to locate occupied habitat.
- ***Action SJKF1.1-2***. Work with willing landowners to protect occupied habitat and suitable habitat.

Objective SJKF1-2. Enhance Habitat Connectivity for San Joaquin Kit Fox. Enhance regional movement corridors for San Joaquin kit fox. Measure progress toward achieving this objective in acres of corridor habitat protected and number of barriers to movement modified, removed, or otherwise ameliorated.

- ***Action SJKF1.2-1.*** Conduct movement studies of San Joaquin kit fox within the grasslands on the east side of the RCIS Area to identify key areas to protect to improve landscape connectivity.

- ***Action SJKF1.2-3.*** Create or enhance wildlife crossings at key locations on Highway 99 and Highway 198.

*Objective SJKF1-3***.** *Enhance Suitable Habitat.* Enhance San Joaquin kit fox habitat. Measure progress toward achieving this objective in acres of habitat enhanced to benefit San Joaquin kit fox.

- ***Action SJKF1.3-1.*** Use livestock grazing to control invasive vegetation and reduce dense vegetation growth in grasslands (U.S. Fish and Wildlife Service 2010b).
- ***Action SJKF1.3-2.*** On protected lands, cease the use of rodenticides and emphasize the conservation and expansion of California ground squirrel colonies and other fossorial mammals.
- ***Action SJKF1.3-3.*** Work with willing landowners with suitable kit fox grassland habitat to cease rodent control of California ground squirrels.

Objective SJKF1-4. Encourage Land Management Practices to Benefit San Joaquin Kit Fox. Work with public landowners and provide incentives to private landowners to conduct land management practices in a way that will benefit San Joaquin kit fox. Measure progress toward achieving this objective in acres of habitat managed to benefit San Joaquin kit fox.

- ***Action SJKF1.4-1.*** Work with private landowners in areas likely to support San Joaquin kit fox to develop land management strategies favorable to San Joaquin kit fox, including minimal fencing and cessation of rodenticide use.

3.10.12.2 Conservation Priorities

- Protect, enhance, and restore San Joaquin kit fox habitat within the Allensworth Ecological Reserve/Creighton Ranch/Pixley National Wildlife Refuge and Porterville/Lake Success satellite areas.

3.10.12.3 Data Gaps

State Highway 99 bisects grassland and vernal pool complex habitat along Cottonwood Creek. Assess the extent to which the highway is a barrier to movement between habitats on both sides of State Highway 99. Information from this work should inform strategies to improve movement of San Joaquin kit fox and other wildlife across the highway.

3.10.13 Kaweah Brodiaea

Kaweah brodiaea is endemic to the Sierra Nevada foothills of central Tulare County (Pires and Preston 2019). This species is typically found in grassland habitats surrounded by foothill woodland (California Department of Fish and Wildlife, Natural Diversity Database 2021, California Native Plant Society, Rare Plant Program 2021). One known occurrence of Kaweah brodiaea is located within the RCIS Area, north of the Kaweah River and west of Lake Kaweah (Figure E-25). There are additional occurrences of this species within the foothills immediately east of the RCIS Area (California Department of Fish and Wildlife, Natural Diversity Database 2021). Because of the relative scarcity of Kaweah brodiaea habitat in the RCIS area, the conservation strategy focuses on protecting and enhancing existing grassland habitat.

The primary source of information used to inform the Kaweah brodiaea conservation strategy is the Kaweah brodiaea treatment in the *Jepson Flora Project* (Pires and Preston 2019).

3.10.13.1 Conservation Goals, Objectives and Actions

Goal KB-1. Sustained occurrences of Kaweah brodiaea in the RCIS Area.

Objective KB1-1. Protect Suitable and Occupied Habitat. Protect (either permanently, or through a term agreement) at least one occurrence of Kaweah brodiaea in the RCIS Area by 2032. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action KB1-1.1.*** Identify and survey suitable habitat, where access is permitted, to locate undocumented occurrences of Kaweah brodiaea, with an emphasis on surveying habitat patches adjacent or nearby to known occurrences. Suitable habitat occurs in valley and foothill grassland, foothill woodland, and meadows and seeps (Pires and Preston 2019). Kaweah brodiaea is strongly associated with granite or clay soils on south-southwest facing slopes (Appendix E).
- ***Action KB1-1.2.*** Work with willing landowners to protect Kaweah brodiaea occurrences.

Objective KB1-2. Enhance Kaweah Brodiaea Habitat. Measure progress toward achieving this objective in acres of enhanced habitat.

- ***Action KB1-2.1.*** Develop and implement management plans to guide maintenance and enhancement of habitat on protected lands to benefit Kaweah brodiaea.
- ***Action KB1-2.2.*** Continue or introduce livestock grazing within an adaptive management framework to better understand and improve grazing as a management tool to benefit Kaweah brodiaea.

Objective KB1-3. Establish Occurrences of Kaweah Brodiaea. Establish two occurrences of Kaweah brodiaea by 2032. Transplantation plans and actions must be informed by the best available science on the species being transplanted and methods for transplantation. Measure progress toward achieving this objective in the number and area of restored occurrences of Kaweah brodiaea.

- ***Action KB1-3.1.*** Develop a thorough transplantation plan in coordination with botanists with expertise on Kaweah brodiaea (or closely related taxa), and with CDFW and USFWS, before transplantation of plant material. The transplantation plan should include a monitoring and adaptive management plan.
- ***Action KB1-3.2.*** Identify source population(s) of plant material to transplant.
- ***Action KB1-3.3.*** Store and maintain seeds from natural occurrences in the RCIS Area at botanic gardens that are part of the Center for Plant Conservation network.
- ***Action KB1-3.4.*** Identify receptor sites for transplantation. Receptor sites of rare plants should be far enough from existing populations, as measured by the potential for genetic exchange among individuals through pollen or propagule (e.g., seed, fruit) dispersal. Receptor sites should be carefully selected on the basis of physical, biological, and logistical considerations (Fiedler 1991, Fiedler and Laven 1996).
- ***Action KB1-3.5.*** Prepare source location and receptor site to ensure that plants are removed and planted in a manner that provides them with the best chance of reestablishment.
- ***Action KB1-3.6.*** Translocate plant material using methods described in the transplantation plan.
- ***Action KB1-3.7.*** Monitor and adaptively manage translocations.

3.10.13.2 Conservation Priorities

- Prioritize protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any newly discovered occurrences of Kaweah brodiaea.
- Survey for undocumented occurrences of Kaweah brodiaea in suitable habitat.
- Develop and implement monitoring and adaptive management plans for Kaweah brodiaea. Plans should include strategies to minimize site-specific threats and identify new threats.
- Establish an incentive program for private landowners to allow for botanical surveys on their property and to ensure the management of habitats with Kaweah brodiaea populations to suppress nonnative invasive vegetation and promote regeneration and recruitment of native species while supporting the natural processes typically found in the communities that support Kaweah brodiaea (ICF International 2010).

3.10.13.3 Data Gaps

- Conduct surveys for Kaweah brodiaea to identify new occurrences for protection.
- Conduct a study to evaluate the positive and negative effects of livestock grazing on the viability of selected populations to develop best management grazing practices for this species.
- Little is known about Kaweah brodiaea microhabitat requirements. Research is needed to better understand its habitat needs to inform management strategies.

3.10.14 Striped Adobe-Lily

Striped adobe-lily is endemic to California, occurring in the southern Sierra Nevada and Tehachapi Mountain foothills in Kern and Tulare Counties (Stebbins 1989, McNeal and Ness 2012). This species is apparently edaphically restricted to abode clay soils. Striped adobe-lily are also associated with north-facing slopes most likely for the preference of the cooler, moister soil conditions (Stebbins 1989). One occurrence of striped adobe-lily is located within the RCIS Area (Figure E-27) (California Department of Fish and Wildlife, Natural Diversity Database 2021).

Striped adobe-lily will benefit from the woodland and grassland and vernal pool complex conservation strategies. The primary source of information used to inform the striped adobe-lily conservation strategy is the *Striped Adobe Lily Species Management Plan* (Stebbins 1989).

3.10.14.1 Conservation Goals, Objectives and Actions

Goal SAL-1. Sustained occurrences of striped adobe-lily in the RCIS Area.

Objective SAL1-1. Protect Occupied Habitat. Protect (either permanently, or through a term agreement) at least one occurrence of striped adobe-lily in the RCIS Area by 2032. Measure progress toward achieving this objective in the number of occurrences protected.

- ***Action SAL1-1.1.*** Identify and survey suitable habitat, where access is permitted, to locate undocumented occurrences of striped adobe-lily, with an emphasis on surveying habitat patches adjacent or nearby to known occurrences. Suitable habitat occurs in valley and foothill grassland and blue oak woodland on clay soils in the lower Sierra Nevada foothills on north-facing slopes and historically, on flatter terrain at the base of the foothills (Stebbins 1989) (Appendix E).

- ***Action SAL1-1.2.*** Work with willing landowners to protect striped adobe-lily occurrences.

Objective SAL1-2. Enhance Suitable Habitat. Enhance striped adobe-lily habitat. Measure progress toward achieving this objective in acres of enhanced habitat.

- ***Action SAL1-2.1.*** Develop and implement management plans to guide maintaining habitat on protected lands to benefit striped adobe-lily.
- ***Action SAL1-2.2.*** Remove invasive vegetation species by manual methods, preferably before maturation of invasive seeds. Develop invasive species control strategies that benefit or do not cause harm to striped adobe-lily. Do not use herbicides or other chemicals.
- ***Action SAL1-2.3.*** Continue or introduce livestock grazing within an adaptive management framework to better understand and improve grazing as a management tool to benefit striped adobe-lily.
- ***Action SAL1-2.4.*** Enhance habitat for striped adobe-lily by planting native shrubs and perennial grasses to restrict invasion by annual invasive species as well as salvaging and transplanting the species from affected areas to protected areas.
- ***Action SAL1-2.5.*** Prepare educational materials for public and private landowners within the range of striped adobe-lily to become informed about the importance of locating occurrences and managing habitat to benefit striped adobe-lily.

Objective SAL1-3. Establish Occurrences of Striped Adobe-Lily. Establish two occurrences of striped adobe-lily by 2032. Transplantation plans and actions must be informed by the best available science on the species being transplanted and methods for transplantation. Measure progress toward achieving this objective in the number and area of created occurrences of striped adobe-lily.

- ***Action SAL1-3.1.*** Develop a thorough transplantation plan in coordination with botanists with expertise on striped adobe-lily (or closely related taxa) and with CDFW and USFWS, before transplantation of plant material. The transplantation plan should include a monitoring and adaptive management plan.
- ***Action SAL1-3.2.*** Identify source population(s) of plant material to transplant.
- ***Action SAL1-3.3.*** Store and maintain seeds from natural occurrences in the RCIS Area at botanic gardens that are part of the Center for Plant Conservation network.
- ***Action SAL1-3.4.*** Identify receptor sites for transplantation. Receptor sites of rare plants should be far enough from existing populations, as measured by the potential for genetic exchange among individuals through pollen or propagule (e.g., seed, fruit) dispersal. Receptor sites should be carefully selected on the basis of physical, biological, and logistical considerations (Fiedler 1991, Fiedler and Laven 1996).
- ***Action SAL1-3.5.*** Prepare source location and receptor site to ensure that plants are removed and planted in a manner that provides them with the best chance of reestablishment.
- ***Action SAL1-3.6.*** Translocate plant material using methods described in the transplantation plan.
- ***Action SAL1-3.7.*** Monitor and adaptively manage translocations.

3.10.14.2 Conservation Priorities

- Prioritize protection and enhancement of known occurrences (i.e., precise CNDDB occurrences) and any newly discovered occurrences of striped adobe-lily.
- Survey for undocumented occurrences of striped adobe-lily in suitable habitat.
- Develop and implement monitoring and adaptive management plans for striped adobe-lily. Plans should include strategies to minimize site-specific threats and identify new threats.
- Establish an incentive program for private landowners to allow for botanical surveys on their property and to ensure the management of habitats with striped-adobe populations to suppress nonnative invasive vegetation and promote regeneration and recruitment of native species while supporting the natural processes typically found in the communities that support striped adobe-lily (ICF International 2010).

3.10.14.3 Data Gaps

Information regarding striped adobe-lily was obtained from Stebbins (1989) and is currently the best information available. Though much of this information is likely still relevant and remains important, the following data gaps identified by Stebbins (1989) should be addressed to advance understanding of the species and its specific needs.

- Survey suitable habitat for undocumented populations.
- Monitor populations to assess status and condition.
- Conduct a study to evaluate the positive and negative effects of livestock grazing on the viability of selected populations to develop best management grazing practices for this species.
- Conduct a study to evaluate the extent to which striped adobe-lily is restricted to adobe clay soils, and determine the slope, aspect, and topographic site preferences of this species.
- Conduct a study to evaluate the effects of competition from nonnative species.
- Conduct a study to evaluate the relationship between rainfall amounts and growth and reproduction of striped adobe-lily.
- Conduct a study to develop and test transplantation methods.

3.10.15 Valley Oak

Valley oak occurs in areas with a Mediterranean climate (i.e., mild, wet winters and hot, dry summers). This species grows on soils typical of floodplains and valley floors and is dependent on water-table access; ideally a water table depth of about 33 feet below the surface (Howard 1992). The valley oak woodland land cover type in the RCIS Area occurs primarily within riparian areas (Figures 2-20 and E-29).

Valley oak suffers from low recruitment and regeneration (Tyler et al. 2006, Zavaleta et al. 2007, McCreary 2009). Valley oak may not regenerate at an adequate rate to sustain current stand levels over most of its range (Crawford 1998, Beckman et al. 2019). The underlying causes of apparent low recruitment in valley oak likely include introduction of Mediterranean annual grasses and forbs that outcompete oak seedlings for limited soil moisture, damage to seedlings and saplings from livestock grazing, inflated populations of granivorous rodents that damage acorns and seedlings, and suppression of fire frequency that leads to an increase of brush and buildup of fuels along with factors such as climate change, habitat fragmentation, and soil conditions altered by past land uses (Tyler et al. 2006, Zavaleta et al. 2007, McCreary 2009).

Climate change presents an adaptation challenge for long-lived tree species such as valley oak. Tree populations must be able to tolerate a changing climate, adapt to new local conditions through selection on local genetic variation, or migrate to new favorable locations (Sork et al. 2010). Habitat fragmentation and loss create barriers that may limit the dispersal of acorns, thus limiting the potential migration of valley oaks to newly suitable habitats in a rapidly changing climate (Sork and Smouse 2006).

Valley oak will benefit primarily from the woodland and riparian conservation strategies, although the species could also benefit from the multibenefit projects outlined in the conservation strategy for groundwater sustainability. Valley oak saplings require a sufficient access to water during establishment, and groundwater recharge projects may facilitate additional water being supplied to young trees. The primary sources of information used to inform the valley oak conservation strategy are the scientific literature referenced in the valley oak species profile (Appendix E,).

3.10.15.1 Conservation Goals, Objectives and Actions

Goal VO-1. Sustained, climate change resilient populations of valley oak in the RCIS Area.

Objective VO1-1. Protect and Restore Valley Oak Woodland. Protect and restore at least 246 acres of valley oak woodland as part of the riparian protection and restoration Objective RR1-1 (i.e., approximately 50% of the riparian natural community conservation gap) and small stands of valley oaks by implementing actions to achieve riparian protection and restoration by 2032. Measure progress toward achieving this objective in acres of valley oak woodland and stands of valley oak protected or restored.

- Implement actions RR1.1-1 through RR1.1-4 under Objective RR1-1, *Protect and Restore Riparian Habitats* to protect and restore valley oak woodland.
- ***Action VO1-1.1.*** Identify suitable habitat within protected areas to plant valley oak, particularly within microrefugia that provide higher levels of soil moisture.
- ***Action VO1-1.2.*** Maintain and create microrefugia, particularly near water, that would improve valley oak sapling survival (McLaughlin and Zavaleta 2012).
- ***Action VO1-1.3.*** Plant acorns and seedlings in microrefugia.
- ***Action VO1-1.4.*** Install irrigation for seedlings and saplings, where necessary, to increase recruitment and survival of young trees.

Objective VO1-2. *Enhance Valley Oak Habitat.* Enhance habitat for valley oak to encourage recruitment into the population of reproducing valley oaks. Measure progress toward achieving this objective in the area of enhanced valley oak woodland.

- ***Action VO1-2.1.*** Develop and implement management plans to guide maintenance and enhancement of habitat on protected lands to benefit valley oak.
- ***Action VO1-2.2.*** Remove invasive vegetation species by manual methods, preferably before maturation of invasive seeds. Develop invasive species control strategies that benefit or do not cause harm to co-occurring valley oak. Do not use herbicides or other chemicals.

- ***Action VO1-2.3.*** Continue or introduce livestock grazing in a variety of grazing regimes with the appropriate timing and intensity to encourage recruitment of valley oak in woodland habitats.
- ***Action VO1-2.4.*** Enhance habitat for valley oak by planting native shrubs and perennial grasses to restrict invasion by annual invasive species as well as salvaging and transplanting the species from affected areas to protected areas.

3.10.15.2 Conservation Priorities

- Protect stands of valley oak woodland riparian habitat.
- Develop and implement monitoring and adaptive management plans for valley oak woodland. Plans should include strategies to improve seedling and sapling survivorship, minimize site-specific threats and identify new threats.

3.10.15.3 Data Gaps

Evidence of long-term declines in valley oak is primarily from short-term studies in current stand structure, rather than demographic analysis. Long-term monitoring, age structure analysis, and population models are needed to resolve uncertainty about the long-term viability of valley oak in California and the RCIS Area (Tyler et al. 2006).

See "genome-informed assisted gene flow" (Browne et al. 2019) in the data gap section of the woodland conservation strategy (Section 3.7.3, *Woodland*). Genome-informed assisted gene flow could be used to identify source populations of valley oak that may be better adapted to the expected future climatic conditions in the RCIS Area.

3.11 Consistency with Approved Conservation Strategies and Recovery Plans

FGC Section 1852(c)(10) states that an RCIS shall have "[p]rovisions ensuring that the strategy is consistent with and complements any administrative draft natural community conservation plan, approved natural community conservation plan, or federal habitat conservation plan that overlaps with the strategy area."

There are no administrative draft NCCPs or approved NCCPs that overlap with the RCIS Area. There are five approved HCPs overlapping the RCIS Area (Table 2-3); two with permits that have expired. Consistency between this Kaweah RCIS and the three active HCPs is summarized in Table 3-4.

FGC Section 1852(c)(11) states that an RCIS shall have "an explanation of whether and to what extent the strategy is consistent with any previously approved strategy or amended strategy, state or federal recovery plan, or other state or federal approved conservation strategy that overlaps with the strategy area."

There are no previously approved or amended RCISs in the Kaweah RCIS Area. There are five approved recovery plans that overlap the RCIS Area. Consistency between this Kaweah RCIS and recovery plans is summarized in Table 3-5.

Table 3-4. Consistency with Current HCPs overlapping the RCIS Area

Habitat Conservation Plan	Habitat Conservation Plan Goals and Objectives	Kaweah RCIS Consistency
Pacific Gas & Electric Company San Joaquin Valley Operations and Maintenance HCP	The principal biological goal for the San Joaquin Valley O&M HCP is to contribute to the conservation of natural communities and their associated covered species in the Plan Area. The natural communities for the plan area can be further generalized: Wetlands: seasonal wetland, permanent freshwater wetland, open water Woodland: blue oak, blue oak/foothill, coastal oak, conifer, montane hardwood, valley oak Grassland: grassland Woody Riparian: woody riparian Upland Scrub: upland shrub Conservation of natural communities will be achieved by implementing the following three objectives for each natural-community type: Objective 1: Acquire, protect, manage, and maintain lands for the benefit of covered species to achieve compensation for project habitat effects. Objective 2: Locate compensation lands with the plan regions (north, central, and south San Joaquin Valley) where project effects occur. Objective 3: Purchase or dedicate land near other preserved areas to maximize the conservation values of the land and assist in meeting land protection goals of existing recovery plans.	The Kaweah RCIS addresses the same general natural communities as the HCP. The following focal species and non-focal species are also covered under the HCP (all covered species are listed in Table 2-3). Vernal pool fairy shrimp California tiger salamander Blunt-nosed leopard lizard Swainson's hawk Burrowing owl Buena Vista Lake ornate shrew Tipton kangaroo rat San Joaquin kit fox Striped adobe-lily *Vernal pool tadpole shrimp* *Hoover's spurge* *Springville clarkia* *San Joaquin orcutt grass* *San Joaquin adobe sunburst* *Keck's checkerbloom* *Greene's tuctoria* The Kaweah RCIS conservation objectives for natural communities aim to protect, enhance, and restore each natural community for the benefit of focal species and non-focal species, consistent with HCP Objective 1. The Kaweah RCIS Area is in the southern San Joaquin Valley, identified in HCP Objective 2. The Kaweah RCIS aims to protect land for conservation values with a conservation easement consistent with CDFW's definition of *permanently protect*, consistent with HCP Objective 3. The Kaweah RCIS conservation strategies were informed by, and consistent with, recovery plans and aim to contribute to the recovery of the focal species, consistent with HCP Objective 3.

Habitat Conservation Plan	Habitat Conservation Plan Goals and Objectives	Kaweah RCIS Consistency
Woodville Solid Waste Facility HCP	This HCP is not publicly available.	Burrowing owl is the only focal species or non-focal species covered by the HCP (all covered species are listed in Table 2-3).
Southern California Edison Cross Valley HCP	The HCP has the following three overarching goals. Help to maintain viable populations of each Covered Species within the HCP Planning Area over the 30-year ITP term. Help to conserve the amount and quality of Covered Species habitat existing within the HCP Planning Area over the 30-year ITP term. Contribute to local and/or regional conservation of each Covered Species and its habitat to fully compensate for unavoidable impacts resulting from implementation of construction and O&M Covered Activities. Each HCP covered species has goals similar to the following. Avoid and minimize direct and indirect impacts on the covered species and its suitable habitat resulting from construction covered activities to the maximum extent practicable to help maintain viable populations of the covered species over the 30-year incidental take permit term. Avoid and minimize impacts on the covered species and its suitable habitat resulting from O&M Covered Activities to the maximum extent practicable in order to conserve the quality of existing covered species habitat and help to maintain viable populations of the covered species in the HCP Planning Area over the 30-year ITP term. Contribute to local and/or regional conservation of habitat for covered species and compensate for impacts resulting from construction and O&M Covered Activities by preserving or enhancing riparian habitat.	The following focal species and non-focal species are also covered under the HCP (all covered species are listed in Table 2-3). Vernal pool fairy shrimp California tiger salamander San Joaquin kit fox *Vernal pool tadpole shrimp* *San Joaquin Orcutt grass* *Hoover's spurge* The Kaweah RCIS aims to protect, enhance, and restore natural communities and focal species habitats consistent with the overarching HCP goals. HCP species goals 1 and 2 address avoiding and minimizing impacts on covered species and suitable habitat. The Kaweah RCIS is non-regulatory and does not address impacts to focal species or their habitats. The Kaweah RCIS aims to protect land for conservation values with a conservation easement consistent with CDFW's definition of *permanently protect*, consistent with HCP species goal 3 and methods 1 and 2 to achieve species goal 3. The Kaweah RCIS aims to enhance riparian habitat (Goal RR-1).

Habitat Conservation Plan	Habitat Conservation Plan Goals and Objectives	Kaweah RCIS Consistency
	The HCP aims to achieve species goal 3 by the following methods. Purchasing MCAs at a USFWS-approved mitigation bank. Preserving in fee title or conservation easement occupied habitat at a USFWS-approved mitigation site, to be managed in perpetuity. Enhance riparian habitat.	

Note: Non-focal species are *italicized*.

CDFW = California Department of Fish and Wildlife; HCP = habitat conservation plan; ITP = incidental take permit; MCA = mitigation credit agreement; O&M = operations and maintenance; RCIS = conservation investment strategy; USFWS = U.S. Fish and Wildlife Service

Table 3-5. Consistency with Recovery Plans overlapping the RCIS Area

Recovery Plan	Recovery Plan Goals and Objectives	Kaweah RCIS Consistency
Central California Distinct Population Segment of the California Tiger Salamander (U.S. Fish and Wildlife Service 2017b)	The goal of this recovery plan is to reduce the threats to the Central California tiger salamander to ensure its long-term viability in the wild and allow for its removal from the list of threatened and endangered species. The recovery objectives are as follows. (1) Secure self-sustaining populations of Central California tiger salamander throughout the full range of the DPS, ensuring conservation of native genetic variability and diverse habitat types (*e.g*., across elevation and precipitation gradients). (2) Ameliorate or eliminate the threats that caused the species to be listed, and any future threats. (3) Restore and conserve a healthy ecosystem supportive of Central California tiger salamander populations.	Achieving the RCIS goals for California tiger salamander, grasslands, and vernal pool complex is consistent with the recovery plan goal to reduce the threats to the Central California tiger salamander to ensure its long-term viability in the wild and allow for its removal from the list of threatened and endangered species. RCIS Goal CTS-1 aims to secure sustained populations of California tiger salamander in the RCIS Area by protecting California tiger salamander occurrences (Objective CTS1-1) and enhancing tiger salamander aquatic breeding and upland habitat (Objective CTS1-2). Achieving these objectives will help to secure self-sustaining populations of California tiger salamander and ameliorate some threats to California tiger salamander by permanently protecting occurrences from habitat destruction. Grassland and vernal pool complex Goals GL1-1 and VPC-1 aim to secure large, contiguous patches of grassland and vernal pool complex, which provides habitat for California tiger salamander. Grassland and vernal pool complex goals will be achieved by implementing actions to achieve objectives to protect and restore grassland and vernal pool complexes (Objectives GL1-1 and VPC1-1, respectively) and enhance grassland and vernal pool complexes and the ecosystem processes (e.g., grazing, burrowing rodents, wildfire) that maintain these natural communities (Objectives GL1-2, GL1-3, GL1-4, VPC1-2, and VPC1-3). Achieving these objectives will ameliorate some threats to California tiger salamander such as habitat loss and fragmentation and degradation of some ecosystem processes such as loss of ecosystem engineers (e.g., burrowing rodents) and grazing by large mammals.

Recovery Plan	Recovery Plan Goals and Objectives	Kaweah RCIS Consistency
Giant Garter Snake (U.S. Fish and Wildlife Service 2017c)	The goal of the giant garter snake recovery plan is to reduce threats to and improve the population status of the giant garter snake sufficiently to warrant delisting. The recovery objectives are as follows. (1) Establish and protect self-sustaining populations of the giant garter snake throughout the full ecological, geographical, and genetic range of the species. (2) Restore and conserve healthy Central Valley wetland ecosystems that function to support the giant garter snake and associated species and communities of conservation concern such as Central Valley waterfowl and shorebird populations. (3) Ameliorate or eliminate, to the extent possible, the threats that caused the species to be listed or are otherwise of concern, and any foreseeable future threats.	Giant garter snake no longer occurs in the RCIS Area. Habitat loss and fragmentation has extirpated giant garter snake from former wetlands associated with the historical Tulare lakebed (U.S. Fish and Wildlife Service 2017c). Tule marsh that historically provided habitat for this species likely overlapped only a small portion of the far southwestern edge of the RCIS Area (Figure 2 in the recovery plan). The Tulare Basin Recovery Unit includes this portion of the RCIS Area (Figure 12 in the recovery plan). Virtually none of the historic wetland that historically supported giant garter snake remains in the RCIS Area. Giant garter snake is not a focal species in this RCIS. It was considered for inclusion as a focal species (Appendix D, *Evaluation of Species for Inclusion as Focal Species*) but was not included because it is no longer in the RCIS Area and so little of the RCIS Area historically provided habitat for this species. RCIS Goal FW-1 aims to secure wetlands that provide habitats for focal species, groundwater recharge and ecosystem functions by implementing actions to achieve Objective FW1-1 to protect, restore, or create two acres of wetlands as part of multibenefit recharge projects. Achieving the wetland natural community goal will not likely restore giant garter snake to the portion of the RCIS Area within the Tulare Basin, however, actions to achieve this goal are not inconsistent with the giant garter snake recovery plan goal and objectives.
Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005)	The overall goal of this recovery plan is to: Achieve and protect in perpetuity self-sustaining populations throughout the full ecological, geographical, and genetic range of each listed species by ameliorating or eliminating the threats that caused the species to be listed. The interim goals of this recovery plan are to: (1) Stabilize and protect populations so further decline in species status and range are prevented.	Achieving the RCIS goals for vernal pool complex is consistent with the recovery plan goal to protect in perpetuity self-sustaining populations of vernal pool species addressed by the recovery plan. Vernal pool complex Goal VPC-1 aims to secure large, contiguous patches of vernal pool complex, which provides habitat for vernal pool species addressed in the recovery plan. Vernal pool complex goals will be achieved by implementing actions to achieve objectives to protect

Recovery Plan	Recovery Plan Goals and Objectives	Kaweah RCIS Consistency
	(2) Conduct research necessary to refine reclassification (i.e., downlisting) and recovery criteria. (3) Reclassify to threatened (i.e., downlist) those taxa currently federally listed as endangered. The overall objectives of this recovery plan are to: (1) Ameliorate or eliminate the threats that caused the species to be listed as endangered or threatened and ameliorate any other newly identified threats in order to be able to delist these species. (2) Ameliorate or eliminate the threats that affect the species of concern and ameliorate any other newly identified threats in order to conserve these species. (3) Confirm the status of *Plagiobothrys hystriculus*, currently presumed extinct. If extant populations are discovered, the ultimate goal would be to ensure the long-term conservation of this species. (4) Promote natural ecosystem processes and functions by protecting and conserving intact vernal pools and vernal pool complexes within the recovery planning area to maintain viable populations of listed species and species of concern, and prevent additional threats from emerging over time.	and restore vernal pool complexes (Objective VPC1-1) and enhance vernal pool complexes and the ecosystem processes (e.g., grazing, burrowing rodents, wildfire) that maintain these natural communities (Objectives GL1-2, GL1-3, GL1-4, VPC1-2, and VPC1-3). Achieving these objectives will ameliorate some threats to the species addressed by the vernal pool recovery plan such as habitat loss and fragmentation and degradation of some ecosystem processes such as loss of ecosystem engineers (e.g., burrowing rodents) and grazing by large mammals. Species-specific goals for vernal pool fairy shrimp (Goal VPFS-1) and western spadefoot (Goal WSF-1) aim to achieve sustained populations of these vernal pool-associated species that are also addressed by the recovery plan.
Upland Species of the San Joaquin Valley (SJV Recovery Plan) (U.S. Fish and Wildlife Service 1998a)	The ultimate goal of this recovery plan is to delist the 11 endangered and threatened species and ensure the long-term conservation of the 23 candidates and species of concern. An interim goal is to reclassify the endangered species to threatened status.	The Kaweah RCIS provides a natural community-level strategy to achieve conservation benefits for focal species, similar to the SJV Recovery Plan. Four focal species are addressed by the SJV Recovery Plan: blunt-nosed leopard lizard, Tipton kangaroo rat, Buena Vista Lake ornate shrew, and San Joaquin kit fox. The Kaweah RCIS goals and objectives to protect, enhance, and restore the natural communities of the San Joaquin Valley, particularly the scrub, grassland, wetland, and riparian natural communities (Goals GL-1, SC-1, WL-1, and RR-1, respectively) and populations of focal species will contribute to the recovery of the natural communities and focal species addressed in the SJV Recovery Plan.

Recovery Plan	Recovery Plan Goals and Objectives	Kaweah RCIS Consistency
Draft Recovery Plan for Least Bell's Vireo (U.S. Fish and Wildlife Service 1998b)	Recovery Objective. The objective of this plan is the reclassification of the least Bell's vireo to threatened, and, ultimately, delisting through recovery.	Least Bell's vireo is not a focal species and is not known to nest in the RCIS Area. However, the conservation strategy for the riparian natural community is consistent with the *Draft Recovery Plan for Least Bell's Vireo* because it focuses on protecting, enhancing, restoring riparian areas (Goal RR-1) that could potentially be used by Least bell's vireo should they expand into the RCIS Area.

3.12 Adaptive Management and Monitoring Strategy

According to FGC Section 1856(b)(1), for an individual or entity to develop an MCA under this Kaweah RCIS, this RCIS must include an adaptive management and monitoring strategy for conserved habitats and other conserved natural resources. This section is intended to provide an overview of adaptive management and monitoring and describes the framework that can be used to inform adaptive management and monitoring used in an MCA in the RCIS Area. Requirements and processes for creating an MCA, including an adaptive management and monitoring plan, will be provided in CDFW's MCA Guidelines.

Adaptive management and monitoring plans will only be required for conservation actions or habitat enhancement actions that are implemented under MCAs. MCA sponsors may be asked by the RCIS proponent to submit progress reports to the RCIS proponent, which can be provided as part of adaptive management and monitoring reporting requirements, or separately (Section 4.2.2.2, *Mitigation Credit Agreement Sponsor Responsibilities*).

An adaptive management and monitoring plan could be developed for any voluntary conservation action or habitat enhancement action in the RCIS Area (unrelated to an MCA), but it is not required. Such an adaptive management and monitoring plan consistent with the strategy described in this section would provide the same benefits as those described for mitigation actions.

The overarching objective of the adaptive management and monitoring strategy is to ensure that conservation and habitat enhancement actions are implemented in ways that benefit focal species and other conservation elements credited under an MCA and contribute to the achievement of conservation goals and objectives stated in the RCIS. As an RCIS focused on multibenefit groundwater sustainability projects, the adaptive management and monitoring strategy for multibenefit projects should include monitoring of groundwater metrics using project-appropriate metrics identified in the three Kaweah Subbasin GSPs, such as estimated average annual water benefits (acre-feet/year).

The key elements of the strategy are outlined and described in this section. The level of detail and application of the strategy will vary depending on the size and complexity of the MCA site or sites, the resources being monitored, and the nature of the conservation or enhancement actions being executed.

3.12.1 Periods of Adaptive Management and Monitoring

Adaptive management and monitoring can be organized into two periods: the interim management period, and the long-term management period. Key aspects of each period are described in this section.

3.12.1.1 Interim Management Period

The interim management period is the period commencing when the MCA site is authorized to use or transfer credits and continues until performance standards have been met and the third anniversary of the full funding of the endowment amount has occurred (see the MCA portion of the Program Guidelines for more details). During this period, conservation actions and habitat enhancement actions are implemented[9] and ecological performance monitoring is conducted to assess the progress and status of resources being enhanced or restored. If ecological performance standards are not met, remedial actions will be implemented. Monitoring is more intensive and frequent during this period than it is under long-term management, and there may be different or additional management actions required during the interim management period that are not required during the long-term management period.

During the interim management period, management of the site will be guided by the interim management plan, which describes the conservation actions or habitat enhancement actions, adaptive management strategy, monitoring, reporting and other activities to be implemented by the MCA sponsor.

3.12.1.2 Long-Term Management Period

The long-term monitoring period begins upon conclusion of the interim management period and continues for the length of the MCA site's durability instrument, which may be in perpetuity for a conservation action, or a shorter period for a habitat enhancement action.

During the long-term management period, management of the site will be guided by the long-term management plan, which will include measures intended to ensure that the MCA site or sites are managed, monitored, and maintained in perpetuity (or a shorter period, as applicable, for a habitat enhancement action), to conserve and protect the resources that support MCA credits, and other natural resources.

As much as possible, the long-term management plan should be a practical guide to management and monitoring actions that will occur on the MCA site over time, written with the land manager, groundwater recharge project manager, and biological monitors in mind. It should also be appropriately scaled to the resources available through the endowment, and provide for a hierarchy of needs (i.e., using funding to manage resource needs that support MCA credits before other needs).

Similar to adaptive management actions, the monitoring program can change over time in response to the information collected and the trends observed. This adaptive approach to monitoring ensures that enough data are being collected to determine whether the mitigation site and groundwater recharge project is performing as expected, while also avoiding unnecessary monitoring costs, particularly once the effectiveness of the site has been documented through several years of monitoring.

3.12.2 Adaptive Management

Adaptive management is a decision-making process that adjust actions as uncertainties become better understood or as conditions change. Documenting actions and monitoring the outcomes of management is the foundation of an adaptive approach, and thoughtful monitoring can both advance scientific understanding and modify management actions iteratively (Williams et al. 2007).

Adaptive management is necessary because of the degree of uncertainty and natural variability associated with ecosystems and their responses to management. It is possible that additional and different actions not described in this Kaweah RCIS or in an MCA will be identified in the future and

[9] The types of conservation and habitat enhancement actions will depend on the condition of resources such as habitat at the site, and on whether resources are being restored or created.

proven to be more effective. Results of monitoring may also indicate that some management measures are less effective than anticipated. To address these uncertainties, an adaptive approach will be used to inform management on land subject to MCAs.

The cornerstone of an adaptive management and monitoring program is an approach in which monitoring yields scientifically valid results that inform management decisions. Information collected through monitoring and other experiments is used to manage mitigation lands and help determine progress toward conservation objectives.

Adaptive management may include the following.

- Evaluate efficacy of monitoring protocols
- Incorporate best available scientific information into management decisions
- Review any unexpected or unfavorable results and test hypotheses to achieve desired outcomes
- Adjust management actions and continue to monitor
- Adjust success criteria and actions, if necessary

3.12.3 Types of Monitoring

Types of ecological monitoring that may be included in an MCA monitoring plan include the following.

Ecological performance monitoring. This is short term monitoring implemented during the interim management period. Monitoring is conducted to assess progress of restoration or enhancement actions toward achieving incremental performance criteria. The criteria are tied to the incremental availability of credits in a credit release schedule.

Conservation easement monitoring and long-term durability instrument monitoring. This is monitoring implemented by the third-party conservation easement holder to monitor the conditions as described in the conservation easement. A similar type of monitoring may be used to track the status of a site used for a habitat enhancement action under a long-term durability instrument.

Effectiveness monitoring. Effectiveness monitoring is often less intensive and implemented at longer intervals than ecological performance monitoring, during the long-term management period. Effectiveness monitoring is implemented in perpetuity. Effectiveness monitoring is implemented to verify that the site is providing the intended mitigation/offset(s) or conservation values and to inform adaptive management.

Chapter 4
Implementation

A Regional Conservation Investment Strategy (RCIS) is used to inform decision-making related to land acquisition, restoration, enhancement, surface water and groundwater management, and management actions for focal species and other conservation elements addressed by the RCIS. This Kaweah RCIS may help to achieve the following.

- Identify conservation and habitat enhancement actions with groundwater sustainability co-benefits that can be achieved concurrently with implementation of Kaweah Subbasin Groundwater Sustainability Plans (GSPs).
- Inform how conservation organizations make conservation investments in the RCIS Area.
- Inform how state or federal agencies evaluate grant or permit applications for local conservation or research projects.
- Help guide project proponents to site and design proposed compensatory mitigation projects, such as conservation or restoration actions, which are required pursuant to 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), Clean Water Act Sections 404 and 401, the State Porter-Cologne Water Quality Control Act, and the California Water Code.
- Support the siting, design, and creation of conservation and mitigation banks.
- Help landowners, public agencies, private entities, or others scope advance mitigation projects that create mitigation credits using a Mitigation Credit Agreement (MCA), which is enabled by an RCIS.

This chapter describes the RCIS implementation process and provides an overview of MCAs. The California Department of Fish and Wildlife (CDFW) will describe the requirements and processes for creating an MCA in their *MCA Guidelines*, which have not yet been released. In this chapter, items that are suggestions—not requirements—are noted as items the RCIS proponent *may* do, as opposed to required elements that proponents *will* do or *shall* do as specified by FGC Sections 1850–1861 and CDFW's *Regional Conservation Investment Strategy Program Guidelines* (Program Guidelines) (California Department of Fish and Wildlife 2018).

Section 4.2, *Required Activities to Create Mitigation Credit Agreements*, describes elements required during RCIS implementation to enable the creation of MCAs in the RCIS Area.

The Kaweah RCIS is a non-binding, voluntary conservation strategy. As the RCIS proponent, the East Kaweah Groundwater Sustainability Agency (EKGSA) is only responsible for updating the scientific information in this RCIS and evaluating the effectiveness of RCIS conservation actions, habitat enhancement actions, and progress toward achieving RCIS goals and objectives at least once every

10 years (Section 4.2.2, *Assessing Progress*). Entities pursuing MCAs under this RCIS are responsible for funding their involvement in an MCA and for developing those MCAs; EKGSA bears no financial or other responsibility for developing or monitoring those MCAs or other aspects of implementing this Kaweah RCIS.

As indicated in FGC Section 1855(b), neither this RCIS nor any MCA adopted pursuant to the RCIS modifies in any way: (a) the standards for issuance of incidental take permits (ITPs) or consistency determinations (CDs) under CESA; (b) the standards for issuance of LSAAs under Section 1600, et seq.; or (3) the standards under CEQA. In addition, nothing in this RCIS or in any MCA adopted pursuant to the RCIS relieves a project proponent of the obligation to obtain all necessary permits, including but not limited to ITPs, CDs, and LSAAs, and to fulfill all avoidance, minimization, and mitigation measures required by those permits. For these reasons, CDFW and any other relevant regulatory agencies should be consulted prior to implementing any actions in this RCIS that have any potential for impacts to regulated resources (such as CESA-listed species or streambeds), to determine if any permits are needed.

4.1 Implementation Goals

An important goal of this Kaweah RCIS is to provide a tool that could be used to provide financial incentives to working landowners who voluntarily participate in groundwater sustainability projects and management actions that also provide habitat values for focal species and other conservation elements addressed by this RCIS. The guidance in this RCIS will help to ensure that conservation actions and habitat enhancement actions in the RCIS Area occur in an informed and strategic manner to achieve the highest degree of conservation benefit at a regional scale. This Kaweah RCIS is also intended to streamline delivery of projects requiring CDFW permits by identifying priority conservation and habitat enhancement actions for focal species and other conservation elements in the RCIS Area that can be used to develop advance mitigation in the RCIS Area (Chapter 3, *Conservation Strategy*).

Collaboration amongst stakeholders will be critical for successful implementation of this Kaweah RCIS. Stakeholders may partner with each other or the EKGSA to help implement this Kaweah RCIS. Organizations such as the Mid-Kaweah GSA, Greater Kaweah GSA, Tulare Basin Watershed Partnership, Sequoia Riverlands Trust, Kaweah Delta Water Conservation District, New Current Water and Land, Environmental Defense Fund, Environmental Incentives, California Natural Resources Conservation Service, Resource Conservation Districts, and other interested parties can make valuable contributions toward achieving the goals and objectives of this Kaweah RCIS.

The following are potential actions supporting organizations may take to implement this Kaweah RCIS; this list is not exhaustive.

- Help the Kaweah Subbasin GSAs align and implement sustainable groundwater projects and management actions with Kaweah RCIS conservation and habitat enhancement actions that provide co-benefits for groundwater sustainability and conservation of focal species and habitats, while providing beneficial economic outcomes for willing landowners.
- Assist willing landowners with developing and implementing MCAs on their lands, including MCA-related monitoring and reporting.

- Connect willing landowners with infrastructure agencies and other entities that need to secure mitigation.
- Publicize this Kaweah RCIS and its successful implementation to participating agencies and other entities that may use the RCIS to inform conservation and habitat enhancement actions in the RCIS Area.
- Oversee preparation of the 10-year progress report, or other documents for CDFW, as needed, documenting implementation of this Kaweah RCIS and MCAs.
- Support the EKGSA in periodically updating (i.e., at least every 10 years) and extending this RCIS based on significant new information on the focal species and their conservation (Section 4.2, *Required Activities for Creating Mitigation Credit Agreements*).

4.2 Required Activities for Creating Mitigation Credit Agreements

As a voluntary planning and guidance document, there are no inherent implementation requirements for this RCIS. However, for an RCIS to be used to create MCAs, FGC Section 1856(b) specifies what must be included in the RCIS, and what must be done after an RCIS is approved by CDFW. This RCIS is intended to support the creation of MCAs; as a result, it includes additional required elements as specified in FGC Section 1856(b) as quoted below.

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

The Program Guidelines define the RCIS proponent, in this case the EKGSA, as the public agency or group of public agencies responsible for technical and administrative updates to an RCIS. EKGSA may share, designate, or transfer its RCIS proponent role to another entity or entities at any time, or elect to terminate its role as RCIS proponent.[1]

[1] The EKGSA intends to remain the RCIS proponent and either renew the RCIS or transfer responsibility for renewing the RCIS to another entity at the end of the first 10 years. However, if the EKGSA is unable to renew the RCIS due to budget or other constraints, and no other entity is willing to take responsibility, the RCIS may expire and no longer be valid.

As the RCIS proponent, EKGSA will be responsible for updating this RCIS and tracking the progress and effectiveness of conservation and habitat enhancement actions in achieving RCIS conservation goals and objectives.

This RCIS includes the following elements to facilitate the creation of MCAs as required by FGC Section 1856(b) and as described in the Program Guidelines.

- An adaptive management and monitoring strategy (Section 3.12, *Adaptive Management and Monitoring Strategy*).
- A process for updating the scientific information at least once every 10 years (Section 4.2.1, *Updating and Extending this RCIS*).
- A process for tracking the progress and effectiveness of conservation and habitat enhancement actions in achieving the goals and objectives, and for offsetting the effects of identified pressures and stressors at least once every 10 years (Section 4.2.2, *Assessing Progress*).
- Identification of an RCIS proponent (see above for a description of the EKGSA agreement to fulfill this role).

4.2.1 Updating and Extending this Regional Conservation Investment Strategy

According to the Program Guidelines, "an update to an RCIS means updates to the best available scientific information contained in a previously approved RCIS." The Program Guidelines further define a data update as follows.

> A data update is generally the submission of GIS data or minor changes to numbers or text in the document that require less than four hours of CDFW staff time. It does not include updates or amendments to the geographic area, focal species, or other conservation elements. An RCIS proponent may update the scientific information in the RCIS at any time.

The EKGSA will contact CDFW to evaluate proposed data updates and incorporate those updates into the RCIS as needed.

Under current state law, CDFW may extend the duration of an approved or amended RCIS for additional periods of up to 10 years. If the EKGSA or other entities intend to use this RCIS to create additional MCAs pursuant to FGC Section 1856 after the RCIS approval period ends, the EKGSA, CDFW,[2] or other entity, with permission from the EKGSA, shall update the scientific information in this RCIS at least once every 10 years. Once this Kaweah RCIS is updated with new scientific information and CDFW finds that the RCIS continues to meet the requirements of FGC Section 1852, CDFW may extend the duration of this RCIS.

Because this Kaweah RCIS is intended to support the creation of MCAs, the EKGSA may, at least once every 10 years, undertake a more substantial update (i.e., not just a data update). This update may include updating and refining the RCIS, if necessary, based on current scientific information that pertains to focal species and other conservation elements addressed in this RCIS, and the goals,

[2] According to the Program Guidelines, "If CDFW determines that an approved RCIS needs to be updated or evaluated more frequently and the RCIS proponent or responsible party declines to do so, MCA sponsors or CDFW may elect to update the RCIS. Any such updates shall become part of the approved RCIS, pending an evaluation by CDFW."

objectives, and conservation and habitat enhancement actions pertaining to those elements. EKGSA may determine when, within the 10-year approval period, to undertake updates (for example, after 5 years, or toward the end of the 10-year approval period). Updates would then be integrated into the RCIS at the end of the 10-year approval period as part of the RCIS renewal process, or earlier if the EKGSA decides to update the RCIS earlier.

The EKGSA may use various data sources to inform the updates, including data from monitoring for MCAs, MCA progress reports (Section 4.2.2.2, *Mitigation Credit Agreement Sponsor Responsibilities*), recent scientific literature, technical reports or studies, and guidance from regulatory agencies. The assumptions on which this RCIS's specific conservation strategy was built, and particularly as related to focal species, other conservation elements, and conservation priorities, may be revised as necessary based on new data or information. If the results of this review reveal that fundamental aspects of this Kaweah RCIS are no longer valid, the EKGSA may elect to amend this RCIS to address these changes, as outlined in Section 4.4, *Amending the Regional Conservation Investment Strategy*.

4.2.2 Assessing Progress

In compliance with FGC Section 1856(b), the EKGSA will assess the effectiveness of RCIS conservation actions and habitat enhancement actions in achieving the goals and objectives for the focal species and other conservation elements and offsetting the effects of identified pressures and stressors.

Because an RCIS is meant to be a platform for information that can be used by any entity or agency to inform their conservation or mitigation planning, it is not expected that the EKGSA will be aware of all actions that occur in relation to this Kaweah RCIS. As such, the EKGSA is not responsible for tracking data for projects of which it is not aware. However, MCA sponsors with mitigation sites in the RCIS Area are required to collect and provide data to the EKGSA—in addition to CDFW—such that the EKGSA can meet its tracking obligations as the RCIS proponent (California Department of Fish and Wildlife 2018).

The EKGSA will use data provided from MCA sponsors to assess the effectiveness of RCIS conservation actions and habitat enhancement actions in achieving the goals and objectives for the focal species and other conservation elements and offsetting the effects of identified pressures and stressors. Other sources of data and information may be used, such as the current versions of the California Protected Areas Database,[3] the California Conservation Easement Database,[4] and websites maintained by CDFW, U.S. Fish and Wildlife Service (USFWS), and U.S. Army Corps of Engineers (USACE)[5] that provide up-to-date information on approved conservation and mitigation banks, among other sources. For example, data from the California Protected Areas Database (CPAD) and California Conservation Easement Database (CCED) can be used to assess changes in the amounts of

[3] http://www.calands.org/data

[4] http://www.calands.org/cced

[5] Up-to-date information on approved conservation and mitigation banks can be found at the following U.S. Fish and Wildlife Service, CDFW, and USACE websites: https://www.fws.gov/sacramento/es/Conservation-Banking/Banks/In-Area/es_conse-bank-in-area.htm

https://www.wildlife.ca.gov/Conservation/Planning/Banking/Approved-Banks

http://www.spn.usace.army.mil/Missions/Regulatory/Mitigation-Banks/Approved-Banks-for-the-San-Francisco-Regulatory-Di/

https://ribits.usace.army.mil/

focal species' habitat from the amounts of habitat protected at the time this RCIS was developed, as presented in gap analysis Tables 3-1 and 3-2.

4.2.2.1 RCIS Progress Report

As RCIS proponent, the EKGSA will evaluate the effectiveness of RCIS conservation and habitat enhancement actions, and progress toward achieving RCIS goals and objectives at least once every 10 years. The evaluation will be submitted as a report to CDFW at the end of the 10-year approval term. Alternatively, the EKGSA may report this progress in an updated Kaweah RCIS, which would be submitted to CDFW for renewal after the 10-year approval period has ended.

To the extent feasible, the RCIS progress report or updated Kaweah RCIS will summarize the following.

- Net change in the amount of focal species' habitat and other conservation elements (e.g., working landscapes) protected in the RCIS Area. Net change in area should be provided in acres, though for certain ecological features, net change may be provided in other relevant metrics (as specified in the MCA), such as length and width of a restored riparian woodland.
- Summary of progress made toward achieving the RCIS conservation goals and objectives through the implementation of conservation actions and habitat enhancement actions described in Chapter 3.
- Summary of the net change in the quality of focal species' habitat addressed in the MCAs, using metrics described in the MCA.
- Summary of the pressures and stressors identified in Section 2.4, *Pressures and Stressors on Conservation Elements*, that were offset by implementing RCIS conservation actions and habitat enhancement actions; summary can be provided in tabular form.
- Summary of groundwater savings and applications, and net benefit to groundwater sustainability, from implementing Kaweah RCIS conservation actions and habitat enhancement actions.

To the extent feasible, the RCIS progress report may summarize other conservation and habitat enhancement actions undertaken in the RCIS Area not conducted as part of an MCA, if this information is available to the EKGSA (e.g., conservation of habitat by non-governmental conservation organizations). Regional partners are encouraged to share data and other information about conservation actions and habitat enhancement actions implemented in the RCIS Area with the EKGSA, but the EKGSA will not be responsible for tracking and reporting data or other information from these entities. The EKGSA may use this information, in combination with information provided by MCA sponsors, to assess progress toward achieving RCIS conservation goals and objectives.

4.2.2.2 Mitigation Credit Agreement Sponsor Responsibilities

MCA sponsors with mitigation sites in the RCIS Area are expected to contribute to tracking the progress and effectiveness of conservation actions and habitat enhancement actions toward achieving RCIS goals and objectives by providing data and relevant information to the EKGSA. MCA sponsors shall use consistent metrics to assess habitat quality. Metrics will be determined during the MCA development and approval process.

The EKGSA may request an MCA summary report from each MCA sponsor with mitigation sites in the RCIS Area. This information will help assess the effectiveness of RCIS conservation and habitat enhancement actions toward achieving goals and objectives for focal species and other conservation elements. Additionally, the EKGSA or CDFW may provide MCA sponsors with an MCA summary report template to facilitate consistent and adequate reporting by MCA sponsors.

MCA sponsors, upon request of the EKGSA, may be asked to provide the following information.

- The amount of focal species' habitat and other conservation elements (i.e., working lands and natural communities) protected, enhanced, or restored/created through MCAs at the MCA sponsor's mitigation sites in the RCIS Area, and the corresponding Kaweah RCIS goal(s) and objective(s) the actions supported.
- The MCA sponsors shall report the amount of land, aquatic features, and habitat for focal species using the same natural community, land cover type, and focal species habitat categories (e.g., breeding habitat, foraging habitat, or upland habitat) as used by this RCIS as described in Chapter 2, *Environmental Setting and the Built Environment* to enable consistent tracking of progress toward achieving RCIS goals and objectives.
- A list of the conservation actions and habitat enhancement actions identified in the MCA and implemented at the MCA sponsor's mitigation sites in the RCIS Area.
- A summary of the net change in quality of the target ecological features and ecological functions addressed by conservation or habitat enhancement actions on the MCA sponsor's mitigation sites in the RCIS Area, using the metrics identified in the MCA(s).
- A brief summary of the pressures and stressors identified in Section 2.4, *Pressures and Stressors on Conservation Elements*, that were offset (or partially offset) by implementing conservation and habitat enhancement actions through the MCA.
- Summary of groundwater savings and applications, and net benefit to groundwater sustainability, from implementing Kaweah RCIS conservation actions and habitat enhancement actions.

Measurable objectives in this RCIS include metrics for tracking progress towards achieving the RCIS goals and objectives. The metrics are intended to enable consistent measurement of the net change in habitat area and habitat quality from habitat restoration actions. When implementing conservation actions and habitat enhancement actions that include habitat restoration as part of an MCA, the MCA sponsor shall select, and submit for CDFW's approval, an appropriate metric(s) from the metrics listed below to measure the net change in habitat area and habitat quality.

If the MCA sponsor determines that a metric not listed below is more appropriate for measuring net change in habitat area and habitat quality, the MCA sponsor may make a written request to CDFW to consider approving that alternative metric instead of, or in addition to, one or more metrics listed below. CDFW will consider the proposed alternative metric and the RCIS proponent's recommendation, if any, when determining whether to approve the alternative metric.

Once a metric is designated and approved, it must be used for the baseline and subsequent measurements of habitat area and habitat quality. If an approved metric turns out to be faulty or problematic, the MCA sponsor may make a written request to CDFW to consider approving a different metric instead of, or in addition to, the approved metric(s), as set forth above. The determination to approve will be based, in part, on whether the new metric can be compared with the original baseline data in a reasonable way to compare the change in habitat area or habitat quality.

MCA sponsors will report on relevant RCIS metrics for corresponding habitat restoration conservation actions and habitat enhancement actions implemented through an MCA. MCA sponsors may include additional measures and performance standards for assessing habitat quality in an MCA, consistent with the MCA Guidelines and with approval by CDFW.

The following metrics are acceptable in this RCIS for measuring the net change in habitat area and habitat quality resulting from habitat restoration actions, or the effectiveness of these changes on focal species.

- Acres
- Linear feet
- 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., number per unit area of nesting trees, ponds, host plants)
- Inundation duration (consecutive days)
- Water depth (inches or feet)
- Stream flow (cubic feet per second)
- Water temperature and chemical composition (e.g., dissolved oxygen)

4.3 Regulatory Uses of this Regional Conservation Investment Strategy

4.3.1 Mitigation Credit Agreements

An MCA is associated with an RCIS and identifies the type and number of credits a person or entity proposes to create by implementing one or more conservation actions or habitat enhancement actions, as well as the terms and conditions under which those credits may be used. As indicated in FGC Section 1856(c), credits created through an MCA could be used to fulfill compensatory mitigation requirements pursuant to the CESA, to reduce adverse impacts to fish and wildlife resources from activities authorized pursuant to a LSAA under FGC Section 1600, or to mitigate significant effects on the environment pursuant to CEQA, and possibly other state or federal regulations. MCAs must be prepared according to the requirements of FGC Section 1856 and the Program Guidelines.

An MCA helps establish advance mitigation and can provide a number of significant benefits, particularly for agencies or entities with predictable long-term mitigation needs as listed below.

- **Cost effectiveness.** The MCA sponsor can set aside or purchase lands when doing so is cost effective, knowing those lands will provide useful mitigation values in the future. A mitigation site should be vetted through the appropriate regulatory agency before the site is purchased.
- **Pooled resources for best results.** Mitigation credits can be pooled across large sites or multiple sites, providing economies of scale to deliver mitigation more efficiently across many projects.
- **Predictable future mitigation costs.** Although mitigation credits to satisfy mitigation obligations for a project must be assessed on a case-by-case basis by the regulating authority, an MCA can establish certainty/predictability about future costs for those mitigations.
- **Alignment with regional conservation priorities.** An MCA gives CDFW and other resource agencies some assurance that proposed mitigation fits within a larger conservation framework and set of regional conservation priorities (i.e., an RCIS). MCA investments in resource protection, restoration, and enhancement contribute to meeting regional conservation goals and objectives.

Only CDFW may approve an MCA; as the RCIS proponent, the EKGSA does not have the authority to approve an MCA. Once this Kaweah RCIS is approved by CDFW, any public or private entity may prepare, for CDFW approval, an MCA for one or more conservation or habitat enhancement actions that measurably advances Kaweah RCIS conservation goals and objectives. A person or entity, including a state or local agency, with mitigation needs may choose to enter into an MCA with CDFW for a single large mitigation site, a single mitigation site with multiple phases, or a suite of mitigation sites.

MCAs will primarily facilitate permitting under the CESA for RCIS focal species that are state listed, and non-focal species whose conservation need is analyzed or otherwise provided for in this RCIS. Credits created through an MCA could be used to "fulfill compensatory mitigation requirements established under any state or federal environmental law, as determined by the applicable local, state, or federal regulatory agency" per Assembly Bill 2087 and FGC Section 1856(c)), including CEQA, and LSAA requirements. This also applies to non-focal species of interest, particularly in the context of CEQA. Conservation actions or habitat enhancement actions aligned with the conservation goals and objectives of this RCIS, and that benefit non-focal species, may also be implemented to create mitigation credits for non-focal species (Section 2.3.12, *Non-Focal Species*, Appendix F, *Non-Focal Species Summaries*). An MCA could also be used to meet federal environmental law and regulation requirements with the approval of applicable federal regulatory agencies.

Mitigation credits can be established by an MCA for any conservation action or habitat enhancement action that contributes to achieving Kaweah RCIS conservation goals and objectives. Typically, mitigation credits will be established for the following types of conservation actions and habitat enhancement actions.

- Acquiring an interest in land to *permanently protect*[6] that land.
- Restoring habitat to create new habitat and increase existing habitat functions for a focal species or non-focal species whose conservation need is analyzed or otherwise provided for in this Kaweah RCIS.
- Implementing habitat enhancement actions under a long-term durability agreement without permanently protecting land for the benefit of focal species or non-focal species whose conservation need is analyzed or otherwise provided for in this RCIS.

FGC Section 1856(f) (quoted below) requires CDFW to publish a notice of availability of any draft MCA for public review for a period of at least 45 days. During this public review period, the public may provide written comments, after which CDFW shall respond to written comments.

> (f) To enter into a mitigation credit agreement with the department, a person or entity shall submit a draft mitigation credit agreement to the department for its review, revision, and approval or disapproval. Within five days of deeming a draft agreement complete, the department shall publish notice of the availability of the draft agreement by filing its notice with the Governor's Office of Planning and Research and the city and county clerks of each county in which the agreement is applicable in part or in whole and shall make the draft agreement available to the public on its Internet Web site, and to any public agency, organization, or individual who has filed a written request to the department for notices regarding agreements, for review and comment for a period of at least 45 days, following which the department shall respond to written comments submitted during the public comment period and may approve the agreement, approve it with revisions, or disapprove it.

Refer to FGC Section 1856(f) parts 1 through 18 for a description of what an MCA must include.

More information about the MCA development and approval process can be found on the CDFW website.[7]

4.3.2 Conservation or Mitigation Banks

FGC Section 1797.5 defines terms associated with mitigation banking in California (Appendix A, *Glossary*). In summary, a conservation or mitigation bank is privately or publicly owned land that is managed for its natural resource values, with an emphasis on the targeted resource (i.e., species and/or aquatic resources). Mitigation banks typically offer credits for restored or created aquatic resources. Conservation banks may also offer credits for restored resources, but they are more heavily focused on the protection and management of existing occupied habitats for the target species. In exchange for permanently protecting and managing the land—and in the case of mitigation banks, restoring or creating aquatic resources—a bank operator is allowed to sell credits to project proponents who need to satisfy legal requirements for compensating environmental impacts of development projects (California Department of Fish and Wildlife 2014).

A total of 11 conservation and mitigation banks with available credits have service areas that overlap with the RCIS Area. See Section 2.3.2, *Conservation and Mitigation Banks* for more information about these banks.

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[6] The Program Guidelines define permanent protection to mean: recording a conservation easement and providing secure, perpetual funding for management of the land, monitoring, legal enforcement, and defense.

[7] https://www.wildlife.ca.gov/Conservation/Planning/Regional-Conservation

Private parties wishing to develop and establish a new conservation or mitigation bank in the RCIS Area should consult guidance and instructions provided by CDFW and USFWS.[8] This Kaweah RCIS can provide guidance on where mitigation or conservation banks could be sited to support the conservation of resources addressed in this RCIS.

4.4 Amending the Regional Conservation Investment Strategy

The EKGSA may amend the Kaweah RCIS. The Program Guidelines define two types of RCIS amendments: simple and complex. A simple amendment includes small or minor changes to the document that are more than a data update (i.e., the submission of geographic information system [GIS] data or minor changes to numbers or text in the document that require less than 4 hours of CDFW staff time), but that do not result in a substantial change as determined by CDFW. A complex amendment would result in a substantial change to the RCIS, such as changes to the geographic area, addition or removal of focal species, or other conservation elements as determined by CDFW.

A simple or complex amended RCIS can be submitted by either the original RCIS proponent, CDFW, or by a third-party public agency with the express written authorization of the original RCIS proponent. A simple amendment does not require public notice. A complex RCIS amendment is subject to the same public notice requirements and review and approval processes as required for original RCIS publication, as stipulated in the Program Guidelines as quoted below.

> If a third-party public agency wishes to amend an approved RCIS and the original RCIS proponent declines to so amend the RCIS or to authorize the third-party public agency to do so, the third-party public agency may seek authorization from CDFW to amend the RCIS. CDFW may, in its sole discretion, authorize a third-party public agency to amend an RCIS if it determines that the proposed amendment will provide a substantial conservation benefit and will not unduly prejudice the rights or interests of the original RCIS proponent. CDFW may also, in its sole discretion, amend an RCIS if it determines that an amendment is necessary to conform to new or amended federal, state, or local laws or regulations, or if it determines that the proposed amendment will provide a substantial conservation benefit and will not unduly prejudice the rights or interests of the original RCIS proponent.

To ensure that proposed amendments to the RCIS do not unduly prejudice the rights or interests of the EKGSA, the Mid-Kaweah Groundwater Sustainability Agency (MKGSA), the Greater Kaweah Groundwater Sustainability Agency (GKGSA), or other stakeholders involved in the original RCIS development process, the EKGSA, in cooperation with the MKGSA and GKGSA, and as set forth in the 20XX *Memorandum of Understanding for Kaweah Subbasin RCIS Cooperation and Coordination* [in development], will evaluate a formal proposal from a third-party public agency to amend the RCIS. Consistent with the Program Guidelines, if the GSAs agree that the proposed amendment will not unduly prejudice their rights or interests, the EKGSA will lead the amendment development process and invite the agencies and entities that participated in the development of the original Kaweah RCIS as Steering Committee members to participate in the amendment process as Steering Committee members or participate in a similar stakeholder process. The third-party public agency proposing amendments to the RCIS will also be invited to participate as a Steering Committee member or participant in a similar stakeholder process.

[8] For additional information on banking see the following website: https://www.wildlife.ca.gov/ConservationPlanning/Banking

CDFW may also, at its sole discretion, amend an RCIS if it determines that an amendment is necessary to conform to new or amended federal, State, or local laws or regulations, or if it determines that the proposed amendment will provide a substantial conservation benefit and will not unduly prejudice the rights or interests of the original RCIS proponent.

The GSAs fully expect and request that CDFW consult with the EKGSA as the RCIS proponent and the local agencies that have land use authority in the RCIS area, as required by FGC Section 1852(a), to ensure that any amendment CDFW proposes will not unduly prejudice the rights or interests of the EKGSA as required by the Program Guidelines. Furthermore, the GSAs fully expect that consultation with local agencies that have land use authority in the RCIS Area will include a formal RCIS amendment planning process similar to the original RCIS development process, with the original Steering Committee members invited to participate.

Chapter 5
References

5.1 Chapter 1

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5.2 Chapter 2

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Appendix A
Glossary

This glossary defines terms that are used throughout this Kaweah RCIS. Additional terms are provided in the *Regional Conservation Investment Strategies Program Guidelines* (Program Guidelines), Section 2.1, *Terms, Abbreviations, Acronyms, and Definitions* (California Department of Fish and Wildlife 2018).

Terms and Definitions

Term	Definitions
action	A conservation action or habitat enhancement action that, when implemented, would contribute toward achieving this Kaweah RCIS's conservation goals and objectives. Actions described in this Kaweah RCIS are not identified as either conservation actions or habitat enhancement actions to retain flexibility in how the action may be implemented under an MCA, as many of the actions can be implemented on land or water permanently protected under a conservation easement (i.e., conservation action), or on land protected under a species- or habitat-appropriate durability agreement that is not permanently protected (i.e., habitat enhancement action). See *conservation action* and *habitat enhancement action*.
adaptive management and monitoring strategy	A component of an RCIS that incorporates an adaptive management process that is informed by periodic monitoring of the implementation of both conservation actions and habitat enhancement actions.[1] Adaptive management means using the results of new information gathered through a monitoring program to adjust management strategies and practices to help provide for the conservation of focal species and their habitats. A monitoring strategy is the periodic evaluation of monitoring results to assess the adequacy of implementing a conservation action or habitat enhancement action and to provide information to direct adaptive management activities to determine the status of the focal species, their habitats, or other natural resources.[2]
administrative draft	A substantially complete draft of a Natural Community Conservation Plan (NCCP) that is released after January 1, 2016, to the general public, plan participants, and CDFW.
advance mitigation	Compensatory mitigation for impacts on ecological resources (species and their habitat) and other natural resources that is implemented prior to impacts occurring.
alliance	A category of vegetation classification which describes repeating patterns of plants across a landscape based on plant species composition, and the effects of local climate, soil, water, disturbance, and other environmental factors (California Native Plant Society 2021).

[1] Fish and Game Code (FGC), Section 1856, subdivisions (b)(1) and (f)(14)

[2] Adapted from FGC Section 2805, subdivisions (a) and (g).

Term	Definitions
Assembly Bill 2087	Amended CFGC Chapter 9, Sections 1850–1861 to create the California Department of Fish and Wildlife's RCIS program (Program). The Program encourages public agencies to develop RCISs, using the best available science to identify regional conservation priorities and other actions to help California's vulnerable species populations. The Program provides additional tools and mechanisms to complement and enhance existing programs and increase options for project proponents, including public infrastructure agencies, to create compensatory mitigation that supports regional conservation priorities in advance of impacts.
association	Diagnostic species, usually from multiple growth forms or layers, which have similar composition that reflects topo-edaphic climate, substrates, hydrology, and disturbance regimes (California Native Plant Society 2021).
biodiversity	The full array of living things considered at all levels, from genetic variants of a single species to arrays of species and arrays of genera, families, and higher taxonomic levels; includes natural communities and ecosystems.
buffer	A transitional area of land between two distinct land uses or types used to lessen the impact of one land use type on another (Greenbelt Alliance 2020).
California Fish and Game Code (FGC)	State code amended by Assembly Bill 2087 to provide for a regional RCIS program (FGC Sections 1850–1861).
California Wildlife Habitat Relationships - CWHR	System that contains the life history, geographic range, habitat relationships, and management information for more than 700 regularly occurring species of amphibians, reptiles, birds, and mammals in the state. It can generate lists of species by geographic location or habitat type and provides information on expert opinion–based habitat suitability ranks for each species within each habitat type (California Department of Fish and Wildlife 2017).
climate change vulnerability	Refers to the degree to which an ecological system, natural community, habitat, or individual species is likely to be adversely affected as a result of changes in climate and is often dependent on factors such as exposure, sensitivity, and adaptive capacity.
compensatory mitigation	Actions taken to fulfill, in whole or in part, mitigation requirements under state or federal law or a court mandate.
conservation, conserve	The use of habitat and other natural resources in ways such that they may remain viable for future generations. This includes permanent protection of such resources. See *permanently protect*.
conservation action	An action identified in an RCIS that, when implemented, would permanently protect or restore, and perpetually manage, conservation elements, including focal species and their habitats, natural communities, ecological processes, and wildlife corridors. In contrast, a habitat enhancement action would have long-term durability but would not involve acquiring land or permanently protecting habitat – see habitat enhancement action. A conservation action is developed to achieve one or more conservation objectives. A conservation action may be implemented through a variety of conservation investments or MCAs. A conservation action that is implemented through an MCA would create conservation credits to be used as compensatory mitigation. See *action*.
conservation bank	Permanently protected land managed for its natural resource values, with an emphasis on targeted resources. May include habitat restoration or creation in addition to protecting federally or state listed species and their habitats.[3] See *mitigation bank.*

[3] https://www.wildlife.ca.gov/Conservation/Planning/Banking

Term	Definitions
conservation easement	A perpetual conservation easement that complies with Chapter 4 (commencing with Section 815) of Title 2 of Part 2 of Division 2 of the Civil Code.[4]
conservation element	An element that is identified and analyzed in an RCIS that will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Conservation elements include focal species and their habitats, natural communities, biodiversity, habitat connectivity, ecosystem functions, water resources, and other natural resources. Conservation elements may benefit through both conservation investments and MCAs.
conservation goal	Broad, guiding principle that describes a desired future condition for a focal species, other species, or other conservation element. Each conservation goal is supported by one or more conservation objectives.
conservation investment	Conservation actions or habitat enhancement actions that are implemented under an approved RCIS, but the implementer does not create credits through an MCA with CDFW. Conservation investments are typically funded by public agencies and nonprofit or other philanthropic organizations.
conservation priority	A conservation or habitat enhancement action (e.g., land acquisition, restoration, or habitat enhancement) that is identified based on its importance for benefiting and contributing to the conservation of focal species and their habitats, or other conservation elements within an RCIS area.
conservation purpose	Statement or statements in an RCIS that identify focal species and other conservation elements within the RCIS area and which outline conservation actions or habitat enhancement actions that, if implemented, will sustain and restore these resources.
conservation strategy	The strategy for restoring viability of focal species. Comprises four elements: conservation goals, conservation objectives, conservation actions, and conservation priorities.
creation (of natural community or focal species' habitat)	The creation of a specified resource condition where none existed before. Also see *establishment*.
critical habitat	Habitat designated as critical[5] refers to specific areas occupied by a federally-listed species at the time it is listed, and that are essential to the conservation of the species and that may require special management considerations or protection. Critical habitat also includes specific areas outside occupied habitat into which the species could spread and that are considered essential for recovery of the species.
ecological function	Ecological function refers to the roles and relationships (e.g., predator and prey relationships) of organisms within an ecological system, and the processes (e.g., pollination, decomposition) that sustain an ecological system. See also, *ecosystem function.*
ecological resources	Species, habitat, biological resources, and natural resources identified in an RCA or RCIS. Also see *conservation element and natural resources.*

[4] *Conservation easement* includes a conservation easement as defined in Civil Code Section 815.1 and an agricultural conservation easement as defined in Public Resources Code, Section 10211.

[5] 16 United States Code Section 1532(5)(a)

Term	Definitions
ecoregion, sub-ecoregion	As used in this document, ecoregion means a USDA Section (Goudey and Smith 1994) and sub-ecoregion means a portion of the USDA Section or USGS Hydrological Units (assigned hydrological unit codes; HUC).[6] The U.S. Department of Agriculture (USDA) describes four geographic levels of detail in a hierarchy of regional ecosystems including domains, divisions, provinces, and sections. Sections are subdivisions of provinces based on major terrain features, such as a desert, plateau, valley, mountain range, or a combination thereof.
ecosystem	A natural unit defined by both its living and non-living components; a balanced system of the exchange of nutrients and energy. See *habitat*.
ecosystem function	The ecosystem processes involving interactions between physical, chemical, and biological components, such as dynamic river meander, floodplain dynamism, tidal flux, bank erosion, and other processes necessary to sustain the ecosystem and the species that depend on it.
ecosystem services	The beneficial outcomes to humans from ecosystem functions such as supplying of oxygen; sequestering of carbon; moderating climate change effects; supporting the food chain; harvesting of animals or plants; providing clean water; recharging groundwater; abating storm, fire, and flood damage; pollinating and fertilizing for agriculture; and providing scenic views.
endemic	A species, subspecies, or variety found only in a specified geographic region.
enhancement	A manipulation of an ecological resource or natural resource that improves a specific ecosystem function. An enhancement does not result in a gain in protected or conserved land, but it does result in an improvement in ecological or ecosystem function.
essential connectivity areas	Those areas essential for ecological connectivity between natural landscape blocks, as depicted in the Essential Connectivity Map prepared as part of CEHC Project,[7] or other connectivity report, plan, or map approved by CDFW or that represents best available science.
establishment	The manipulation of the physical, chemical, or biological characteristics present on a site to develop an aquatic or terrestrial habitat resource for Focal Species. Establishment will result in a gain in resource area and/or function. Also see *creation*.
focal species	Sensitive species that are identified and analyzed in an RCIS and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Focal species may benefit through both conservation investments and MCAs. See also, *sensitive species*, *special-status species*, and *non-focal species*.
gap analysis	An analysis that identifies gaps between land areas that are rich in biodiversity and areas that are managed for conservation.
habitat	An ecological or environmental area that is, or may be, inhabited by a species of animal, plant or other type of organism. It is also the physical and biological environment that surrounds, influences, and is utilized by a species' population and is required to support its occupancy.

[6] The United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), the United States Geological Survey (USGS), and the Environmental Protection Agency (EPA). The Watershed Boundary Dataset (WBD) was created from a variety of sources from each state and aggregated into a standard national layer for use in strategic planning and accountability. Available: http://datagateway.nrcs.usda.gov.

[7] California Essential Habitat Connectivity Project. Available: https://www.wildlife.ca.gov/conservation/planning/connectivity/CEHC.

Term	Definitions
habitat connectivity	The capacity of habitat to facilitate the movement of species and ecological functions.
habitat enhancement action	An action identified in an RCIS that, when implemented, is intended to improve the quality of wildlife habitat, or to address risks or stressors to wildlife. A habitat enhancement action is developed to achieve one or more conservation objectives. A habitat enhancement action would have long-term durability but would not involve acquiring land or permanently protecting habitat. In contrast, a conservation action would permanently protect or restore, and perpetually manage, conservation elements – see Conservation Action. Examples of habitat enhancement actions include improving in-stream flows to benefit fish species, enhancing habitat connectivity, and controlling or eradicating invasive species. A habitat enhancement action may be implemented through a variety of conservation investments or MCAs. A habitat enhancement action that is implemented through an MCA would create habitat enhancement credits intended for use as compensatory mitigation for temporary impacts.[8] See *action*.
habitat conservation plan (HCP)	Habitat Conservation Plan. A planning document that is required as part of an application for an incidental take permit under the federal Endangered Species Act. HCPs provide for partnerships with non-federal parties to conserve the ecosystems upon which listed species depend, ultimately contributing to their recovery. 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.[9]
Hydrologic Unit Code (HUC)	A code identifying a unique hydrologic unit.[10]
Integrated Pest Management (IPM)	IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment (University of California Agriculture and Natural Resources 2021).
in-lieu fee program	An agreement between a regulatory agency or agencies (state, federal, or local) and a single sponsor which must be a public agency or non-profit organization. Under an in-lieu-fee agreement, the mitigation sponsor collects funds from permittees in lieu of providing permittee-responsible compensatory mitigation required under the U.S. Army Corps of Engineers or a state or local aquatic resource regulatory program. The sponsor uses the funds pooled from multiple permittees to create one or more sites under the authority of the agreement to compensate for aquatic resource functions lost as a result of the permits issued.
indicator species	A species, the presence or absence of which is indicative of a particular habitat, community, or set of environmental conditions (Lincoln et al. 1998).

[8] FGC Section 1856, subdivision (d) states that "…the habitat enhancement action shall remain in effect at least until the site of the environmental impact is returned to pre-impact ecological conditions."

[9] https://www.fws.gov/endangered/esa-library/pdf/hcp.pdf

[10] The United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), the United States Geological Survey (USGS), and the Environmental Protection Agency (EPA). The Watershed Boundary Dataset (WBD) was created from a variety of sources from each state and aggregated into a standard national layer for use in strategic planning and accountability. Available: http://datagateway.nrcs.usda.gov.

Term	Definitions
invasive species	Invasive species means, with regard to a particular ecosystem, a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.[11] Also see *non-native species*.
keystone species	A species whose impacts on its community or ecosystem are much larger than would be expected from its abundance or a species whose loss from an ecosystem would cause a greater-than-average change in other species populations or ecosystem processes and whose continued well-being is vital for the functioning of a whole community (Groom et al 2006).
land conversion	The conversion of natural and agricultural land to other land uses through the process of development.
land cover type	The dominant feature of the land surface discernible from aerial photographs and defined by vegetation, water, or human uses.
macrogroup	Combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and subcontinental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (California Native Plant Society 2021).
mitigation bank	Permanently protected land managed for its natural resource values, with an emphasis on federally or state listed species and their habitats. Typically requires the restoration or creation of aquatic resources.[12] See *conservation bank*.
mitigation credit agreement (MCA)	An agreement between CDFW and one or more persons or entities that identifies the types and numbers of credits the person(s) or entity(ies) proposes to create by implementing one or more conservation actions or habitat enhancement actions. An MCA includes the terms and conditions under which those credits may be used. The person or entity may create and use, sell, or otherwise transfer the credits upon CDFW's approval that the credits have been created in accordance with the MCA. To enter into an MCA with CDFW, a person or entity shall submit a draft MCA to CDFW for its review, revision, and approval. An MCA may only be created within an area where an RCIS has been approved.
natural community	A group of organisms living together and linked together by their effects on one another and their responses to the environment they share (Sawyer et el. 2009). A general term often used synonymously with vegetation community and aquatic community.
Natural Community Conservation Plan (NCCP)	A plan developed pursuant to the Natural Community Conservation Planning Act (FGC sections 2800-2835) which identifies and provides for the regional protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity.[13] An NCCP allows for take of species listed under CESA, as well as other, non-listed species.
natural resources	Biological and ecological resources including species and their habitats, Waters of the State, Waters of the United States, wetlands, and natural communities. See *ecological resources* and *conservation element*.

[11] Obama, Barack – the White House, Executive Order -- Safeguarding the Nation from the Impacts of Invasive Species. December 5, 2016. Available: https://obamawhitehouse.archives.gov/the-pressoffice/2016/12/05/executive-order-safeguarding-nation-impacts-invasive-species.

[12] https://www.wildlife.ca.gov/Conservation/Planning/Banking

[13] FGC Sections 2800 – 2835

Term	Definitions
non-focal species	Species that are not "focal species", as defined in these Guidelines, but which are associated with a focal species or other conservation element and will benefit from conservation actions and habitat enhancement actions set forth in the RCIS. Non-focal species may benefit through both conservation investments and MCAs. See also, *focal species*, *sensitive species*, and *special-status species*.
non-native species	Any species introduced to California after European contact and as a direct or indirect result of human activity (California Invasive Plant Council 2006). See *invasive species*.
objective	A concise, measurable statement of what is to be achieved and that supports a conservation goal. The objective should be based on the best available scientific information to conserve the focal species or other conservation elements for which the conservation goal and objective is developed. It should be measurable by using a standard metric or scale (i.e., number, percent), in a region (e.g., county, watershed, jurisdictional area) over a period of time (e.g., years).
permanently protect	Permanent protection means: (1) recording a conservation easement and (2) providing secure, perpetual funding for management of the land, monitoring, legal enforcement, and defense.
phreatophyte extraction	Groundwater losses due to consumption by plants with deep root systems.
population	The number of individuals of a particular taxon inhabiting a defined geographic area.
pressure	See *stressor, pressure*.
protected area	Public or private lands protected through legal or other effective means, where the primary intent of land management is to manage the land for open space use and habitat.
rangeland	Land on which the existing vegetation, whether growing naturally or through management, is suitable for grazing or browsing of domestic livestock for at least a portion of the year. Rangeland includes any natural grasslands, savannas, shrublands (including chaparral), deserts, wetlands, and woodlands (including Eastside ponderosa pine, pinyon, juniper, and oak) which support a vegetative cover of native grasses, grasslike plants, forbs, shrubs, or naturalized species.[14]
RCIS Area	The geographic area encompassed by an RCIS.
RCIS proponent	The public agency or group of public agencies developing an RCIS for review and approval by CDFW and who is responsible for the technical and administrative updates of an RCIS.
recovery	The process by which the decline of an endangered or threatened species is halted or reversed or threats to its survival are neutralized, so that its long-term survival in nature can be ensured. Recovery entails actions to achieve the conservation and survival of a species (National Marine Fisheries Service. and U.S. Fish and Wildlife Service 2018), including actions to prevent any further erosion of a population's viability and genetic integrity. Recovery also includes actions to restore or establish environmental conditions that enable a species to persist (i.e., the long-term occurrence of a species through the full range of environmental variation).
recovery area	Area identified in a draft or approved recovery plan for a federally listed species.

[14] California Public Resources Code, Section 4789.2 subdivision (i)

Term	Definitions
recovery goal	An established goal, usually quantitative, in a recovery plan that identifies when a listed species is restored to a point at which the protections of the federal Endangered Species Act or California Endangered Species Act are no longer required.
recovery plan	A document published by USFWS, NMFS, or CDFW that lists the status of a listed species and the actions necessary to remove the species from the endangered species list.
regional conservation investment strategy (RCIS)	Information and analyses to inform nonbinding and voluntary conservation actions and habitat enhancement actions that would advance the conservation of focal species and their habitats, natural communities, and other conservation elements. The RCIS provides nonbinding, voluntary guidance for the identification of conservation priorities, investments in ecological resource conservation, or identification of priority locations for compensatory mitigation for impacts on species and natural resources. RCISs are intended to provide scientific information for the consideration of public agencies and are voluntary. RCISs do not create, modify, or impose regulatory requirements or standards, regulate the use of land, establish land use designations, or affect the land use authority of, or exercise of discretion by, any public agency. RCISs are required if MCAs are to be developed.
Regional Conservation Investment Strategies Program Guidelines (Program Guidelines)	Guidelines for regional conservation investment strategies, published in support of Assembly Bill 2087 (California Department of Fish and Wildlife 2018).
rehabilitation	Manipulation of a piece of land with the goal of repairing natural or historic ecosystem functions to degraded habitat or natural resources. This results in an improvement in ecological or ecosystem functions, but it does not result in a gain in area.
restore, restoration	Manipulation of a site with the goal of returning species, habitat, and ecological and ecosystem functions to a site that historically supported such species, habitat, and functions, but which no longer supports them due to the loss of one or more required ecological factors or as a result of past disturbance. Compare with *conservation*, *preserve*, and *rehabilitation*.
sensitive species	Any special-status species identified by a state or federal agency. See also, *focal species* and *special-status species*.
special-status species	For the purpose of the Program, a species identified as endangered, threatened, or candidate under state or federal law; as rare or fully protected under state law; or otherwise identified by CDFW through the approval of an RCIS. See also, *focal species* and *sensitive species*.
Species of Greatest Conservation Need (SGCN)	Species of Greatest Conservation Need are selected, for each state, to indicate the status of biological diversity in the state, specifying at-risk species that have the greatest need for conservation. The latest SGCN list for the state of California is found in the California State Wildlife Action Plan 2015 Update (California Department of Fish and Wildlife 2015).

Term	Definitions
Species of Special Concern (SSC)	Species of Special Concern[15] is an administrative designation and carries no formal legal status. The intent of designating SSCs is to: 1) focus attention on animals considered potentially at conservation risk by CDFW, other state, local and federal governmental entities, regulators, land managers, planners, consulting biologists, and others; 2) stimulate research on poorly known species; and 3) achieve conservation and recovery of these animals before they meet CESA criteria for listing as threatened or endangered.
strategy term	The initial 10-year period of RCIS approval. May be extended by CDFW after review.
stressor, pressure	Stressor is a degraded ecological condition of a focal species or other conservation element that resulted directly or indirectly from a negative impact of pressures such as habitat fragmentation. A pressure is an anthropogenic (human-induced) or natural driver that could result in changing the ecological conditions of a focal species or other conservation element. Pressures can be positive or negative depending on intensity, timing, and duration. Negative or positive, the influence of a pressure to the target focal species or other conservation elements is likely to be significant.
State Wildlife Action Plan (SWAP)	The California State Wildlife Action Plan (SWAP) is a CDFW publication developed to address the highest conservation priorities of the state, providing a blueprint for actions necessary to sustain the integrity of California's diverse ecosystems.[16] CDFW also created companion plans to support SWAP 2015 implementation through collaboration with partner agencies and organizations. The companion plans identify shared priorities among partner organizations to conserve natural resources in nine sectors that are experiencing significant pressures affecting natural resources (California Department of Fish and Wildlife 2015).[17]
watershed	An area or ridge of land that contains a common set of streams and rivers that all drain into one location such as a marsh, stream, river, lake, or ocean.
working land	An area where people live and work in a way that allows ecosystems or ecosystem functions to be sustained (e.g., farms, ranches). Human activities are done in a way that minimizes disturbance on native plants and animals while still retaining the working nature of the landscape.

[15] https://wildlife.ca.gov/Conservation/SSC
[16] https://www.wildlife.ca.gov/SWAP/Final
[17] https://www.wildlife.ca.gov/SWAP/Final/Companion-Plans

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Combined State Agency Letter and Infrastructure Mitigation Letter

California Fish and Game Code (FGC) Section 1852(a) requires that, in order for California Department of Fish and Wildlife (CDFW) to approve a Regional Conservation Investment Strategy (RCIS), one or more state agencies must sponsor the RCIS. FGC Section 1852(a) also generally limits the number of RCISs that CDFW can approve to eight. An RCIS is exempt from this limit, however, if the RCIS is accompanied by a letter to the CDFW Director from a state water or transportation agency. According to the CDFW RCIS Program Guidelines[1] "[t]o qualify for the exemption, the state water or transportation agency must state in the support letter that the RCIS may be used to facilitate mitigation for an infrastructure project."

Below is a combined State Agency Letter and Infrastructure Letter from the California Department of Transportation (Caltrans). This letter requests that CDFW approve the Kaweah Subbasin Regional Conservation Investment Strategy, and states that Caltrans is requesting approval of the RCIS in part to facilitate mitigation for transportation infrastructure.

[1] California Department of Fish and Wildlife. 2018. Regional Conservation Investment Strategies. Program Guidelines. September 14. Sacramento, CA. Available: https://www.wildlife.ca.gov/Conservation/Planning/Regional-Conservation.

California Department of Transportation

DISTRICT 6 OFFICE
1352 WEST OLIVE AVENUE | P.O. BOX 12616 | FRESNO, CA 93778-2616
(559) 488-4057 | FAX (559) 488-4195 | TTY 711
www.dot.ca.gov

June 24, 2021

Mr. Charlton H. Bonham
Director
California Department of Fish and Wildlife
rcis@wildlife.ca.gov
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Mr. Bonham:

The California Department of Transportation (Caltrans), District 6, is pleased with the opportunity to support the California Department of Fish and Wildlife's (CDFW) Regional Conservation Investment Strategies Program. In response to the written request from the East Kaweah Groundwater Sustainability Agency (GSA), and in accordance with Fish and Game Code Section 1852(a), Caltrans District 6 requests CDFW approve the Kaweah Subbasin Regional Conservation Investment Strategy (RCIS), with the East Kaweah GSA as RCIS Proponent.

The proposed RCIS contains information that may guide Caltrans' planning for avoidance, minimization and mitigation of environmental impacts during transportation project delivery. Further, the proposed RCIS contains information that may guide Caltrans' advance mitigation project development under Article 2.5(b) of Chapter 4 of Division 1 of the Streets and Highway Code, by laying the natural-resource related groundwork for CDFW to enter into Mitigation Credit Agreement(s) (MCAs) with Caltrans and/or others. Compensatory mitigation credits developed in accordance with MCA tiered off the RCIS may be usable by, and hence increase the delivery efficiency of, Caltrans' future transportation projects. Thus, because the RCIS will support both avoidance and minimization, as well as MCA development, Caltrans expects the RCIS to support the State of California's goals for both (1) conservation and (2) public infrastructure, specifically the State Highway System.

The basis for Caltrans' request for RCIS approval encompasses four main points:

- Caltrans anticipates future transportation project permit conditions for the regulated natural resources addressed by the RCIS, including special-status species and their associated habitats.
- Caltrans anticipates future permits may require compensatory mitigation and, at this time, the available supply of compensatory mitigation credits to address potential anticipated future permit requirements are limited.
- Resource-related information presented in the RCIS is provided in a manner that would facilitate Caltrans engagement with other environmental agencies, whose jurisdiction overlaps with CDFW's and with whom Caltrans will also seek mitigation agreements.
- The RCIS anticipates Caltrans' requirements for MCAs. Specifically, there are actions proposed in the RCIS that, can reasonably be expected to yield compensatory mitigation credits for use by Caltrans and acceptable to CDFW, in the future.

This letter in no way obligates Caltrans to enter a specific MCA. Caltrans retains sole discretion for its own future purchase and use of mitigation credits, Caltrans will not be responsible for updating or amending the RCIS. All applicable environmental compliance (including California Environmental Quality Act review) will be conducted by the lead agency, East Kaweah GSA.

Sincerely,

DIANA GOMEZ
District Director

Cc: Chad Dibble, Chief Deputy Director, CDFW
Jeff Drongenson, Habitat Conservation Planning Branch Chief, CDFW
Ronald Unger, Landscape Conservation Planning Program Manager, CDFW

Bcc: Melinda Molnar, Advance Mitigation Program Acting Office Chief, Caltrans
Harpreet Binning, Central Region Environmental Planning Acting Division Chief, Caltrans

Appendix C
Public Outreach

This appendix includes public notices regarding the Kaweah RCIS, followed by written public comments, and responses to written public comments.

Public Notices

This section includes the following two public notices.

1. A notice published on February 26, 2021 of the intent to prepare the Kaweah Groundwater Subbasin Regional Conservation Investment Strategy (Kaweah RCIS).
2. A notice published on June 16, 2021 of a public meeting to be held on July 21, 2021 about the Kaweah RCIS.

EAST KAWEAH
GROUNDWATER SUSTAINABILITY AGENCY

315 E. Lindmore Street
Lindsay, CA 93247
Tel: (559) 562-2534
www.ekgsa.org

NOTICE OF INTENT TO PREPARE THE KAWEAH GROUNDWATER SUBBASIN REGIONAL CONSERVATION INVESTMENT STRATEGY

Published February 26, 2021

Description of Proposed Regional Conservation Investment Strategy: The East Kaweah Groundwater Sustainability Agency is preparing a Regional Conservation Investment Strategy (RCIS) for the Kaweah Groundwater Subbasin (Kaweah RCIS) in parts of Tulare County and eastern Kings County. RCISs are a voluntary, landscape-scale conservation planning tools, guided by state legislation (AB 2087) that took effect January 1, 2017. An RCIS identifies conservation priorities to guide voluntary public and private conservation actions and investments, such as habitat enhancement, restoration, and protection. An RCIS is strictly non-binding and voluntary. By passing AB 2087, it was not the intent of the California State Legislature to regulate the use of land, establish land use designations, or to affect, limit, or restrict the land use authority of any public agency. Nothing in the Kaweah RCIS will be intended to, nor shall it be interpreted to, conflict with controlling federal, state, or local law, including Fish and Game Code sections 1850-1861, or any Guidelines adopted by the Department of Fish and Wildlife pursuant to Section 1858. Actions carried out as a result of a Kaweah RCIS would be in compliance with all applicable state and local requirements. Furthermore, a Kaweah RCIS would not preempt the authority of local agencies to implement infrastructure and urban development described in local general plans.

The Kaweah RCIS will provide a framework to guide voluntary conservation investments and compensatory mitigation for infrastructure or other development projects to enhance the conservation benefits of working lands, natural communities, and sensitive species within the Kaweah Subbasin. The Kaweah RCIS will serve as a tool that could be used to identify conservation and habitat enhancement actions with groundwater sustainability co-benefits that can be achieved concurrently with implementation of Kaweah Subbasin Groundwater Sustainability Plans. This would enable farmers and other landowners in the region to identify where habitat or other ecological values could best be protected, restored, or enhanced. In turn, the Kaweah RCIS would also create a framework for them to receive financial compensation—either by developing credits through an agreement with the California Department of Fish and Wildlife to be sold as compensatory mitigation to public or private agencies and entities negatively impacting species or habitats, or by applying for conservation funding in the form of state or local grants, bond funding, or private philanthropy.

For more information about the Kaweah RCIS, please contact Michael Hagman at mhagman@lindmoreid.com

For more information about California Department of Fish and Wildlife's RCIS Program, see: https://wildlife.ca.gov/Conservation/Planning/Regional-Conservation

Location: The geographic area addressed by the Kaweah RCIS includes portions of Tulare County and eastern Kings County and includes the entire Kaweah Groundwater Subbasin (see Figure 1 below for a draft map of the RCIS area).

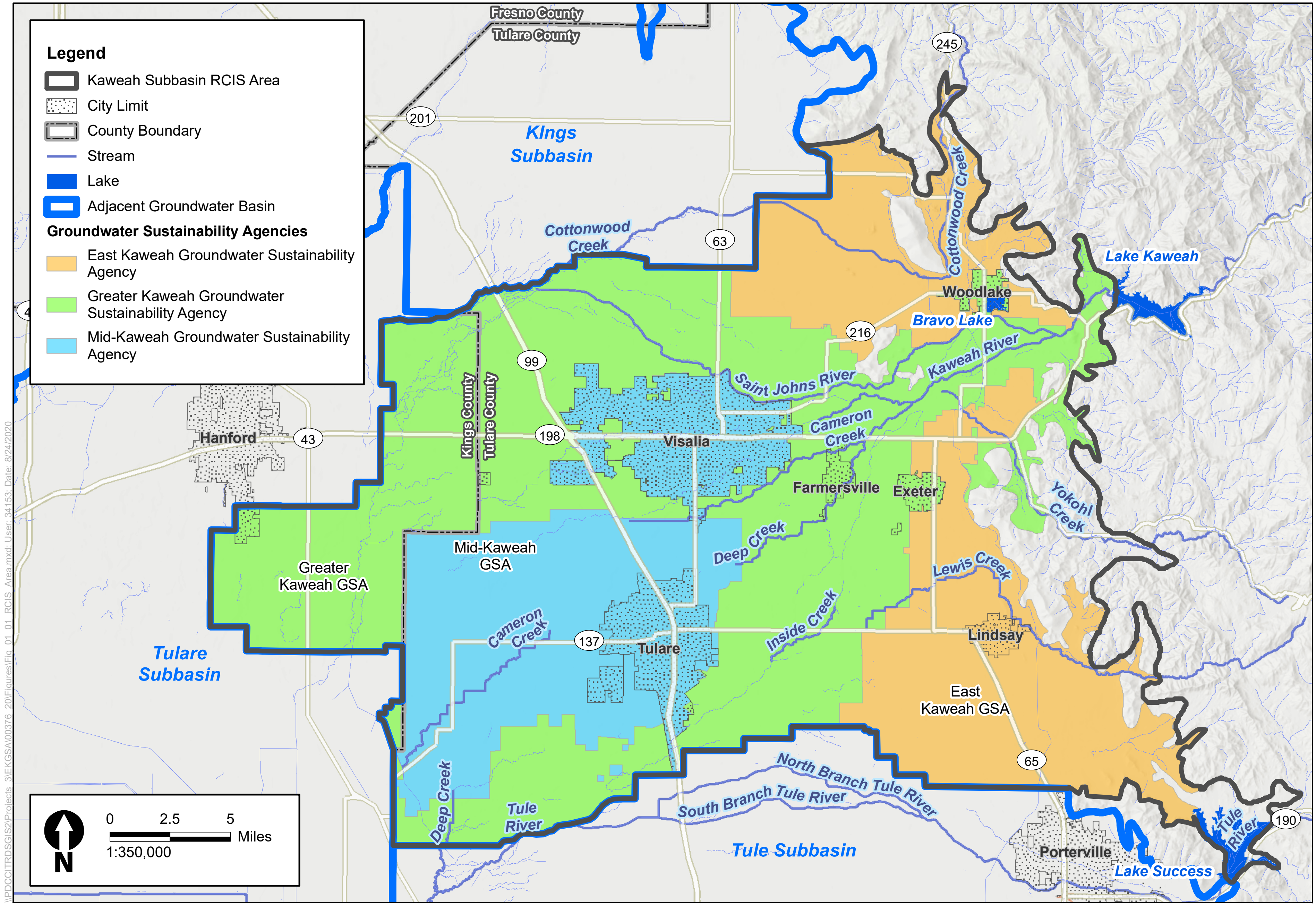

Figure 1-1
Draft Kaweah Subbasin RCIS Area

EAST KAWEAH
GROUNDWATER SUSTAINABILITY AGENCY

315 E. Lindmore Street
Lindsay, CA 93247
Tel: (559) 562-2534
www.ekgsa.org

NOTICE OF PUBLIC MEETING ABOUT KAWEAH GROUNDWATER SUBBASIN REGIONAL CONSERVATION INVESTMENT STRATEGY

Published June 16, 2021

A public meeting will be held on July 21, 2021 from 5:00 – 6:30 PM at the International Agri-Center (see last page of this notice for address and directions) to provide oral or written comments for consideration in the document's development.

Description of the Kaweah Regional Conservation Investment Strategy:

Regional Conservation Investment Strategies are voluntary, landscape-scale conservation planning tools, guided by state legislation (AB 2087) that took effect January 1, 2017. The Kaweah Groundwater Subbasin (Kaweah Subbasin) Regional Conservation Investment Strategy (Kaweah RCIS) is a locally-driven, non-binding, and voluntary conservation strategy to guide conservation investments and compensatory mitigation in portions of Tulare and Kings Counties (Figure 1).

The Kaweah RCIS is intended to support the implementation of Kaweah Subbasin Groundwater Sustainability Plans (refer to Figure 1 for a map of the Kaweah Subbasin and the Kaweah Subbasin Groundwater Sustainability Agencies) by identifying conservation and habitat enhancement actions that can be used to provide multi-benefit compensatory mitigation projects for infrastructure or other development projects, as well as conservation investments, in the Kaweah Subbasin.

Under the Sustainable Groundwater Management Act, critically over-drafted basins, including the Kaweah Subbasin, should achieve sustainability within 20 years of implementing their groundwater sustainability plan. The Kaweah RCIS will provide a tool that could be used to provide financial incentives to working landowners that voluntarily participate in groundwater sustainability projects and management actions that also provide habitat values for focal species and other conservation elements addressed by the RCIS.

For more information on the Kaweah RCIS: http://kaweahrcis.org/

Public Meeting: Pursuant to Fish and Game Code section 1854(c)(3), the East Kaweah Groundwater Sustainability Agency will sponsor a public meeting to provide information about the Kaweah RCIS and to give the public an opportunity to provide oral or written comments. Comments must be provided in written form to ensure that the comments are considered by the East Kaweah Groundwater Sustainability Agency in the draft Kaweah RCIS that will be submitted to the California Department of Fish and Wildlife for final review. Comment cards will be available to provide written comments at the public meeting. Interested parties are invited to attend.

Meeting Date and Time: Wednesday, July 21, 2021, 5:00 to 6:30 PM

Meeting Location: International Agri-Center in the Conference Dining Room, 4500 S. Laspina St., Tulare CA 93274

Optional Zoom Link:
https://zoom.us/j/91085239572?pwd=ZVR0REZDYmNvWk0ySDIrMHZET3lqQT09

Meeting ID: 910 8523 9572

Passcode: 161731

Or to call in without video, dial (669) 900-6833 and enter 161731#

Please follow these directions:

From the North via CA-99S: From CA-99S take exit 85 toward East Paige Ave. Turn left onto S. Blackstone Street, then take the first left onto E. Paige Ave. Go approximately 0.4 miles and turn right onto S. Laspina St, which you will stay on for approximately 1.3 miles. The International Agri-Center is on your left. **Park through Gate B.**

From Visalia: Take Mooney Blvd South through Tulare. Continue onto E. Foster Turn left onto S. Laspina St. after 0.7 miles. The International Agri-Center is on your left in approximately 1.3 miles. **Park through Gate B.**

From the South: From CA-99N take exit 83 (Ave 200). Turn slight right onto E. Rankin Ave, then take the first left onto Tex Dr. Go approximately 0.75 mile and turn left onto S. Laspina St. Travel approximately 0.25 mile and you will see the International Agri-Center on your right**. Park through Gate B**

Contact Person: Kathy Bennett, East Kaweah Groundwater Sustainability Agency: kbennett@lindmoreid.com; phone: (559) 562-2534

* * *

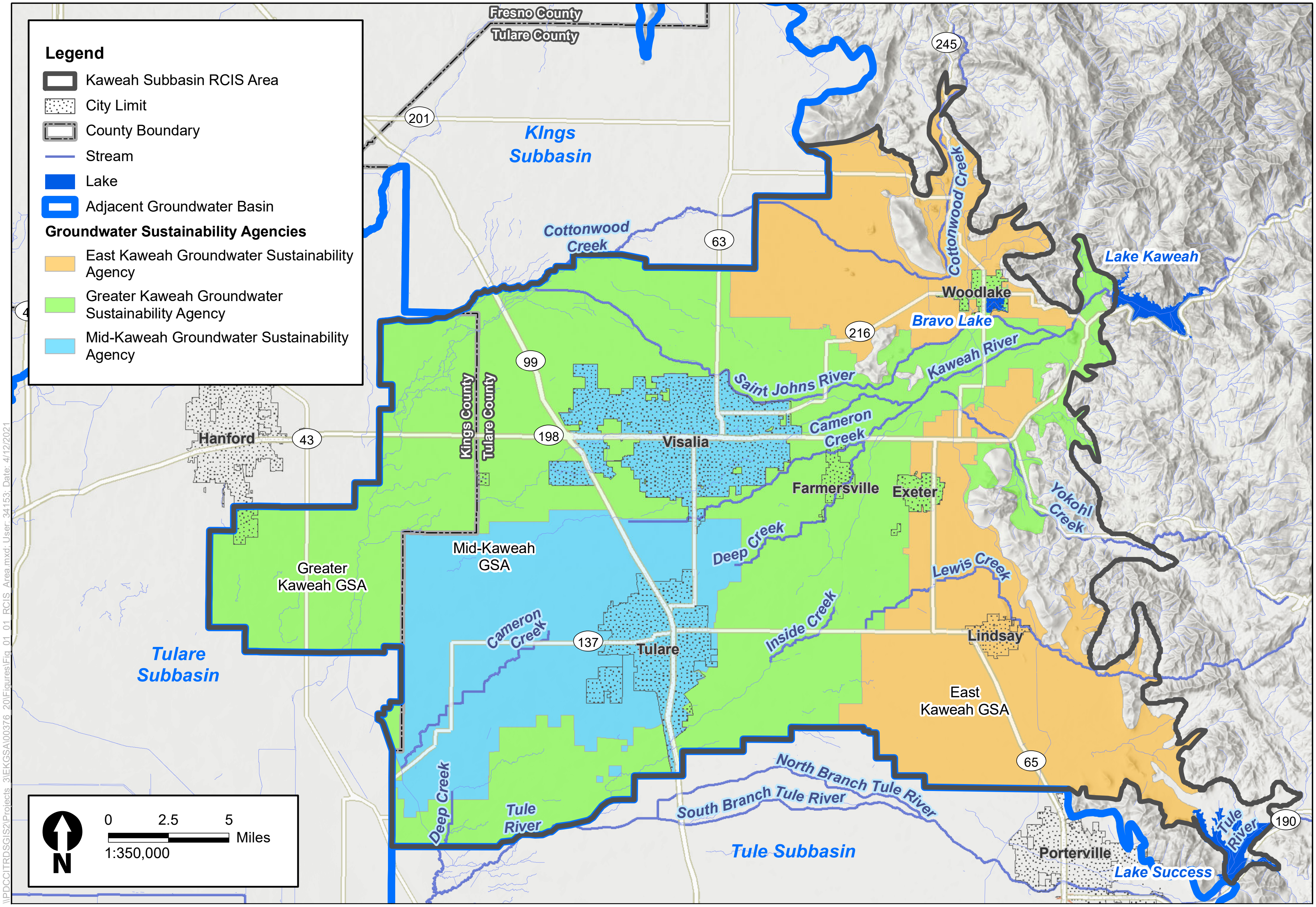

Figure 1
Kaweah Subbasin RCIS Area

Written Public Comments

This section contains the written comments received on the Draft Kaweah RCIS. California Department of Fish and Wildlife's (CDFW) RCIS Program Guidelines (Program Guidelines) (California Department of Fish and Wildlife 2018) require that the RCIS proponent provides an adequate opportunity for interested persons and entities to provide oral and written comments. The Program Guidelines also require the RCIS proponent to "respond to written comments submitted during the public meeting(s) and during the public comment period which begins after CDFW deems the draft RCIS complete and pursuant to public notice."

During the public meeting held by the RCIS proponent, on July 21, 2021, the RCIS proponent provided comment cards and requested that individuals or parties wishing to provide comments shall provide written comments in order for those comments to be included in this RCIS with the RCIS proponent's response. No written comments were provided by the public during the public meeting or during the period of time between the public meeting and the public review period.

This section is organized by presentation of each comment letter, ordered by date the comment letter was received (earliest to latest). Each comment within the comment letter is assigned a unique number, noted in the left margin. For example, the code "A-3" indicates the third distinct comment (indicated by the "3") in letter designated A. Immediately following the comment letter is a summary of the comment and the RCIS proponent's response including a description of how each comment was addressed in the RCIS.

The RCIS proponent received written public comments from the person listed in Table C-1 before submitting this RCIS to CDFW for completeness review. Table C-1 shows the commenting agency/organization/individual, comment letter signatory, and the date of the letter.

Table C-1. Comment Letter

Letter	Agency/Organization/Individual	Comment Letter Signatory	Date
A	David C. Roberts	David C. Roberts	June 17, 2021

Letter A – David C. Roberts

Copied from body of email from David C. Roberts, Director EKGSA to Michael Hagman, Executive Director EKGSA on June 17, 2021

Public Comments on the Kaweah Subbasin Regional Conservation Investment Strategy

A-1 1) How much money is available for projects?
A-2 2) What % Is spent on administration costs?
A-3 3) How much $ per acre per year on projects ? It needs to be equivalent or greater to other farms net profit or property values will be hurt.
A-4 4) Which agencies decide how much water goes out to the ocean through the delta? The more that goes out the less goes into storage leaving us at risk of losing our surface supply and therefore causing more ground water to be pumped. I believe the same agencies that control this decision also want us to stop farming.
A-5 5) Is this part of rewilding California or North America? Creating wildlife corridors.
A-6 6) Areas such as Terra Bella have a high percentage of immigrant farmers. 1st generation Americans. These will be the first to be forced out of agriculture.
A-7 7) The climate is always changing. There is a group of astrometeorologists that believe have started a multi decade cooling period based on sun and planet cycles. Is this opinion being considered?
A-8 8) California has passed many water bonds, over the decades, what storage projects have been built or solutions to helping the delta work better instituted? Where did the billions go?
A-9 9) Why isn't desalination being considered to supply water to the population close to the coast? This would free up more water for the environment and agriculture.
A-10 10) Why aren't we considering the environmental damage that will be caused in other areas as they start to farm in new areas as we stop farming the most productive area in the world. THE WORLD NEEDS FOOD California farmers are less than.003% of the population in California and therefore an easy target to push around. THE TYRANNY OF THE MAJORITY AGAINST A MINORITY.
A-11 11) How many acre feet or percentage of San Francisco water supply (360000 acre feet) from Hetch Hetchy reservoir is released into the bay and sent to the ocean?
A-12 12) California hasn't been responsible in development and has allowed cities to expand without developing the water necessary to support them. The only answer being proposed is to take water from family farmers and disadvantaged communities to compensate for California's lack of foresight. THE TYRANNY OF THE MAJORITY AGAINST THE MINORITY.
A-13 12) What time period was chosen to depict when the valley was "pristen" and why?
A-14 13) The final goal? Is there a point where the California government, has converted enough highly productive family farms to open space, that they will be satisfied? What's the GOAL?

A-15 I have a concern for myself and my family farm by being involved in discussions with potentially overbearing, punative government agencies.

Comments and Responses

A. David C. Roberts

Summary of Comment A-1

The comment asks how much money is available for projects.

Response to Comment A-1

This Kaweah RCIS is intended to support the implementation of Kaweah Subbasin Groundwater Sustainability Plans (GSPs) by identifying conservation and habitat enhancement actions that can be used to provide multibenefit compensatory mitigation projects for infrastructure or other development projects, as well as conservation investments, in the region. The RCIS serves as a tool to identify conservation and habitat enhancement actions with groundwater sustainability co-benefits that can be achieved concurrently with implementation of Kaweah Subbasin GSPs.

The allocation of funding for projects would be determined by the agency choosing to implement such projects. The Groundwater Sustainability Agencies (GSAs) may use this RCIS as a tool to identify and potentially facilitate funding for multibenefit actions that reduce surface water and groundwater use or improve recharge while providing conservation benefits for the focal species and other conservation elements addressed by this RCIS. Each individual agency has the discretion to implement the RCIS in a manner consistent with the vision of their organization and level of funding available at any given time.

Funding to implement RCIS conservation and habitat enhancement actions may come from a diversity of sources, including from grants, state and federal budget allocations, and private investments. The amount that would be available from these sources to implement Kaweah RCIS conservation and habitat enhancement actions will likely vary annually and is not known.

Summary of Comment A-2

The comment asks what percent of available money is spent on administration costs.

Response to Comment A-2

The allocation of available funding to administrative costs would be determined by the individual agency choosing to implement the RCIS.

The Kaweah RCIS is a non-binding, voluntary conservation strategy. As the RCIS proponent, the East Kaweah Groundwater Sustainability Agency (EKGSA) is only responsible for updating the scientific information in this RCIS and evaluating the effectiveness of RCIS conservation actions, habitat enhancement actions, and progress toward achieving RCIS goals and objectives at least once every 10 years. EKGSA bears no financial or other responsibility for developing or monitoring Mitigation Credit Agreements (MCAs) or other aspects of implementing this Kaweah RCIS.

Entities or individuals pursuing MCAs under this RCIS are responsible for funding their involvement in an MCA and for developing those MCAs.

Summary of Comment A-3

The comment asks how much money per acre per year will be available for projects, and expresses that if this amount is not equal or greater to the net profit of other farms, property values may be negatively affected.

Response to Comment A-3

Please see responses to comments A-1 and A-2 in regard to money available for projects.

This Kaweah RCIS is a non-binding and voluntary conservation strategy. As such, the participation of landowners would be at their own discretion. The landowner may use financial considerations to determine whether to participate in an MCA. An MCA is associated with an RCIS and identifies the type and number of credits a person or entity proposes to create by implementing one or more conservation actions or habitat enhancement actions, as well as the terms and conditions under which those credits may be used. The MCA sponsor can set aside lands when doing so is cost effective, knowing those lands will provide useful mitigation values in the future.

Summary of Comment A-4

The comment asks which agencies decide how much water goes to the ocean through the Delta, and expresses concern that allowing water to reach the ocean rather than impounding it in storage will lessen the available surface water supply and lead to increased groundwater pumping, and that the agencies regulating water rights are not in favor of farming.

Response to Comment A-4

The waters of California are considered to be "the property of the people of the State" and the California State Water Resources Control Board is the state agency authorized to regulate water rights permits and water quality issues. For further information regarding California water law and water rights, Congressional Research Service Report RL34554: *California Water Law and Related Legal Authority Affecting the Sacramento-San Joaquin Delta*[1] may be informative.

Summary of Comment A-5

The comment asks if creating wildlife corridors as part of the RCIS is part of rewilding California or North America.

Response to Comment A-5

The Kaweah RCIS is not part of rewilding California or North America. The EKGSA is the RCIS proponent (Section 1.3.1, *Regional Conservation Investment Strategy Proponent*) and is not part of rewilding California or North America.

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

[1] https://www.everycrsreport.com/

conservation elements." Habitat connectivity is a critical consideration when developing conservation strategies for the focal species. It is important in determining how to maintain sustainable populations and gene pools and how to provide for wildlife movement at different scales. The creation of wildlife corridors is in furtherance of the goal of increasing habitat connectivity.

Summary of Comment A-6

The comment notes that areas such as Terra Bella have a high percentage of first generation immigrant farmers, and expresses concern that this demographic group will be forced out of farming.

Response to Comment A-6

FGC Section 1852(e)(1) requires an RCIS to consider "[t]he conservation benefits of preserving working lands for agricultural uses." Working landscapes are included in this Kaweah RCIS as a conservation element because they dominate and characterize the RCIS Area. Working lands are important to the economy and social fabric of the RCIS Area and provide important habitat for native birds and other wildlife, including focal species (refer to Section 2.3.9, *Working Landscapes*).

Linking the implementation of Kaweah Subbasin GSP projects and management actions with RCIS conservation and habitat enhancement projects creates an opportunity to provide revenue to landowners who could undertake actions to protect species with conservation and mitigation needs in the region. Given that land repurposing may be part of the strategy for groundwater sustainability as defined in the GSPs, this Kaweah RCIS will help to identify strategies for land repurposing that could create dual habitat and groundwater sustainability benefits. This would enable farmers and other landowners in the region to identify where habitat or other ecological values could best be protected, restored, or enhanced. In turn, the RCIS would also create the framework for them to receive financial compensation, either by developing credits under an MCA to be sold as compensatory mitigation to public or private agencies and entities negatively impacting species or habitats, or by applying for conservation funding in the form of state or local grants, bond funding, or through private philanthropy.

Summary of Comment A-7

The comment states that the climate is always changing and asks if the opinion of a group of astro-meteorologists who believe that the climate has entered a multi-decade cooling period based on sun and planet cycles has been considered.

Response to Comment A-7

This Kaweah RCIS was developed to advance the conservation of focal species and their habitats, including working lands and natural communities, to sustain those species over time as environmental conditions in the RCIS Area change (e.g., through increased development or climate change). The conservation strategy is designed to be adaptable to changing conditions as they occur.

FGC Section 1852(c)(5) requires that an RCIS include "[a] summary of historic, current, and projected future stressors and pressures in the RCIS Area, including climate change vulnerability, on the focal species, habitat, and other natural resources, as identified in the best available scientific information..." The RCIS Program Guidelines further direct that for all new analyses, global climate models selected for the state's most recent California Climate Change Assessment[2] should be used, and information on the climate vulnerability of California species and habitats should refer to CDFW's climate change vulnerability assessment website.[3] This Kaweah RCIS was developed consistent with the FGC. The opinion of astrometeorologists who believe that a multi-decade cooling period has started based on sun and planet cycles was not considered in the development of the Kaweah RCIS. Kaweah RCIS conservation and habitat actions that are implemented would benefit focal species, other conservation elements, and groundwater sustainability if a multi-decade cooling period occurs.

Summary of Comment A-8

The comment asks what water storage projects have been built and what solutions have been implemented in the Delta to help it work better using the money from California water bonds passed over the last several decades. The comment also asks where the billions were spent.

Response to Comment A-8

The Sacramento-San Joaquin Delta is outside the RCIS Area, and therefore water storage projects that have been, or may be implemented in the future, in the Delta are not considered in this Kaweah RCIS.[4] The California Natural Resources Agency maintains Bonds Oversight[5] and Bond Accountability[6] webpages that allow users to view information related to projects that have been funded with California water bond dollars.

Summary of Comment A-9

The comment asks why desalinization has not been considered as a source of water for coastal populations and expresses that utilizing desalination would leave more water available for the environment and agriculture.

Response to Comment A-9

The RCIS Area does not include any coastal geography or populations, and thus the consideration of water supply for coastal populations is outside the scope of this Kaweah RCIS. Information regarding current regulations surrounding desalination, including a comprehensive listing of all current and proposed desalination plants in California, can be found on the State Water Resources Control Board website.[7]

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[2] http://climatechange.ca.gov/climate_action_team/reports/climate_assessments.html

[3] https://www.wildlife.ca.gov/Conservation/Climate-Science/Resources/Vulnerability

[4] Information on work being done by the State of California to find solutions to water-related issues in the Sacramento-San Joaquin Delta can be found at the following (but not limited to) websites:

https://water.ca.gov/Programs

https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/

[5] https://resources.ca.gov/Bonds-Oversight

[6] https://bondaccountability.resources.ca.gov/PropBondMenu.aspx

[7] https://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/

Summary of Comment A-10

The comment asks "Why aren't we considering the environmental damage that will be caused in other areas as they start to farm in new areas as we stop farming the most productive area in the world." The comment further expresses that farmers in California represent less than 0.003 percent of the state population, and that farmers, as a minority, are subject to the tyranny of the majority.

Response to Comment A-10

This Kaweah RCIS provides a framework to guide voluntary conservation investments and compensatory mitigation to enhance the conservation benefits of working lands, natural communities, and sensitive species within the Kaweah Subbasin. The RCIS provides a framework within which mitigation can be designed to support desired conservation in the region by identifying areas where compensatory mitigation could be implemented and actions that could be implemented as mitigation. Actions that occur outside the RCIS Area are outside the scope of the RCIS and are therefore not considered.

Summary of Comment A-11

The comment asks how many acre-feet or what percentage of the 360,000 acre-feet per year San Francisco water supply from Hetch Hetchy Reservoir is released into the Bay and ocean.

Response to Comment A-11

The Hetch Hetchy Regional Water System is owned and managed by the San Francisco Public Utilities Commission to supply water to residents and businesses across southern Alameda, northern Santa Clara, San Mateo, and San Francisco counties which are all outside the RCIS Area and thus outside the scope of this Kaweah RCIS. Water storage and delivery information for the Hetch Hetchy Regional Water System is available on the San Francisco Public Utilities Commission website.[8]

Summary of Comment A-12

The comment expresses that urban development in California has not been responsible in considering the water supply necessary to support city growth, and that the only solution now being proposed for this lack of foresight is to take water from family farmers and disadvantaged communities.

Response to Comment A-12

This Kaweah RCIS provides a framework to guide voluntary conservation investments and compensatory mitigation to enhance the conservation benefits of working lands, natural communities, and sensitive species within the Kaweah Subbasin. This Kaweah RCIS is a non-binding conservation strategy intended to inform conservation investments and guide advance mitigation within the Kaweah Subbasin. As such, the Kaweah RCIS does not consider or address allocation of water across California or differences in water allocation for urban uses compared to agricultural uses.

[8] https://www.sfwater.org/kiwidgets/SFPUC/index.html

Summary of Comment A-13

The comment asks what time period was chosen to depict the Valley as pristine, and why that period was chosen.

Response to Comment A-13

The Kaweah Subbasin has an extensive history of human habitation and landscape modification prior to European settlement. The RCIS includes a description of the historical vegetation present in the Subbasin prior to the 1850s which is roughly the time period that saw the initiation of irrigated agriculture and urban development (refer to Section 2.3.8.1 *Historical Vegetation*). An understanding of historical habitat conditions helps to inform present-day conservation and habitat restoration actions. For example, vernal pools typically occur in depressions underlain by a subsurface layer that limits drainage. Identifying the historical extent of vernal pools can help locate areas that may still maintain vernal pools that could be protected, or that have physical features such as suitable soils, to support vernal pool restoration.

Summary of Comment A-14

The comment asks what is the final goal, and if there will be a point at which the California government will be satisfied with how many highly productive family farms have been converted to open space.

Response to Comment A-14

The creation of this Kaweah RCIS was driven by the desire of stakeholders, including representatives from local county and city municipalities, groundwater sustainability agencies, growers, disadvantaged communities, and conservation organizations to achieve multibenefit conservation and mitigation outcomes for sensitive species and their habitats that contribute to improving groundwater sustainability in the Kaweah Groundwater Subbasin. An important goal of this Kaweah RCIS is to provide a tool that could be used to provide financial incentives to working landowners who voluntarily participate in groundwater sustainability projects and management actions that also provide habitat values for focal species and other conservation elements addressed by this RCIS. Agriculture plays a central role in the economy, environment, and culture of the region; this Kaweah RCIS emphasizes the continued economically-viable stewardship of working lands in ways that benefit native biodiversity and ecosystem processes.

Summary of Comment A-15

The commenter expresses a concern for himself and his family farm by being involved in discussions with potentially overbearing, punitive government agencies.

Response to Comment A-15

An RCIS is used to inform decision-making related to land acquisition, restoration, enhancement, surface water and groundwater management, and management actions for focal species and other conservation elements addressed by the RCIS. It is both non-regulatory and non-binding, and does not create, modify, or impose regulatory requirements or standards. Participation in the RCIS is fully voluntary.

References

California Department of Fish and Wildlife. 2018. Regional Conservation Investment Strategies. Program Guidelines. September. Sacramento, CA. Available: https://www.wildlife.ca.gov/Conservation/Planning/Regional-Conservation.

Appendix D
Evaluation of Species for Inclusion as Focal Species

Table D-1. Kaweah Subbasin RCIS Potential Focal Species Evaluation

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
Invertebrates											
An Adrenid bee *Andrena macswaini*	–	–	N	_	Y	N	Grasslands	N	Y	N	Not a SWAP species of greatest conservation need; no near term mitigation needs; Addressed by natural community conservation strategy.
Crotch bumble bee *Bombus crotchii*	SC	–	Y	N	Y	N	Grasslands, scrub	Y	Y	FS	State candidate endangered. Indicator of grassland and scrub natural communities.
Zavortink's protodufourea bee *Protodufourea zavortinki*	–	–	N	–	N	N	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Tulare cuckoo wasp *Chrysis tularensis*	–	–	N	–	Y	N	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Vernal pool fairy shrimp *Branchinecta lynchi*	–	FT	Y	N	Y	Y	Vernal Pool	Y	N	FS	Found within RCIS Area; species of conservation need. Indicator of vernal pool natural community.
Vernal pool tadpole shrimp *Lepidurus packardi*	–	FE	Y	N	Y	Y	Vernal Pool	Y	N	NFS	Addressed by natural community conservation strategy. Indicator of vernal pool natural community.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
California linderiella *Linderiella occidentalis*	–	–	N	–	N	N	Vernal Pool	N	N	N	No known occurrences in RCIS Area; addressed by natural community conservation strategy.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	–	FT	Y	N	N	Y	Riparian	Y	Y	N	Range does not likely south of Fresno and into Tulare County. Elderberry beetle occurrences in Tulare County previously thought to be *D. californicus dimorphus* are now presumed to be *D. californicus californicus*.
Hoppings blister beetle *Lytta hoppingi*	–	–	N	–	Y	N	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Molestan blister beetle *Lytta molesta*	SSC	–	N	–	Y	N	Vernal Pool	N	N	N	Single occurrence in RCIS Area; addressed by natural community conservation strategy.
Morrison's blister beetle *Lytta morrisoni*	–	–	N	–	Y	N	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
San Joaquin tiger beetle *Cicindela tranquebarica*	–	–	Y	N	Y	N	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
San Joaquin dune beetle *Coelus gracilis*	–	FC	Y	N	Y	N	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Moody's gnaphosid spider *Talanites moodyae*	–	–	N	–	Y	N	Grasslands	N	Y	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Amphibians											
California tiger salamander *Ambystoma californiense*	ST	FT	Y	Y	Y	Y	Vernal pools, grasslands	Y	Y	FS	Occurs in vernal pools in the RCIS Area; mitigation needs likely.
California red-legged frog *Rana draytonii*	ST	FT	Y	N	N	Y	Freshwater marsh, ponds, grasslands	N	Y	N	No known occurrences in RCIS Area.
Foothill yellow-legged frog *Rana boylii*	SC	–	Y	Y	Y	Y	Foothill streams	N	Y	N	Little habitat in RCIS Area; range primarily in foothills east of RCIS Area.
Western spadefoot *Spea hammondii*	SSC	UR	Y	N	Y	Y	Vernal pool, slow moving creeks	N	Y	FS	Potential mitigation needs. Indicator of vernal pool natural community.
Reptiles											
Western pond turtle *Emys marmorata*	SSC	UR	Y	N	Y	Y	Freshwater marsh, pond	Y	Y	NFS	SWAP species of greatest conservation need. Indicator of freshwater marsh natural community.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
San Joaquin Whipsnake *Masticophis flagellum ruddocki*	–	–	N	–	N	Y	N/A	N	N	N	No occurrence documented in the RCIS Area; no near term mitigation needs.
Giant garter snake *Thamnophis gigas*	ST	FT	Y	N	N	Y	Freshwater marsh, canals, ditches	N	N	N	Not known to occur in the RCIS Area.
Blunt-nosed leopard lizard *Gambelia silus*	FP, SE	FE	Y	N	N	Y	Scrub	Y	Y	FS	SWAP species of greatest conservation need; historical range overlaps with RCIS Area; has near term mitigation needs. Indicator of scrub natural community.
Coast horned lizard *Phrynosoma blainvillii*	SSC	–	N	–	N	Y	N/A	N	N	N	RCIS Area in known range of species; no known occurrences; no near term mitigation needs.
Northern California legless lizard *Anniella pulchra*	SSC	–	Y	Y	Y	Y	Chaparral, scrub, woodland	Y	N	NFS	SWAP species of greatest conservation need. Addressed by natural community conservation strategy.
Birds											
American white pelican *Pelacanus erythrorhynchos*	SSC	–	Y	Y	N	Y	Freshwater marsh	N	Y	N	No near term mitigation needs.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
Burrowing owl *Athene cunicularia*	SSC	–	Y	N	Y	Y	Grasslands	Y	Y	FS	Known to occur in RCIS Area; species of conservation concern: mitigation needs. Indicator of grasslands natural community.
Greater sandhill crane *Grus canadensis tabida*	ST	–	Y	N	N	Y	Grasslands, freshwater marsh	N	Y	N	No CNDDB occurrences in RCIS Area.
Lesser sandhill crane *Grus canadensis canadensis*	SSC	–	Y	N	N	Y	Grasslands, freshwater marsh	N	Y	N	No CNDDB occurrences in RCIS Area.
Great blue heron *Ardea herodias*	–	–	N	–	Y	Y	Freshwater marsh, pond	N	N	N	No near term mitigation needs.
Mountain plover *Charadrius montanus*	SSC	FPT	Y	N	N	Y	Grasslands	N	Y	N	Fully protected species; no near term mitigation needs.
Swainson's hawk *Buteo swainsoni*	ST	–	Y	Y	Y	Y	Grasslands, riparian	Y	Y	FS	Found within RCIS Area; SWAP species of greatest conservation need; climate vulnerable; in need of mitigation. Indicator of grasslands natural community.
Northern harrier *Circus cyaneus*	SSC	–	Y	N	Y	Y	N/A	N	Y	N	No near term need for mitigation.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Tricolored blackbird *Agelaius tricolor*	ST	UR	Y	N	Y	Y	Freshwater marsh and pond, grassland, croplands	Y	Y	FS	State listed species; SWAP species of greatest conservation need; potential mitigation need. Indicator of freshwater marsh natural community.
Southwestern Willow flycatcher *Empidonax traillii extimus*	SE	FE (only ssp. *extimus*)	Y	N	Y	Y	Freshwater marsh, riparian	Y	Y	N	Only single CNDDB occurrence in RCIS Area.
California condor *Gymnogyps californianus*	SE, FP	FE	Y	N	Y	Y	Grasslands, scrub	N	Y	N	Only single CNDDB occurrence in RCIS Area; no near term mitigation needs; fully protected species.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	SE	FT	Y	Y	N	Y	Riparian	Y	Y	N	Does not nest in the RCIS Area.
Least Bell's vireo *Vireo bellii pusillus*	SE	FE	Y	Y	N	Y	Riparian	Y	N	N	Not known to nest in the RCIS Area but may nest close to the RCIS Area.
Fulvous whistling duck *Dendrocygna bicolor*	SSC	–	Y	N	N	Y	Freshwater marsh, pond	N	Y	N	No known CNDDB occurrences in RCIS Area.
Redhead *Aythya americana*	SSC	–	Y	N	Y	Y	Freshwater marsh, pond	N	Y	N	Addressed by natural community conservation strategy.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Canvasback *Aythya valisineria*	SSC	–	N	–	Y	Y	Freshwater marsh	N	Y	N	Addressed by natural community conservation strategy.
American bittern *Botaurus lentiginosus*	–	–	N	–	Y	Y	Freshwater marsh, pond	N	Y	N	Occurs rarely in the RCIS Area during the non-breeding season; addressed by natural community conservation strategy.
Least bittern *Ixobrychus exilis*	SSC	–	Y	N	N	Y	Freshwater marsh, pond	N	Y	N	No known occurrences in RCIS Area; addressed by natural community conservation strategy.
LeConte's thrasher *Toxostoma lecontei*	SSC	–	Y	N	N	Y	Chaparral	N	Y	N	No known occurrences in RCIS Area.
Great egret *Ardea alba*	–	–	N	–	Y	Y	Freshwater marsh, pond	N	Y	N	Addressed by natural community conservation strategy.
Snowy egret *Egretta thula*	–	–	N	–	Y	Y	Freshwater marsh, pond	N	Y	N	Addressed by natural community conservation strategy.
Black-crowned night heron *Nycticorax nycticorax*	–	–	N	–	Y	Y	Freshwater marsh, pond	N	Y	N	Addressed by natural community conservation strategy.
Golden eagle *Aquina chrysaetos*	SE/FP	FD, BGPA	N	–	Y	Y	N/A	N	Y	N	Addressed by natural community conservation strategy; fully protected species.
Bald eagle *Haliaeetus leucocephalus*	SE/FP	FD, BGPA	Y	N	Y	Y	Riparian, Freshwater marsh	N	Y	N	Addressed by natural community conservation strategy; fully protected species.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
White-faced ibis *Plegadis chihi*	–	–	N	–	Y	Y	Freshwater marsh	N	Y	N	Addressed by natural community conservation strategy.
American peregrine falcon *Falco peregrinus anatum*	FP	FD	N	–	Y	Y	Grassland, freshwater marsh, scrub and chaparral	N	Y	N	Addressed by natural community conservation strategy; no near-term mitigation needs.
Prairie falcon *Falco mexicanus*	–	–	N	–	Y	Y	Grasslands, woodlands	N	Y	N	Addressed by natural community conservation strategy.
Long-eared owl *Asio otus*	SSC	–	Y	N	N	Y	Woodlands, grasslands	N	Y	N	Not known to occur in RCIS Area; no near-term mitigation needs.
Short-eared owl *Asio flammeus*	SSC	–	Y	N	Y	Y	Freshwater marsh, grasslands, scrub and chaparral	N	Y	N	Addressed by natural community conservation strategy; occurs in RCIS Area rarely during non-breeding season; no near-term mitigation needs.
Nuttall's woodpecker *Picoides nuttallii*	–	–	N	–	Y	Y	Woodlands, riparian	N	Y	N	Addressed by natural community conservation strategy; not a SWAP species of greatest conservation concern.
Merlin *Falco columbarius*	SSC	–	N	–	Y	Y	Grasslands, scrub and chaparral	N	Y	N	Addressed by natural community conservation strategy; not a SWAP species of greatest conservation concern.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Osprey *Pandion haliaetus*	SSC	–	N	–	Y	Y	Freshwater marsh, riparian	N	Y	N	Addressed by natural community conservation strategy; not a SWAP species of greatest conservation concern.
Ferruginous hawk *Buteo regalis*	SSC	–	N	–	Y	Y	Grasslands, scrub and chaparral	N	Y	N	Addressed by natural community conservation strategy; not a SWAP species of greatest conservation concern.
Western snowy plover *Charadrius nivosus nivosus*	SSC	FE	Y	Y	Y	Y	Freshwater marsh	N	Y	N	Addressed by natural community conservation strategy; occurs rarely at wastewater treatment plants and managed ponds.
California horned lark *Eremophila alperstris actia*	SSC	–	N	–	Y	Y	Scrub and chaparral	N	Y	N	Addressed by natural community conservation strategy; not a SWAP species of greatest conservation need.
California least tern *Sterna antillarum*	SE	FE	Y	Y	N	Y	Freshwater marsh	Y	Y	N	No known occurrences in RCIS Area.
Black tern *Chlidonias niger*	SSC	–	Y	Y	Y	Y	Freshwater marsh	Y	Y	N	Addressed by natural community conservation strategy.
Loggerhead shrike *Lanius ludovicianus*	SSC	–	Y	N	Y	Y	Scrub and chaparral, riparian, grasslands	Y	Y	N	Addressed by natural community conservation strategy.

Species	Status[a] State/CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
White-tailed kite *Elanus leucurus*	FP	–	N	–	Y	N	Grasslands, freshwater marsh	N	Y	N	Addressed by natural community conservation strategy; fully protected species.
Yellow warbler *Icteria virens*	–	–	Y	N	Y	Y	Riparian, freshwater marsh	N	Y	N	Addressed by natural community conservation strategy; no near term mitigation needs.
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	SSC	–	Y	N	Y	Y	Freshwater marsh, pond	N	Y	N	Addressed by natural community conservation strategy; no near term mitigation needs.
Mammals											
Townsend's big-eared bat *Corynorhinus townsendii*	SSC	–	Y	N	Y	Y	Woodlands, riparian. Roosts in caves, mines, other structures	Y	Y	N	Addressed by natural community conservation strategy; known occurrences in RCIS Area.
Pallid bat *Antrozous pallidus*	SSC	–	Y	N	Y	N	Grasslands, scrub and chaparral, woodlands. Roosts in crevices in rocky outcrops and cliffs, caves, trees, and mines, other structures	Y	Y	FS	SWAP species of greatest conservation concern; known to occur in RCIS Area.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
Western mastiff bat *Eumops perotis californicus*	SSC	–	N	–	Y	N	Woodlands, scrub and chaparral, grasslands. Roosts in crevices in cliffs, boulders, buildings, under rock slabs	N	Y	N	Not a SWAP species of greatest conservation concern; no near-term mitigation needs.
Hoary bat *Lasiurus cinereus*	–	–	N	–	Y	Y	Woodland, riparian,	N	Y	N	Not a SWAP species of greatest conservation need. No near-term mitigation needs.
American badger *Taxidea taxus*	SSC	–	Y	N	Y	Y	Grasslands, scrub and chaparral	N	Y	NFS	Grassland natural community indicator; wide-ranging species; ecosystem engineer.
Buena Vista Lake shrew *Sorex ornatus relictus*	SSC	FE	Y	N	N	Y	Riparian, freshwater marsh	Y	N	FS	SWAP species of greatest conservation need; range overlaps RCIS Area; suitable habitat occurs on western side of RCIS Area.
San Joaquin kit fox *Vulpes macrotis mutica*	ST	FE	Y	N	Y	Y	Grasslands, scrub and chaparral	Y	Y	FS	State and federally listed species; species of greatest conservation need; wide-ranging species. Indicator of grasslands and scrub natural communities.
Giant kangaroo rat *Dipodomys ingens*	SE	FE	Y	N	N	Y	Scrub and chaparral	Y	N	N	No known occurrences in RCIS Area.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	SE	FE	Y	N	N	Y	Scrub	Y	N	FS	Range overlaps RCIS Area; restoration opportunities in RCIS Area; nearest known occurrences (historical) to near the southern border of the RCIS Area. Indicator of scrub natural community.
Fresno kangaroo rat *Dipodomys nitratoides exilis*	SE	FE	Y	N	N	Y	Scrub	Y	N	N	Not known to occur in RCIS Area.
Short-nosed kangaroo rat *Dipodomys nitratoides brevinasus*	SSC	–	N	–	N	Y	Grasslands, scrub and chaparral	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area.
San Joaquin antelope squirrel *Ammospermophilus nelsoni*	ST	–	Y	N	N	Y	Grasslands	N	N	N	No know occurrences in RCIS Area. RCIS Area adjacent to edge of range.
San Joaquin pocket mouse *Perognathus inornatus*	–	–	Y	N	N	Y	Grasslands, scrub and chaparral	N	N	N	No known occurrence records from the RCIS Area.
Tulare grasshopper mouse *Onychomys torridus tularensis*	SSC	–	Y	N	N	Y	Scrub and chaparral	N	N	N	No known occurrences in RCIS Area.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
Plants											
Forked fiddleneck *Amsinckia vernicosa* var. *furcata*	–/4.2	–	N	-	N	Y	Woodlands, grasslands	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area.
Oval-leaved snapdragon *Antirrhinum ovatum*	–/4.2	–	N	-	N	Y	Chaparral, grasslands	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area.
Horn's milk-vetch *Astragalus hornii* var. *hornii*	–/1B.1	–	Y	N/E	N	Y	Alkali sink wetlands	N	N	N	No known occurrences in RCIS Area.
Alkali milk-vetch *Astragalus tener* var. *tener*	–/1B.2	–	N	-	N	Y	Vernal pools	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area.
Heartscale *Atriplex cordulata*	–/1B.2	–	N	–	Y	Y	Scrub, grasslands	N	N	N	Not a SWAP species of great conservation need; addressed by natural community conservation strategy.
Lost Hills crownscale *Atriplex coronata* var. *vallicola*	–/1B.2	–	N	–	Y	Y	Vernal pools, scrub, grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Earlimart orache *Atriplex cordulata* var. *erecticaulis*	–/1B.2	–	N	–	Y	Y	Vernal pool, grasslands	N	N	N	Not a SWAP species of great conservation need; addressed by natural community conservation strategy.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Brittlescale *Atriplex depressa*	–/1B.2	–	N	–	Y	Y	Scrub, grasslands	N	N	N	Not a SWAP species of great conservation need; addressed by natural community conservation strategy.
Lesser saltscale *Atriplex minuscula*	–/1B.1	–	Y	N/E	Y	Y	Scrub, vernal pool, grasslands	Y	N	N	Addressed by natural community conservation strategy.
Vernal pool smallscale *Atriplex persistens*	–/1B.1	–	N	–	Y	Y	Vernal pools	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Bakersfield smallscale *Atriplex tularensis*	SE/1A	–	Y	N/E	N	Y	Scrub	N	N	N	Presumed extinct in California. Historic range to the south of RCIS Area in Kern County
Subtle orache *Atriplex subtilis*	–/1B.2	–	N	–	Y	Y	Grasslands, vernal pools	N	N	N	Not a SWAP species of great conservation need; addressed by natural community conservation strategy.
Recurved larkspur *Delphinium recurvatum*	–/1B.2	–	N	–	Y	Y	Grasslands, scrub	N	N	N	Not a SWAP species of great conservation need; addressed by natural community conservation strategy.
Round-leaved filaree *California macrophylla*	–/1B.1	–	N	–	N	Y	Grasslands	N	Y	N	Not a SWAP species of great conservation need; no known occurrences in RCIS Area.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
Alkali mariposa lily *Calochortus striatus*	–/1B.2	–	N	–	N	Y	Scrub, chaparral	N	Y	N	Not a SWAP species of great conservation need; no known occurrences in RCIS Area.
Kaweah brodiaea *Brodiaea insignis*	SE/1B.2	–	Y	N/E	Y	Y	Grasslands, woodlands	Y	N	FS	Occurs in RCIS Area; potential mitigation needs; indicator of grassland and woodlands in foothills.
California jewelflower *Caulanthus californicus*	SE/1B.1	FE	Y	N/E	Y	Y	Scrub, woodlands, grasslands	Y	N	N	SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Lemmon's wild cabbage *Caulanthus lemmonii*	–/1B.2	–	N	–	N	N	Scrub	N	Y	N	Not a SWAP species of great conservation need; no known occurrences in RCIS Area.
Slough thistle *Cirsium crassicaule*	–/1B.1	–	Y	N/E	N	Y	Scrub, freshwater marsh, riparian	N	Y	N	Not a SWAP species of great conservation need; addressed by natural community conservation strategy. No known occurrences in RCIS Area. Nearest occurrences southwest of RCIS Area in southeast corner of Kings County

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Springville clarkia *Clarkia springvillensis*	SE/1B.2	FT	Y	N/E	Y	Y	Chaparral, grasslands, woodlands	Y	N	NFS	SWAP species of great conservation need; state and federal listed species; sparse occurrence in low foothills.
Vasek's clarkia *Clarkia tembloriensis* ssp. *calientensis*	–/1B.1	–	Y	N/E	N	Y	Grasslands	N	N	N	No known occurrences in RCIS Area.
Palmate bracted bird's-beak *Chloropyron palmatum*	SE/1B	FE	Y	N/E	N	Y	Scrub, grasslands	Y	N	N	No known occurrences in RCIS Area.
Hispid salty birds-beak *Cordylanthus mollis* ssp. *hispidum*	–/1B.1	–	Y	N/E	N	Y	Grasslands	N	N	N	No known occurrences in RCIS Area.
Hall's tarplant *Deinandra halliana*	–/1B.2	–	Y	N/E	N	Y	Scrub, grasslands	N	N	N	No known occurrences in RCIS Area.
Gypsum-loving larkspur *Delphinium gypsophilum* ssp. *gypsophilum*	–/3.2	–	N	–	N	Y	Grassland, alkali sink	N	N	N	No known occurrences in RCIS Area.
Hoover's eriastrum *Eriastrum hooveri*	–/4.2	FD	N	–	N	Y	Scrub, grasslands	N	N	N	No known occurrences in RCIS Area, though occurrence close to RCIS Area in Kings and Kerns Counties; not a SWAP species of greatest conservation concern.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Tracy's eriastrum *Eriastrum tracyi*	SR/3.2	–	Y	N/E	N	N	Chaparral	Y	N	N	No known occurrences in RCIS Area. Occurrences in Tulare County in the foothills east of the RCIS Area.
Munz's tidy-tips *Layia munzii*	–/1B.2	–	N	-	N	Y	Scrub, grasslands	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area, though occurrence close to RCIS Area in Kings and Kerns Counties.
Tejon poppy *Eschscholzia lemmonii* ssp. *kernensis*	–/1B.1	–	Y	N/E	N	Y	Grassland	Y	N	N	No known occurrences in RCIS Area.
Kern mallow *Eremalche parryi* ssp. *kernensis*	–/1B.2	FE	Y	N/E	N	Y	Scrub, grasslands	Y	N	N	No known occurrences in RCIS Area, though occurrences adjacent to south border of RCIS Area near Pixley; addressed by natural community conservation strategy.
Cottony buckwheat *Eriogonum gossypinum*	–/4.2	–	N	-	Y	Y	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Temblor buckwheat *Eriogonum temblorense*	–/1B.2	–	N	-	N	Y	Grasslands	N	N	N	No known occurrences in RCIS Area.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Alkali goldfields *Lasthenia ferrisiae*	–/4.2	–	N	-	N	Y	Vernal pools	N	N	N	No known occurrences in RCIS Area, though occurrences adjacent to south border of RCIS Area near Pixley; addressed by natural community conservation strategy.
Paleyellow tidytips *Layia heterotricha*	–/1B.1	–	Y	N/E	N	Y	Woodlands	Y	N	N	No known occurrences in RCIS Area.
Comanche Point layia *Layia leucopappa*	–/1B.1	–	Y	N/E	N	Y	Scrub, grasslands	Y	N	N	No known occurrences in RCIS Area.
Panoche pepper-grass *Lepidium jaredii* ssp. *album*	–/1B.1	–	N	–	N	Y	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area.
Showy golden madia *Madia radiata*	–/1B.1	–	Y	N/E	N	Y	Woodlands	N	N	N	No known occurrences in RCIS Area.
Indian Valley bush mallow *Malacothamnus aboriginum*	–/1B.2	–	N	–	N	Y	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area.
Calico monkeyflower *Diplacus pictus*	–/1B.2	–	Y	N/E	Y	Y	Woodlands	N	N	N	Primarily a species of the Sierra Foothills just beyond the RCIS Area.
San Joaquin woolly threads *Monolopia congdonii*	–/1B.2	FE	Y	N/E	N	N	Scrub, grasslands	Y	N	N	No known occurrences in RCIS Area.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
Paso Robles navarretia *Navarretia jaredii*	–/1B.2	–	N	–	N	N	Grasslands	N	N	N	Not a SWAP species of greatest conservation need; no known occurrences in RCIS Area.
Piute Mountains navarretia *Navarretia setiloba*	–/1B.1	–	Y	N/E	N	Y	Woodlands	Y	N	N	No known occurrences in RCIS Area.
Spiny-sepaled button-celery *Eryngium spinosepalum*	–/1B.2	–	N	–	Y		Vernal pools, grasslands	N	N	N	Not a SWAP species of conservation need; addressed by natural community conservation strategy.
Hoover's spurge *Euphorbia hooveri*	–/1B.2	FT	Y	N/E	Y	Y	Vernal pools	N	N	NFS	Addressed by natural community conservation strategy. Indicator of vernal pool natural community.
Striped adobe-lily *Fritillaria striata*	ST/1B.1	–	Y	N/E	Y	Y	Grasslands	N	N	FS	State listed species; SWAP species of greatest conservation need. Indicator of grassland natural community.
Winter's sunflower *Helianthus winteri*	–/1B.2	–	N	–	Y	Y	Woodlands, grasslands	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
California satintail *Imperata brevifolia*	–/2B.1	–	N	–	Y	Y	Scrub, chaparral	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.

Species	Status[a]				Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale
	State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]							
Coulter's goldfields *Lasthenia glabrata* ssp. *coulteri*	–/1B.1	–	Y	N/E	Y	Y	Freshwater marsh, vernal pools	N	N	N	Addressed by natural community conservation strategy.
Bakersfield cactus *Opuntia basilaris* var. *treleasei*	SE/1B.1	FE	Y	N/E	N	Y	Scrub	Y	N	N	No known occurrences in RCIS Area.
San Joaquin Valley Orcutt grass *Orcuttia inaequalis*	SE/1B.1	FT	Y	N/E	Y	Y	Vernal pools	Y	N	NFS	State and federal listed species; SWAP species of greatest conservation need. Indicator of vernal pool natural community.
San Joaquin adobe sunburst *Pseudobahia peirsonii*	SE/1B.1	FT	Y	N/E	Y	Y	Grasslands, woodlands	Y	N	NFS	State and federal listed species; SWAP species of greatest conservation need.
California alkali grass *Puccinellia simplex*	–/1B.2	–	N	–	Y	Y	Grasslands, vernal pools, scrub	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Valley oak *Quercus lobata*	CBR	–	N	-	Y	Y	Woodlands	Y	Y	FS	Occurs in RCIS Area; high climate vulnerability; potential mitigation needs; indicator of woodlands.
Sanford's arrowhead *Sagittaria sanfordii*	–/1B.2	–	N	–	Y	Y	Freshwater marsh	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Keck's checkerbloom *Sidalcea keckii*	–/1B.1	FE	Y	N/E	Y	Y	Grasslands, woodlands	Y	Y	NFS	Addressed by natural community conservation strategy.

	Status[a]										
Species	**State/ CNPS**	**Federal**	**SWAP Species of Greatest Conservation Need**	**Climate Vulnerable[b]**	**Occurs in RCIS Area**	**Data**	**Natural Community Associations**	**Potential Mitigation Need**	**Wide-Ranging Species**	**Recommend as Focal Species or Non-focal Species[c]**	**Rationale**
Oil neststraw *Stylocline citroleum*	–/1B.1	–	Y	N/E	N	Y	Scrub	Y	N	N	No known occurrences in RCIS Area.
San Joaquin blue curls *Trichostema ovatum*	–/4.2	–	N	–	N	Y	Grassland	N	N	N	Not a SWAP species of greatest conservation need; addressed by natural community conservation strategy.
Greene's tuctoria *Tuctoria greenei*	SR/1B.1	FE	Y	N/E	?	Y	Vernal pools	Y	N	NFS	May occur in RCIS Area. One historic occurrence in RCIS Area has been extirpated. May need mitigation.
King's gold *Tropidocarpum californicum*	–/1B.1	–	Y	N/E	N	Y	Scrub	Y	N	N	No known occurrences in RCIS Area.

Species	Status[a] State/ CNPS	Federal	SWAP Species of Greatest Conservation Need	Climate Vulnerable[b]	Occurs in RCIS Area	Data	Natural Community Associations	Potential Mitigation Need	Wide-Ranging Species	Recommend as Focal Species or Non-focal Species[c]	Rationale

Notes

[a] Status

State Status

FP = Fully Protected.
SE = State listed as endangered.
ST = State listed as threatened.
SC = listed as a candidate species. A candidate species is one that the California Fish and Game Commission has formally declared a candidate species.
SR = State listed as rare.
SSC = California special concern species (July 2005 list).
CBR = Considered but rejected.

Federal Status

BGPA = Bald Eagle and Golden Eagle Protection Act.
FE = Federally endangered.
FT = Federally threatened.
FC = Candidate for federal listing.
FPT = Federally proposed for threatened listing.
FPD = Federally proposed for delisting.
FD = Federally delisted.
UR = Under review. Species that have been petitioned for listing and for which a 90 day finding has not been published or for which a 90 day substantial has been published but a 12 Month finding have not yet been published in the Federal Register. Also includes species that are being reviewed through the candidate process, but the Candidate Notice of Review has not yet been signed.

California Native Plant Society (CNPS) Ranking

1A = Presumed extinct in California.
1B = Rare or endangered in California and elsewhere.
2 = Rare or endangered in California, more common elsewhere.
3 = Plants about which more information is needed.
4 = Plants of limited distribution.

State Wildlife Action Plan (SWAP) Species of Great Conservation Need

Y = Listed as species of great conservation need in SWAP.
N = Not listed as species of great conservation need in SWAP.

[b] Climate Vulnerable (as identified in the SWAP).

Y = listed as climate vulnerable by SWAP.
N = not listed as climate vulnerable by SWAP.
-- = not included as a SWAP species of greatest conservation need
N/E = plants were not evaluated for climate vulnerability in SWAP.

[c] Recommended Focal Species Status.

FS = recommended as focal species.
NFS = recommended as non-focal species.
N = not recommended as focal species or non-focal species.

Appendix E
Focal Species Profiles

Crotch bumble bee (*Bombus crotchii*)

Regulatory Status

- **State:** Candidate Endangered
- **Federal**: None
- **Critical Habitat**: None
- **Recovery Planning**: None

Distribution

General

Crotch bumble bee is nearly endemic to California, historically ranging from southern to central California, with occasional records in the northern portion of the state. This species occurs from the coast and coastal ranges, through the Central Valley, and to the adjacent foothills. Outside of California, Crotch bumble bee range extends into Baja California, Mexico and southwest Nevada near the California border (Williams et al. 2014, Hatfield et. al. 2018) (Figure E-1).

Within the RCIS Area

Of the 437 California Natural Diversity Database (CNDDB) occurrences, 4 (0.9%) are within the Regional Conservation Investment Strategy (RCIS) Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). These occurrences are concentrated in the eastern portion of the RCIS Area, with one occurrence in Visalia. All the occurrences were documented prior to 1980 and most of the occurrences are on private land (Figure E-2).

Natural History

Colonies are comprised of a queen, worker females, and drone males. Queens initiate colonies and lay eggs. Workers collect food, defend colonies and feed young. The males' sole function is to mate with queens. Colonies are annual, with only new, mated queens overwintering. Queens emerge from hibernation in late February and initially do all the foraging and colony care until the first workers emerge (Hatfield et al. 2018). Colonies typically consist of between 50 and 500 workers at their peak (Plath 1927, Thorp et al. 1983, Macfarlane et al. 1994), and the queen. Production of queens depends on sufficient access to pollen. As such, pollen availability directly affects the number of queens that can be produced and ultimately, population levels (Burns 2004, Hatfield et al. 2018).

The flight period for Crotch bumble bee queens is from late February to late October. Their flight period peaks in early April and there is a second pulse in July. The flight period for workers and males is from late March through September; worker and male abundance peaks in early July

(Thorp et al. 1983). Queens produced at the end of the colony cycle mate before entering diapause (a form of hibernation) (Hatfield et al. 2018).

Bumble bees depend on floral resources for nutrition. Bumble bees collect nectar and pollen and in turn, pollinate those plants provisioning nectar and pollen. Such pollination services are critical for many plant species to produce seeds and fruit. Tomatoes, blueberries, and other important food crop plants are pollinated by bumble bees. Bumble bees, including Crotch bumble bee, are generalist foragers, gathering pollen and nectar from a diversity of plant species, though individual species may prefer different plant species for resources, depending on the length of their tongue. Crotch bumble bees have a short tongue, and forage at open flowers with short corollas (Hatfield et. al. 2018).

Habitat Requirements

Bumble bees have three basic habitat requirements: colony nest sites, available floral resources (nectar and pollen for carbohydrates and protein, respectively) for the duration of the colony period (spring through fall), and overwintering sites for the queens. Bumble bee colony success and overwinter survival is often limited by the diversity and availability of suitable nesting and overwintering sites (Hatfield et al. 2018). There are no described nests for this species in the scientific literature; however, this species is thought to nest underground in abandoned rodent nests. Crotch bumble bees could also nest above ground in tufts of grass, old bird nests, rock piles, or cavities in dead trees (Williams et al. 2014).

Bumble bees depend on habitats with an abundance and diversity of floral resources that bloom continuously throughout the entirety of a colony’s life. Crotch bumble bee inhabits open grassland and scrub habitats, requiring a hotter and drier environment than most bumble bee species (Hatfield et. al. 2015, NatureServe 2021).

Little is known about Crotch bumble bee overwintering sites. Generally, bumble bees overwinter in soft, disturbed soil (Goulson 2010), or under leaf litter or other debris (Williams et al. 2014).

Pressures and Stressors

Crotch bumble bee abundance, relative to other bumble bee species, has declined significantly in recent decades. Crotch bumble bee, once abundant in the Central Valley, now appears to be absent from most of it. Habitat loss and degradation, toxins, disease, competition, and climate change are apparent threats to this species. There are no known management efforts specifically designed to conserve or recover this species (Hatfield et al. 2015, 2018, California Department of Fish and Wildlife 2019a).

Threats to Crotch bumble bee in the RCIS Area include urban development, loss of habitat and fragmentation, and toxins such as pesticide use from agriculture (Hatfield et. al. 2018). Habitat alteration and fragmentation, including that from agriculture and urban development, result in the loss of suitable grasslands and prairie habitat, can reduce sufficient food sources (nectar and pollen from flowers), and nesting and overwintering sites. Isolated patches of habitat may not be sufficient to support bumble bee populations (Hatfield and LeBuhn 2007, Öckinger and Smith 2007). Habitat fragmentation has been shown to reduce bumble bee foraging rates and alter their foraging patterns (Rusterholz and Baur 2010). Decreased source populations for recolonization may also result from habitat fragmentation (National Research Council 2007). This can cause a reduction in genetic diversity, and disruption of their method of sex determination due to inbreeding (Hatfield et al. 2015). Plowing, right-of-way vegetation management, or other ground disturbing activities can destroy nesting and overwintering sites (Hatfield et. al 2012, 2018). Crotch bumble bee is believed to nest in rodent burrows; therefore, loss of rodent populations can reduce nest site availability (Hatfield et al. 2018). Urbanization and agricultural intensification in the Central Valley may have contributed to the decline of Crotch bumble bee populations (Hatfield et al. 2015).

Well managed livestock grazing is beneficial for grassland and scrub habitats at low to moderate levels because it helps to manage invasive species and thatch, encourages growth of nectar-rich plants, limits shrub and tree succession in grasslands, and provides the structural diversity that creates nesting habitat (Hatfield et al. 2012). Overgrazing of livestock, however, can negatively affect Crotch bumble bee by removing floral resources and trampling nesting and overwintering sites (Hatfield et al. 2012, 2018).

Fire suppression can also pose a threat to Crotch bumble bee. Fire regimes are an important natural occurrence for many ecosystems. Fires maintain forbs and grasses within meadows and prairies and prevent encroachment of shrubs and trees (Hatfield et al. 2018). Fire suppression can lead to changes in vegetation structure of Crotch bumble bee habitat, including degradation and loss of grasslands and herbaceous species (Schultz and Crone 1998, Panzer 2002). In addition to the reduction of suitable grassland habitat, forest encroachment due to fire suppression causes habitat fragmentation by closing off corridors between meadows, which reduces dispersal and foraging opportunities (Roland and Matter 2007). Fire suppression also causes an increase in combustible fuel loads, tree density, and fire intolerant species, leaving habitats susceptible to large-scale, highly intensive fire events (Huntzinger 2003). The introduction of prescribed fire can have a beneficial impact on restoring native habitat; however, prescribed burns must take into consideration the life history timing of Crotch bumble bee otherwise they can have an opposite, detrimental effect (Hatfield et a. 2018).

Climate Change Vulnerability Assessment

Effects of climate change may include increased temperature and precipitation, increased drought, increased variability in temperature and precipitation extremes, early snow melt, and late frost events (Hatfield et al. 2018). The changing climate is likely to alter the timing of food plant availability and reduce the habitable area for bumble bee populations, including Crotch bumble bee, in the southern portion of their ranges without a corresponding range expansion to the north or upslope in elevation (Kerr et al. 2015, Hatfield et al. 2018).

Change in climate can lead to a change in flowering phenology, creating a mismatch between blooming plants and bumble bee flight seasons. Bumble bees are generalist foragers, and do not require synchrony with a specific plant. However, asynchrony may limit resource availability at critical times, jeopardizing bumble bee colony success (Hatfield et al. 2018). Bumble bees rely on flowering resources throughout their flight season, and changes in the timing of flowering can have significant effects. Queens need reliable food sources in the early spring when they emerge from hibernation and initiate nests, collecting pollen to form a food mass for young (Hatfield et al. 2018, Thorp et al. 1983). Toward the end of the season, adequate resources are needed to produce the reproductive members, new queens and males, for the colony (Hatfield et al. 2012). A decrease in reproductive success is likely to occur if flowering is delayed at the start of the flight season or truncated at its end (Memmott et al. 2010).

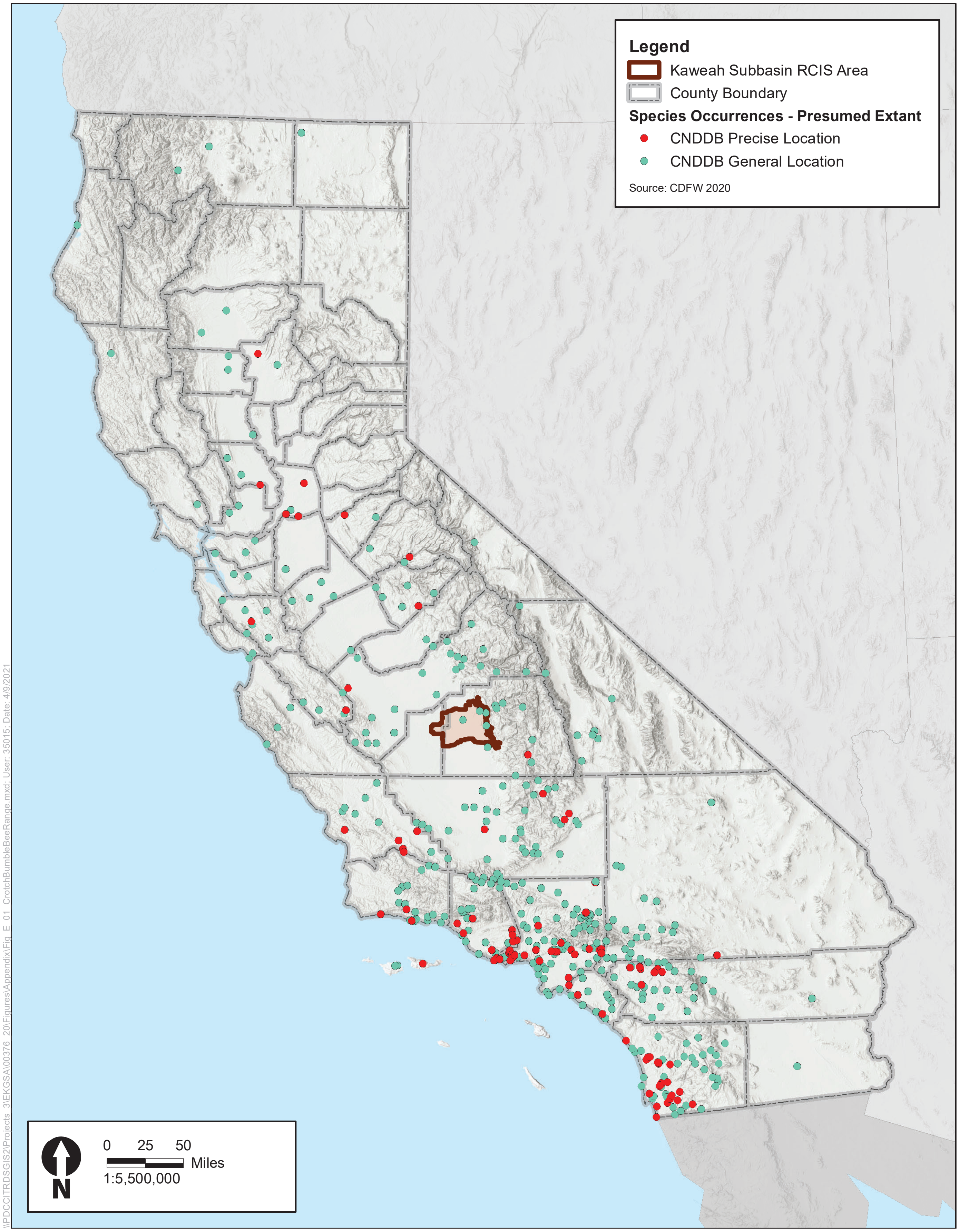

Figure E-1
Crotch's Bumble Bee Range

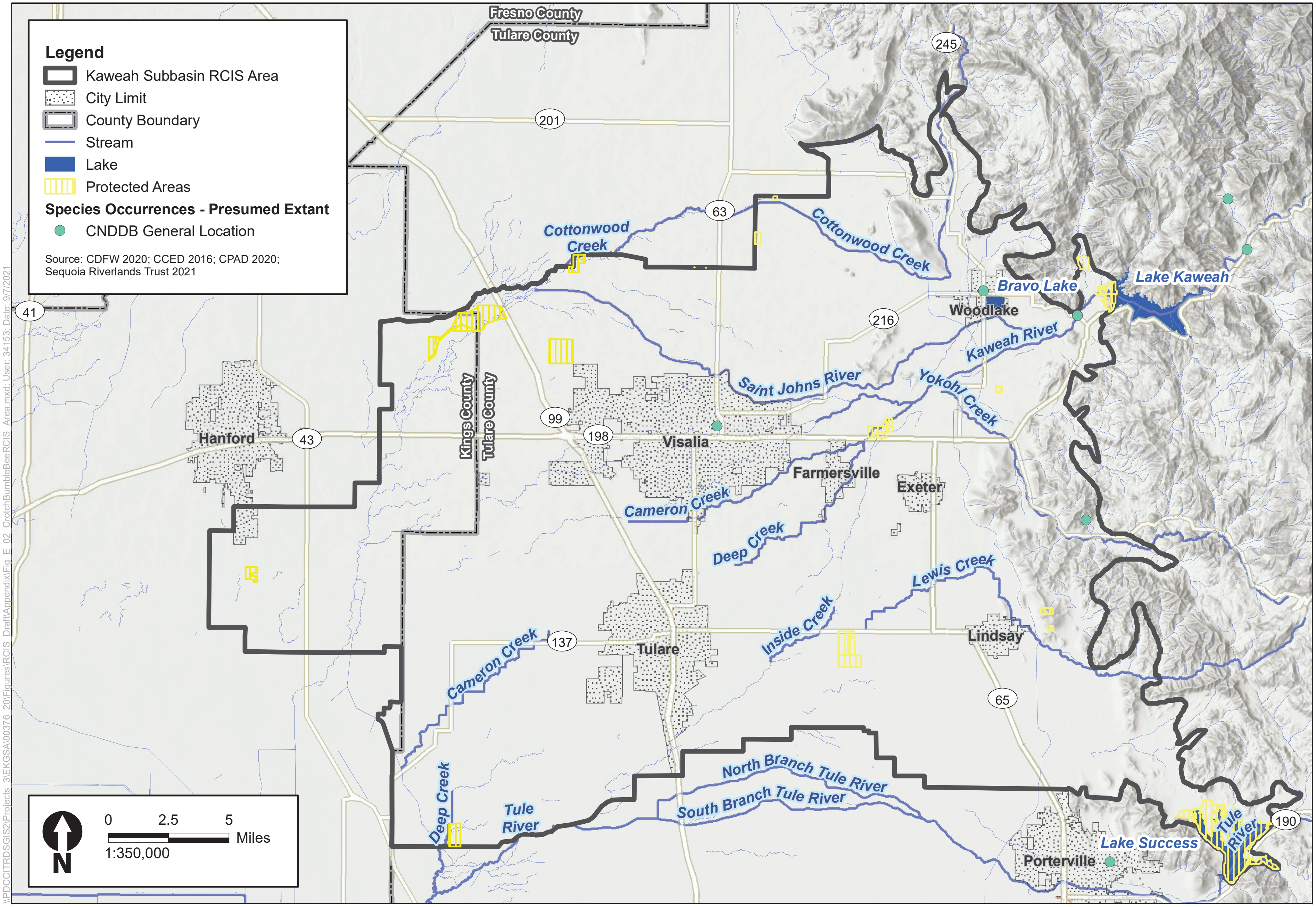

Figure E-2
Crotch's Bumble Bee

Vernal pool fairy shrimp (*Branchinecta lynchi*)

Regulatory Status

- **State:** None
- **Federal:** Threatened
- **Critical Habitat:** Final critical habitat designated for four vernal pool crustaceans and eleven vernal pool plants (U.S. Fish and Wildlife Service 2006a)
- **Recovery Planning:** Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005a)

Distribution

General

Vernal pool fairy shrimp is found from southern Oregon to southern California, through the Central Valley, and west to the central Coast Ranges. Disjunct populations occur in San Luis Obispo County, Santa Barbara County, and Riverside County. In southern Oregon, it is located in two vernal pool habitats within the Agate Desert area of Jackson County (U.S. Fish and Wildlife Service 2005a, California Department of Fish and Wildlife, California Natural Diversity Database 2021) (Figure E-3). Although vernal pool fairy shrimp is distributed more widely than other fairy shrimp species, it is generally uncommon throughout its range and rarely abundant where it does occur (Eng et al. 1990, Eriksen and Belk 1999).

Within the RCIS Area

The RCIS Area falls within the San Joaquin Valley Vernal Pool Region (U.S. Fish and Wildlife Service 2005a). There are 24 CNDDB occurrences within the RCIS Area. These occurrences are within the eastern portion and northern portion of the RCIS Area located in the Southern Sierra Foothills Vernal Pool Region (U.S. Fish and Wildlife Service 2005a, California Department of Fish and Wildlife, California Natural Diversity Database 2021). There are six U.S. Fish and Wildlife Service (USFWS) recovery plan core areas overlapping the RCIS Area: Cross Creek, Cottonwood Creek, Tulare, Kaweah, Yokohl, and Pixley. Occurrences are located in all of the core areas (U.S. Fish and Wildlife Service 2005a) (Figure E-4).

Natural History

Vernal pool fairy shrimp is adapted to the environmental conditions of its ephemeral habitats. One adaptation is the ability of vernal pool fairy shrimp eggs, or cysts, to remain dormant in the soil when its vernal pool habitats are dry. The cysts survive the hot, dry summers and, when pools and swales refill in fall and winter, some but not all of the eggs may hatch. The egg bank in the soil may consist of eggs from several years of breeding (U.S. Fish and Wildlife Service 2005a, 2007). Beyond inundation of habitat, the specific cues for hatching are unknown, although temperature and conductivity (solute concentration) are believed to play a large role (Helm 1998, Eriksen and Belk 1999).

Vernal pool fairy shrimp is an omnivorous filter-feeder. In general, all fairy shrimp species indiscriminately filter particles that include bacteria, unicellular algae, and micrometazoa (Eriksen and Belk 1999). The precise size of items these fairy shrimp are capable of filtering is currently unknown; however, fairy shrimp species will attempt to consume whatever material they can fit into their feeding groove and do not appear to discriminate based upon taste, as do some other crustacean groups (Eriksen and Belk 1999).

Planktonic Crustacea are important in the food web, as they represent a high-fat, high-protein resource for migratory waterfowl. Mallard (*Anas platyrhynchos*), green-winged teal (*A. crecca*), bufflehead (*Bucephala albeola*), greater yellowlegs (*Tringa melanoleuca*), and killdeer (*Charadrius vociferus*) all forage actively in vernal pools on invertebrate and amphibian fauna during the winter months (Silveira 1996, Bogiatto and Karnegis 2006).

Predator consumption of vernal pool fairy shrimp cysts aids in distributing populations of fairy shrimp. Predators (e.g., birds and amphibians) expel viable cysts in their excrement, often at locations other than where they were consumed. If conditions are suitable, these transported cysts may hatch at the new location and potentially establish a new population. Cysts are also transported by wind and in mud carried on the feet of animals, including livestock that may wade through fairy shrimp habitat. This type of dispersal aids ephemeral pool crustaceans in exploiting a wide variety of ephemeral habitats (Erickson and Belk 1999).

Habitat Requirements

Vernal pool fairy shrimp is entirely dependent on the aquatic environment provided by the temporary waters of natural vernal pool and playa pool ecosystems, as well as the artificial environments of ditches and tire ruts (King et al. 1996, Helm 1998, Erikson and Belk 1999). The temporary waters this species inhabits fill in the fall and winter during the beginning of the wet season, dry in late spring at the beginning of the dry season, and remain desiccated throughout the summer (Helm 1998, Eriksen and Belk 1999). Pools fill directly from precipitation as well as from runoff from the watershed (Williamson et al. 2005, Rains et al. 2006, 2008, O'Geen et al. 2008). The watershed extent necessary for maintaining the hydrological functions of the temporary waters depends on a number of complex factors, including the hydrologic conductivity of the surface soil horizons; the continuity and extent of hardpans and claypans underlying non-clay soils; the existence of a perched aquifer overlying the pans; slope; effects of vegetation on evapotranspiration rates; compaction of surface soils by grazing animals; and other factors (Pyke and Marty 2005, Williamson et al. 2005, Rains et al. 2006, 2008, O'Geen et al. 2008).

The temporary waters that are habitat for vernal pool fairy shrimp are extremely variable and range from clear sandstone pools with little alkalinity to turbid vernal pools on clay soils with moderate alkalinity (King et al. 1996, Eriksen and Belk 1999). Common wetland plant species that co-occur with vernal pool fairy shrimp include toad rush (*Juncus bufonius*), coyote thistle (*Eryringium* spp.), downingia (*Downingia ornatissma* or *D. bicornuta*), goldfields (*Lasthenia* spp.), woolly marbles (*Psilocarphus* spp.), and hair grass (*Deschampsia* spp.) (King et al. 1996, Helm 1998, Eriksen and Belk 1999). Vernal pool fairy shrimp has also occasionally been found in degraded vernal pool habitats and artificially created seasonal pools (Helm 1998).

Vernal pool fairy shrimp commonly co-occurs with California fairy shrimp (*Linderiella occidentalis*), Conservancy fairy shrimp (*Branchinecta conservatio*), and vernal pool tadpole shrimp (*Lepidurus packardi*). Midvalley shrimp (*B. mesovallensis*) and longhorn fairy shrimp occur within the range of vernal pool fairy shrimp but are typically found in different habitats (U.S. Fish and Wildlife Service 2005a, 2007).

Pressures and Stressors

Vernal pool fairy shrimp are threatened by the same activities as other vernal pool invertebrates. These threats include the conversion of vernal pool habitat to urban development, infrastructure construction, particularly along the periphery of urban areas, and agricultural conversion (U.S. Fish and Wildlife Service 2007). Habitat destruction also fragments remaining populations of vernal pool fairy shrimp, leaving small, isolated populations more susceptible to stochastic extinction (U.S. Fish and Wildlife Service 1994).

Activities that alter the suitability of habitat, including the hydrology of vernal pool wetland complexes, can impact vernal pool fairy shrimp. These activities include damaging the impermeable clay and/or hardpan layers of the habitat bottom, filling in the habitat, and altering (e.g., through contaminants) or destroying the watershed that conveys overland flow into the habitat. Other activities that can affect hydrology include the construction of roads, trails, ditches, or canals that can block the flow of water into, or drain water away from, the vernal pool complex. Additionally, introduction of nonnative plants, destruction or degradation of the surrounding upland habitat, introduction of fish (such as *Gambusia* spp.) into vernal pool habitats that depredate vernal pool fairy shrimp, and activities that would discourage or prevent waterfowl and waders from feeding at occupied habitats and thereby restrict gene flow between populations also significantly affect vernal pool shrimp populations (U.S. Fish and Wildlife Service 2005a, 2007).

Climate Change Vulnerability Assessment

Climate change has the potential to adversely affect vernal pool fairy shrimp through changes in vernal pool inundation patterns and temperature regimes. Water availability will likely be one of the most significant impacts of climate change on vernal pool branchiopods. Vernal pools are particularly sensitive to slight increases in evaporation or reductions in rainfall due to their shallow depths and seasonality (Field et al. 1999, as cited in U.S. Fish and Wildlife Service 2005a). Drought-mediated decreases in water depth and inundation period could increase the frequency at which pools dry before shrimp have completed their life cycle, or cause pool temperatures to more often exceed temperatures suitable for hatching and persistence of the species (U.S. Fish and Wildlife Service 2005a).

Vernal pool branchiopods in the Central Valley have been identified as being moderately to highly vulnerable to climate change (California Landscape Conservation Cooperative 2017). This assessment is the result of moderate sensitivity to climate change and high sensitivity to future exposure. Shifts in precipitation will affect temperatures within the vernal pool branchiopod ranges, resulting in changes in the timing and length of inundation in vernal pools. Smaller, shallower pools have the greatest potential to be affected by climate change (Pyke and Marty 2005). The vulnerability assessment also found that vernal pool branchiopods have low to moderate adaptive capacity due to extensive habitat fragmentation, low landscape occupancy, and limited dispersal ability (California Landscape Conservation Cooperative 2017).

Very little vernal pool habitat remains in the RCIS Area (1.8%; Table 2-17) and remaining habitat and vernal pool branchiopod occurrences are patchily distributed along the edges of the RCIS Area (Figure E-4). Dispersal to suitable habitat is vital to adapting to shifting habitat range; the limited, highly fragmented patches of remaining habitat limit the opportunities for adaptations to climate change in the RCIS Area for this species group.

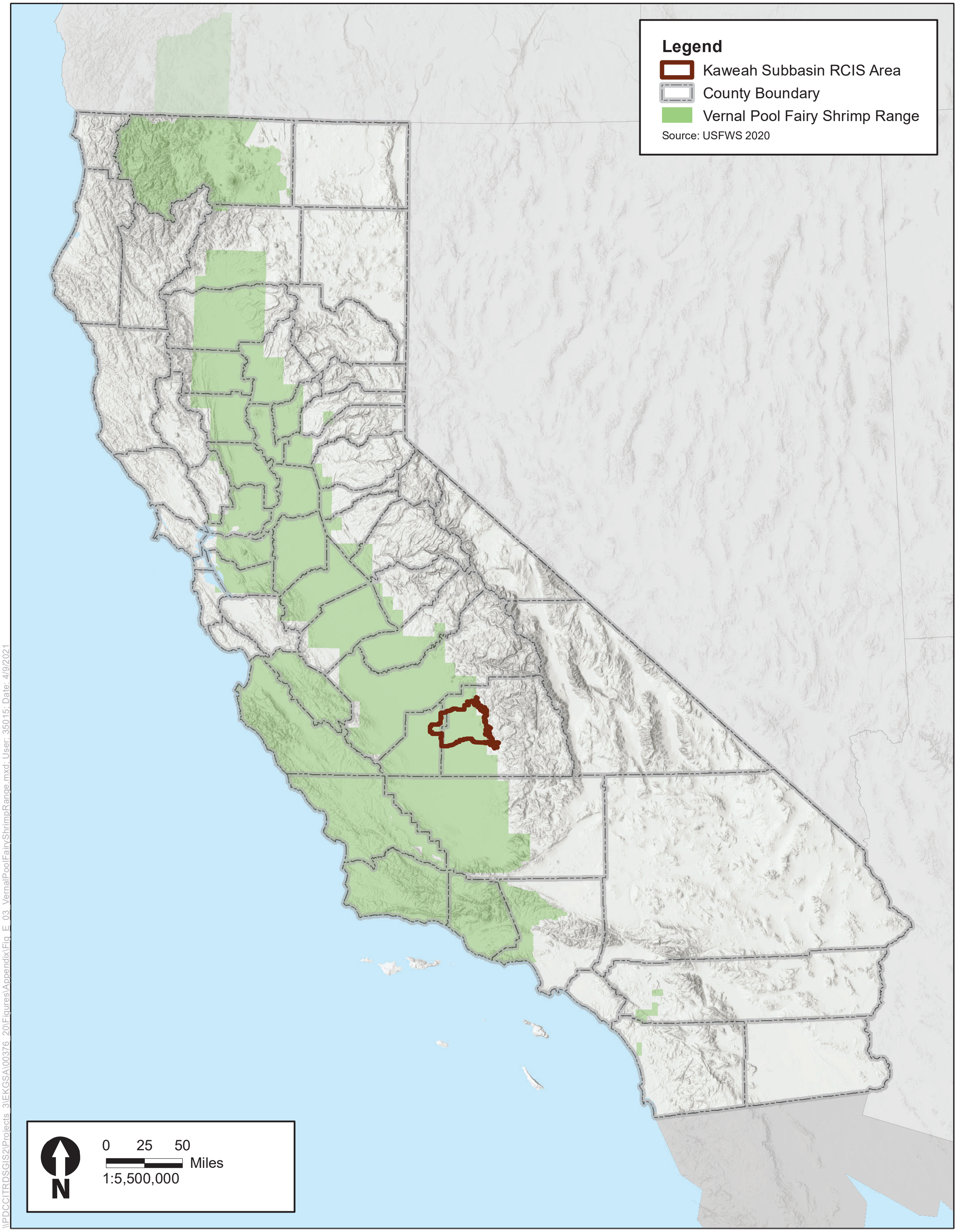

Figure E-3
Vernal Pool Fairy Shrimp Range

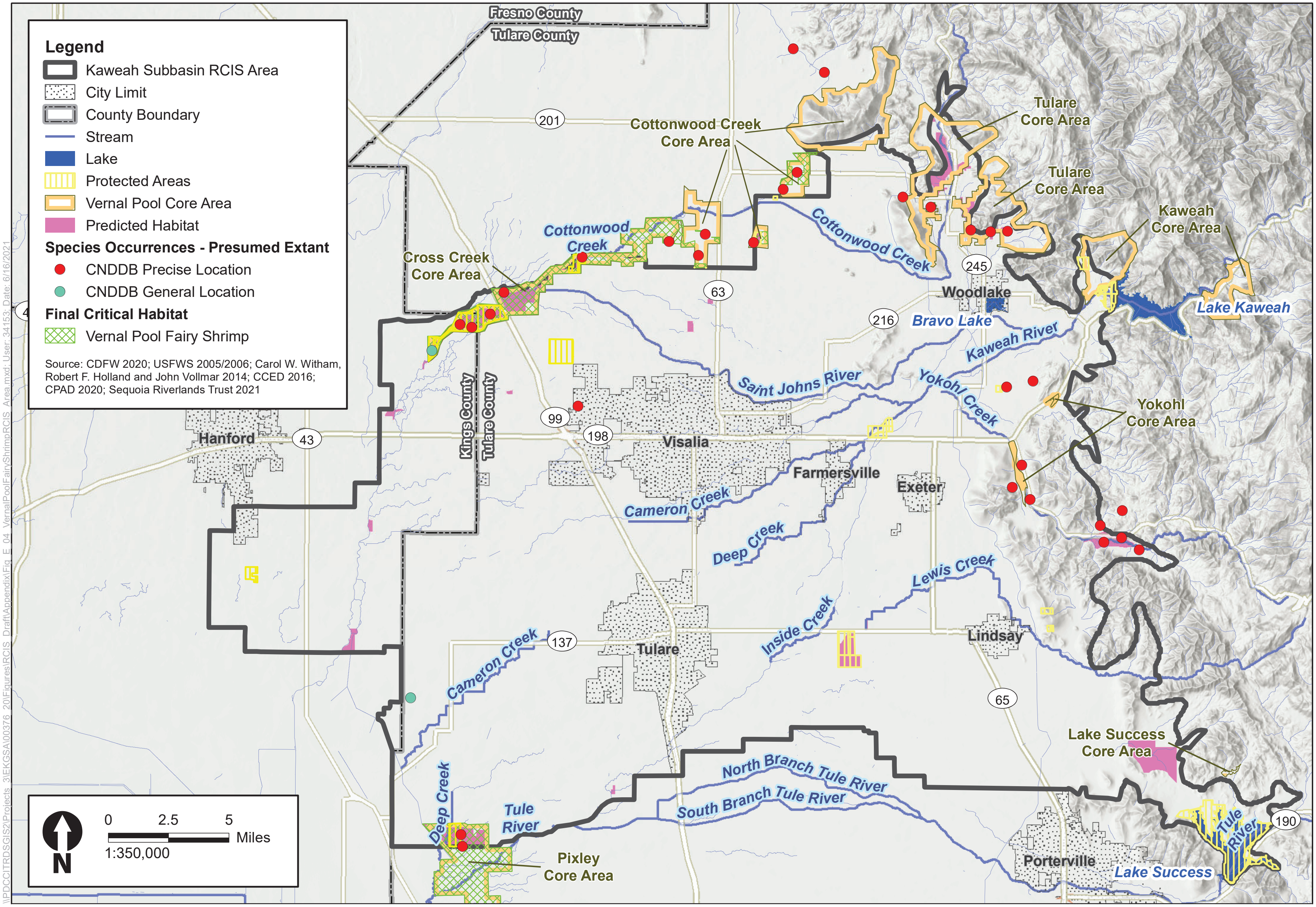

Figure E-4
Vernal Pool Fairy Shrimp

California tiger salamander (*Ambystoma californiense*)

Regulatory Status

- **State:** Threatened
- **Federal:** Threatened
- **Critical Habitat:** Final critical habitat designated for California tiger salamander, central population (U.S. Fish and Wildlife Service 2005b)
- **Recovery Planning:** Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (*Ambystoma californiense*) (U.S. Fish and Wildlife Service 2017a)

Distribution

General

California tiger salamander is endemic to California. It is distributed throughout grasslands and low foothill regions, up to 3,940 feet in elevation, though most occurrences are known from elevations below 1,500 feet (Shaffer et al. 2013) (Figure E-5). The central California tiger salamander distinct population segment is restricted to disjunct populations that form a ring along the foothills of the Central Valley and Inner Coast Range from San Luis Obispo, Kern, and Tulare Counties in the south, to Sacramento and Yolo Counties in the north (U.S. Fish and Wildlife Service 2017a).

Within the RCIS Area

There are seven CNDDB occurrences within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). These occurrences are concentrated in vernal pools and rangeland on private lands in the northern half of the RCIS Area (Figure E-6). Two of the occurrences are from the 1990s while the remaining occurrences are from 2011 and 2013.

Highly suitable habitat, as modeled by CDFW, is located primarily in the northeast and southwest portions of the RCIS Area (California Department of Fish and Wildlife 2016a) (Figure E-6). Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

California tiger salamander uses aquatic and terrestrial habitats at different stages in its life cycle. Adults emerge from underground burrows to breed, but only for brief periods during the year. Adults migrate during rainy nights between November and April, although migrating adults have been observed as early as October and as late as May (Trenham et al. 2001). Eggs are laid singly or in clumps on submerged and emergent vegetation and on submerged debris in shallow water. In ponds without vegetation, females lay eggs on objects on pond bottoms (U.S. Fish and Wildlife Service 2017a). After breeding, adults leave breeding ponds and return to their refugia (e.g., small mammal burrows). After approximately 2 weeks, salamander eggs begin to hatch into larvae. Once larvae reach a minimum body size they metamorphose into terrestrial juvenile salamanders. The amount of time spent in the larval stage, and the size of individuals at the time of metamorphosis, is dependent on many factors. Larvae in small ponds develop faster, while larvae in larger ponds that retain water for a longer period tend to be larger at the time of metamorphosis. At a minimum, 10 weeks living in ponded water are needed to complete metamorphosis, but in general, development is completed in 3 to 6 months (Petranka 1998, U.S. Fish and Wildlife Service 2017a). If a pond dries prior to metamorphosis, larvae will desiccate and die (U.S. Fish and Wildlife Service 2000). Following metamorphosis, juveniles depart from their natal ponds during the evening, migrating into the upland habitat in search of underground burrows. Peak timing of migration varies based on locality, environmental conditions, and degree of hybridization with nonnative barred tiger salamander. In rare instances, larvae have been reported to overwinter in ponds (U.S. Fish and Wildlife Service 2017a).

Aquatic tiger salamander larvae feed on algae, small crustaceans, and small mosquito larvae for about 6 weeks after hatching (U.S. Fish and Wildlife Service 2000). As they grow larger, larvae feed on zooplankton, amphipods, mollusks, and smaller tadpoles of Pacific tree frogs (*Pseudacris regilla*), California red-legged frogs (*Rana draytonii*), western toads (*Anaxyrus boreas*), and western spadefoot toad (*Spea hammondii*) (Kucera 1997, U.S. Fish and Wildlife Service 2000). Adults eat earthworms, snails, insects, fish, and small mammals (Kucera 1997).

Habitat Requirements

Adults breed and lay eggs primarily in vernal pools and other ephemeral ponds that fill in winter and often dry out by summer (Loredo and Van Vuren 1996); they sometimes use ephemeral and permanent human-made ponds (e.g., stock ponds), reservoirs, and small lakes that do not support predatory fish or bullfrogs (U.S. Fish and Wildlife Service 2017a). Streams in riparian forests or woodlands are rarely used for reproduction, but this species has been reported in ditches with seasonal wetland habitat and in slow-flowing swales and creeks with riparian habitat (Alvarez et al. 2013). Upland habitats surrounding breeding pools are dominated by annual grassland, oak savanna, or oak woodland. Large tracts of upland habitat are necessary for California tiger salamanders to persist (U.S. Fish and Wildlife Service 2017a). Small mammal burrows are also required by California tiger salamander for underground refugia (U.S. Fish and Wildlife Service 2017a).

California tiger salamander is particularly sensitive to the duration of ponding in aquatic breeding sites. Because of its long developmental period, the longest lasting vernal pools or seasonal ponds are the most suitable type of breeding habitat for this species; these pools are also typically the largest in size (Jennings and Hayes 1994). A minimum of 10 weeks is required to complete metamorphosis in ideal conditions (Feaver 1971); however, four to five months is usually required (Shaffer and Trenham 2005). Aquatic sites suitable for breeding should pond or retain water for a minimum of 10 weeks. Optimum breeding sites are ephemeral and dry down for at least 30 days before rains begin again in fall, in order to prevent the establishment of nonnative predators (U.S. Fish and Wildlife Service 2017a). The *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander* (U. S. Fish and Wildlife Service 2017a) recommends that, to remain viable, California tiger salamander populations require at least four ponds on preserves of no less than 3,398 acres, and that the ponds should have variation in depth and ponding duration so that at least some fill during different environmental conditions (e.g., low annual rainfall).

Suitability of habitat is proportional to the abundance of upland refuge sites that are near aquatic breeding sites. This species primarily uses California ground squirrel (*Otospermophilus beecheyi*) burrows as refuge sites (Loredo et al. 1996, Trenham and Shaffer 2005), as well as Botta's pocket gopher (*Thomomys bottae*) burrows (Barry and Shaffer 1994, Thomson et al. 2016) and human-made structures. California tiger salamander also will use logs, piles of lumber, and shrink-swell cracks in the ground for cover (Holland et al. 1990). The presence and abundance of California tiger salamander in many areas is limited by the number of small mammal burrows available. Loredo et al. (1996) emphasized the importance of California ground squirrel burrows as refugia and suggested that a commensal relationship exists between California tiger salamander and California ground squirrel.

The proximity of refuge sites to aquatic breeding sites also affects the suitability of salamander habitat. California tiger salamander travels distances up to 1.54 miles from breeding sites (Searcy and Shaffer 2011) and tends to live between approximately 100 yards and 1.16 miles from breeding sites, with an average migration distance of 0.35 mile (Searcy and Shaffer 2011). Based on capture data from a single-season study at Olcott Lake in Jepson Prairie Preserve in Solano County, Trenham and Shaffer (2005) estimated that 95% of adults and subadults occurred within approximately 0.4 mile of a breeding pond. However, their model also suggested that 85% of subadults were concentrated between 0.1 and 0.4 mile from the pond. Orloff (2011) recorded the majority of captured individuals at least 0.5 mile from the nearest breeding pond at a study site in Contra Costa County, and continuing work at has documented a few individuals moving up to 0.6 mile from a pond (Trenham pers. comm. in Orloff 2011). Therefore, although individuals may migrate up to 1.4 miles from breeding sites, migration distances are likely to be less in areas supporting refugia closer to breeding sites. Habitat complexes that include upland refugia relatively close to breeding sites are considered more suitable because predation risk and physiological stress probably increases with migration distance.

Pressures and Stressors

Habitat loss, degradation, and fragmentation are the primary causes of the decline of the California tiger salamander. Urbanization and habitat conversion to agriculture has eliminated almost all of the valley grassland and oak-savannah habitat from the Central Valley. Most of the remaining suitable habitat occurs in a ring around the Central Valley along the base of the foothills (U.S. Fish and Wildlife Service 2014). Since the time of listing, USFWS considers habitat loss and fragmentation to be a primary threat to California tiger salamander. Most of the current known and potential tiger salamander breeding ponds and surrounding upland occur on privately-owned grazing lands, where grazing is declining in favor of conversion to vineyards, orchards, and urbanization (U.S. Fish and Wildlife Service 2014). Agricultural impacts to tiger salamander habitat result from the discing and deep-ripping of grassland habitat to plant row crops, orchards, and vineyards. These practices have led to direct losses of tiger salamander populations (U.S. Fish and Wildlife Service 2014). Marsh (1994) found that vernal pool grasslands converted to irrigated pasture, and flooded repetitively throughout the summer months, decreased the abundance of ground squirrels and thereby reduced the number of available burrows for tiger salamanders.

Aquatic breeding habitat adjacent to intensive agricultural uses may be affected by changes to hydrology (i.e., seasonal pools becoming perennial), changes in predator and prey assemblages, increases in sediment input, and increases in harmful contaminants. Ground squirrel and gopher eradication programs in upland areas adjacent to agricultural areas reduce the number of small mammal burrows available (U.S. Fish and Wildlife Service 2014). A 1982 to 1986 study in Stanislaus County found a significant decline in California tiger salamander numbers in an area that had been converted from grazing to orchards and vineyards (Morey and Guinn 1992). The study also found an increase in bullfrogs throughout the study area, suggesting changes in aquatic habitat from seasonal wetlands to permanent and semi-permanent wetlands.

Livestock grazing has been shown to be compatible with the continued successful use of rangelands by California tiger salamanders. Grazing management plays an important role in vernal pool habitat management, as grazed vernal pools have longer ponding periods. Additionally, taller grass or grass with significant thatch build up may make adult and metamorph dispersal more difficult for migrating California tiger salamanders (Marty 2005).

Bullfrogs and other introduced predators are significant threats to California tiger salamanders. Bullfrogs are known to prey on adult and larval tiger salamanders and have eliminated some California tiger salamander populations. Bullfrogs and tiger salamanders do not co-occur in the same wetlands (U.S. Fish and Wildlife Service 2014). Hybridized and nonnative tiger salamanders tend to be larger than native California tiger salamander and are also known to prey upon California tiger salamanders. Nonnative tiger salamanders are cannibalistic and appear to have kin recognition. Therefore, nonnative and hybridized tiger salamanders may be more likely to feed on pure California tiger salamanders than on more similarly related hybrid salamanders (U.S. Fish and Wildlife Service 2014).

Introduced mosquito fish (*Gambusia affinis*) have been determined to be a threat to California tiger salamander. Introducing mosquito fish to breeding ponds can eliminate entire populations of California tiger salamanders. Negative effects of mosquito fish tend to be more pronounced in perennial ponds than in seasonal wetlands. California tiger salamander larvae that metamorphose from ponds with mosquito fish were smaller, took longer to reach metamorphosis, and had injuries that result in shortened tails (U.S. Fish and Wildlife Service 2014). Many other nonnative fish such as largemouth bass (*Micropterus salmoides*) and blue gill (*Lepomis macrochirus*) and nonnative crayfish (*Pacifastacus*, *Orconectes*, and *Procambarus* ssp.) have been introduced into suitable California tiger salamander breeding ponds. These nonnative species prey on adult and larval tiger salamanders and are thought to have eliminated some populations of California tiger salamanders (Thomson et al. 2016).

Nonnative barred tiger salamanders hybridize with native California tiger salamanders, reducing the distribution of fully native California tiger salamanders. Barred tiger salamanders (*Ambystoma tigrinum mavortium*) were introduced to California over 50 years ago. The number and range of these nonnative salamanders and their hybrid progeny have expanded since introduction, likely from introduction sites in the Salinas Valley (Fitzpatrick and Shaffer 2007). Hybridization is not known to occur in the San Joaquin Valley. Hybridization is most prevalent in populations along the Central Coast Range and the San Francisco Bay Area (California Tiger Salamander Science Advisory Committee 2017).

Ranavirus is an infectious disease of amphibians, reptiles, and fish caused by viruses from the genus *Ranavirus*. Ranaviruses such as *Ambystoma tigrinum* virus have caused die-offs in other tiger salamanders throughout western North America, though pathogen outbreaks have not been documented in central California tiger salamander populations (U.S. Fish and Wildlife Service 2017a).

Chytrid fungus (*Batachochytrium dendrobatidis*), which causes the disease Chytridiomycosis, is one cause for large, global declines in amphibian populations (Stuart et al. 2004, Wake and Vredenburg 2008). California tiger salamanders infected in the laboratory with chytrid fungus did not die or exhibit clinical signs of disease (Padgett-Flohr 2008). *B. dendrobatidis* has not been found responsible for California tiger salamander mortality in the field and there is no evidence of negative effects on California tiger salamanders (U.S. Fish and Wildlife Service 2017a).

Climate Change Vulnerability Assessment

Because California experiences highly variable annual rainfall events and droughts, California tiger salamander has adapted a life history strategy to deal with these seasonal environmental conditions (U.S. Fish and Wildlife Service 2017a). California tiger salamander breeding success is tied very closely to rainfall amounts and timing, as adults generally migrate to breeding ponds during rainy nights between November and April (Trenham et al. 2001). Drought, and changes in precipitation and temperature, may prevent ponds from filling, or cause ponds to dry out before larvae transform and can emerge from aquatic habitats. Although the longevity of adult California tiger salamander may be sufficient to enable populations to withstand droughts within the historical range of duration and intensity (Barry and Shaffer 1994), it may not be sufficient to withstand extreme droughts that may occur with climate change (U.S. Fish and Wildlife Service 2017a). Climate change could also have implications for increased effects from diseases, altered predator/prey relationships, increased effects from ultraviolet radiation, and serve as an advantage for hybrid tiger salamanders (U.S. Fish and Wildlife Service 2014).

Wright et al. (2013) estimated that the California tiger salamander was at “intermediate risk” from climate change. Modeled under four climate change scenarios, it was estimated that 20 to 80% of current California tiger salamander occurrences would persist through 2050, but that 20 to 99% of modeled habitat would no longer be suitable. Across the four climate change scenarios, the prediction of future habitat suitability is generally low, with suitability increasing with elevation in the Sierra Nevada foothills (Figure 3 in Wright et al [2013]).

ICF

Figure E-5
California Tiger Salamander Range

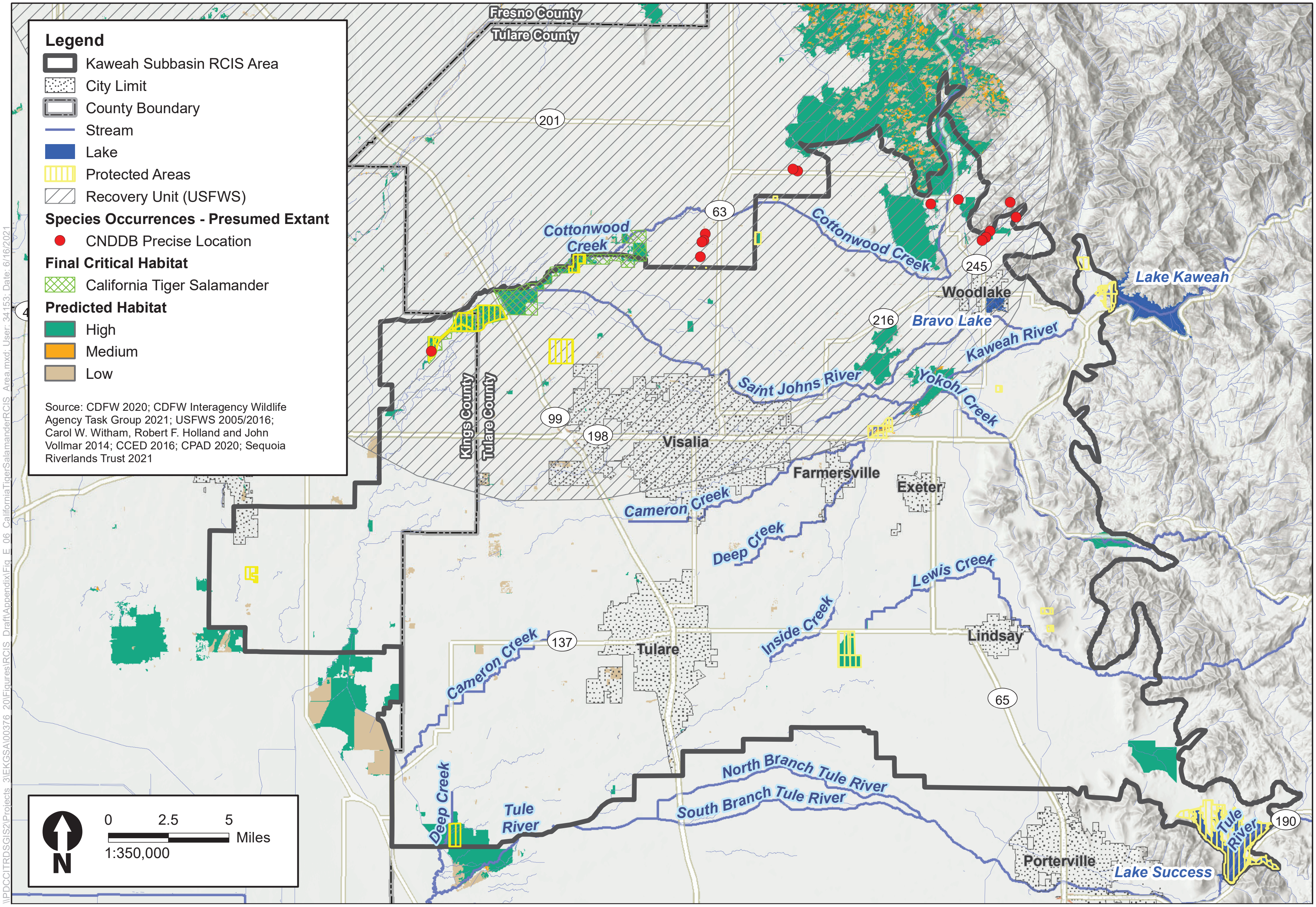

Figure E-6
California Tiger Salamander

Western spadefoot (*Spea hammondii*)

Regulatory Status

- **State:** Species of Special Concern
- **Federal:** Under Review
- **Critical Habitat:** None
- **Recovery Planning:** Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (U.S. Fish and Wildlife Service 2005a)

Distribution

General

In California, the range of western spadefoot includes portions of the Central Valley and bordering foothills from Shasta County south through the Coast Ranges south of Monterey Bay, and across southern California (Thomson et al. 2016) (Figure E-7). The species has experienced severe declines in the Northern California and lower elevation portions of its range (Stebbins 2003).

Within the RCIS Area

Of the 1,409 western spadefoot CNDDB occurrences, 43 (3.1%) are within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). These occurrences are concentrated in the northern edge of the RCIS Area with most occurrences northwest of Visalia and north of Woodlake. There are additional occurrences scattered around the riparian corridor of Yokohl Creek and at the southern edge of the RCIS Area near North Branch Tule River (Figure E-8).

Highly suitable habitat, as modeled by CDFW (2016b), is located primarily in the eastern and southwest portions of the RCIS Area (Figure E-8). Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

Typical of toads, adult western spadefoots forage on a variety of terrestrial arthropods, and other prey, including beetles, moths, flies and earthworms (Morey and Guinn 1992). Western spadefoot tadpole diet has not been studied, although tadpoles of other species of spadefoot are generalists, eating animals, including dead amphibian larvae as well as their own species, plants, and organic detritus (Pfennig 1990).

A terrestrial species, western spadefoots enter water only to breed (Dimmit and Ruibal 1980a). The breeding cycle of western spadefoot is dependent on temperature and rainfall patterns (Thomson et al. 2016) but generally occurs between January and May (Stebbins 2003). Western spadefoot utilizes vernal pools or other temporary pools for breeding (Thomson et al. 2016) but may also breed in slow-moving streams (Stebbins 2003). Western spadefoot requires water temperatures between 48 degrees Fahrenheit [°F] and 86°F (9 degrees Celsius (°C) and 30°C) for breeding to occur (Brown 1967), and egg deposition does not occur until pools begin warming in late winter (Thomson et al. 2016).

Western spadefoot is an explosive breeder, with the number of individuals in a breeding aggregation potentially exceeding 1,000 (Thomson et al. 2016), although aggregations are typically much smaller. Females lay 300–500 eggs in small, irregularly cylindrical clusters, attaching them to plant stems or pieces of detritus (Stebbins 1951). Larvae hatch from eggs approximately 3–4 days after oviposition (Morey 2005). The larval period can last approximately 58 days (Thomson et al. 2016), depending on environmental conditions.

Larvae are frequently at risk of desiccation due to pools drying before larvae can successfully metamorphosize (Thomson et al. 2016). Morey and Reznick 2001 found that individuals that were larger at metamorphosis had higher survivorship. Holland and Goodman (1998) reported that individuals may remain in the vicinity of natal pools for as long as several weeks following metamorphosis, hiding within drying mud cracks or beneath surface objects such as boards or decomposing cow dung (Weintraub 1980).

Adult western spadefoot can consume roughly 11% of their body mass at a single feeding (Dimmitt and Ruibal 1980b) and can probably acquire the resources needed for aestivation in just a few weeks (Thomson et al. 2016). This aestivation period may continue for nine months at a time (Thomson et al. 2016). The skin of western spadefoot is permeable, enabling them to absorb moisture from surrounding soil. The species may also be able to retain urea, increasing their internal osmotic pressure, thereby preventing water loss and facilitating water absorption from soils with relatively high moisture tensions (Ruibal et al. 1969, Shoemaker et al. 1969).

Movement patterns and colonization abilities of adult western spadefoot are not fully understood (Thomson et al 2016). Western spadefoot typically emerges at night during periods of warm rainfall to forage. They move toward breeding sites in late winter to spring, in response to favorable temperatures and rainfall. The breeding season is brief (Stebbins 2003), sometimes lasting no more than 1 to 2 weeks. Following breeding, individuals return to upland habitats, where they spend most of the year aestivating (in a dormant state) in burrows. Western spadefoot may breed in the same ponds as California tiger salamanders, in areas where the two species co-occur (California Department of Fish and Wildlife, California Natural Diversity Database 2021).

Habitat Requirements

Western spadefoot toad requires two different types of habitat in close proximity to complete its life cycle (U.S. Fish and Wildlife Service 2005a): an aquatic habitat for breeding and a terrestrial upland habitat for feeding and aestivation.

Western spadefoot lay their eggs in a variety of permanent and temporary wetlands such as rivers, creeks, pools in intermittent streams, vernal pools, and temporary rain pools, and stock ponds (California Department of Fish and Wildlife, California Natural Diversity Database 2021). Water must be present for more than 3 weeks for toad larvae to undergo complete metamorphosis (Morey 1998, Thomson et al. 2016). Optimal habitat is free of native and nonnative predators such as fish, bullfrogs, and crayfish. The presence of these predators may impair recruitment by western spadefoot (Thomson et al. 2016).

Adult western spadefoot are mostly terrestrial and use upland habitats to feed and as refuge for their long dry-season dormancy. Upland western spadefoot toad habitat includes grasslands, oak woodlands, and chaparral vegetation in washes, floodplains, alluvial fans, and alkali flats, extending into foothills and mountains to an elevation of 4,500 feet (1,365 meters) (Thomson et al. 2016).

Western spadefoot may be active above ground on soil types ranging from loose sand to hardpan clay, although soil characteristics of burrow refugia are not known (Thomson et al. 2016).

During dry periods, individuals typically excavate burrows into the ground at depths up to 3 feet, but they may also occupy burrows constructed by small mammals; whether these are used as short-term refugia during periods of surface activity is unknown (Thomson et al. 2016).

Research is needed to better understand terrestrial habitat use, including juvenile dispersal, adult migration patterns and distances traveled, and the importance of rodent burrows for all age classes (Thomson et al. 2016). Information on terrestrial uses is important to determine how much and what kinds of habitats around breeding sites to focus on for protection.

Pressures and Stressors

The loss of vernal pool or other seasonal pool habitats due to land conversion is likely the greatest threat to western spadefoot. More than 80% of occupied habitat in southern California and more than 30% in northern California has been lost to development or other land uses (Thomson et al. 2016). Fisher and Shaffer 1996 reported that western spadefoot have been nearly extirpated from the Sacramento Valley and populations densities in the eastern San Joaquin Valley have been significantly reduced. Habitat fragmentation and loss due to urban development, conversion of native habitats to agricultural lands, introduction of nonnative predators, and pesticide use are among the causes (Fisher and Shaffer 1996, Hobbs and Mooney 1998, Davidson et al. 2002). The relationship between habitat fragmentation and the metapopulation structure of western spadefoot is not entirely understood (Thomson et al. 2016); however, ongoing land conversion is undoubtedly resulting in smaller, isolated populations.

Western spadefoot suffers from habitat degradation due to discing, intensive livestock grazing, and contaminant runoff (Fisher and Shaffer 1996, Hobbs and Mooney 1998, Davidson et al. 2002). Direct mortality of toads may occur when toads burrow in actively tilled fields or are run over by vehicles when dispersing across roads. Where agricultural activities coincide with the conservation of western spadefoot toad, appropriately grazed pastures will provide better habitat than intensively farmed lands subject to disking, planting, harvesting and other activities that could kill aestivating toads (U.S. Fish and Wildlife Service 2005a).

Natural predators of larval and post-metamorphic western spadefoots include raccoons (*Procyon lotor*), garter snakes (*Thamnophis* spp.), great blue herons (*Ardea alba*), and California tiger salamanders (Childs 1953). The presence of introduced predators in breeding pools, such as mosquitofish (*Gambusia affinis*), crayfish (order Decapoda), and bullfrogs (*Lithobates catesbeiana*) may prevent recruitment (Thomson et al. 2016).

Dimmitt and Ruibal (1980a) reported that low-frequency noises and vibrations can cause aestivating western spadefoot to become active and emerge from their burrows. Potential anthropogenic sources of such low-frequency noises and vibrations include seismic exploration for natural gas, land grading or discing, or other motorized vehicles or machinery. Artificial irrigation can induce toads to emerge and begin vocalizing in any month (Morey 1988). Such artificially induced, aseasonal emergence could result in adverse effects such as mortality or decreased productivity.

Breeding habitats located near roads are especially vulnerable to mortality caused by automobile strikes, which result in the loss of individuals and impedes access to potential movement corridors.

Moreover, the low-frequency noises and vibrations that occur during road construction, and the normal automobile and truck usage that follow, could result in aseasonal emergences of aestivating toads, generating additional adverse effects.

Diseases such as ranavirus and chytridiomycosis may be a contributing threat to western spadefoot, though little is known about the specific effects of disease on western spadefoot populations (Shaffer 2020).

Climate Change Vulnerability Assessment

Because California experiences highly variable annual rainfall events and droughts, western spadefoot has adapted a life history strategy to deal with these seasonal environmental conditions (U.S. Fish and Wildlife Service 2005a). Western spadefoot breeding success is tied closely to rainfall amounts and timing. Drought, and changes in precipitation and temperature, may prevent ponds from filling, or cause ponds to dry out before larvae transform and can emerge from aquatic habitats. Although the longevity of adult western spadefoot may be sufficient to enable populations to withstand droughts within the historical range of duration and intensity, it may not be sufficient to withstand extreme droughts that may occur with climate change (Thomson et al. 2016).

Wright et al. (2013) estimated that western spadefoot was at risk from climate change. Modeled under four climate change scenarios, it was estimated that 60-80% of current western spadefoot occurrences would persist through 2050, but that 0-49% of modeled habitat would no longer be suitable. Across the four climate change scenarios, the prediction of future habitat suitability varied from nearly all of the current habitat in the RCIS Area remaining somewhat suitable, to a large amount of habitat loss, with a patchy distribution of remaining habitat.

Figure E-7
Western Spadefoot Range

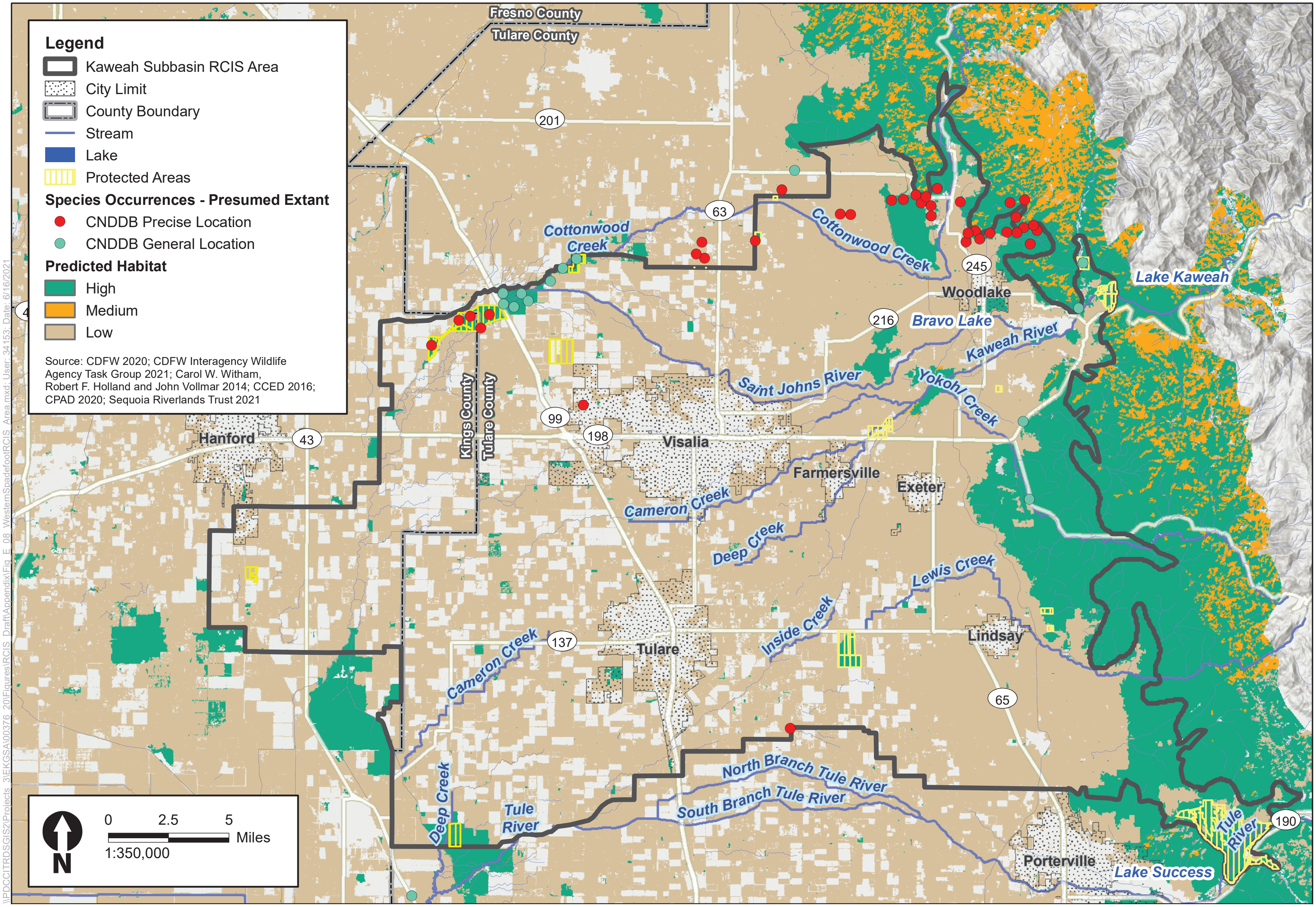

Figure E-8
Western Spadefoot

Blunt-nosed leopard lizard (*Gambelia sila*)

Regulatory Status

- **State:** Endangered, Fully Protected
- **Federal**: Endangered
- **Critical Habitat:** None
- **Recovery Planning:** Recovery Plan for the San Joaquin Valley, California (U.S. Fish and Wildlife Service 1998)

Distribution

General

Blunt-nosed leopard lizards are endemic to the San Joaquin Valley and the Carrizo Plain in California. Historically, this species was found from Stanislaus County in the north to the Tehachapi Mountains in Kern County in the south. The lower foothills of the Sierra Nevada and Coast Ranges roughly define the eastern and western boundaries of its distribution, except for populations on the Carrizo Plain, the Cuyama Valley, and Panoche Valley west of the San Joaquin Valley (Figure E-9). Blunt-nosed leopard lizard occurs at elevations below 2,600 feet (U.S. Fish and Wildlife Service 2020a). The current distribution of blunt-nosed leopard lizard is highly fragmented, and it is restricted to scattered parcels of undeveloped land on less than 15% of its historical range (Germano and Williams 1992a, U.S. Fish and Wildlife Service 2020a).

Within the RCIS Area

There are no blunt-nosed leopard lizard CNDDB occurrences within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). The closest population is about 12 miles south of the RCIS Area on the Pixley National Wildlife Refuge (NWR) (U.S. Fish and Wildlife Service 2020a).

Moderately suitable habitat, as modeled by CDFW is located primarily in the southwest portion of the RCIS Area and just south and west of the RCIS Area (Figure E-10) (California Department of Fish and Wildlife 2016c). There is no highly suitable habitat modeled in the RCIS Area. Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

Blunt-nosed leopard lizard feeds primarily on insects (including grasshoppers, moths, and crickets) and other lizards (including side-blotched lizards [*Uta stansburiana*], California whiptails [*Aspidoscelis tigris munda*], and western fence lizards [*Sceloporus occidentalis*]) (Germano and Williams 2005). They are opportunistic feeders and will consume anything they can catch. Adults are also known to cannibalize young (U.S. Fish and Wildlife Service 1998). Because of similar size and diet between blunt-nosed leopard lizards and California whiptail, interspecific competition probably occurs when the two species are sympatric (U.S. Fish and Wildlife Service 1998).

Blunt-nosed leopard lizard is potential prey for gopher snakes (*Pituophis catenifer*), loggerhead shrikes (*Lanius ludovicianus*), American kestrels (*Falco sparverius*) and other raptors, American badgers (*Taxidea taxis*), coyotes (*Canis latrans*), and San Joaquin kit foxes (*Vulpes mactrotis mutica*) (U.S. Fish and Wildlife Service 1998, Germano 2018).

Adult males are significantly larger than adult females (upper decile snout to vent length is approximately 116 millimeters for males and about 113 millimeters for females), and males are territorial (Germano 2019). The reproductive season of blunt-nosed leopard lizard generally begins within a month after emergence from dormancy, usually from the end of April continuing through the beginning of June and occasionally to the end of June. During this time, adults pair and frequently occupy the same burrow. Males aggressively defend territories using a repertoire of distinct behavioral displays and active aggression against intruders. Blunt-nosed leopard lizard communicates primarily through visual displays, including seasonal and permanent body coloration and ritualistic head and body movements (U.S. Fish and Wildlife Service 1998).

Female blunt-nosed leopard lizard lay two to six eggs from late April to the middle of July (Germano and Williams 1992b), the number of eggs being positively correlated with the size of the female. During adverse conditions, reproduction may be delayed up to 2 months or even forgone for a season. Incubation lasts about 2 months, and young hatch from early July through early August. Sexual maturity occurs by 9–21 months. Females are able to breed after their second year of hibernation (U.S. Fish and Wildlife Service 1998).

Male home ranges overlap and are significantly larger than those of females, averaging 15.4–18.8 acres (6.2–7.6 hectares) compared with 7.0–7.8 acres (2.85–3.17 hectares) for females (Germano and Rathbun 2016). Environmental factors such as drought can affect lizard density, which can vary over time. Population density at Pixley NWR ranges from 0.7–26.7 lizards per acre (0.3–10.8 lizards per hectare), while at the Elkhorn Plain, from 1989 to 1994, the population density ranged from 12.1–49.9 adults per acre (4.9–20.2 adults per hectare) (U.S. Fish and Wildlife Service 2010a).

The seasonal and daily aboveground activity of blunt-nosed leopard lizards is strongly correlated with temperature. Lizards are aboveground predominately after 0800 (Germano 2019). Optimal activity occurs when air temperatures are between 74 and 104°F and ground temperatures are between 72 and 97°F (U.S. Fish and Wildlife Service 2010a). At higher temperatures, lizards are generally in the shade of bushes (Germano 2019).

Habitat Requirements

Blunt-nosed leopard lizard is found in large areas of contiguous habitat (Bailey and Germano 2015) comprised of sparsely vegetated grasslands, valley sink scrub, and saltbush scrub habitats, canyon floors, and large washes. They inhabit areas with friable, sandy soils and scattered vegetation, and are usually absent from thickly vegetated habitats. Typical suitable habitats on the San Joaquin Valley floor include nonnative grassland and valley sink scrub habitats (Germano et al. 2001). The soils there are usually saline and alkaline playa clays with a white salty crust and are occasionally covered by introduced annual grasses. Non-friable clay soils are generally not suitable. Blunt-nosed leopard lizard is known to occur in areas with light development and the species will recolonize areas that have been abandoned. However, population densities decrease as the density of development increases (U.S. Fish and Wildlife Service 1998).

Blunt-nosed leopard lizard is often found in habitats with scattered shrubs. Shrubs are an important component for thermal regulation, for escape cover, and for perching. Blunt-nosed leopard lizard also uses small rodent burrows for shelter, predator avoidance, and behavioral thermoregulation. These burrows may be either abandoned ground squirrel tunnels or occupied or abandoned kangaroo rat (*Dipodomys* spp.) tunnels (U.S. Fish and Wildlife Service 2020a). Blunt-nosed leopard lizard avoids predation primarily by quick escape movements or by seeking refuge in small rodent burrows in their territory or under shrubs and rocks (U.S. Fish and Wildlife Service 2020a). Blunt-nosed leopard lizard will occupy habitats without shrubs if small mammal burrows (especially kangaroo rats) are abundant (Saslaw, pers. comm.).

Patch size is an important predictor of blunt-nosed leopard lizard occupancy (Bailey and Germano 2015). Blunt-nosed leopard lizard were not found in habitat patches smaller than 588 acres in a survey of 13 isolated patches of potential habitat ranging from 47 to 10,910 acres in size (Bailey and Germano 2015). Patch occupancy was positively correlated with patch size, and habitat patches greater than 1,236 acres have a 90.7% chance of being occupied by blunt-nosed leopard lizard. Based on these findings, USFWS defines a high quality habitat patch as having at least 1,236 acres of contiguous suitable habitat; moderate quality habitat patches as patches with at least 588 acres of suitable habitat; and low quality habitat patches as patches smaller than 588 acres (U.S. Fish and Wildlife Service 2020a).

Pressures and Stressors

The current distribution of blunt-nosed leopard lizard reflects a climatic niche contraction and range contraction from its historical distribution and range, corresponding with dense invasive vegetation (Stewart et al. 2019, U.S. Fish and Wildlife Service 2020a, 2020b). Habitat loss, fragmentation, and degradation of remaining habitat continue to threaten this species. Urban development, cultivation, inappropriate levels of grazing, habitat modification for petroleum and mineral extraction, pesticide application, construction for transportation, communication, and irrigation infrastructure, above- or below-average precipitation, and climate all have resulted in pervasive habitat loss throughout the San Joaquin Valley and present ongoing threats to the survival of blunt-nosed leopard lizard (U.S. Fish and Wildlife Service 2020a, 2020b).

Invasion of nonnative grasses has been a significant contributor to the decline of blunt-nosed leopard lizard in shrubland habitats. Heavy growth of nonnative grasses tends to depress populations of blunt-nosed leopard lizard (Riensche 2008, Stewart et al. 2019), and habitat with greater than 50% ground cover is unsuitable for blunt-nosed leopard lizard. Light or moderate grazing may be beneficial for blunt-nosed leopard lizard. In areas with greater nonnative grass biomass, more intensive livestock grazing to reduce nonnative grass biomass in the late spring/early summer may provide more open habitats which are suitable for blunt-nosed leopard lizard (U.S. Fish and Wildlife Service 1998, Germano et al. 2001). Nonnative grasses contribute to a feedback cycle between grass thatch buildup and the size, intensity, and frequency of fire (Brooks et al. 2004). Wildfires have likely contributed to the habitat domination by nonnative grasses in some areas. At the northern range limit of blunt-nosed leopard lizard, dense exotic vegetation corresponds with climatic niche contraction and associated range contraction. Due to blunt-nosed leopard lizard's low population abundance and limited occupancy of fragmented habitat patches, large-scale fires have the potential to be detrimental to blunt-nosed leopard lizard populations (U.S. Fish and Wildlife Service 2020a).

Solar power development projects pose potential threats to blunt-nosed leopard lizard and may impact large areas of habitat. These projects can destroy, fragment, or impact blunt-nosed leopard lizard habitat by altering landscape topography, vegetation, and drainage patterns; increasing vehicle-strike mortality; and reducing habitat quality through interception of solar energy normally reaching the ground surface, affecting ambient air temperatures through habitat shading, and altering soil moisture regimes (U.S. Fish and Wildlife Service 2010a, 2020a).

In recent years, however, there has been a shift from large-scale solar projects in undeveloped habitats toward smaller solar projects on lands that provide lower conservation value for blunt-nosed leopard lizard (U.S. Fish and Wildlife Service 2020a). Though solar development does involve short-term land disturbance, responsibly developed solar plants can provide a stable land use that can support biodiversity. Post-construction surveys at the 550-megawatt (MW) Topaz Solar Farm in San Luis Obispo County found similar to higher vegetation production compared to pre-project conditions, and the presence of dozens of wildlife species utilizing the solar farm. Best practices in responsible land use as well as future solar project development innovations that reduce ground disturbance can help to minimize adverse effects of solar farm developments and enhance habitat suitability for wildlife species while improving landscape connectivity (Sinha et al. 2018, Phillips and Cypher 2015, 2019, U.S. Fish and Wildlife Service 2020a).

Climate Change Vulnerability Assessment

The Central Valley Landscape Conservation Assessment (California Landscape Conservation Cooperative 2017) found that blunt-nosed leopard lizard has a moderate-high vulnerability to climatic change. The score is a result of the species having a moderate-high sensitivity, high future exposure, and low capacity to adapt.

Climate models predict an overall warming for California of 3–10.4°F by 2100 (Cayan et al. 2006) but vary in their predictions for precipitation. VanRheenen et al. (2004) predicts a decrease in precipitation in the southern San Joaquin Valley. Changes in precipitation, air temperature, and drought can affect blunt-nosed leopard lizard habitat quality, foraging opportunities, and vulnerability to invasive plants (U.S. Fish and Wildlife Service 2010a, 2020a). However, Stewart et al. (2019) predict habitat to remain suitable through mid to late century (2050s and 2080s) under a drought scenario within the RCIS Area and across much of the lizard's historic range in the San Joaquin Valley.

The frequency and severity of drought conditions in the Central Valley is expected to increase due to climatic changes over the next century. More frequent and severe drought conditions are likely to impact blunt-nosed leopard lizard survival, growth, and recruitment. During a drought year in 1990, it was observed that adult blunt-nosed leopard lizards did not emerge from their burrows the entire year, aboveground activity for yearling lizards was shorter than average, and yearlings did not breed (Germano et al. 1994). Climate change may result in an increase in wildfire frequency and intensity, which could convert scrubland habitat to less suitable grassland habitat dominated by nonnative species (Germano and Rathbun 2016, Germano 2019). Though drought conditions could have negative effects on blunt-nosed leopard lizard, some contend that climate change could benefit blunt-nosed leopard lizard by potentially increasing suitable habitat over present climate conditions (Stewart et al. 2019). Additionally, drought conditions could increase the amount of farmland retired due to reduced water availability and increased evaporation. The prospect of restoring land that is no longer cost-effective for agriculture may represent an efficient means of habitat conservation, thus benefiting species such as blunt-nosed leopard lizard.

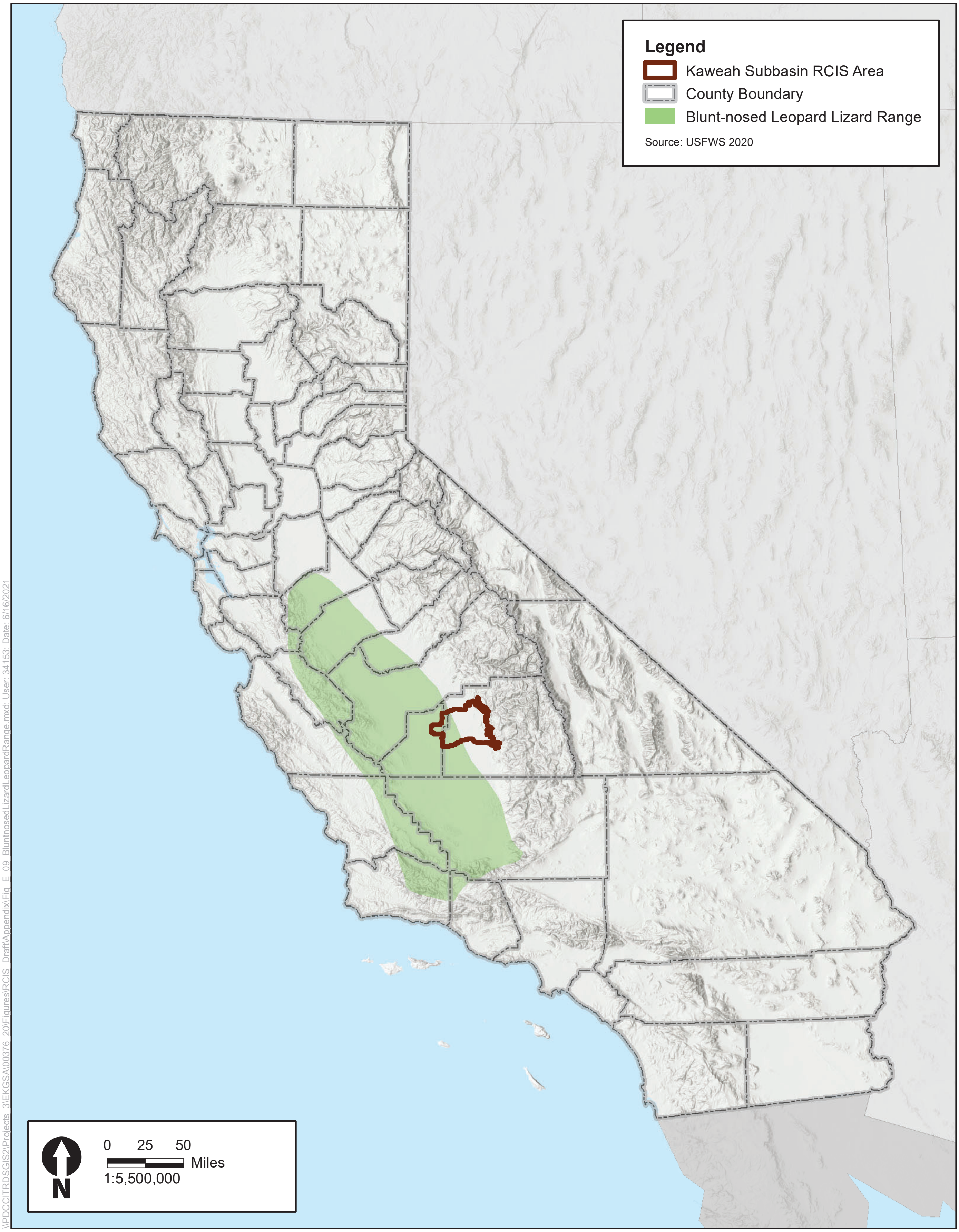

Figure E-9
Blunt-nosed Leopard Lizard Range

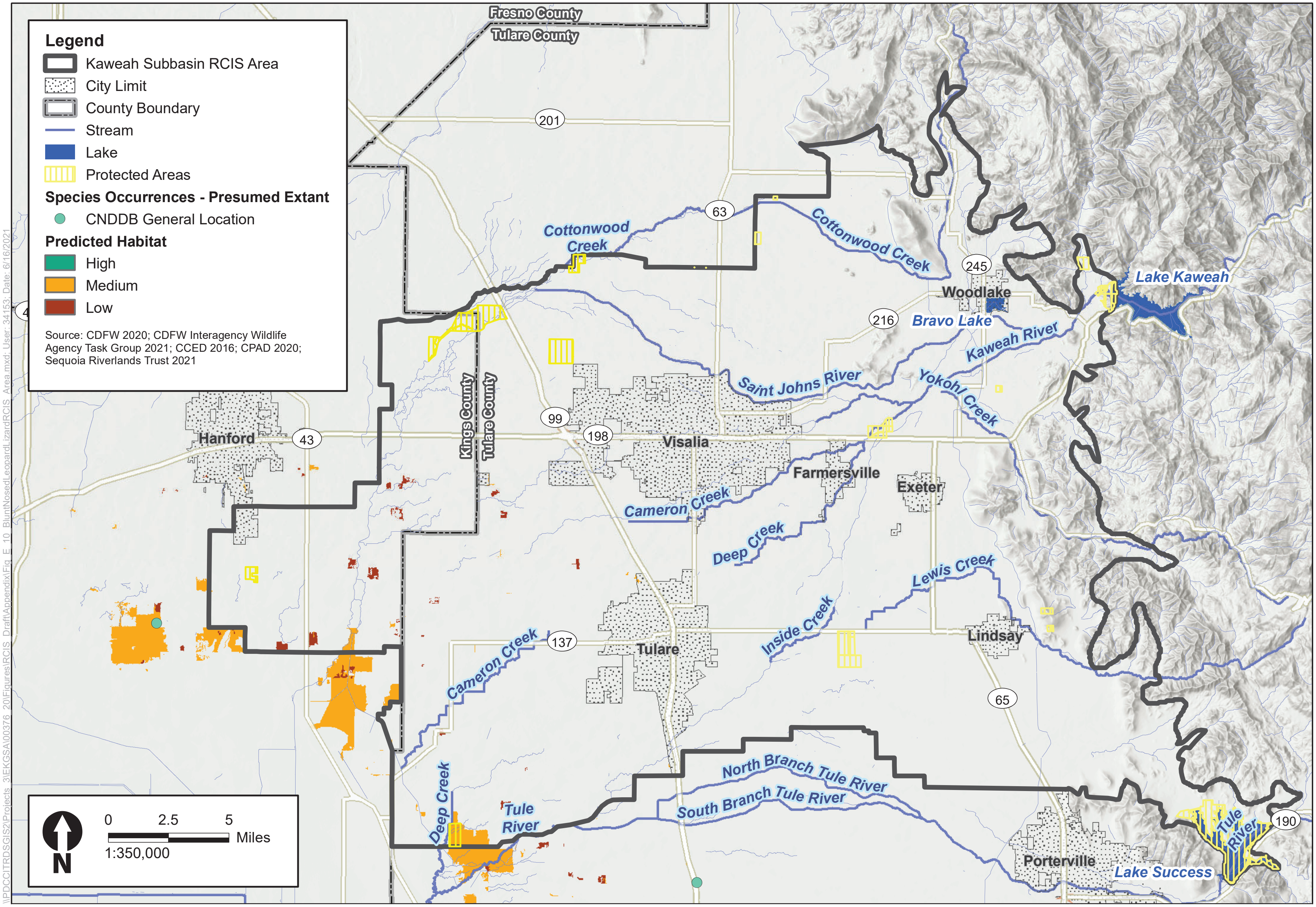

Figure E-10
Blunt-nosed Leopard Lizard

Swainson's hawk (*Buteo swainsoni)*

Regulatory Status

- **State:** Threatened
- **Federal:** None
- **Critical Habitat:** None
- **Recovery Planning:** None

Distribution

General

Swainson's hawk breeds in North America and overwinters primarily in isolated areas of California, Mexico, Central America, and South America (Woodbridge 1998, Bechard et al. 2020, Kochert et al. 2011, Battistone et al. 2019). Although not common, Swainson's hawk has been reported overwintering in suitable habitat in the Central Valley and in the Sacramento–San Joaquin River Delta (Erickson et al. 1990, Yee et al. 1991, Herzog 1996).

In California, Swainson's hawk is an uncommon resident and migrant during the breeding season in the Central Valley and Great Basin bioregions (Woodbridge 1998). The largest population of breeding Swainson's hawk in California is located in the middle of the Central Valley between Sacramento and Modesto, and in the northern San Joaquin Valley (California Department of Fish and Wildlife 2016d, Battistone et al. 2019).

Within the RCIS Area

There are 44 CNDDB occurrences within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). These occurrences are concentrated in agricultural lands in the western half of the RCIS Area with most occurrences west of Highway 99 and southwest of Tulare (Figure E-12). Other occurrences are scattered around the riparian corridor of Inside Creek, Cottonwood Creek, and Cameron Creek. All occurrences are recent (1990 and later) and most of the occurrences are on private land. There are considerably more citizen sightings documented on eBird (eBird 2021). The sightings on eBird may include multiple records of the same individual, individuals flying high overhead (and not necessarily associated with the area or habitat where the sighting was documented, particularly if the individual is migrating or dispersing) and often do not include breeding status. eBird sightings are not included on Figure E-12.

Highly suitable habitat, as modeled by CDFW is distributed throughout the RCIS Area in agricultural and natural community habitats (Figure E-12). Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover (California Department of Fish and Wildlife 2016e).

Natural History

Swainson's hawk arrive on their breeding grounds in late February and early March in the Central Valley, and in mid-April in the Great Basin. Swainson's hawk exhibits a high degree of nest site fidelity, using the same nests, nest trees, or nesting stands for many years (Bechard et al. 2020). Pairs are monogamous and may maintain bonds for many years (Bechard et al. 2020). Immediately upon arrival in breeding territories, breeding pairs begin constructing new nests or repairing old ones. One to four eggs are laid in mid- to late April, followed by a 30- to 34-day incubation period. Nestlings begin to hatch by mid-May followed by an approximately 20-day brooding period. Young remain in the nest until they fledge at 38 to 42 days after hatching (Bechard et al. 2020). By late August–October, most Swainson's hawk migrate to the pampas of southern South America (Bechard et al. 2020).

Habitat Requirements

Breeding

Swainson's hawk habitat generally consists of large, flat, open, undeveloped landscapes that include suitable grassland or agricultural foraging habitat and sparsely distributed trees for nesting (Bechard et al. 2020). Swainson's hawk usually nests in large, native trees such as valley oaks (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), and willows (*Salix* spp.), although nonnative trees such as eucalyptus (*Eucalyptus* spp.) are also used (Bechard et al. 2020). Swainson's hawk may nest in riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, trees in windbreaks, and on the edges of remnant oak woodlands (Bechard et al. 2020). If food resources are locally abundant, nesting areas may be within easy flying distance to foraging habitat such as alfalfa or hay fields (Sernka 1999). When food resources are limited, Swainson's hawk routinely forages across large landscapes to meet their energetic demands (Estep 1989, England et al. 1995).

Home ranges are highly variable depending on cover type, and fluctuate seasonally and annually with changes in vegetation structure (e.g., growth, harvest) (Estep 1989, Woodbridge 1991, Babcock 1995). Smaller home ranges consist of high percentages of alfalfa, fallow fields, and dry pastures (Estep 1989, Woodbridge 1991, Babcock 1995). Larger home ranges are generally associated with higher proportions of cover types with reduced prey abundance or accessibility, such as orchards and vineyards.

Foraging

Historically, Swainson's hawk foraged in grass-dominated, relatively sparse shrublands, and desert habitats throughout most of lowland California. Over the past century, conversion of much of the historical range to agricultural use has shifted the nesting distribution into open agricultural areas that mimic grassland habitats or otherwise provide suitable foraging habitat. Agricultural uses that provide suitable foraging habitat include a mixture of alfalfa and other hay crops, grain, row crops, and lightly grazed pasture with low-lying vegetation that support adequate rodent prey populations (Estep 1989, Bechard et al. 2020, Estep and Dinsdale 2012). Battistone et al. (2019), found a positive association of Swainson's hawk breeding pair density with crop diversity, native vegetation, and alfalfa crops. Alfalfa fields are particularly important for Swainson's hawk in California, with Swainson's hawk regularly foraging in alfalfa more than other crop types (Estep 1989, Anderson et al. 2011). Alfalfa crops comprise a modest part of the agricultural landscape in the RCIS Area with about 29,858 acres grown (8.4% of total agricultural crops) (California Department of Water Resources 2019).

Swainson's hawk regularly forages across a large landscape compared with most raptor species. Data from Estep (1989) and England et al. (1995) indicate that it remains energetically feasible for Swainson's hawk to successfully reproduce when food resources are limited around the nest and large foraging ranges are required. Radio-telemetry studies indicate that breeding adults in the Central Valley routinely forage as far as 18.7 miles from the nest (Estep 1989, Babcock 1995). Swainson's hawk hunts primarily from the wing, searching for prey from a low-altitude soaring flight, 98 to 295 feet above the ground, and attacks prey by stooping toward the ground (Estep 1989). Swainson's hawk also hunts from perches such as tree limbs, poles or posts, rocks, and elevated grounds; follow farm equipment to prey on rodents disturbed by farming activities; and perch on the ground near ground squirrel and pocket gopher mounds to pounce on rodents as they emerge (Bechard et al. 2020). During late summer, the diet of post-breeding adults and juveniles includes an increasing volume of insects, including grasshoppers and dragonflies (Bechard et al. 2020). Grasshoppers (*Dischroplus* spp.), dragonflies (*Aeshna bonariensi*), butterflies and moths (Lepidoptera), and leaf beetles (Coleoptera: Chrysomelidae) may constitute a major proportion of the diet of post-breeding and migrant birds (Bechard et al. 2020) Following their arrival on breeding grounds, Swainson's hawk shift their diet to include larger prey such as small rodents, rabbits, birds, and reptiles (Bechard et al. 2020). In central California, California vole (*Microtus californicus*) are a frequent part of the Swainson's hawk diet (Woodbridge 1998, Estep 1989). This shift to a higher quality diet is prompted by nestlings' nutritional demands during rapid growth and the adults' high energetic costs of breeding.

Pressures and Stressors

Primary pressures facing Swainson's hawk in the RCIS Area are loss of preferred nesting habitat in mature riparian forests, and loss or modification of high-quality foraging habitat to growth and urban development for housing and urban areas, and farming practices that lead to conversion to incompatible crop types (e.g., orchards). Swainson's hawk habitat occupancy in the Central Valley is strongly influenced by the pattern of land ownership in the areas supporting most of the remaining population. Over 95% of the known nest sites are on private lands and are vulnerable to changes in the agricultural environment and urban development (Estep 1989). For example, the loss of shelterbelts and tree plantings near farm sites has been shown to harm Swainson's hawk through the loss of nest sites (Olendorff and Stoddart 1974, Inselman et al. 2015). The loss of high-quality foraging habitat (e.g., perennial grasslands, alfalfa fields) to development or conversion to high-intensity crops (e.g., orchards, vineyards) adjacent to riparian forests or other patches of suitable nesting trees can also reduce or eliminate Swainson's hawk habitat. Briggs et al. (2011) found that individual Swainson's hawk have higher survival and fitness in areas with high proportions of irrigated agriculture that provides high prey densities, particularly alfalfa.

Conversion of agricultural habitats to urban or other forms of development and land idling are primary factors in the loss of Swainson's hawk habitat. Continued habitat conversion of compatible agriculture to urban development will likely continue to reduce the species' range, distribution, and abundance (California Department of Fish and Wildlife 2016d). The distribution of crops in the Central Valley, in part, dictates the distribution and abundance of Swainson's hawk; the conversion of undeveloped lands to vineyards and orchards results in low value foraging habitat for the species and continued conversion has the potential to negatively impact Swainson's hawk breeding and foraging habitat (California Department of Fish and Wildlife 2016d).

Although Swainson's hawk is not an obligate riparian species, the availability of nesting habitat is strongly tied to the distribution of riparian forest or riparian trees in the Central Valley portion of the species' range in California (Bloom 1980, Estep 1989). Loss or degradation to agriculture and urban development of remnant riparian forest within areas of highly suitable foraging habitat would reduce and fragment remaining Swainson's hawk breeding habitat. This is a concern in the San Joaquin Valley where suitable nest trees are lower in abundance (California Department of Fish and Wildlife 2016d). Additionally, loss of lone roadside trees and trees along levees also affects breeding hawks as many of these trees are located near suitable foraging habitat and are often used by Swainson's hawk (California Department of Fish and Wildlife 2016d).

Other potential pressures on Swainson's hawk in the RCIS Area include development of solar projects. Solar fields can make undeveloped natural areas unsuitable through the loss of nesting or foraging habitat (Friends of the Swainson's Hawk 2009).

Pesticide use in agricultural practices has resulted in high mortality of Swainson's hawk (Woodbridge 1998). Significant effects of pesticide use on Swainson's hawk wintering in the pampas of Argentina were reported by Woodbridge et al. (1995) and Goldstein et al. (1996). Direct mortality of large numbers of hawks was attributed to poisoning by the organophosphate insecticides monocrotophos and dimethoate used to control grasshopper outbreaks in sunflower, corn, and alfalfa fields (Woodbridge et al. 1995, Goldstein et al. 1996). Application of anticoagulant rodenticide is also a threat to raptors from ingestion of poisoned prey. Pesticide use throughout the Swainson's hawk range, specifically targeting ground squirrels, may negatively stress the species and cause secondary poisoning (California Department of Fish and Wildlife 2016d).

Nonnative plants and animals also exhibit pressures on Swainson's hawk in the RCIS Area, although to a lesser degree than loss of habitat due to development. The primary effect of exotic species on Swainson's hawk is reduction in prey availability in habitats dominated by weedy exotic plant species. In northeastern California, weedy ruderal fields and cheatgrass-dominated grazing lands support low prey populations and received little use by foraging Swainson's hawk (Woodbridge 1991); similar patterns were reported by Estep (1989) in the Central Valley. Invasion by Russian thistle (*Salsola tragus*), cheatgrass (*Bromus tectorum*) and tumble-mustard (*Symbrissum* sp.) also result in increased fire potential, further reducing cover of less fire-resistant native perennial grasses and shrubs.

Climate Change Vulnerability Analysis

Gardali et al.'s (2012) Climate Variability Assessment ranked the climate vulnerability of 358 California bird species. Those rankings were based on both the exposure and sensitivity that a species experiences to climate change, based on the current understanding of their life history. Exposure to climate change was based on expected changes in habitat suitability, changes in food availability, and exposure to extreme weather. Sensitivity to climate change was based on a species' habitat specialization, physiological tolerance, migratory status, and dispersal ability. Analyses were only conducted on the portion of a species' life history spent in California. Each species was given Climate Vulnerability Scores, which ranged from 12 to 72, with a median score of 24. All species with a score of 30 or higher (128 species) were considered prioritized taxa and given a ranking of low, moderate, or high vulnerability to climate change.

Swainson's hawk was given a score of 42 and moderate climate priority in the Climate Vulnerability Assessment (Gardali et al. 2012) and was therefore considered a priority with respect to climate vulnerability (Table E-1). Swainson's hawk is vulnerable to the effects of climate change due to an expected loss of nesting habitat in the Central Valley, loss of foraging habitat to urban development and to conversion to unsuitable agricultural practices, and a potential increase in exposure to extreme weather events because it is a long-distance migrant.

Table E-1. Climate Vulnerability Scoring for Swainson's Hawk as Described in Gardali et al. (2012)[1]

Criteria	Score[2, 3]
Exposure	
Habitat suitability	3—high; habitat suitability is expected to decrease by >50%
Food availability	1—low; food availability for taxon would be unchanged or increase
Extreme weather	2—moderate; taxon is expected to be exposed to some increase in extreme weather events
Sensitivity	
Habitat specialization	2—moderate; taxon that tolerates some variability in habitat type or element
Physiological tolerance	1—low; minimal or no evidence of physiological sensitivity to climatic conditions
Migratory status	3—high; long-distance migrants (migrates at least to the neotropics)
Dispersal ability	1—low; taxon with high dispersal ability

[1] Additional information about species scoring, including the database of scores is located here: http://data.prbo.org/apps/bssc/index.php?page=climate-change-vulnerability
[2] Scores range from 1 – 3; generally low, medium, and high
[3] Climate vulnerability score = Sum of exposure score x Sum of sensitivity score

The Audubon Society's climate model (National Audubon Society 2013) used to predict future habitat distributions affected by climate change, predicts that the probability of Swainson's hawk distribution will generally decline throughout the RCIS Area and shift outside of the RCIS Area as it becomes more unsuitable. The model projects a 77% loss of current summer breeding range by 2080, contracting across the western United States. Similarly, Point Blue Conservation Science's mapping tool to predict current (1971–2000) and projected (2038–2069/2070) bird species distribution projects a large-scale statewide decline in Swainson's hawk distribution. The probability of occurrence of Swainson's hawk in the RCIS Area by 2070 is projected to be low (0–20%) (Point Blue Conservation Science n.d.).

Changing climate adds unpredictability to existing suitable breeding and foraging habitat and may stress Swainson's hawk populations. Annual variation in climate may have a dramatic effect on territory occupancy and reproductive success of Swainson's hawk (Woodbridge 1998). Direct effects caused by increased severity of spring rains and windstorms include mortality of eggs and nestlings, and destruction of occupied nests (Bechard et al. 2020). In addition, limited availability of water during the summer may result in significant shifts of agricultural crops from high water utilization crops such as alfalfa (a high-quality foraging crop), to lower water utilization crops, such as safflower, which could result in low-quality foraging habitat (Friends of the Swainson's Hawk 2009). Widespread indirect effects are caused by climate's effects on prey abundance. For example, in northeastern California, abundance of montane voles, a primary prey species, is strongly linked to winter precipitation and snow depth. Likewise, abundance of grasshoppers is negatively affected by heavy spring rains (Woodbridge 1991).

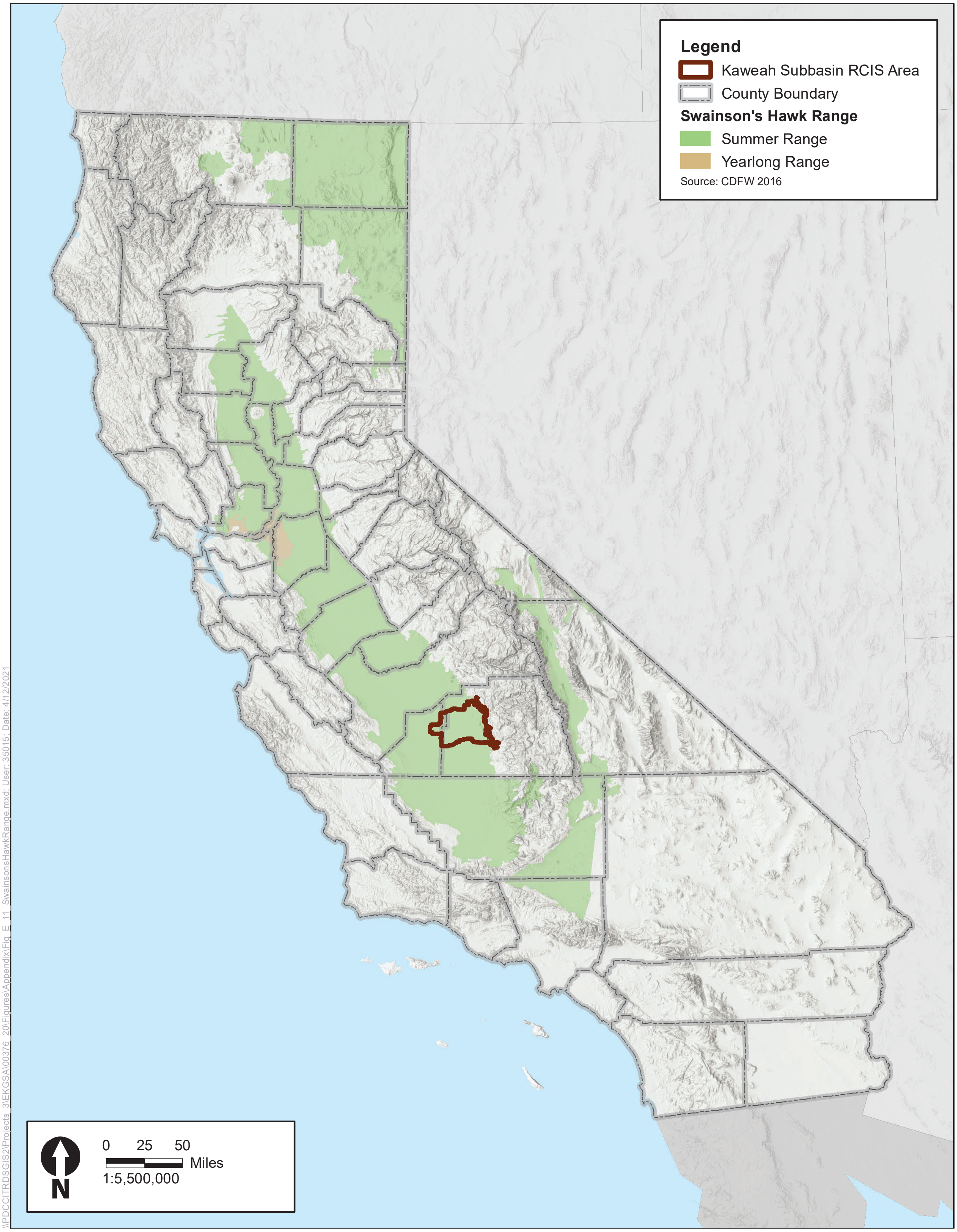

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Figure E-11
Swainson's Hawk Range

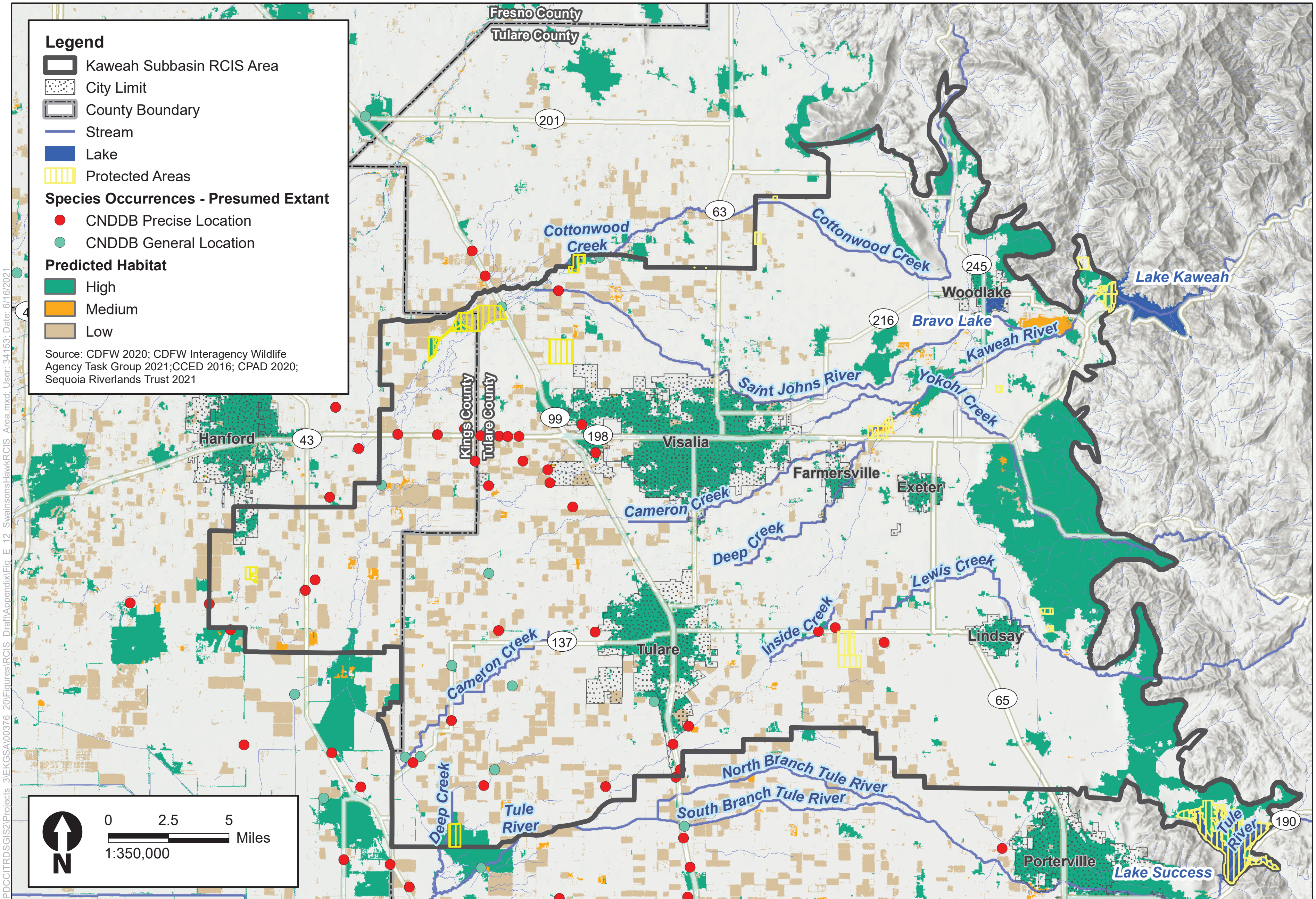

Figure E-12
Swainson's Hawk

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Burrowing owl (*Athene cunicularia*)

Regulatory Status

- **State:** Species of Special Concern
- **Federal:** None
- **Critical Habitat:** None
- **Recovery Planning:** None

Distribution

General

Burrowing owl is found west of the Mississippi River throughout non-mountainous areas of western North America, from the Great Plains grasslands in southern portions of the western Canadian provinces, south through the United States into Mexico (Poulin et al. 2020). In California, burrowing owl range extends throughout lowlands from the northern Central Valley to Mexico, with a small (potentially extirpated) population in the Great Basin bioregion in northeast California (Cull and Hall 2007) and the desert regions of southeast California (Gervais et al. 2008). This species is absent from the coast north of Sonoma County and from high mountain areas such as the Sierra Nevada and the Transverse Ranges extending east from Santa Barbara County to San Bernardino County. Burrowing owl is found at elevations as high as 5,300 feet in Lassen County and on larger offshore islands (Polite 1988) (Figure E-13).

Within the RCIS Area

There are six CNDDB occurrences within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). All the occurrences are recent (1990 and later) and all but one occurrence is on private land. The most recent occurrence is from 2017 between Cross Creek and Settlers Ditch, northwest of Visalia. Most of these occurrences are near Cross Creek; an occurrence is southeast of Sequoia Field on CDFW-managed land and another occurrence on private land has been reported approximately 10 miles west, southwest of Tulare (Figure E-14). There are considerably more citizen sightings documented on eBird (eBird 2021). The sightings on eBird may include multiple records of the same individual and often do not include breeding status or are of overwintering birds. eBird sightings are not included on Figure E-14. Highly suitable habitat, as modeled by CDFW is distributed throughout the RCIS Area in agricultural and natural community habitats (Figure E-14) (California Department of Fish and Wildlife 2016f). Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

California supports year-round resident burrowing owls and overwintering migrants (Gervais et al. 2008). Burrowing owls are active yearlong and hunt during the day or night, frequently perching at burrow entrances. Burrowing owls in California typically begin pair formation and courtship in February or early March, when adult males attempt to attract a mate. Like other owls, burrowing owls breed once per year in an extended reproductive period, during which most adults mate monogamously. Both sexes reach sexual maturity at 1 year of age. Clutch sizes vary, and the number of eggs laid is proportionate to prey abundance (the more prey that is available, the more eggs owls tend to lay). Clutches in museum collections in the western United States contain from one to 11 eggs (Murray 1976). The incubation period is 28–30 days. The female performs all incubation and brooding and is believed to remain continually in the burrow while the male does all the hunting. Young begin emerging from the nest burrow when about 2 weeks old, and they remain closely associated with their nest burrow or nearby satellite burrows for several weeks (Thomsen 1971). Young fledge at 44 days but remain near the burrow and join the adults in foraging flights at dusk (Rosenberg et al. 2009).

In California, adults have been observed dispersing post breeding approximately 33 miles from breeding sites; juveniles have been observed dispersing (natal dispersal) roughly 93 miles (Gervais et al. 2008), although individuals vary in their movement patterns. While part of this variation may be attributed to environmental variation, Catlin and Rosenberg (2014) hypothesized that sex, fledging date, and sibling relationships can also be important after studying post-fledging movements of 34 juvenile owls in the Imperial Valley between June 2002 and April 2003. Long-distance dispersal may account for observed low genetic differentiation among resident burrowing owl populations in California, suggesting that the patchy and discontinuous nature of burrowing owl habitat does not, by itself, isolate subpopulations (Korfanta et al. 2005).

Dispersal and migration in burrowing owls that nest in California is variable depending on location and the age of the owls. Many burrowing owls remain resident throughout the year in their breeding locales (especially in central and southern California) while some apparently migrate or disperse in the fall (Coulombe 1971, Harman and Barclay 2007, Poulin et al. 2020).

Burrowing owls are generalist foragers and consume any terrestrial vertebrate or invertebrate they can physically capture; although invertebrates tend to be numerically the most frequent prey in the diet, vertebrate prey comprise the majority of the biomass (Littles et al. 2007). In agricultural landscapes, small rodents, such as California vole, are the dominant prey species (Gervais and Anthony 2003). During the breeding season, burrowing owls also need enough permanent cover and taller vegetation within their foraging range to provide them with sufficient insect prey, which are the most frequent foods taken (Poulin et al. 2020).

Habitat Requirements

Throughout its range, burrowing owl requires habitats with three basic attributes: open, well-drained terrain; short, sparse vegetation generally lacking trees; and underground burrows or burrow facsimiles (Klute et al. 2003, Gervais et al. 2008). Burrowing owls select sites that support short vegetation, even bare soil, presumably because they can easily see over it. They will tolerate tall vegetation, however, if it is sparse. Burrowing owls will perch on raised burrow mounds or other topographic relief, such as rocks, tall plants, fence posts, and debris piles, to attain good visibility (Poulin et al. 2020).

Burrowing owls occupy grasslands, deserts, scrublands, agricultural areas (including pastures and untilled margins of cropland), earthen levees and berms, coastal uplands (especially overwintering migrants) (Poulin et al. 2020), and urban vacant lots, as well as the margins of airports, golf courses, and roads (Gervais et al. 2008). The presence of burrows, usually excavated by fossorial mammals such as California ground squirrels, skunks (*Mephitis* spp.), kangaroo rats, or badgers (Zarn 1974), is a critical component of suitable habitat for burrowing owls because burrows provide security for nesting, and shelter from predators and weather. The species prefers nesting areas with many available burrows (Poulin et al. 2020). Structures such as culverts, piles of concrete rubble, and pipes are also used as nest sites (Trulio 1997). Artificial nest boxes are frequently used (Poulin et al. 2020). Burrowing owls have strong nest site fidelity and return to the same nest areas year after year, and in non-migratory populations, owls use and maintained burrows year-round (Poulin et al. 2020).

This species typically forages in habitats characterized by low-growing, sparse vegetation and opportunistically consumes arthropods, small mammals, birds, amphibians, and reptiles (Gervais et al. 2008, Poulin et al. 2020). Foraging typically occurs within 0.37 miles (600 meters) of nests (California Department of Fish and Game 2012). Although adults tend to forage close to their nest during the breeding season, owls have been recorded hunting up to 1.7 miles away (Gervais and Anthony 2003). Foraging area selection does not appear to be habitat based, as owls in the same region have been observed foraging in different types of cropland. Home range size is undetermined but appears to be a function of distance from the nest site (Gervais et al. 2008). Nocturnal foraging can occur up to a few miles away from burrows, and owls concentrate their hunting in uncultivated fields, ungrazed areas, and other habitats with an abundance of small mammals (Haug and Oliphant 1990). In urban areas, burrowing owls are often attracted to streetlights, where insect prey congregate. Inter-nest distances, which indicate the limit of an owl's territory, have been found to average between 198 and 695 feet (Thomsen 1971, Haug and Oliphant 1990).

Pressures and Stressors

Pressures that affect burrowing owl in the RCIS Area are housing and urban areas, farming, renewable energy projects, and climate change. Of these pressures, the most immediate threat to burrowing owl is the loss, fragmentation, and degradation of suitable habitats to urban development and agricultural uses (Gervais et al. 2008). DeSante and Ruhlen (1995) estimated that at least 50% of the state's owl population was lost in the previous decade in both urban and agricultural areas of the state. This rate of decline was a loss of approximately 8% of the population per year. Remsen (1978) estimated a 70% reduction in suitable burrowing owl habitat in Tulare County during the decade from 1968 to 1978. Beedy and Granholm (1985) also reported declines in Tulare County.

Agricultural lands and natural habitats in the Central Valley are threatened by short and long-term human population growth and development, which is converting open fields and agricultural lands used by burrowing owl to urban development (Barclay et. 1998). Most burrowing owl populations suffering from either extirpation or reductions have been in areas that experience intense urbanization; human population in the Central Valley is projected to be over 10 million by 2040 and the Central Valley is considered to be among the most threatened of all U.S. farmland regions (Gervais et al. 2008).

Other anthropogenic threats include agricultural and construction activity, grading, discing, and shooting, especially during the breeding season (Zarn 1974, Thomsen 1971, Poulin et al. 2020); predation by domestic pets (Coulombe 1971, Green 1983, Poulin et al. 2020); vehicular collisions; disease; parasites (Poulin et al. 2020); and secondary poisoning (Zarn 1974, Remsen 1978). Additionally, control and loss of fossorial rodents (e.g., ground squirrel) in remaining habitat, results in loss of burrows. Eradication programs that largely depend on the use of rodenticides have decimated populations of these rodents and have in turn disrupted the ecological relationships on which the owls depend; because burrowing owls typically utilize other animals to dig their burrows, the loss of fossorial rodents limits the extent of year-round habitat throughout their range (Poulin et al. 2020). Although burrowing owl is generally tolerant of non-destructive disturbances near nest sites, as remaining nesting areas tend to be located in high disturbance areas such as road allowances, golf courses, and railroad berms, reproductive success at sites where residential construction occurs has been shown to be significantly lower than at sites away from construction or where construction was not taking place (Millsap and Bear 1988).

Although farming environments can support populations of burrowing owls, agricultural practices also pose threats to burrowing owls through disturbance or destruction of nests by farm equipment, loss of burrowing rodents which affect prey and burrow availability, and pesticide exposure (Konrad and Gilmer 1984, Ratcliff 1986). Intensive agriculture has been shown to result in the loss of burrows, loss of foraging habitat, creating of suboptimal nesting habitat, and increased vulnerability to predation, as well as potentially reducing the chances of unpaired owls finding mates (Haug and Oliphant 1990, Poulin et al. 2020). Discing or tilling of farmland destroys burrows and can lead to direct mortality; mowing is a preferable alternative (Rosenberg et al. 2009). Dechant et al. (1999) reported that heavily grazed pastures tend to have low relative abundance of prey, thereby affecting foraging habitat suitability. Burrowing owls nesting along agricultural canals also face threats from maintenance and repair of embankments (Center for Biological Diversity et al. 2013). Due to direct toxicity, agricultural insecticide can reduce burrowing owl survival and reproductive success when sprayed over nest burrows (James and Fox 1987, Fox et al. 1989). Indirect mortality may result due to an owl consuming contaminated prey; in pastures where strychnine-coated grain was used to control ground squirrels, breeding burrowing owls were significantly lower in weight than in control pastures, suggesting potential sub-lethal effects (James et al. 1990). Gervais et al. (2000) reported that burrowing owl eggs in the San Joaquin Valley contained levels of dichlorodiphenyldichloroethylene (p,p'-DDE) as high as 33 micrograms per gram (i.e., levels that cause reproductive failure in other avian species), had 22% thinner eggshells, and owl feather samples contained low levels of p,p'-DDE. Significant negative effects on reproductive success have also been reported in burrowing owl eggs showing varying levels of p,p'-DDE (Gervais and Anthony 2003).

Renewable energy-related stressors in the RCIS Area include the development of solar farms. Like housing and urban area pressures, renewable energy stressors result in the loss of agricultural lands; thereby contributing to the loss of suitable habitat for burrowing owl. Construction activities related to solar farms can also contribute to direct mortality of owls and indirect degradation of foraging habitat and habitat fragmentation.

Climate Change Vulnerability Analysis

Gardali et al. (2012) ranked the climate vulnerability of 358 California bird species, as described above for Swainson's hawk. Burrowing owl was given a score of 21 and was not considered a priority with respect to climate vulnerability (Table E-2). However, due to burrowing owl's high degree of habitat specialization, Gardali et al. (2012) considered burrowing owl more sensitive to climate change than habitat generalists.

Table E-2. Climate Vulnerability Scoring for Burrowing Owl as Described in Gardali et al. (2012)[1]

Criteria	Score[2, 3]
Exposure	
Habitat suitability	1—low; habitat suitability is expected to increase or decrease by 0–10%
Food availability	1—low; food availability for a taxon would be unchanged or increase
Extreme weather	1—low; there is no evidence that a taxon would be exposed to more frequent or severe extreme weather events
Sensitivity	
Habitat specialization	3—high; taxon uses only specific habitat types or elements
Physiological tolerance	1—low; minimal or no evidence of physiological sensitivity to climatic conditions
Migratory status	2—moderate; short-distance migrants (movements primarily restricted to the Nearctic zone)
Dispersal ability	1—low; taxon with high dispersal ability

1 Additional information about species scoring, including the database of scores is located here: http://data.prbo.org/apps/bssc/index.php?page=climate-change-vulnerability
2 Scores range from 1 – 3; generally low, medium, and high
3 Climate vulnerability score = Sum of exposure score X Sum of sensitivity score

The Audubon Society's climate model (National Audubon Society 2013) predicts that by 2080, burrowing owl could lose 77% of its current breeding range. The model predicts climate change will disrupt the owls' winter range, leaving only 33% intact, and shifting the remaining 67% elsewhere. Both breeding and winter range of burrowing owl is predicted to decrease in the RCIS Area. This finding is counter to projections modeled by Point Blue Conservation Science, which indicates little change in probability of occurrence in the RCIS Area by 2070 (Point Blue Conservation Science n.d.).

Shifting weather patterns and changes in precipitation related to climate change, and subsequent effects on agricultural water use will affect burrowing owl. Burrowing owl is a species that has come to rely, in part, on some type of agriculture. Changes in water availability for agriculture may severely change the production of crops and pasturelands, affecting agricultural habitats used by burrowing owl (Point Reyes Bird Observatory Conservation Science 2011).

Increased frequency and intensity of extreme weather in the future could also stress burrowing owl in the RCIS Area. Grassland birds are vulnerable to extreme weather because they and their nests may be directly exposed to wind, temperature extremes, and rain during the breeding season. Heavy precipitation from extreme rainfall linked to changing climate could flood burrows and destroy nests (Fisher et al. 2015). Fisher et al. (2015) also noted that hunting for prey to feed young was more difficult during extreme weather conditions and nests that experienced more difficulties were less reproductively successful. Cruz-McDonnel and Wolf (2016) show a correlation between decreased precipitation and increased air temperatures and significant decreases in breeding population size, decrease in body mass, and delayed nest initiation and hatching; taken together, these population and reproductive trends have negative implications for local population persistence.

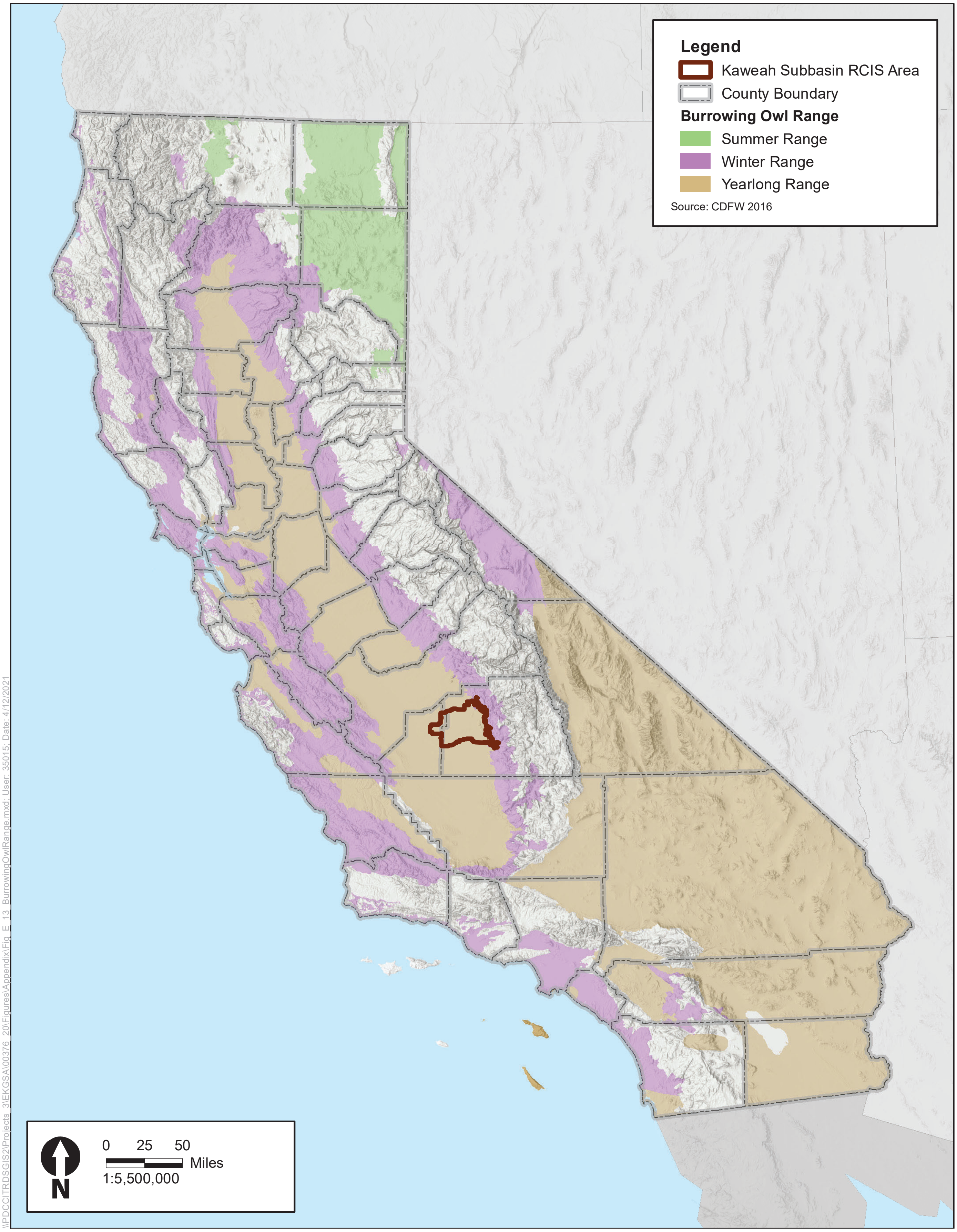

Figure E-13
Western Burrowing Owl Range

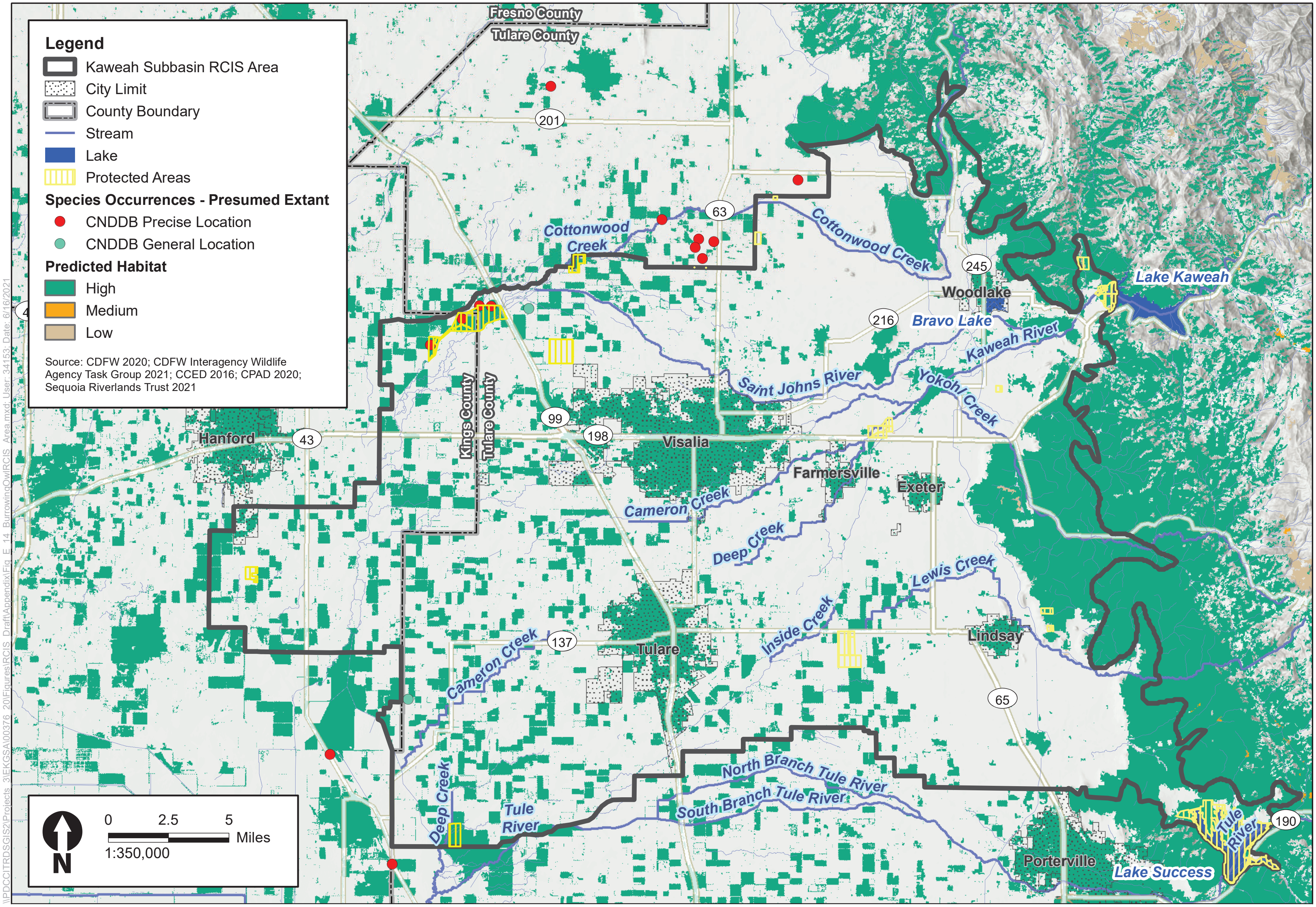

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Figure E-14
Burrowing Owl

Tricolored blackbird (*Agelaius tricolor*)

Regulatory Status

- **State:** Threatened
- **Federal:** None
- **Critical Habitat:** None
- **Recovery Planning:** None

Distribution

General

Tricolored blackbird is nearly endemic to California, with more than 99% of the global population occurring in the state, and other populations in Oregon, Washington, Nevada, and western coastal Baja California, Mexico (Beedy et al. 2020). In California, tricolored blackbird occurs in the Central Valley and in coastal areas from Sonoma County to San Diego County. This species locally breeds in northeastern California and along the California coast from Humboldt to San Diego Counties. In winter, it is widespread along the Central Coast and Bay Area (Figure E-15).

Within the RCIS Area

There are eight CNDDB occurrences within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021) (Figure E-16). Surveys conducted in 2018 found two tricolored blackbird colonies nesting in silage, and four other non-nesting tricolored blackbird detections within the RCIS Area (California Department of Fish and Wildlife 2018). There are considerably more citizen sightings documented on eBird (eBird 2021). The sightings on eBird may include multiple records of the same individual or flock and often do not include breeding colony status or are of overwintering birds. eBird sightings are not included on Figure E-14.

Most of the RCIS Area is modeled as having low suitability habitat (California Department of Fish and Wildlife 2016g), within agricultural and natural community habitats (Figure E-16). Small patches of medium suitability habitat are scattered throughout the RCIS Area. Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

Tricolored blackbird is among the most colonial of North American passerine birds (Bent 1958, Orians 1961a, 1961b, 1980, Orians and Collier 1963, Payne 1969, Beedy and Hamilton 1997). Breeding colonies historically were comprised of thousands of birds. In the 1930s, a single colony in Glenn County was estimated to include as many as 200,000 nests (approximately 300,000 adults) (Neff 1937). In more recent years, as many as 20,000 or 30,000 tricolored blackbird nests have been recorded in cattail (*Typha* spp.) marshes of 9 acres or less (DeHaven et al. 1975a), and individual nests may be built less than 1.5 feet apart (Neff 1937). The average size of breeding colonies varies among geographic regions and nesting substrate (Graves et al. 2013). Tricolored blackbird's colonial breeding system may have adapted to exploit a rapidly changing environment where the locations of secure nesting habitat and rich insect food supplies were ephemeral and likely to change each year (Orians 1961a, Orians and Collier 1963, Collier 1968, Payne 1969).

An itinerant breeder, tricolored blackbird generally moves to a different breeding location after the first breeding attempt, with most birds nesting first in the San Joaquin Valley, and subsequently moving north (Hamilton 1998, Wilson et al. 2016). Banding studies indicate that significant movement into the Sacramento Valley occurs during the post-breeding period (DeHaven et al. 1975b). However, when breeding conditions are favorable, a second breeding attempt may occur in the same or adjacent locations (Meese 2006, 2007, 2008). Comparable movements have not been reported in southern California, where the species is believed to be resident.

Habitat Requirements

Tricolored blackbird has three basic requirements for selecting breeding colony sites: open, accessible water; a protected nesting substrate, including either flooded, thorny, or spiny vegetation; and a suitable foraging space such as grasslands, agricultural lands, and open woodland, providing adequate insect prey within a few miles of the nesting colony (Hamilton et al. 1995, Beedy and Hamilton 1997, Beedy et al. 2020). Historically, tricolored blackbirds nested primarily in freshwater marshes dominated by cattails and bulrushes (*Schoenoplectus* [formerly *Scirpus*] spp.), with colony sites occurring to a lesser extent in were in willows, blackberries (*Rubus* spp.), thistles (*Cirsium* and *Centaurea* spp.), or nettles (*Urtica* spp.) (Neff 1937). An increasing percentage of tricolored blackbird colonies since the 1980s and 1990s have been reported in Himalayan blackberry (*Rubus discolor*) (Cook 1996), and silage and grain fields (e.g., triticale) have become important for nesting, with some of the largest recent colonies occurring in these fields (Hamilton et al. 1995, Beedy and Hamilton 1997, Hamilton 2000). Preferred foraging habitats include crops such as alfalfa, sunflower, and irrigated pastures as well as annual grasslands and shrublands (Beedy 2008, Beedy et al. 2020). Tricolored blackbird also forages in remnant native habitats, including wet and dry vernal pools and other seasonal wetlands and open marsh borders. Vineyards, orchards, and row crops (sugar beets, corn, peas, beets, onions, etc.) do not provide suitable nesting substrates or foraging habitats for tricolored blackbird (Beedy et al. 2020).

The last statewide surveys for nesting tricolored blackbird occurred in 2017. Most of the largest nesting colonies were located in the Central Valley. The San Joaquin Valley saw a marked increase in the number of nesting tricolored blackbirds over the 2014 statewide survey. Many of these colonies nested in agricultural fields, with approximately 45% of nesting occurring in active or fallow agricultural fields (Meese 2017). Additionally, tricolored blackbird monitoring in 2018 in Merced, Tulare, and Kern Counties found that 12 of 15 colony sites occurred in grain crops adjacent to dairies (California Department of Fish and Wildlife 2018). Concentrations of more than 15,000 wintering tricolored blackbirds may gather at one location and disperse up to 20 miles to forage (Beedy et al. 2020). Individual birds may leave winter roost sites after less than 3 weeks and move to other locations (Collier 1968), suggesting winter turnover and mobility. In early March and April, most birds vacate wintering areas in the Central Valley and along the coast and move to breeding locations in the Sacramento and San Joaquin Valleys (DeHaven et al. 1975b).

Pressures and Stressors

The greatest threat to tricolored blackbird is loss and degradation of habitat from human activity. Urban development and agricultural practices have replaced native habitats throughout the Central Valley that historically supported tricolored blackbirds. Historically, most nesting colonies were in freshwater marshes dominated by cattails or tules. With the loss of this natural breeding habitat, tricolored blackbirds have adapted to nesting in silage and grain fields near dairies in the San Joaquin Valley (California Department of Fish and Wildlife 2019b, California Farm Bureau Federation 2019).

Nesting in agricultural fields poses a significant risk to tricolored blackbird. Entire colonies (up to 10,000 nests) in grain fields or silage have been destroyed by harvesting and plowing. The species' propensity for concentrating in a few large breeding colonies increases the risk of major reproductive failures, especially in vulnerable habitats such as agricultural fields (Beedy 2008).

Climate Change Vulnerability Analysis

Gardali et al. (2012) ranked the climate vulnerability of 358 California bird species, as described above in for Swainson's hawk. Tricolored blackbird was given a score of 25 and was not considered a priority with respect to climate vulnerability (Table E-3).

Table E-3. Climate Vulnerability Scoring for Tricolored Blackbird as Described in Gardali et al. (2012)[1]

Criteria	Score[2, 3]
Exposure	
Habitat suitability	2—moderate; habitat suitability is expected to decrease by 10–50%
Food availability	1—low; food availability for taxon would be unchanged or increase
Extreme weather	2—moderate; taxon is expected to be exposed to some increase in extreme weather events
Sensitivity	
Habitat specialization	2—moderate; taxon that tolerates some variability in habitat type or element
Physiological tolerance	1—low; minimal or no evidence of physiological sensitivity to climatic conditions
Migratory status	1—low; year-round resident
Dispersal ability	1—low; taxon with high dispersal ability

[1] Additional information about species scoring, including the database of scores is located here: http://data.prbo.org/apps/bssc/index.php?page=climate-change-vulnerability
[2] Scores range from 1–3; generally low, medium, and high
[3] Climate vulnerability score = Sum of exposure score X Sum of sensitivity score

Despite the assessment that tricolored blackbird may not be among the most vulnerable bird species to climate change, extreme weather, including flooding, wind, and severe spring storms may cause the mass mortality of nests, reducing or eliminating colony reproductive success.

Projections of tricolored blackbird habitat suitability in the RCIS Area under future climate conditions indicate that the probability of occurrence in the RCIS Area will drop to 20–40% from current conditions (i.e., approximately 60–80%) in the valley portion of the RCIS Area. Within the foothills of the RCIS Area, projected future distribution may remain similar to current conditions or decline to 40-80% of current conditions in some patches (Point Blue Conservation Science n.d.).

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Figure E-15
Tricolored Blackbird Range

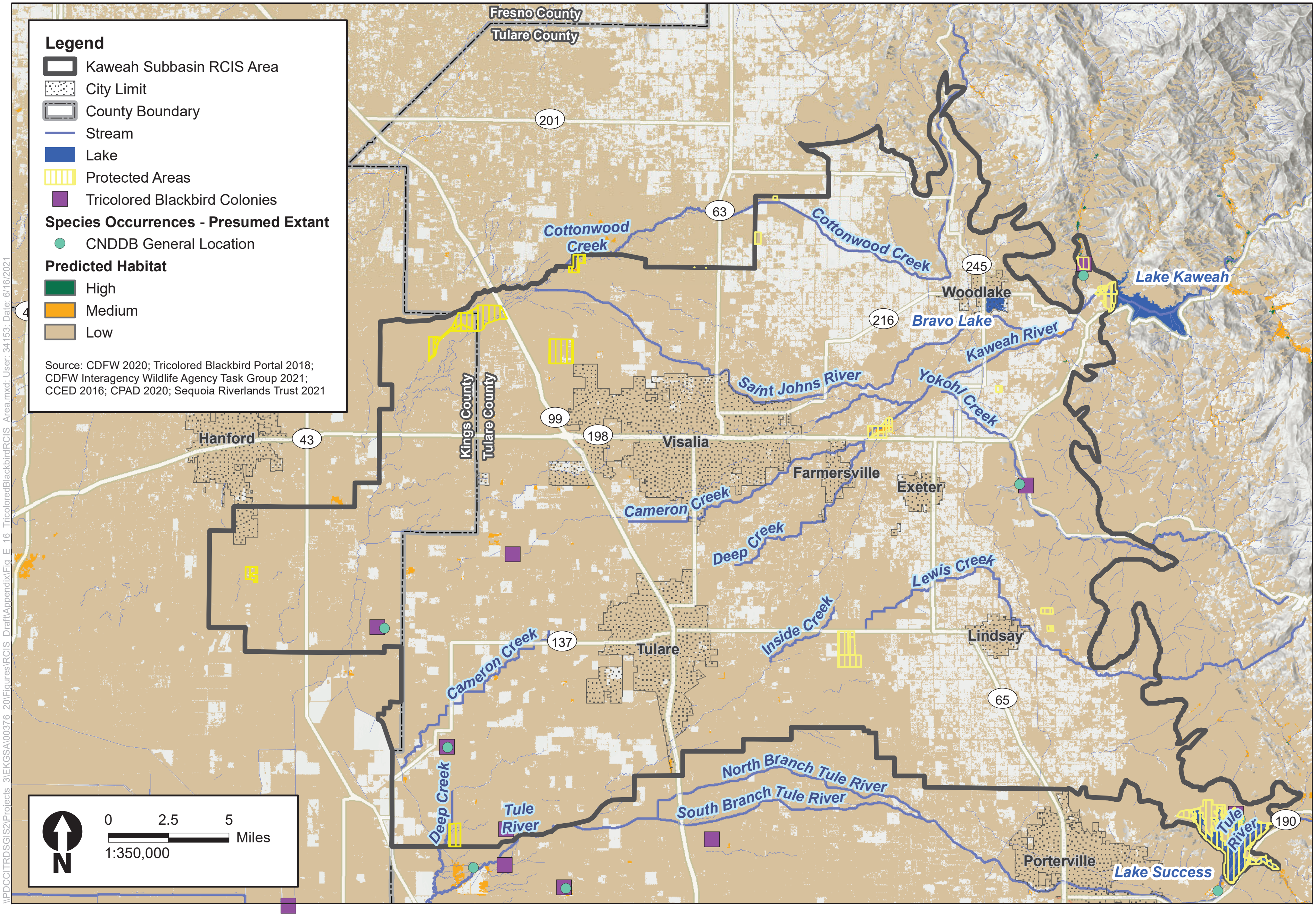

Figure E-16
Tricolored Blackbird

Buena Vista Lake ornate shrew (*Sorex ornatus relictus*)

Regulatory Status

- **State:** Species of Special Concern
- **Federal:** Endangered
- **Critical Habitat:** Final critical habitat designated for Buena Vista Lake shrew (U.S. Fish and Wildlife Service 2013)
- **Recovery Planning:** Recovery Plan for the San Joaquin Valley, California (U.S. Fish and Wildlife Service 1998)

Distribution

General

Buena Vista Lake ornate shrew historically occurred in the wetlands around Buena Vista Lake and throughout the Tulare Basin. The species began to decline due to disappearance of lakes and sloughs when the lakes occurring in the area were drained, the rivers feeding Tulare Lake were impounded and diverted, and wetlands and riparian woodlands were destroyed for agriculture (U.S. Fish and Wildlife Service 2011) (Figure E-17). As early as 1933, the distribution of the Buena Vista Lake ornate shrew was found to be greatly restricted due to the loss of habitat (Grinnell 1932). The species was through to be extinct before it was rediscovered at the Kern lake Preserve in 1986, at the Kern NWR, and on private property (U.S. Fish and Wildlife Service 2011).

Currently Buena Vista Lake ornate shrew is known from 15 locations; mainly in small remnant patches of natural habitat along the margins of areas in agricultural production. The localities where the species is considered present in 2020 include the following (U.S. Fish and Wildlife Service 2020c).

- NAS Lemoore
- Lemoore Wetland Reserve
- Pixley NWR
- Atwell Island
- Kern NWR
- Poso Creek
- Semitropic Ecological Reserve
- Kern River Overflow Canal at I-5 and Hwy 46
- Kern River Overflow Canal at Semitropic Canal crossing
- Goose Lake
- Kern Fan Water Recharge Area
- Coles Levee Ecological Preserve

- Kern Lake
- Wind Wolves Preserve–Twin Fawns site
- Wind Wolves Preserve–The Willows site

Within the RCIS Area

There are no CNDDB occurrences for Buena Vista Lake ornate shrew within the Kaweah RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). Suitable habitat occurs in the riparian and wetland habitat on the western side of the RCIS Area.

Natural History

Buena Vista Lake shrew is one of nine subspecies of ornate shrew (*Sorex ornatus*), seven of which occur in California. Little is known specifically about the reproduction or demography of this shrew subspecies (U.S. Fish and Wildlife Service 2020c). Up to two litters of four to six young each are produced per year (U.S. Fish and Wildlife Service 2011). The reproductive season of Buena Vista Lake ornate shrew is thought to begin in late autumn and end with the onset of the dry season in May or June (U.S. Fish and Wildlife Service 1998). Males are not known to care for young (Churchfield 1990). Female ornate shrews typically stay in their territories for life, but males may leave their territories during the breeding season to search for more females (Churchfield 1990).

Juvenile ornate shrews typically disperse only as far as is necessary to find an area of unoccupied habitat to establish a territory (Churchfield 1990). Observed dispersal distances for individuals of the *Sorex* genus have ranged from a few meters to, in one case, approximately 800 m (0.5 mi) (Churchfield 1990). This is considerably less than the distance between known Buena Vista Lake ornate shrew populations, but occasional migration and genetic exchange between populations may potentially be possible due to longer-distance dispersal along unlined canals, and the establishment of short-lived populations at intermediate distances between known populations during wet years (Cypher pers. comm. 2019, Tennant pers. comm, both as cited in U.S. Fish and Wildlife Service 2020c).

Little is known regarding the home ranges and territoriality of Buena Vista Lake ornate shrew (U.S. Fish and Wildlife Service 2020c) although other species of shrew have small home ranges in which they nest, forage, and reproduce. The vagrant shrew (*Sorex vagrans*) in the Sierra Nevada, a closely related species, has a home range that averages 4,000 square feet (372 square meters), with reproductive males having larger home ranges than reproductive females (U.S. Fish and Wildlife Service 2011). The density of Buena Vista Lake ornate shrew is thought to be relatively low. Trapping results suggest that population densities for Buena Vista Lake shrew range from four to six individuals per acre (10–15 individuals per hectare (U.S. Fish and Wildlife Service 1998).

In general, shrews primarily feed on insects and other invertebrates. Shrews are indiscriminate foragers and will consume both adult and larval insects that are encountered during foraging bouts. Shrews will also feed on other invertebrates including snails, slugs, earthworms, and arachnids (U.S. Fish and Wildlife Service 2011). The specific feeding and foraging habits of Buena Vista Lake shrew are unknown (U.S. Fish and Wildlife Service 2020c).

Small mammals generally are prey for many carnivores such as foxes (*Vulpes* spp.), coyotes (*Canis latrans*), long-tailed weasels (*Mustela frenata*), owls and other raptors. Shrews are often unpalatable to many predators because of distasteful excretions from their flank glands, though most owls have a poor sense of smell and are known predators of shrews (U.S. Fish and Wildlife Service 2011).

Habitat Requirements

The habitat requirements of Buena Vista Lake shrew are generally similar to those of other ornate shrews, i.e., thick understory vegetation with downed logs and branches, and an abundance of leaf litter and detritus. Another important habitat feature is an abundant supply of forage species (Collins 1998). Buena Vista Lake ornate shrew has most commonly been found in areas with a dense vegetation understory or deep leaf litter near open water (Collins 1998, U.S. Fish and Wildlife Service 2011). The dense vegetation provides cover and protection from predators and supports prey such as insects and other invertebrates (U.S. Fish and Wildlife 2017b). Moist soil under vegetation or detritus makes earthworms and other soil-dwelling prey more accessible.

Plant species associated with occupied habitat include Fremont cottonwood, willows, Baltic rush (*Juncus balticus*), and wild-rye grass (*Elymus* spp.) (Collins 1998). Habitat associated with captures at the Wind Wolves Preserve were characterized by moist soils, dense ground cover with stands of willow, cottonwood, or cattails, near running or standing water (Cypher et al. 2011). Downed logs and branches may be important, as they are common where Buena Vista Lake ornate shrew has been found (Collins 1998).

Buena Vista Lake ornate shrew has occasionally been found in suboptimal areas that are drier and have fairly dense vegetation in grassland, alkali desert scrub, alkali sink scrub, or disturbed habitats. A seasonal or artificial water source is usually within several hundred feet, or the area has a high water table that maintains fairly moist soils at or just below surface level (U.S. Fish and Wildlife Service 2017b). Where the soil moisture is below the surface, rodent burrows or cracks in the soil surface may provide access to moist areas and the invertebrate prey those areas support (U. S. Fish and Wildlife Service 2013, 2017b).

Some suboptimal areas may support Buena Vista Lake ornate shrew throughout the year, whereas others may enable a population to temporarily expand (U.S. Fish and Wildlife Service 2017b). Managed wetlands likely support sustainable populations of Buena Vista Lake ornate shrew throughout the year where shrews can occupy dense wetland vegetation maintaining adequate soil moisture during the dry season, and occupy margins of flooded areas during the wet season (Saslaw, pers. comm.). In managed wetlands, undisturbed moist soil and vegetation should be maintained in a management unit to serve as refugia for Buena Vista Lake ornate shrews when vegetation management is implemented (Saslaw, pers. comm.). It is speculated that Buena Vista Lake ornate shrew may not require permanent wetlands, but a nearly annual application of water for several months to maintain required soil moisture, vegetation, and litter cover. Thus, wetlands created and managed for natural values and as duck clubs may provide sustainable habitats for Buena Vista Lake ornate shrew as long as water is provided seasonally and suitable vegetation cover that maintains soil moisture is maintained. These prescriptions need to be studied further before used as a management tool, however (Saslaw, pers. comm.).

Large areas with somewhat dense vegetative cover and soils moist enough to support a marginal prey base, may be important to Buena Vista Lake ornate shrew as dispersal habitat. Narrow corridors of similar habitat or suboptimal habitat may also provide dispersal habitat (U.S. Fish and Wildlife Service 2017b).

Pressures and Stressors

Pressures and stressors to Buena Vista Lake ornate shrew include urban development, agriculture, and loss of habitat and fragmentation. Urban development and agricultural uses consume open water, lower the water table, reduce prey abundance, and remove vegetation cover. They can also result in direct mortality of individuals through the application of pesticides and herbicides and injury or mortality from heavy equipment used in agriculture or construction (U.S. Fish and Wildlife Service 2020c).

Reduction in water supply to wetlands due to the diversion and impoundment of streams and rivers that feed wetlands, especially in years of low precipitation, can result in the degradation or removal of optimal and suboptimal habitat. Canals that have been built to carry water for agricultural and urban water delivery are steep sided and kept free of emergent and riparian vegetation. Therefore, canals do not provide optimal, suboptimal, or dispersal habitat (U.S. Fish and Wildlife Service 2020c).

Pesticides have been identified as a potential stressor for Buena Vista Lake ornate shrew. Because patches of suitable habitat in the RCIS Area are surrounded by areas dominated by agricultural uses, Buena Vista Lake ornate shrew could be exposed to unhealthy or lethal levels of pesticides sprayed on nearby crops. Pesticides could also diminish the prey base for shrews (U.S. Fish and Wildlife Service 2020c).

Climate Change Vulnerability Assessment

Climate models for the Sacramento-San Joaquin River Basins show projected warming with substantial inter-annual and decadal variability in precipitation. This will affect streamflow seasonality in the southern San Joaquin Valley, suggesting that water infrastructure modifications would be needed to address changing conditions (U.S. Fish and Wildlife Service 2012). Buena Vista Lake ornate shrew is reliant on dense riparian vegetation and wetlands with adequate moisture. Changes in water delivery practices that reduce water runoff and overall drying throughout the shrew's range would negatively affect populations of Buena Vista Lake ornate shrew; while conversely, increases in runoff could benefit shrews (U.S. Fish and Wildlife 2012). If the frequency and severity of droughts increases within the range of the Buena Vista Lake shrew, as predicted with climate change, then the delivery of water to sustain optimal and suboptimal habitat may decrease. This would put stresses on the small patches of remaining habitat for the shrew, resulting in the decline of populations in those habitats (U.S. Fish and Wildlife Service 2020c).

The overall viability of Buena Vista Lake ornate shrew is dependent, in part, on the resiliency of its populations across the 15 known occupied sites. Site conditions that affect resiliency include the size and quality of the habitat patch, protection and management of the site, water supply stability, presence of selenium, and the presence of pesticides. Larger sites with better quality habitat, that are protected and managed, have more reliable water supply, and lower indicators of selenium and pesticides have a high resiliency (U.S. Fish and Wildlife Service 2020c). Overall, resiliency appears to be high at four of the 15 occupied sites, low at four sites, and moderate at seven of the sites. The middle and southern geographic areas are well represented by sites with high resiliency, but the northern-most sites near Lemoore have moderate resiliency levels (U.S. Fish and Wildlife Service 2020c).

To help ensure continued existence of Buena Vista Lake ornate shrew, even with changes in climatic conditions, translocation of shrews to suitable, but apparently unoccupied sites, should be investigated. Such sites could include protected areas with existing habitat (e.g., Panorama Vista Preserve, Tejon Ranch, Buena Vista Recreation Area) or areas with restored/created habitat. Some regulatory protection, such as a Safe Harbor Agreement, could enhance the willingness of landowners to host introduced Buena Vista Lake ornate shrew populations (Cypher et al. 2017).

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Figure E-17
Buena Vista Lake Ornate Shrew Range

Pallid bat (*Antrozous pallidus*)

Regulatory Status

- **State:** Species of Special Concern
- **Federal**: None
- **Critical Habitat**: None
- **Recovery Planning**: None

Distribution

General

Pallid bat occurs in western North America, from British Colombia, Canada, south to central Mexico, and in Cuba (Arroyo-Cabrales and de Gramnont 2018). In California, pallid bat ranges throughout the state at low elevations (Harris 1990) (Figure E-18).

Within the RCIS Area

There is one CNDDB occurrence within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). This occurrence is a maternity colony in a bridge located northeast of the City of Visalia along the Saint Johns River (Figure E-19) (California Department of Fish and Wildlife, California Natural Diversity Database 2021).

Highly suitable habitat, as modeled by CDFW is scattered in small patches throughout the RCIS Area and is increasingly common in the Sierra Nevada foothills (Figure E-19) (California Department of Fish and Wildlife 2016h). Medium suitability habitat is modeled to occur primarily in the cities and communities of the RCIS Area. Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

Pallid bat is highly social, forming large day roosting colonies. The type of day roost varies depending on season and the reproductive status and sex of the bat (Gervais 2016). During the spring, females will form single-sex, or maternity colonies, while rearing young. Females and males can be found roosting together in colonies consisting of 20 to over 100 individuals, with roosts documented as large as 162 once young are weaned and capable of flight (Harris 1990). This species is not known to migrate, and forms winter roosts, or hibernacula, near summer roosts (Harris 1990, Hermanson and O'Shea 1983). Pallid bat uses roost sites that offer a range of thermal environments and most commonly uses rock crevices. They will use night roosts for resting throughout evenings. These roosts may be in more open areas such as underneath bridges, porches, or open buildings (Harris 1990).

Like other bat species, pallid bat is nocturnal and remains within the roost during daylight hours. Bats emerge between 30 and 60 minutes after to sunset to forage. Pallid bat is an insectivore that feeds primarily on large arthropods, caught on the ground or in flight within a few meters of the ground. They utilize open vegetation at ground level up to a few meters above the ground for foraging. Although arid and semi-arid shrubland in proximity to rocky outcrops is considered primary habitat, studies of foraging bats have mostly occurred in dry forest environments (Gervais 2016). Typical prey includes scorpions (Vaejovidae), ground crickets (Gryllacrididae), sun spiders (Solpugidae), and darkling ground beetles (Tenebrionidae), among others (Hermanson and O'Shea 1983).

Mating occurs in fall to late winter (October-February). Fertilization is delayed, with sperm being stored in the reproductive tract of the female until ovulation and implantation occurs in the spring (Harris 1990, Hermanson and O'Shea 1983). The gestation period for this species is about 53 to 71 days (Harris 1990). A litter of one to two young, but up to three, are born from as early April to late July, but typically from May to June. Young are born altricial and are weaned at about 7 weeks.

Habitat Requirements

Pallid bat uses a wide variety of habitats including grasslands, shrublands, woodlands, and forests; however, this species is most common in open, arid habitats with rocky outcrops for roosting. Pallid bat requires day roosts that protect against high temperatures in the summer months and low temperatures in the winter. Bats are known to move between roosts seasonally. Pallid bat roosts are most commonly within rocky outcrops and crevices but may also be located within a variety of other structures and substrates including caves, mines, hollow trees, bridges, and buildings. Roosts sites used by pallid bat are typically spacious crevices that are inaccessible to predators or other shelter seekers (such as mice and woodrats), protect against precipitation, have a microenvironment with fairly moderate temperatures, protect against direct sunlight throughout the day, and have an unobstructed entrance at least 1.5 m above the ground (Vaughan and O'Shea 1967).

Pressures and Stressors

Pressures to pallid bat within the RCIS Area include loss or degradation of roosting and foraging habitat due to development and other anthropogenic disturbances. Transportation projects such as new bridge or bridge replacement construction, highway realignments, and new highway corridors are contributors to the loss and degradation of habitat (H. T. Harvey & Associates 2019). Loss or modification of foraging habitat due to prescribed fire, urban development, and agricultural expansion are also a threat (Gervais 2016).

Pallid bat is highly sensitive to disturbance (Harris 1990), from direct and indirect impacts (noise, dust, etc.). Disturbance of maternity roosts may cause females to leave behind non-volant young. In the winter months, disturbance to a winter roost can arouse bats from torpor or hibernation, causing individuals to expend energy. Arousals are important factors determining hibernation energy budgets and can cause overwinter mortality due to energy shortfalls (Thomas 1995).

White-nose syndrome, a disease caused by the fungus *Pseudogymnoascus destructans* that has caused the death of more than six million bats in North America since 2006, has been detected in California (Blehert et al. 2009, 2011). The fungus grows on and in the skin of bats during winter hibernation, appearing as white fuzz on the muzzle, wings, and ears. Affected bats arouse more often during hibernation, causing them to use up fat reserves needed to sustain them through winter, leading to starvation and death (Blehert et al. 2011). The fungus is spread between individuals within the colony, but also between colonies through human vectors, spreading the fungus spores from infected areas to non-infected areas on shoes, clothes, or gear (White-nose Syndrome Disease Management Working Group 2020). Detections of the fungus in California are so far limited to the northeastern part of the state (California Department of Fish and Wildlife 2019c). Pallid bat has not yet been documented as infected by white-nose syndrome in California, but there is potential risk (California Department of Fish and Wildlife 2021).

Climate Change Vulnerability Assessment

Bats are considered likely to be affected by climate change because of their sensitivity to roost temperatures and their need for large insect populations; however, for most bat species, the specific impacts are unknown due to a lack of sufficient study, and the full range of responses by bats to climate change are not well known (Jones and Rebelo 2013, Sherwin et al. 2013, Hammerson et al. 2017). In arid regions, bats must drink every night, particularly females when nursing their pups in summer. Climate change-related drought in arid regions in western North America will likely reduce reproductive success in bats and could cause large declines (Adams and Hayes 2008, Adams 2010, Hammerson et al. 2017). While bats could shift their ranges more rapidly in response to climate change than most mammals, bat populations may decline due to climate change, habitat loss, and white-nose syndrome. It is not known whether negative responses to climate change will be offset by positive responses. For example, it is unknown if declines in one part of a species' range could be offset by increases in another. The degree to which bats can respond to climate change through physiological and ecological adjustments is also largely unknown (Hammerson et al. 2017).

Figure E-18
Pallid Bat Range

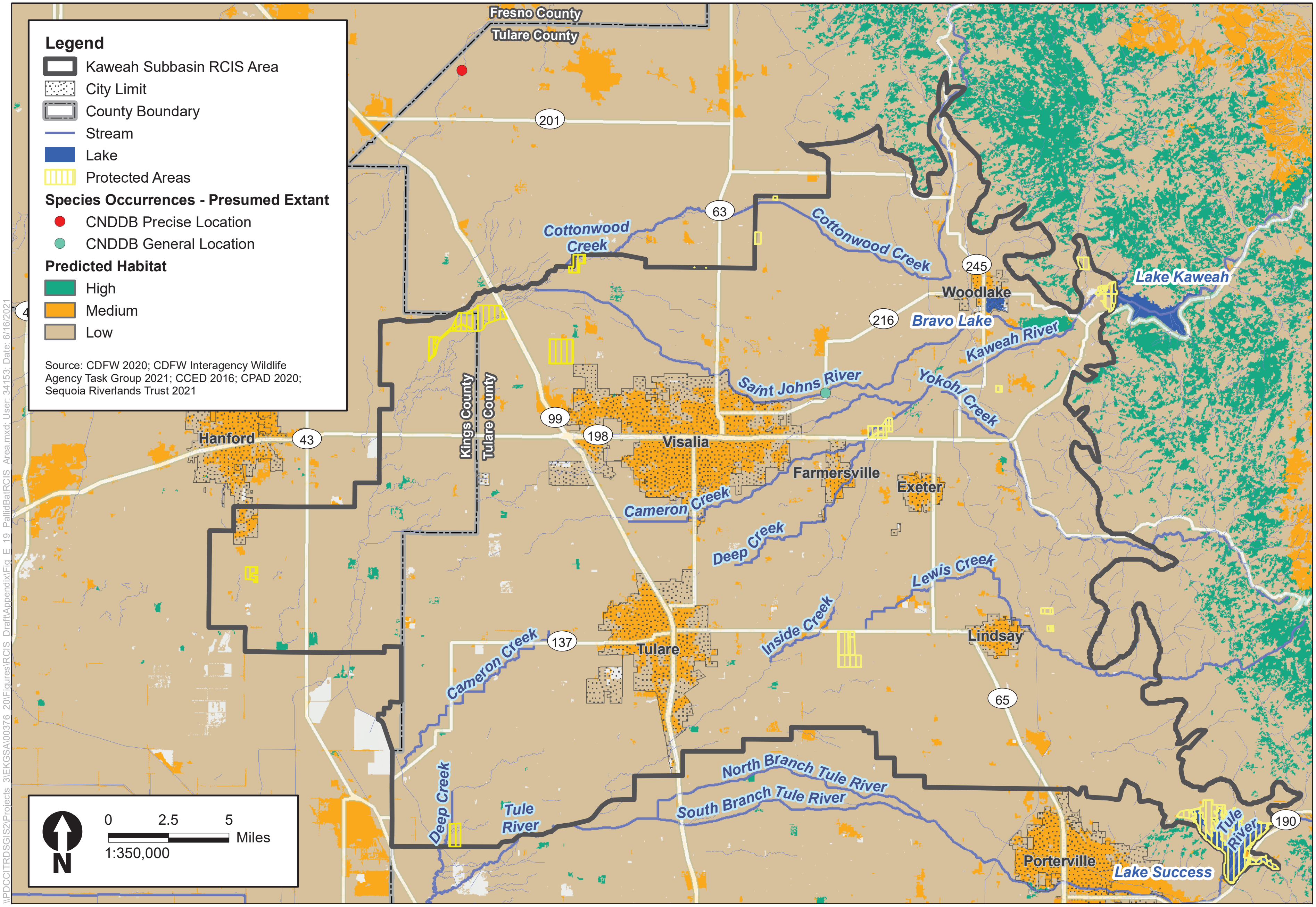

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Figure E-19
Pallid Bat

Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*)

Regulatory Status

- **State:** Endangered
- **Federal:** Endangered
- **Critical Habitat**: None
- **Recovery Planning**: Recovery Plan for Upland Species of the San Joaquin Valley, California (U.S. Fish and Wildlife Service 1998)

Distribution

General

Historically, Tipton kangaroo rat was distributed in the southern San Joaquin Valley. The northern extent of the range was along the southern margins of Tulare Lake in the vicinity of the towns of Lemoore and Hanford, just west of the RCIS Area, and extended south along the eastern edge of the valley floor in Tulare and Kern Counties. The range extended south and west to the foothills of the Tehachapi Mountains (Figure E-20). The marshes and open water of Kern and Buena Vista Lakes, and the sloughs and channels of the Kern River alluvial fan, were unsuitable Tipton kangaroo rat habitat (U.S. Fish and Wildlife Service 1998).

Within occupied habitat, Tipton kangaroo rat distribution is not continuous. Tipton kangaroo rat occurs in a mosaic pattern of small and isolated patches that are dynamic over time and are separated by distances well beyond any reported dispersal distance. Tipton kangaroo rat populations frequently are separated by physical barriers such as roads and canals that cannot be crossed. Therefore, the net occupied habitat is much less than either the gross size of the occupied habitat or the approximate size of the site (e.g., reserve size). There is little habitat remaining where this subspecies could possibly occur, making future discoveries unlikely. The potential for reintroduction also becomes more limited as suitable habitat is lost and converted to other uses (U.S. Fish and Wildlife Service 2010b). Habitat suitability models suggest that across Tipton kangaroo range, an estimated 30,000 hectares of moderately-high or high-quality habitat and 60,000 hectares of lower quality habitat remain (Cypher et al. 2016).

In the past decade, populations of Tipton kangaroo rat on several protected areas declined rapidly and may now be locally extirpated in some areas; declines are evident in the northern and eastern portions of the species range (U.S. Fish and Wildlife Service 2020d). The largest extant populations occur in areas of contiguous suitable habitats, such as Lokern Ecological Reserve, Semi Tropic Ecological Reserve, and adjacent lands. However, available information suggests that the species has declined throughout the range, and that some populations have become locally extirpated within the past 10 years (Cypher et al. 2016, U.S. Fish and Wildlife Service 2020d).

Within the RCIS Area

There are no CNDDB occurrences within the RCIS Area. Tipton kangaroo rat occurrences are documented within 0.7 miles of the RCIS Area but were documented prior to 1995. Recent occurrences (1995 or later) are documented within 7.5 miles of the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021) (Figure E-21).

Potential habitat occurs in the western portion of the RCIS Area where suitable alkaline or saline soils occur (Figures 2-9a – 2-9e). Medium suitable habitat, as modeled by CDFW is located primarily in the southwest and northwest portions of the RCIS Area, and just south and west of the RCIS Area (Figure E-21) (California Department of Fish and Wildlife 2016i). There is no high or moderately-high suitable habitat modeled in the RCIS Area. Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

Tipton kangaroo rat mates in winter, with peak mating activity in early spring (late March to early April). Females usually produce one litter per season, though some females may have two or more litters in a single season. The young are born in a burrow where they remain until they are fully furred and able to move about on their own, which is generally at about 6 weeks of age.

Tipton kangaroo rat has a short lifespan and may only live for 10-12 months; individuals rarely survive longer than 3 years. Due to their short lifespan, Tipton kangaroo rat is particularly sensitive to stressors (e.g., increased interspecific competition, increase of nonnative grasses etc.) that may disrupt their life cycle (U.S. Fish and Wildlife Service 2020d). Tipton kangaroo rat populations are known to fluctuate annually based on climate conditions, such as precipitation and vegetative productivity (Cypher *in litt.* 2019, as cited in U.S. Fish and Wildlife Service 2020d).

Tipton kangaroo rat eats a wide variety of annual and perennial grass and forb seeds. These include wild oat (*Avena fatua*), wild barley (*Hordeum murinum leporinum*), brome grasses (*Bromus* sp.), alkali sacaton (*Sporobolus airoides*), filaree (*Erodium cicutarium*), peppergrass (*Lepidium virginicum*), and spikeweed (*Hemizonia* sp.). Seeds from saltbush shrubs (*Atriplex* sp.), iodine bush (*Allenrolfea occidentalis*), and bush seepweed (*Sueda moquini*) are also important food items. In the fall and winter, grass sprouts and new shoots of grasses and forbs provide important food sources. When seeds are available, kangaroo rats collect them, and carry them in cheek pouches to caches where they are stored for later consumption. Caches are often in small depressions in the soil and are scattered throughout the home range of the individual. Tipton kangaroo rat also consumes insects on occasion (U.S. Fish and Wildlife Service 1998).

Habitat Requirements

Tipton kangaroo rat inhabits valley saltbush scrub, valley sink scrub, and grassland habitats located on the San Joaquin Valley floor to 300 feet in elevation. They occur on level to nearly-level terrain with alluvial fan and floodplain soils ranging from fine sands to clay-sized particles with high salinity (Cypher et al. 2016). Suitable soils in the RCIS Area include Grangeville loam, saline-alkali, Kimberlina loam-saline-alkali, and Kimberlina saline alkali-Graces complex (Figures 2-9a – 2-9e), Desert communities with large alkali scalds (areas naturally bare of vegetation) and no apparent signs of past or present agriculture appear to be preferred habitat for Tipton kangaroo rat (Cypher et al. 2016). Sparse ground cover with bush seepweed and few invasive grasses also correlate with the species' occurrences (Cypher et al. 2016, Cypher et al. 2020, U.S. Fish and Wildlife 2020d).

Tipton kangaroo rat is fossorial, requiring friable soils for digging burrows. Burrows are typically simple, but may be unbranched or branched, including interconnecting tunnels. Although Tipton kangaroo rat occurs in terrace grasslands devoid of woody shrubs, sparse to moderate shrub cover is associated with populations of high density (U.S. Fish and Wildlife Service 1998). Densities range-wide typically are low, and populations are known to vary across habitat type. Seasonal or short-lived invasion of vegetation, particularly by nonnative grasses, can exacerbate Tipton kangaroo rat declines (U.S. Fish and Wildlife Service 2010b).

Pressures and Stressors

Pressures to Tipton kangaroo rat within the RCIS Area include urban development, agriculture, and habitat loss and fragmentation. The decline of Tipton kangaroo rat is attributed primarily to the loss of habitat due to agricultural conversion, including the cultivation of the alkaline soils of the saltbush and valley sink scrub communities, and urban development (U.S. Fish and Wildlife Service 2020d). Tipton kangaroo rat is rarely found on sites with evidence of past tilling. Tilling and crop production collapse burrows and remove native vegetation. Once tilling and farming are discontinued, however, habitat suitability should improve, and Tipton kangaroo rat could reasonably be expected to recolonize the site, particularly if the site were adjacent to occupied habitat (Cypher et al. 2016). Nearly every parcel of land in private ownership that is currently inhabited by Tipton kangaroo rat is surrounded by cultivated fields or urbanized land where this species cannot survive (U.S. Fish and Wildlife Service 1998).

Habitats invaded by nonnative grasses may have thick layers of thatch, rendering areas unsuitable for Tipton kangaroo rat (U.S. Fish and Wildlife Service 1998). Tipton kangaroo rat persists in areas where exotic grasses are absent or have been removed by controlled burns, indicating that management to control nonnative grasses could improve habitat suitability and likelihood of persistence (Uptain et al 1999). Climate change, as well Sustainable Groundwater Management Act regulations, will likely result in the fallowing of some areas currently under agricultural production, which over time, could be restored to areas that are suitable for Tipton kangaroo rat (U.S. Fish and Wildlife Service 2020d).

The use of rodenticides to control California ground squirrels has likely contributed to the elimination of small, isolated populations of Tipton kangaroo rat (U.S. Fish and Wildlife Service 2010). The illegal application of rodenticides in agricultural fields adjacent to giant kangaroo rat (*Dipodomys ingens*) habitat, a species similar to Tipton kangaroo rat, has been identified as a potential hazard and possible cause for decline (U.S. Fish and Wildlife Service 2020d). There are large areas in the Sunflower Valley (western corners of Kings and Kern Counties), Kettleman and Tent Hills in Kings County, and the eastern foothills of the Panoche Hills, Fresno County, for example, that exhibit characteristic features of giant kangaroo rat habitat, but are unoccupied by any species of kangaroo rat (U.S. Fish and Wildlife Service 1998). Given the similarities between Tipton and giant kangaroo rat, as well as the fact that large expanses of the original range are no longer occupied, illegal application of rodenticides may be an increasingly important threat to the conservation status of Tipton kangaroo rat (U.S. Fish and Wildlife Service 2010b).

Climate Change Vulnerability Analysis

Tipton kangaroo rat is vulnerable to changes in climate, with drastic population fluctuations highly correlated with inter-annual variations in precipitation (Uptain et al. 1999, U.S. Fish and Wildlife Service 2010b, Cypher et al. 2016). Climate change may alter the vegetation structure and composition of Tipton kangaroo rat habitat, which could affect population size (Single et al. 1996, U.S. Fish and Wildlife Service 2010b). Large amounts of precipitation can increase the growth of invasive, nonnative grasses, which can negatively influence habitat suitability with corresponding declines in population size (Single et al. 1996, Grisdale pers. comm. 2019, Tennant pers. comm. 2019 both as cited in U.S. Fish and Wildlife Service 2020d). Dense, nonnative grasses might decrease the ability of kangaroo rats to hop and move quickly through the environment (Tennant pers. comm. 2019, as cited in U.S. Fish and Wildlife Service 2020d).

Conversely, Cypher et al. (2016) documented Tipton kangaroo rat population increases in dry years or during short periods of drought. Similar population changes in response to drought conditions between 2012 and 2017 were observed at the CDFW Semi-tropic Ecological Reserve (U.S. Fish and Wildlife Service 2020d). Short, mild droughts might help reduce competition with Heermann's kangaroo rat and reduce density of annual vegetation, allowing Tipton kangaroo rat abundance to increase (U.S. Fish and Wildlife Service 2010b).

Under prolonged drought, however, Tipton kangaroo rat abundance is expected to decline, as was the case during the most recent drought (Cypher *in litt*. 2019, Warrick *in litt*. 2019, both as cited in U.S. Fish and Wildlife Service 2020d). During prolonged drought, abundance might initially increase, but is likely to be followed by eventual population crashes as the drought persists (Warrick in litt. 2019, as cited in U.S. Fish and Wildlife Service 2020d). While exact outcomes are difficult to predict, the timing and duration of precipitation cycles have a large effect on Tipton kangaroo rat populations (U.S. Fish and Wildlife Service 2020d).

When habitat patches are small, populations are at a higher risk of local extirpation due to climatic changes and the subsequent population response (Cypher *in litt.* 2019, as cited in U.S. Fish and Wildlife Service 2020d). Habitats of adequate size are needed to support populations large enough to survive extremely dry or wet climatic spells and during times when populations decline to low numbers (U.S. Fish and Wildlife Service 2020d). The exact size and type of habitat needed to accomplish this, however, is not well understood (Cypher et al. 2016). Periodic flooding of low-lying areas occupied by Tipton kangaroo rats may contribute to localized population declines. Microtopographic relief provides refugia for Tipton kangaroo rat in areas that experience periodic flooding. Historic lake bottoms and cultivated lands lack these features, which may contribute to local extirpations. Future climate scenarios with increased numbers of high rainfall events may contribute to population declines (Saslaw pers. comm.).

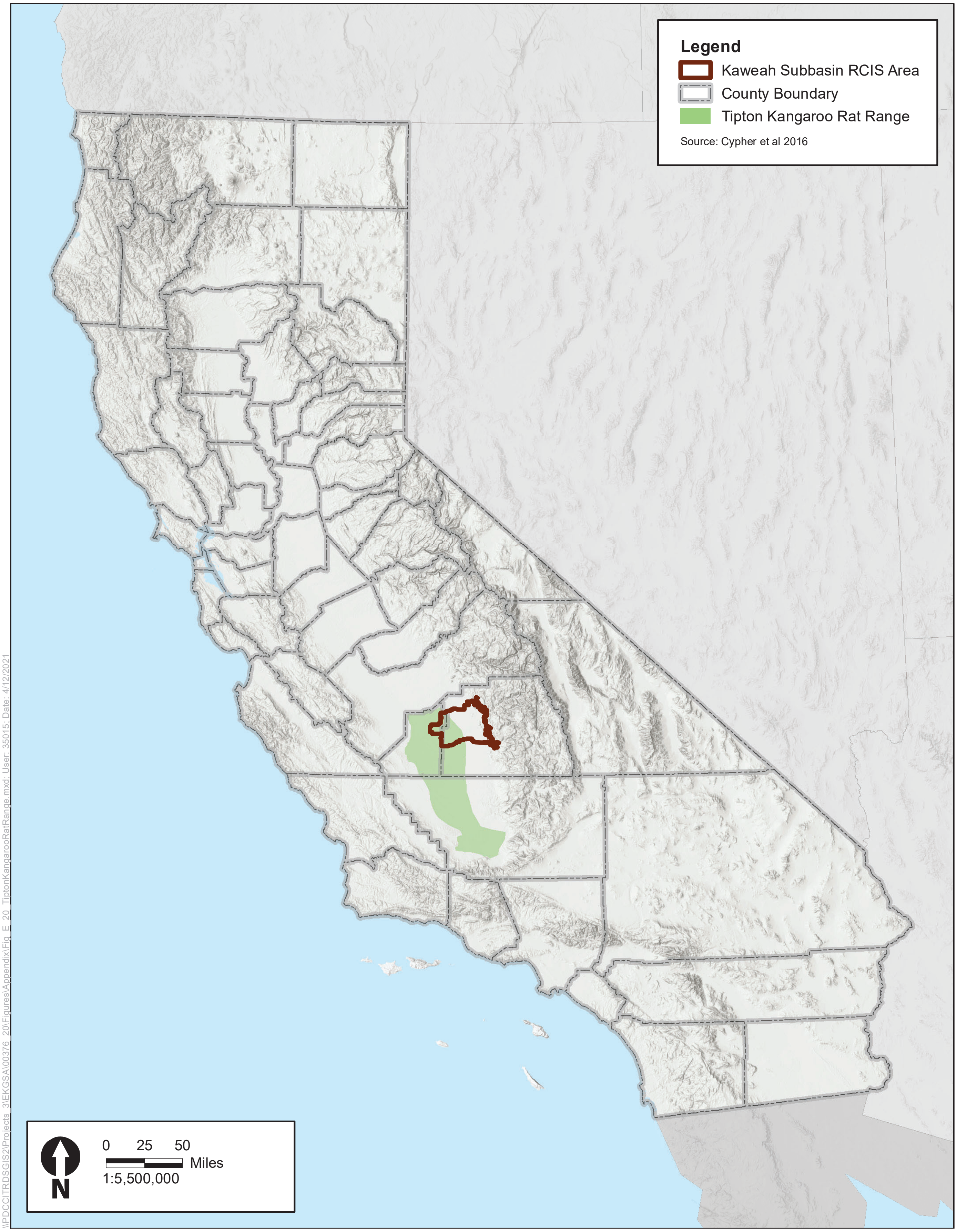

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Figure E-20
Tipton Kangaroo Rat Range

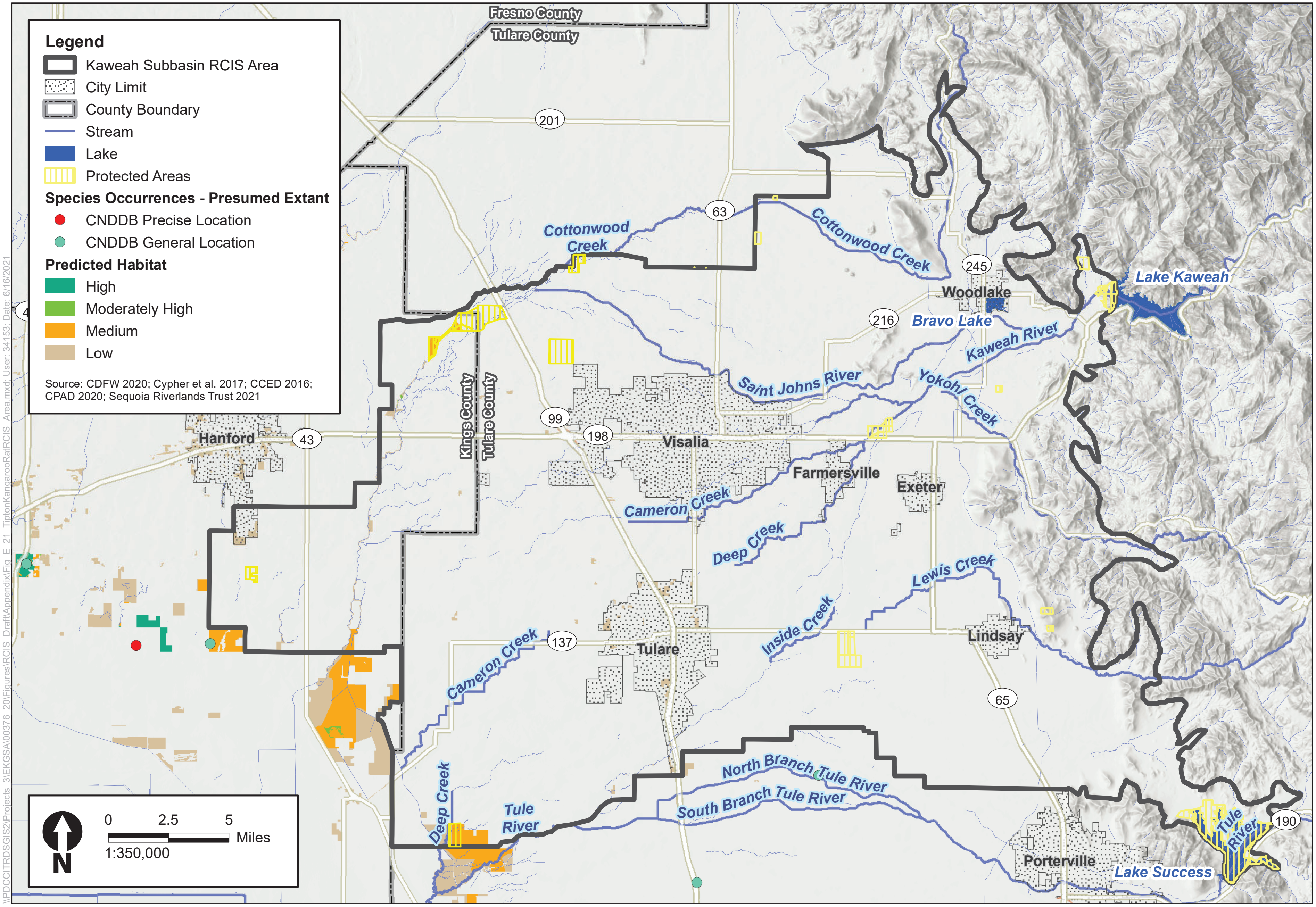

Figure E-21
Tipton Kangaroo Rat

San Joaquin kit fox (*Vulpes macrotis mutica*)

Regulatory Status

- **State:** Threatened
- **Federal:** Endangered
- **Critical Habitat:** None
- **Recovery Planning:** Recovery Plan for Upland Species of the San Joaquin Valley, California (U.S. Fish and Wildlife Service 1998)

Distribution

General

San Joaquin kit fox occurs in some areas of suitable habitat on the floor of the San Joaquin Valley and in the surrounding foothills of the Sierra Nevada and Coast Ranges, from Kern County north to Contra Costa, Alameda, and San Joaquin Counties (U.S. Fish and Wildlife Service 1998, U.S. Fish and Wildlife Service 2020e). Within the region, San Joaquin kit fox ranges across the larger scattered islands of natural land on the San Joaquin Valley floor in Tulare, Kings, Kern, Fresno, Madera, and Merced Counties (Figure E-22). The largest extant populations of kit fox are in Kern County (Elk Hills and Buena Vista Valley) and San Luis Obispo County in the Carrizo Plain National Monument (U.S. Fish and Wildlife Service 1998, U.S. Fish and Wildlife Service 2020e).

Within the RCIS Area

There are approximately 30 CNDDB occurrences within the RCIS Area, dispersed throughout the RCIS Area on agricultural lands (California Department of Fish and Wildlife, California Natural Diversity Database 2021). Of these, only two occurrences are recent (1995 or later); one south of Cottonwood Creek and north of Goshen, and the second near Lewis Creek north of Lindsay (Figure E-23).

The northern extent of two USFWS satellite recovery units extend into the southern corners of the RCIS Area: Allensworth Ecological Reserve/Creighton Ranch/Pixley NWR in the southwest and Porterville/Lake Success in the southeast (Figure E-23) (U.S. Fish and Wildlife Service 2020e). Satellite areas are more fragmented or of lower quality with kit fox populations that are smaller than core populations.

Highly and moderately suitable habitat, as modeled by Cypher et al. (2013), is scattered throughout the RCIS Area. The largest patches are located in the eastern and southwestern portions of the RCIS Area (Figure E-23). Habitat suitability rankings are based on the mean expert opinion suitability value for each habitat type for breeding, foraging, and cover.

Natural History

San Joaquin kit fox can, but do not necessarily, breed their first year. Adult pairs remain together year-round, sharing the same home range, but not always the same den (U.S. Fish and Wildlife Service 2020e). Mating and conception occur from late December to March (Morrell 1972, Spencer et al. 1992). Sometime between February and late March, a litter of two to six pups is produced (Zoellick et al. 1987, Cypher et al. 2000). Males provide most of the food for the female and her pups while she is lactating. Pups emerge from dens a little after one month. After four to five months, young generally disperse, though occasionally young will remain with the family group longer than the first summer (Koopman et al. 2000, U.S. Fish and Wildlife Service 2020e). Pups have been found to disperse approximately 5 miles on average from the natal den. Dispersing adults and juveniles have been tracked moving through disturbed habitats such as agricultural fields, oil fields, rangelands, and across highways and aqueducts (Scrivner et al. 1987).

Annual reproductive success for adults can range between 20 and 100% (mean: 61%) and 0 and 100% for juveniles (mean: 18%) (Cypher et al. 2000). Population growth rates generally vary with reproductive success, and kit fox density is often related to both current and previous year's prey availability (Cypher et al. 2000). Prey abundance is generally strongly related to the previous year's precipitation, particularly drought conditions (Cypher et al. 2000, Dennis and Otten 2000, U.S. Fish and Wildlife Service 2010c).

The diet of San Joaquin kit fox varies seasonally and geographically, based on local availability of potential prey, though kangaroo rats (*Dipodomys* spp.) comprise the majority of their prey (Laughlin 1970, Cypher et al. 2000, U.S. Fish and Wildlife Service 2010c, 2020e). Secondary prey in non-urban populations include rabbits and hares (*Lepus* and *Sylvilagus* spp.), ground squirrels, ground-nesting birds, reptiles, and insects (Laughlin 1970, Cypher and Brown 2006). In populations in developed areas in the southern San Joaquin Valley, prey more commonly include smaller rodents (Spiegel et al. 1996).

San Joaquin kit fox use numerous dens throughout the year. Dens are used for temperature regulation, shelter from adverse environmental conditions, reproduction, and escape from predators (U.S. Fish and Wildlife Service 2020e). San Joaquin kit fox dens are generally found in flat or gently rolling terrain with slopes of less than 10 degrees, and most dens are found on slopes of less than 30% (Archon 1992). Natal and pupping dens are generally found on flatter ground with slopes of about 6 degrees (O'Farrell et al. 1980, O'Farrell and McCue 1981).

San Joaquin kit fox generally modify and use dens constructed by other animals, such as ground squirrels (Jensen 1972, Morrell 1972, Hall 1983, Berry et al. 1987), as well as human-made structures (Cypher pers. comm., as cited in U.S. Fish and Wildlife Service 1998). The number of dens used varies between seasons, with a greater number of dens used during the dispersal season than during the breeding or pup-rearing seasons. San Joaquin kit fox changes dens four or five times during the summer, and changes natal dens one or two times per month (Morrell 1972). Factors influencing den changes may include depletion of prey resources near the den, predator avoidance, or a buildup of external parasites such as fleas (Egoscue 1956, White et al. 1994, as cited in U.S. Fish and Wildlife Service 2020e).

San Joaquin kit fox home range size appears to be related primarily to prey density (U.S. Fish and Wildlife Service 2020e). San Joaquin kit fox can readily navigate a matrix of land use types (Spiegel and Bradbury 1992, White and Ralls 1993). Average home range size from a number of studies varies from 1.3 square miles in a fragmented agricultural landscape (Cypher et al. 2014) to 4.5 square miles in the Carrizo Plain (White and Ralls 1993). The home ranges of pairs or family groups of San Joaquin kit fox generally do not overlap (White and Ralls 1993).

Habitat Requirements

San Joaquin kit fox occurs in a variety of habitats, including grasslands, scrublands, vernal pool areas, alkali meadows and playas, and an agricultural matrix of row crops, irrigated pastures, orchards, vineyards, and grazed annual grasslands (U.S. Fish and Wildlife Service 1998). San Joaquin kit fox prefers areas with loose-textured soils (Grinnell et al. 1937, Egoscue 1962), suitable for digging, but can occur on virtually every soil type. Dens are generally located in open areas with grass or grass and scattered brush, and seldom occur in areas with thick brush. They are seldom found in areas with shallow soils due to high water tables (McCue et al. 1981) or impenetrable bedrock or hardpan layers (O'Farrell and Gilbertson 1979, O'Farrell et al. 1980). However, San Joaquin kit fox may occupy soils with a high clay content where they can modify burrows dug by other animals, such as California ground squirrels, kangaroo rats, and badgers (Orloff et al. 1986, Cypher et al. 2012).

Cypher et al. (2013) mapped the remaining distribution and suitability of habitat within San Joaquin kit fox's range, classifying habitat into one of three categories of quality: highly suitable, moderately suitable, or low suitability. Habitat attributes most important to San Joaquin kit fox were land cover, terrain, and low vegetation density. Highly suitable habitat includes saltbush scrublands (*Atriplex polycarpha, A. spinifera*) and grassland dominated by red brome, while moderately suitable habitat includes alkali sink scrublands and grassland dominated by wild oat species. Highly suitable habitat also includes flat or gently rolling terrain (i.e., average slopes less than 5%), with suitability declining as the average slope increases and terrain becomes more rugged. Though anthropogenic habitat (e.g., agriculture and urban areas) were considered to have low suitability, a substantial San Joaquin kit fox population occurs within the urban environment of Bakersfield. Open areas of schools, business campuses, community parks, sports fields, detention basins, and walkways are used by San Joaquin kit foxes (Deatherage 2020).

Fallowed agricultural land has the potential to provide habitat for San Joaquin kit fox, particularly if natural land is adjacent to fallowed agricultural land, and site-specific restoration (Uptain et al. 2005, U.S. Fish and Wildlife Service 2020e).

Pressures and Stressors

Historically, the main threat to San Joaquin kit fox and the reason for population decline has been the loss of habitat due to conversion of native habitat for urban development, agriculture, and oil and gas development (U.S. Fish and Wildlife Service 2010c, 2020e). By the late 1970s, much of the native habitat in the San Joaquin Valley had been developed, with only 370,000 acres out of an estimated 8.5 million acres remaining undeveloped. The conversion of natural habitat to agriculture, urban sprawl, gas and oil extraction, and the siting of solar facilities in core areas remains a significant threat. Land conversion contributes to the decline of kit foxes through direct mortality from anthropogenic causes, reduced suitable denning sites, reduced prey abundance, changes in the distribution and abundance of larger canids that compete for resources, and reduced carrying capacity as suitable habitat becomes increasingly fragmented (U.S. Fish and Wildlife Service 2010c, 2020e).

Predation by coyotes is currently the primary source of mortality for San Joaquin kit fox and may contribute to the decline of kit foxes (Nelson et al. 2007, U.S. Fish and Wildlife Service 2010c, 2020e, Cypher et al. 2012). White et al. (2000) determined that coyotes were responsible for 59% of San Joaquin kit fox deaths during a 4-year telemetry study at Camp Roberts in southern Monterey

County. Coyotes have accounted for approximately 75% of San Joaquin kit fox mortalities on the Carrizo Plain and the Naval Petroleum Reserve (Nelson et al. 2007). Other predators of San Joaquin kit foxes include red fox, feral dogs, badger, and golden eagle (*Aquila chrysaetos*) (Cypher et al. 2012).

Serological tests for diseases in San Joaquin kit fox found high numbers have been exposed to canine distemper virus and canine parvovirus (U.S. Fish and Wildlife Service 2010c, 2020e). Though high numbers have been exposed to these pathogens, mortality due to disease does not seem to be an important mortality factor (U.S. Fish and Wildlife Service 2010c, 2020e, Cypher et al. 2012). Diseases in general do not appear to be a significant mortality source for non-urban San Joaquin kit foxes (Cypher et al. 2012), though disease combined with predation have contributed to the catastrophic decline in the isolated population of San Joaquin kit fox at Camp Roberts in San Luis Obispo County (U.S. Fish and Wildlife Service 2020e). Sarcoptic mange, caused by *Sarcoptes scabiei* mites precipitated a significant decline of the formerly stable urban kit fox population in Bakersfield in 2013. A similar, but smaller outbreak, occurred in the urban kit fox population in Taft, California in 2019 (Rudd et al. 2020).

Vehicle strikes are a small, but consistent source of mortality for San Joaquin kit fox on natural lands (U.S. Fish and Wildlife Service 2020e). Within human-altered landscapes, including urban environments, vehicle strikes can be a more substantial source of San Joaquin kit fox mortality (Bjurlin et al. 2005, U.S. Fish and Wildlife Service 2020e).

Changes in wildfire prevalence and fire suppression in the eastern portion of the RCIS Area has the potential to alter San Joaquin kit fox habitat and affect kit fox persistence (U.S. Fish and Wildlife Service 2010c). Wildfires may increase under drought conditions or with increasing human population. Wildfire may directly endanger individual kit fox, particularly in grassland habitat where there is exotic grasses or shrub overgrowth that carry fire into native kit fox habitat. Studies suggest, however, that kit fox populations may benefit from some fires in the long term because fires reduce vegetation density and create open habitats (Zoellick et al. 1989, Warrick and Cypher 1998, U.S. Fish and Wildlife Service 2010c).

Climate Change Vulnerability Analysis

San Joaquin kit fox may be moderately or less vulnerable to climate change, based on an analysis of 27 climate change vulnerability criteria (e.g., natural history, habitat requirements, physiology, interactions with other species) (Stewart et al. 2016). Although up to 74% of current occurrence locations are projected to become climatically unsuitable by 2070–2099, there is an expected increase in suitable habitat within dispersal distance across San Joaquin kit fox range by between approximately 13% and 33% (Stewart et al. 2016). San Joaquin kit fox may also benefit from an upslope expansion of habitat into nearby foothills, provided other ecological factors align (e.g., interactions with predators, prey availability) (Stewart et al. 2016).

In the RCIS Area, suitable habitat for San Joaquin kit fox is expected to remain at lower elevations and increase at higher elevations under a warm and wet scenario for lower and higher emissions and hot and dry scenario for low emissions. Under the hot and dry scenario for high emissions, habitat will no longer be suitable at lower elevations, but suitable habitat will increase at higher elevations into the lower foothills (Stewart et al. 2016).

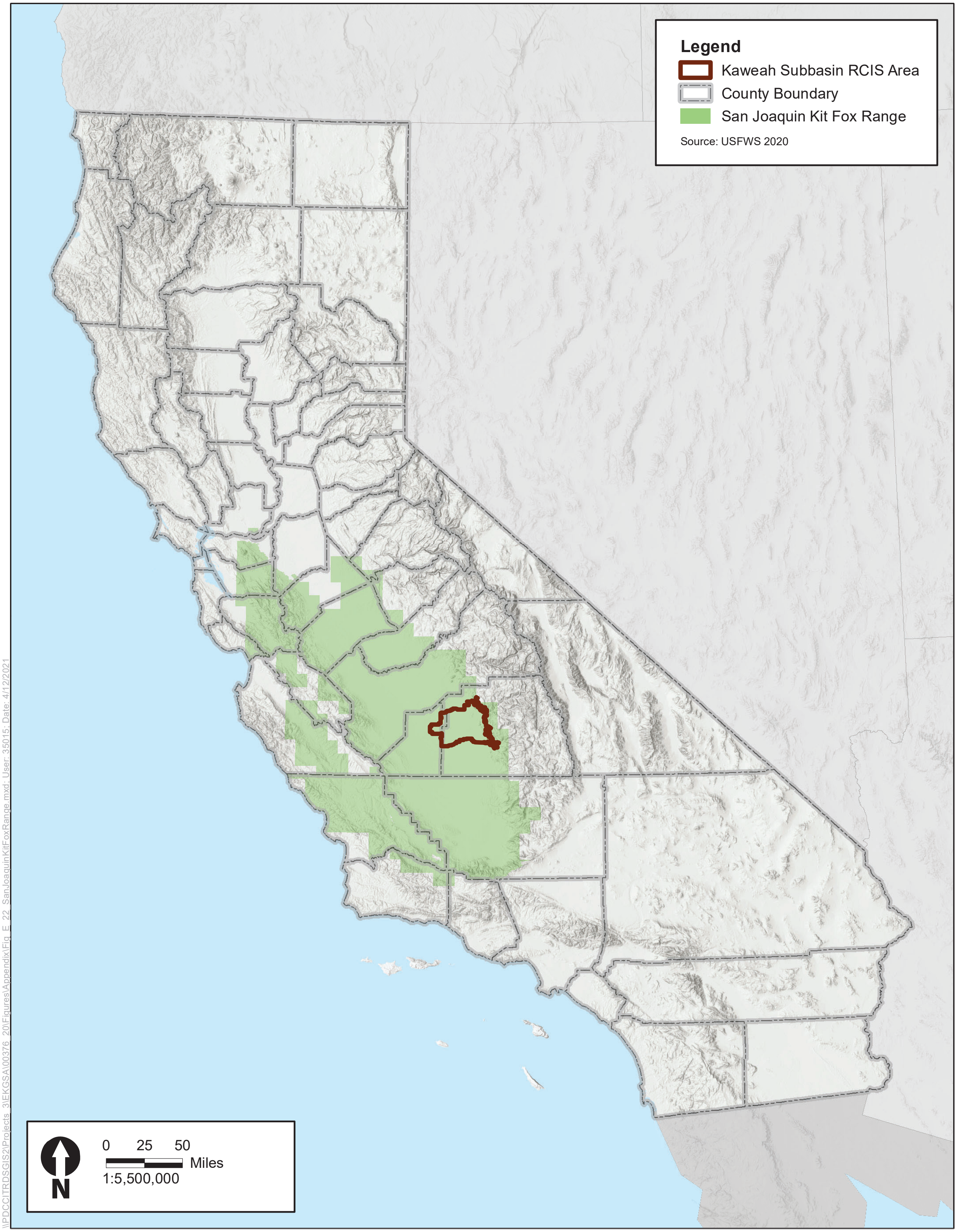

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Figure E-22
San Joaquin Kit Fox Range

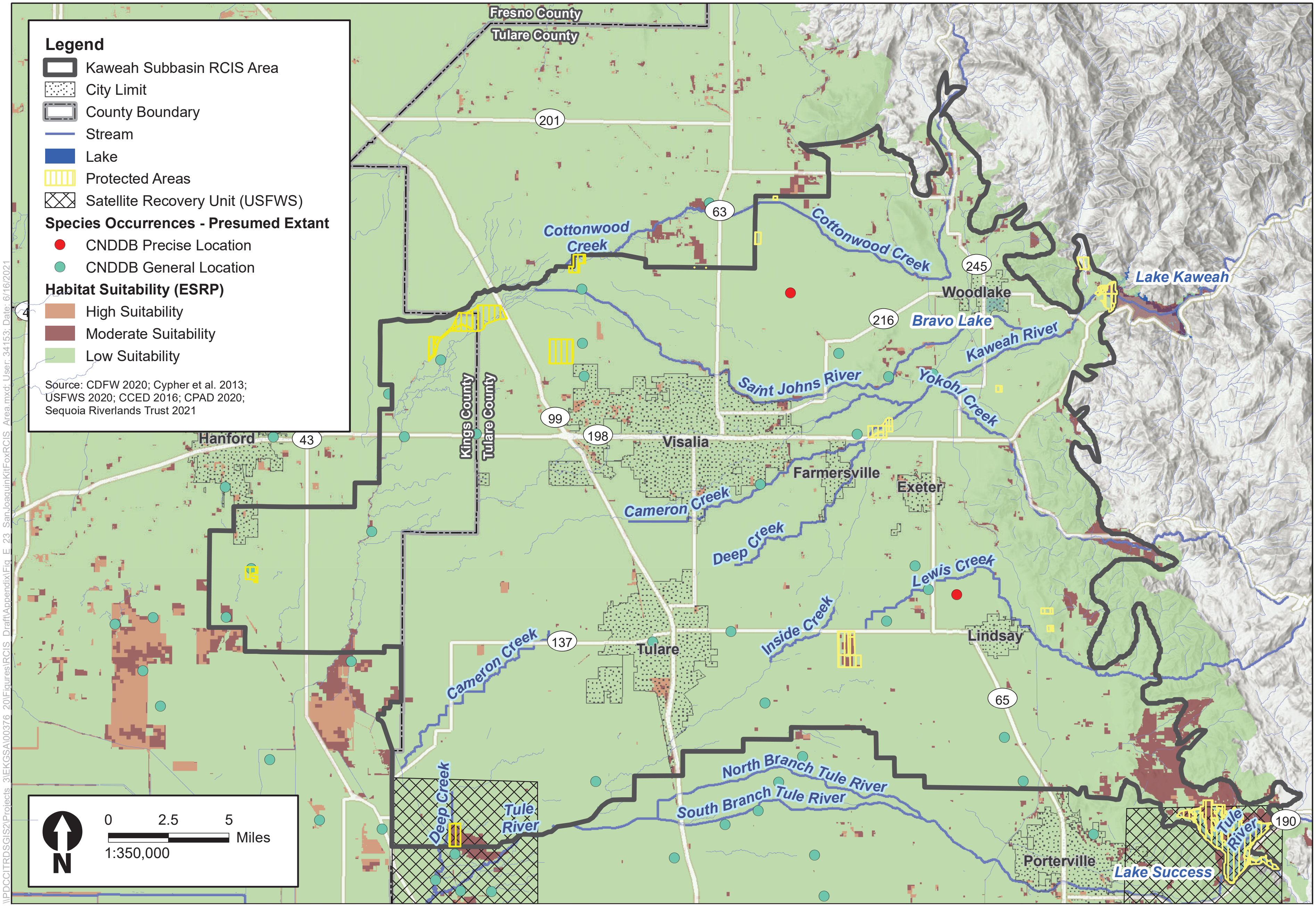

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Figure E-23
San Joaquin Kit Fox

Kaweah brodiaea (*Brodiaea insignis*)

Regulatory Status

- **State:** Endangered, California Rare Plant Rank 1B.2
- **Federal**: None
- **Critical Habitat**: None
- **Recovery Planning**: None

Distribution

General

Kaweah brodiaea is endemic to the Sierra Nevada foothills of central Tulare County in the Tule and Kaweah River drainages in Tulare County (Pires and Preston 2019). It can be found between 558 and 4,610 feet of elevation (California Department of Fish and Wildlife, California Natural Diversity Database 2021) (Figure E-24). There are 27 CNDDB occurrences for Kaweah brodiaea within California (California Department of Fish and Wildlife, California Natural Diversity Database 2021).

Within the RCIS Area

Of the 27 CNDDB occurrences, 1 (3.7%) is within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). This occurrence is located in the northeastern portion of the RCIS Area, north of the Kaweah River and west of Lake Kaweah (Figure E-25). The majority of occurrences for this species are located in the foothills immediately east of the RCIS Area.

Natural History

Kaweah brodiaea is a monocot, perennial herb that grows from a bulb. Kaweah brodiaea has purple to pinkish flowers on long pedicels. Each flower has a narrow cylindrical tube which opens into a flat face of six tepals (California Native Plant Society, Calscape 2021). The plant produces an inflorescence up to 9.8 inches long (25 centimeters). This species blooms from April to June, with the peak blooming period in May (Pires and Preston 2019, California Native Plant Society, Rare Plant Program 2021).

Habitat Requirements

Kaweah brodiaea grows in foothill woodland, meadows and seeps, and valley and foothill grassland (Pires and Preston 2019, California Department of Fish and Wildlife, California Natural Diversity Database 2021, California Native Plant Society, Rare Plant Program 2021). Kaweah brodiaea is found usually in grassland habitats surrounded by foothill woodland. This species is strongly associated with granite or clay soils on south-southwest facing slopes (California Department of Fish and Wildlife, California Natural Diversity Database 2021).

Pressures and Stressors

Threats to Kaweah brodiaea include residential development, road maintenance, vehicles, grazing, and nonnative plants (Pires and Preston 2019, California Native Plant Society, Rare Plant Program 2021).

Climate Change Vulnerability Analysis

Like all organisms, plants need to be able to move away from unsuitable conditions caused by climate change into areas that are either still suitable or newly suitable under changed climate conditions. In general, the predicted consequence of climate change will result in shifts of suitable habitat to higher elevations and latitudes (Jump and Peñuelas 2005). If climate change causes current habitat to become unsuitable, populations of Kaweah brodiaea will likely have to (1) complete a multi-generational physical movement to suitable habitat; or (2) genetically adapt to changes in place to cope with the new conditions; or (3) go extinct. If climate change produces unsuitable conditions more rapidly than either (1) or (2) above, then extinction will be inevitable (Thomas et al. 2004). Under climatic changes, temperature and water availability are the two variables most often documented as influencing either genetic change or physical movement (Jump and Peñuelas 2005).

No specific climate change vulnerability analysis has been done for Kaweah brodiaea. However, vulnerability assessments conducted on Kaweah brodiaea habitats that occurs within the RCIS Area, e.g., California annual and perennial grassland, can be used extrapolate the vulnerability of the species to climate change.

Thorne et al. (2016) conducted a climate change vulnerability assessment on terrestrial vegetation in California. The assessment was based on the following models.

- Warm and wet global climate model
- Hot and dry global climate model
- Representative concentration pathway (RCP) 4.5 greenhouse gas medium emission scenario
- RCP 8.5 greenhouse gas high emission scenario

California annual and perennial grassland received a mean vulnerability raking of mid-high (Thorne et al. 2016). Within the RCIS Area, most of the existing range of California annual and perennial grassland is not expected to remain suitable for this vegetation macrogroup by the end of the century under a high emission, hot and dry climate scenario. The extent of the existing range of California annual and perennial grassland expected to remain stable for this vegetation macrogroup by the end of the century is greater, but more variable, under the less likely, low emission, warm and wet climate scenario or high emission, warm and wet climate scenario (Thorne et al. 2016).

Reduction in the area of California annual and perennial grassland would likely result in the reduction of suitable habitat for Kaweah brodiaea. The limited geographic range of this species may reduce its ability to migrate to more suitable areas as habitats shift with climate change (Anacker et. al. 2013).

Figure E-24
Kaweah Brodiaea Range

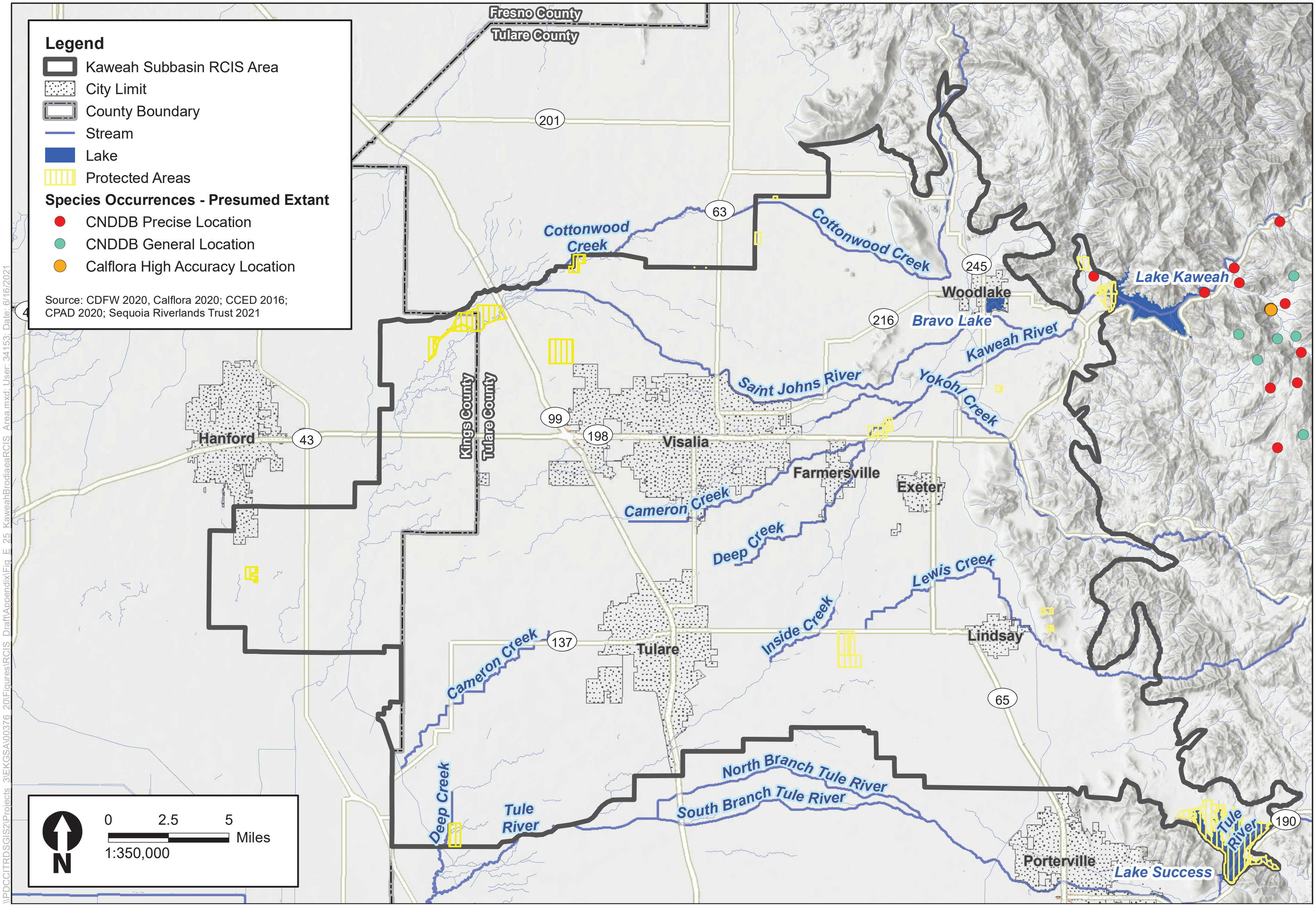

Figure E-25
Kaweah Brodiaea

ICF

Striped adobe-lily (*Fritillaria striata*)

Regulatory Status

- **State:** Threatened, California Rare Plant Rank 1B.1
- **Federal**: None
- **Critical Habitat**: None
- **Recovery Planning**: None

Distribution

General

Striped adobe-lily is endemic to California, occurring in the southern Sierra Nevada and Tehachapi Mountain foothills in Kern and Tulare Counties (Stebbins 1989, McNeal and Ness 2012). It can be found between 443 and 4,700 feet (Stebbins 1989, California Department of Fish and Wildlife, California Natural Diversity Database 2021). There are 23 CNDDB occurrences for striped adobe-lily within California (California Department of Fish and Wildlife, California Natural Diversity Database 2021)
(Figure E-26). The majority of the CNDDB occurrences for this species occur south of the RCIS Area in the foothills, northeast of Bakersfield.

Within the RCIS Area

Of the 23 CNDDB occurrences, one (4%) is within the RCIS Area (California Department of Fish and Wildlife, California Natural Diversity Database 2021). This occurrence is located in the southeastern portion of the RCIS Area (Figure E-27). Stebbins (1989) identified an historic occurrence in Frazier Valley in the southeast corner of the RCIS Area (not shown on Figure E-27) and five miles east of Lindsey, east of the RCIS Area. These occurrences were likely extirpated for conversion to agricultural uses (Stebbins 1989). Other occurrences are located just south of the RCIS Area in this region.

Natural History

Striped adobe-lily is a slender bulbiferous perennial herb, with unbranched stem (Stebbins 1989, McNeal and Ness 2012). This species has a terminal inflorescence and predominantly basal oblanceolate leaves. The flowers of the striped adobe-lily consist of six pink to white tepals with prominent red striations (Stebbins 1989). This species blooms from February to April (McNeal and Ness 2012).

Vegetative and reproductive phenology appear to be closely correlated with rainfall (Stebbins 1989). The amount and timing of winter rain appears to affect plant size and number of flowers produced per plant (Stebbins 1989). Pollination mechanisms are not known but flowers are likely pollinated by insect species similar to other lilies in the region (Stebbins 1989).

Habitat Requirements

Striped adobe-lily grows in valley and foothill grassland and cismontane woodland (California Native Plant Society, Rare Plant Program 2021). This species has been documented in nonnative grassland and blue oak (*Quercus douglasii*) woodland (Stebbins 1989). Stebbins considers this species to be edaphically restricted to abode clay soils. At lower elevations, striped adobe-lily has been found on Porterville Clay, Mount Olive Clay, and Cibo Clay, as well as other minor series clay-rich soils. These soils are located in the foothills of eastern portion of the RCIS Area (Figures 2-9b, 2-9d, 2-9e). The largest historical populations occurred on more level ground with deep clays and likely higher soil moisture availability. Striped adobe-lily is also associated with north-facing slopes most likely due to cooler, moister soil conditions (Stebbins 1989).

Pressures and Stressors

Threats to striped adobe-lily include loss of habitat to urbanization and agriculture, competition for resources by nonnative plants, and possibly loss of individuals and occurrences to vehicular use of habitat and road maintenance (Stebbins 1989, California Native Plant Society, Rare Plant Program 2021). Although striped adobe-lily was never common, it was once much more widespread than currently, with remaining populations likely representing fragments of larger historical occurrences (Stebbins 1989).

The extirpation of four populations of striped adobe-lily has been the direct result of land conversion to agricultural uses (Stebbins 1989). Livestock grazing may also impact this species. Light grazing or grazing regimes that allow the plants to flower and produce seed may have a beneficial impact. However, heavy grazing and trampling from livestock directly impact populations. Stebbins (1989) surmised that ungrazed stands of nonnatives such as *Avena* or *Bromus* species would provide formidable competition. Grazing regimes can also contribute to predation of striped adobe-lily by fossorial mammals. Species such as California ground squirrel are often found in large numbers within heavily grazed areas. They often feed on bulbs of perennials or graze herbaceous perennials to ground level. It is presumed that large populations of California ground squirrels could impact striped adobe-lily populations (Stebbins 1989).

Transportation projects, such as road widening or maintenance activities, also pose a potential threat to striped adobe-lily. The clay soils associated with this species grows are unstable during wet months, and emergency slope stabilization activities are a potential direct impact to populations (Stebbins 1989).

Climate Change Vulnerability Assessment

No specific climate change vulnerability analysis has been done for striped adobe-lily. However, vulnerability assessments conducted on striped adobe-lily habitat that occurs within the RCIS Area, e.g., California annual and perennial annual grassland and California forest and woodland macrogroups, can be used extrapolate the vulnerability of the species to climate change. California annual and perennial grassland includes all annual forb/grass vegetation including nonnative grasses. California forest and woodland includes all Mediterranean climate woodlands and forests in California from sea level to the point where snow and frost, in combination with high winter precipitation, enables cool temperate species of trees to dominate the overstory layer, including blue oak woodland (Thone et. al. 2016).

Thorne et al. (2016) conducted a climate change vulnerability assessment on terrestrial vegetation in California as described for Kaweah brodiaea. The assessment was based on the following models.

- Warm and wet global climate model
- Hot and dry global climate model
- RCP 4.5 greenhouse gas emission scenario
- RCP 8.5 greenhouse gas emission scenario

Within the RCIS Area, most of the existing range of the California annual and perennial grassland macrogroup is not expected to remain suitable for this vegetation macrogroup by the end of the century under a high emission, hot and dry climate scenario. The extent of the existing range of California annual and perennial grassland expected to remain stable for this vegetation macrogroup by the end of the century is greater, but more variable, under the less likely low emission, warm and wet climate scenario or high emission, warm and wet climate scenario (Thorne et al. 2016).

Within the RCIS Area, the existing range of the California forest and woodland macrogroup is not expected to remain suitable for this macrogroup under any but a lower emission, warm and wet climate scenario. Under this scenario, some of the RCIS Area may remain suitable for California forest and woodland. Under all scenarios, suitable habitat for the California forest and woodland macrogroup is expected to shift eastward, upslope in the Sierra Nevada foothills (Thorne et al. 2016).

Reduction in the area of California annual and perennial grassland and woodland habitats would likely result in the reduction of suitable habitat for striped adobe-lily in the RCIS Area. The limited geographic range of this species may reduce its ability to migrate to more suitable areas as habitats shift with climate change (Anacker et. al. 2013).

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Figure E-26
Striped Adobe-lily Range

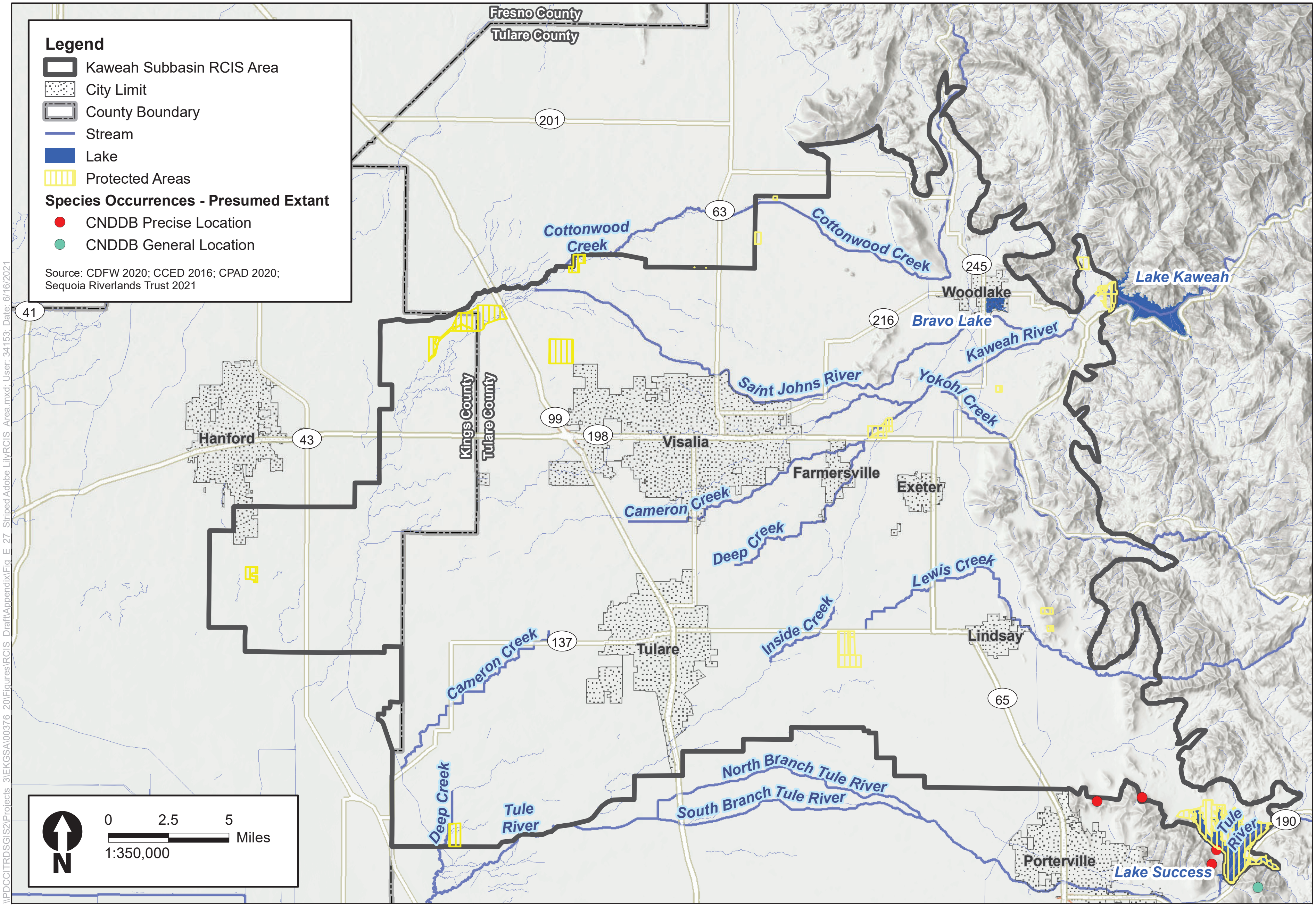

Figure E-27
Striped Adobe-lily

Valley oak (*Quercus lobata*)

Regulatory Status

- **State:** None
- **Federal:** None
- **Critical Habitat:** None
- **Recovery Planning:** None

Distribution

General

Valley oak is tree species endemic to California, occurring from Shasta County south through the Central Valley to Los Angeles County. It is found in the lower-elevation foothills and valleys of the Sierra Nevada and Coast Ranges (Howard 1992, Rosatti and Tucker 2014) (Figure E-28). Valley oak occurs from sea level up to 6,000 feet (1,830 m) (Rosatti and Tucker 2014).

Within the RCIS Area

Valley oak is scattered throughout the RCIS Area in suitable habitats (Calflora 2020) (Figure E-29) Occurrences shown on Figure E-29 are likely an underestimate, as locations of valley oak are likely under-reported to Calflora.

Natural History

Valley oak is reported to be the largest and longest lived North American oak species (Pavlik et al. 1991). It is a deciduous oak, typically growing to 1.8 to 2.4 feet in diameter at breast height and 30 to 75 feet tall, but larger individuals have been documented. Mature stands typically range from 100 to 200 years old, but individuals are estimated to reach between 400 to over 500 years old (Howard 1992).

Valley oak displays a highly branched growth habit, with very large crowns. The density of this species varies from closed-canopy forests to open savannahs in drier parts of the range (Gharehaghaji et al. 2017). Established valley oak trees are drought and flood tolerant and are thought to be dependent on groundwater (Lewis and Burgy 1964, Griffin 1973). Trees have vertical roots that tap groundwater, with root depth that have been measured as deep as 80 feet. Sapling and young valley oaks may be particularly vulnerable to drought stress (McLaughlin and Zavaleta 2012).

Valley oak is monoecious (having both male and female reproductive parts), and wind pollinated (Howard 1992). This species blooms from March to April (Rosatti and Tucker 2014). It is a dominant species in valley oak woodland and riparian forests (Beckman et al. 2019).

Habitat Requirements

Valley oak grows in deep, silty loam, clay loam, and sandy clay loam soils typical of floodplains and valley floors. The species is dependent on water table access, with ideal growing conditions at a water table depth of about 33 feet below the surface. Valley oak grows in a Mediterranean climate, with wet, mild winters and hot, dry summers (Howard 1992). Valley oak-savannah woodlands typically consist of valley oak as the only tree species, and annual grasslands between the widely spaced individual oak trees (Howard 1992, Beckman et al. 2019). Within valley oak riparian forests, species composition is more diverse, including other oak species, Fremont cottonwood, black walnut (*Juglans californica*), western sycamore (*Platanus racemosa*), and willows, among others (Howard 1992, Beckman et al. 2019). Valley oak riparian forests typically extend either side of major rivers approximately 0.6 to 5 miles (Howard 1992).

Pressures and Stressors

Clearing of land for urban development and agricultural uses, ranching and grazing, wildfire suppression, altered hydrologic processes, and climate change are all identified threats to valley oak (Beckman et al. 2019). Land conversion affects remaining populations of valley oaks through removal of individuals and fragmentation of remaining populations (Crawford 1998). In additional to the removal of mature trees, low recruitment of valley oak is also a major concern (Tyler et al., 2006, Zavaleta et al. 2007). Valley oak may not regenerate at an adequate rate to sustain current stand levels over most of its range (Crawford 1998, Beckman et al. 2019). In valley oak woodlands, few young trees grow in open, dry sites, although reproduction of valley oak near streams with floodplain development can be good, especially following flood events. The underlying causes of apparent low recruitment in valley oak are not clear, but likely include factors such as climate change, habitat fragmentation, altered herbivore populations, changing fire regimes, invasive nonnative plants and animals, livestock grazing, and soil conditions altered by past land uses (Tyler et al. 2006, Zavaleta et al. 2007).

Climate Change Vulnerability Assessment

Valley oak may be particularly vulnerable to climate change-related drought (Matzner et al. 2003, Tyler et al. 2006). A regional bioclimatic model for valley oak using soil and climate parameters associated with mature trees projects a decrease in extent (to 54% of modern potential range sizes) and general northward and upslope elevational expansion of the species' distribution. Increased warming and large decreases in precipitation during the growing season are a primary driver of these projected changes (Kueppers et al. 2005). Climate change may amplify causes for low recruitment, particularly where drought stress limits sapling survival (McLaughlin and Zavaleta 2012). Drought stress in sapling valley oak may restrict the species to areas around water. Localized areas with a suitable water table may provide microrefugia for valley oak as climatic conditions warm, at least up to a certain maximum temperature (McLaughlin and Zavaleta 2012).

Climate change is problematic for long-lived tree species such as valley oak. Tree populations must be able to tolerate a changing climate, adapt to new local conditions through selection on local genetic variation, or migrate to new favorable locations (Sork et al. 2010). Habitat fragmentation and loss create barriers to movement of acorns that may limit migration of valley oak to newly suitable habitats in a rapidly changing climate (Sork and Smouse 2006).

Population-level differences in genes and gene expression may regulate response to drought in valley oak (Mead et al. 2019). When tested in a common environment, individual valley oaks representing different populations from different climates were found to have qualitatively different responses to drought stress, possibly related to temperature differences among the climates. This differential response to water stress may determine how populations will be affected by increasingly severe and frequent droughts, especially when accompanied by increased temperatures (Mead et al. 2019). With wind-dispersed pollen, valley oak populations have historical genetic connectivity; however, the expected rate of rapid climate change is likely to cause shifts in climate zones that exceed the rate of migration for most local populations, in part due to limited seed dispersal (Sork et al. 2010). Regional populations may be adapted to current local climate conditions or recent conditions; however, some regions will experience particularly dramatic shifts in climate zones. Regional populations may not have the genetic composition or plasticity to adapt to a rapidly changing climate (Sork et al. 2010).

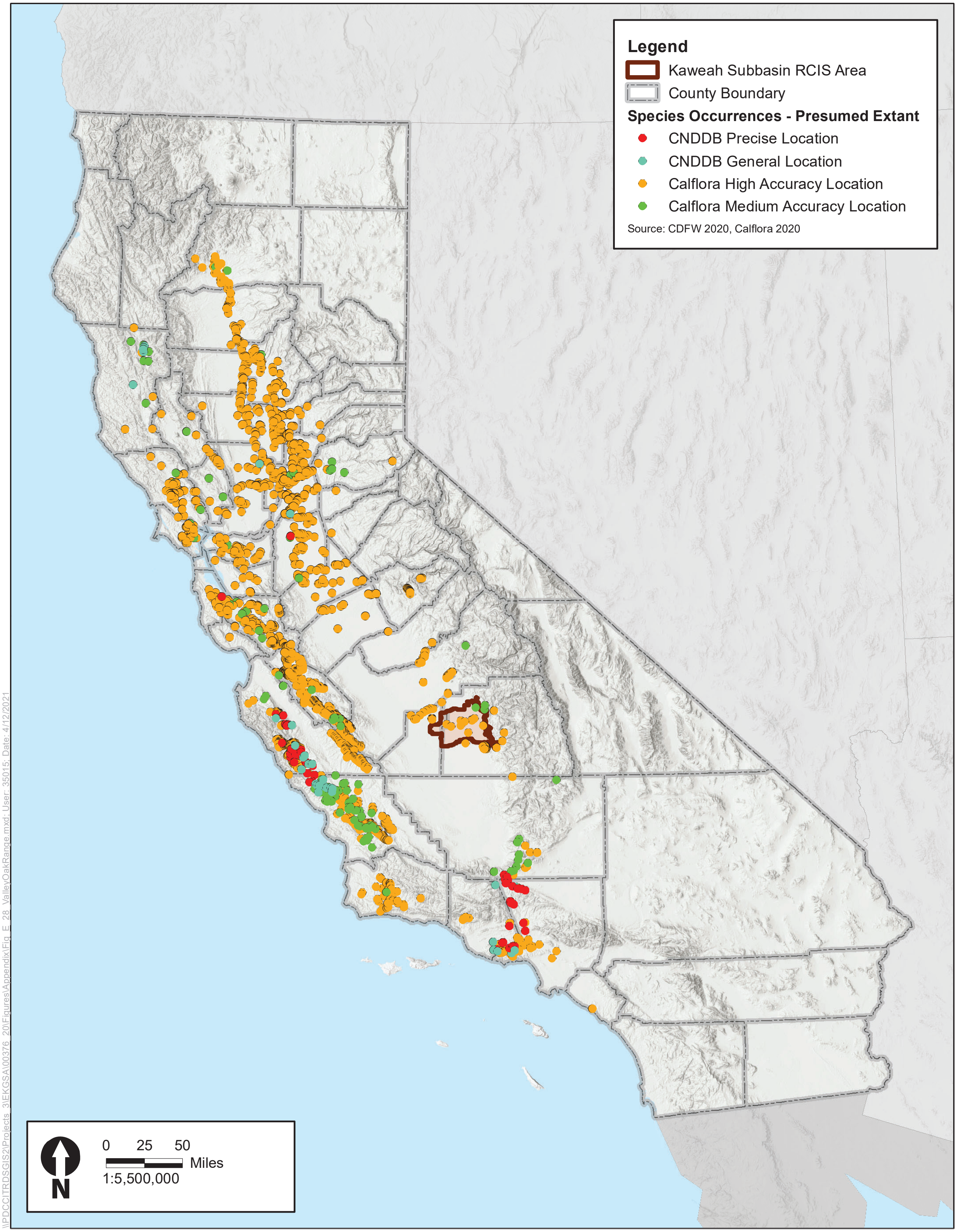

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Figure E-28
Valley Oak Range

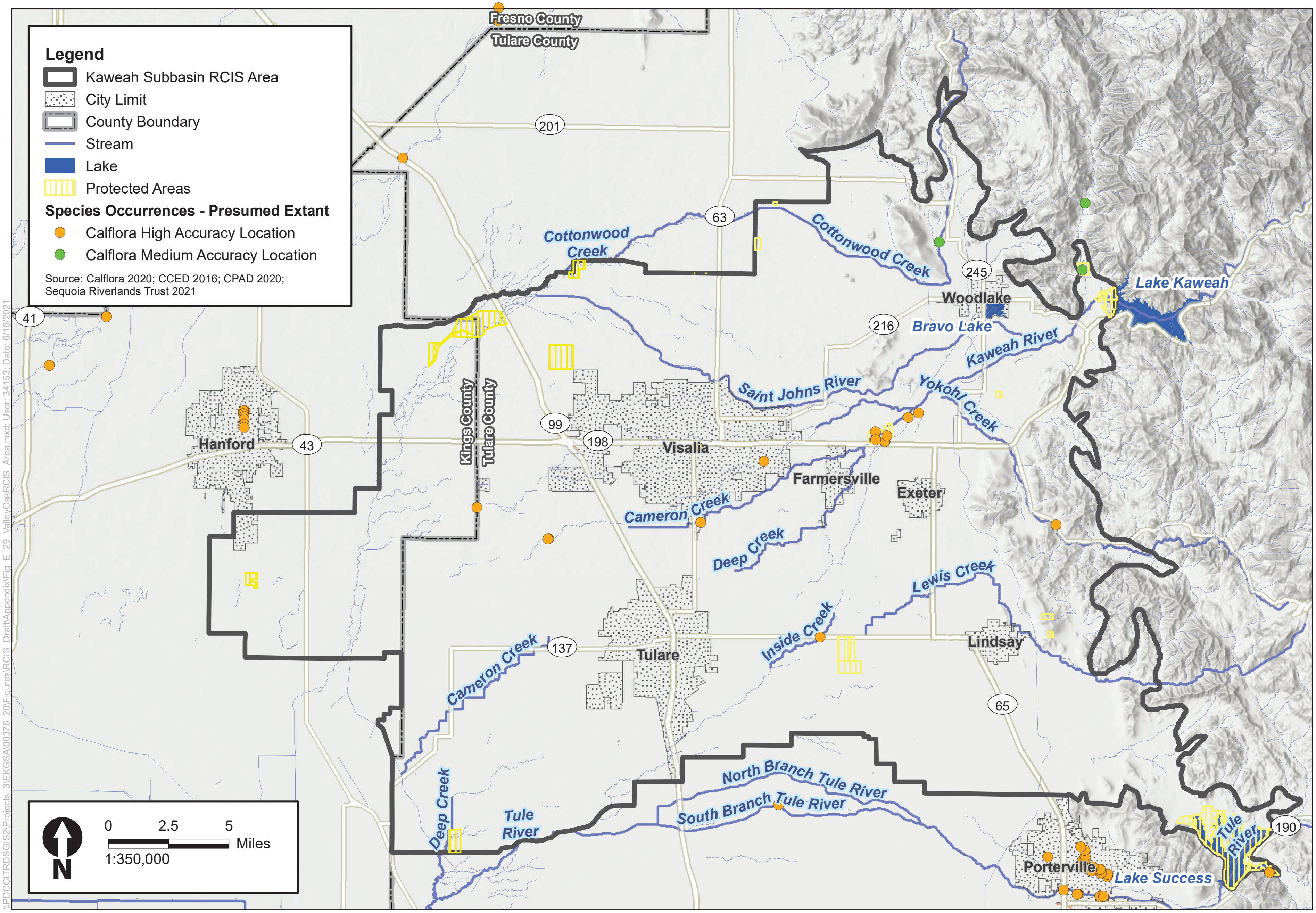

Figure E-29
Valley Oak

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Personal Communications

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Appendix F
Non-Focal Species Summaries

Non-Focal Species Summaries

This appendix briefly describes the habitat requirements of the Kaweah Subbasin Regional Conservation Investment Strategy (Kaweah RCIS) non-focal species and explains the ecological rationale behind the association of each non-focal species with focal species so that mitigation credit agreement (MCA) credits may be created for non-focal species. California Fish and Game Code (FGC) Section 1856(a) states that "[a] conservation action or habitat enhancement action that measurably advances the conservation objectives of an approved regional conservation investment strategy may be used to create mitigation credits that can be used to compensate for impacts to focal species and *other species*, habitat and other natural resources, as provided in this section" (emphasis added). The *Regional Conservation Investment Strategies Program Guidelines* (Program Guidelines) (California Department of Fish and Wildlife 2018) provide additional guidance for what must be included in an RCIS to enable credits to be created through an MCA for species not included in an RCIS as focal species (i.e., "non-focal species"): "[t]o create credits through an MCA (mitigation credit agreement) to offset future impacts to a specific species that species must be an approved RCIS' focal species or a species whose conservation need was analyzed or otherwise provided for in the RCIS."

Many non-focal species have conservation needs similar to the focal species, which would be addressed by implementing conservation actions and habitat enhancement actions for focal species that use the same habitats. Similarly, many non-focal species will benefit from the implementation of conservation actions and habitat enhancement actions for natural communities (Section 3.7), working landscapes (Section 3.8), and habitat connectivity (Section 3.9). For example, non-focal species that have habitat requirements that overlap with the habitat requirements of focal species will benefit from conservation actions and habitat enhancement actions that protect, restore, and enhance habitat for focal species and natural communities. The following sections briefly describe the habitat requirements of the non-focal species and explain the ecological rationale behind the association of each non-focal species with conservation actions and habitat enhancement actions for focal species and other conservation elements.

At the end of this appendix are two tables to show how the RCIS provides for the conservation needs of non-focal species. Table F-1 shows the general habitat associations of non-focal species, represented by this RCIS's natural communities (Section 2.3.8.2, *Current Natural Communities and Land Cover*). Table F-2 highlights the general similarities in habitat use and overlap between non-focal species and focal species identified by similarities in use of natural communities.

The tables in this appendix are only intended to illustrate the general relationships between non-focal species, natural communities, and focal species to show how implementation of this RCIS's conservation actions and habitat enhancement actions could benefit non-focal species. An organism's habitat is influenced by factors other than natural community, such as microclimate and current and historic land use (e.g., livestock grazing), among others, such that not all of a natural community would be expected to be suitable. Also, most species do not completely overlap habitat usage with other species. As such, Tables F-1 and F-2 are not intended to precisely depict non-focal species' habitat relationships or overlap in habitat use between non-focal and focal species.

Vernal Pool Tadpole Shrimp

Vernal pool tadpole shrimp (*Lepidurus packardi*) is federally listed as endangered. This species is adapted to the environmental conditions of its ephemeral habitats. One adaptation is the ability of vernal pool tadpole shrimp eggs, or cysts, to remain dormant in the soil when their vernal pool habitats are dry. The cysts survive the hot, dry summers and when the pools refill in fall and winter, some, but not all, of the eggs may hatch. The egg bank in the soil may comprise eggs from several years of breeding (U.S. Fish and Wildlife Service 2005, 2007). Vernal pool tadpole shrimp is entirely dependent on the aquatic environment provided by the temporary waters of natural vernal pool and playa pool ecosystems, as well as the artificial environments of ditches and tire ruts (King et al. 1996, Helm 1998, Eriksen and Belk 1999).

The watershed extent necessary for maintaining the hydrological functions of ephemeral pools depends on a number of complex factors. These include the hydrologic conductivity of surface soils, the continuity and extent of hardpans and claypans underlying non-clay soils, and the existence of a perched aquifer overlying the pan. Slope, effects of vegetation on evapotranspiration rates, and compaction of surface soils by grazing animals are also important in the hydrological function of vernal pools (Marty 2005, Pyke and Marty 2005, Williamson et al. 2005, Rains et al. 2008, O'Geen et al. 2008).

Vernal pool tadpole shrimp share the same vernal pool habitats as focal species that occur in vernal pool and seasonal wetland habitats, including vernal pool fairy shrimp, California tiger salamander, and western spadefoot. Therefore, actions that protect or enhance vernal pools or other seasonal wetland habitats for focal species will also benefit vernal pool tadpole shrimp.

Western Pond Turtle

Western pond turtle (*Actinemys pallida*) is a California species of special concern. Since western pond turtle is primarily found in natural aquatic habitats (Ernst et al. 2009) with ample basking sites (Thomson et al. 2016), the species would share many of the ecological requirements of California tiger salamander and western spadefoot which also require aquatic habitat in pools, slow-moving streams, and small ponds (California tiger salamander only) in the foothills. Upland habitats are important to western pond turtles for nesting, overwintering, and overland dispersal (Holland 1994), with nesting sites as far as 1,312 feet (400 meters) or more from the aquatic habitat (Jennings and Hayes 1994, Slavens 1995). Grassland habitat suitable for Crotch bumble bee, burrowing owl, and Swainson's hawk may also be suitable for western pond turtle if it is near occupied aquatic habitat. Therefore, actions that protect or enhance aquatic habitat may benefit western pond turtle if the aquatic habitat includes basking sites and sufficient protected adjacent upland habitat, ideally with connectivity to other aquatic habitat. Conservation actions that protect or enhance grassland habitat may benefit western pond turtle if the actions improve grassland habitat that is within an appropriate distance of suitable aquatic habitat.

Northern California Legless Lizard

Northern California legless lizard (*Anniella pulchra*) is a California species of special concern. This species is a small, slender lizard with eyelids but no legs, smooth shiny scales, and a blunt tail (Papenfuss and Parham 2013). Northern California legless lizard lives mostly underground, burrowing in loose sandy soil. Individuals are active mostly during the morning and evening, when they may be found resting just below warmed surface substrate or foraging beneath the surface of loose soil or leaf litter which has been warmed by the sun (Papenfuss and Parham 2013, Thomson et al. 2016); however, individuals have been found above ground at night when substrate temperatures remain warm (> 70° Fahrenheit [F]) for extended durations (Jennings and Hayes 1994).

Northern California legless lizard is restricted to habitats with sandy or loose loamy soils such as under sparse vegetation of open grassland, desert scrub, or near sycamores, cottonwoods, or oaks that grow on stream terraces, coastal sand dunes, and chaparral, pine-oak woodland (Gorman 1957, Stebbins 1985, Thomson et al. 2016). The species is often found under or close to logs, rocks, old boards, and the compacted debris of woodrat nests (Jennings and Hayes 1994, Papenfuss and Parham 2013). Soil moisture is essential for legless lizard to conserve energy at high temperatures; it also allows shedding to occur (Jennings and Hayes 1994). Northern California legless lizard forages in loose soil, sand and leaf litter during the day. Both adult and juvenile lizards are insectivorous and hunt by hiding beneath leaf litter or substrate and ambushing prey that consists primarily of larval insects, beetles, termites, and spiders (Thomson et al. 2016). Rocky soils or areas disturbed by agriculture, sand mining, or other human uses are not suitable habitat (Miller 1944, Bury 1972, Hunt 1983, Stebbins 1985).

California northern legless lizard shares ecological requirements with focal species that also require grassland and riparian woodland habitats, including tricolored blackbird, Swainson's hawk, and Buena Vista Lake ornate shrew. Therefore, actions that protect or enhance grassland and riparian woodland habitats for these focal species will also benefit California northern legless lizard.

American Badger

American badger (*Taxidea taxus*) is a California species of special concern. This species is found in open, arid landscapes with vegetation that can range from forest to grassland (Zeiner et al. 1988). Quinn (2007) found in a study at the Fort Ord National Monument in Monterey, California, that the top three habitat preferences within American badger's home range were annual grassland, coastal sage scrub, and urban areas. Natural communities in the RCIS Area that serve as habitat for American badger include grassland, vernal pool complex (i.e., the grassland component of vernal pool complexes), woodland, chaparral, and scrub. American badger shares ecological requirements with focal species that also require these natural communities. Therefore, actions that protect or enhance grassland, vernal pool complex, woodland, and scrub will benefit American badger. American badger also requires habitat with friable soils to dig burrows (Zeiner et al. 1988, California Department of Fish and Game 1995), as do some of the burrowing focal species such as Tipton kangaroo rat, and San Joaquin kit fox, and prey such as ground squirrels and other small mammals (Zeiner et al. 1988, California Department of Fish and Game 1995). Actions to protect, enhance and restore grassland habitat with friable soils necessary for American badger denning, and populations of ground squirrels will protect prey resources for the American badger.

Actions implemented to improve habitat connectivity and landscape linkages (another conservation element) would improve these features for American badger if the action is implemented in American badger habitat or connects patches of American badger habitat.

Springville Clarkia

Springville clarkia (*Clarkia springvillensis*) is federally listed as threatened, state listed as endangered, and is a California Native Plant Society (CNPS) 1B.2 species (rare or endangered in

California). This species is an annual herb with red or pink flowers that grows to a height of about 3.3 feet (1meter)**.** The blooming period for this species is from May through July (California Native Plant Society 2021).

Springville clarkia is native to central Tulare County where it is known from fewer than 20 occurrences near Springville. The species occurs primarily in the Tule River watershed at elevations from 800 to 4,000 feet (245 to 1,220 meters) and generally grows in decomposing granite in blue oak woodland communities (California Department of Fish and Wildlife 2013). Several populations grow on lands protected by the California Department of Fish and Wildlife, Bureau of Land Management, and U.S. Forest Service (California Native Plant Society 2021). Blue oak woodland habitat suitable for striped adobe-lily may also be suitable for Springville clarkia. Therefore, actions that protect or enhance blue oak woodland or striped adobe-lily habitat will also benefit Springville clarkia.

Hoover's Spurge

Hoover's spurge (*Euphorbia hooveri*) is federally listed as threatened and is a CNPS 1B.2 species. This species is an annual herb that forms flat mats of thin, hairless stems. The blooming period for Hoover's spurge is July through September (California Native Plant Society 2021).

Hoover's spurge is native to California and grows in vernal pool habitats in the Central Valley. It occurs at elevations from 82 to 820 feet (25 to 250 meters). Vernal pools suitable for vernal pool fairly shrimp, California tiger salamander, and western spadefoot may also be suitable for Hoover's spurge. Therefore, actions that protect or enhance vernal pool complex natural communities or habitats for vernal pool fairy shrimp, California tiger salamander, and western spadefoot will also benefit Hoover's spurge.

San Joaquin Valley Orcutt Grass

San Joaquin Valley Orcutt grass (*Orcuttia californica* var. *inaequalis*) is federally listed as threatened, state listed as endangered, and is a CNPS 1B.1 species (rare, threatened, or endangered). This species is a small, grayish-green, sticky, aromatic, tufted annual grass that occurs in vernal pools (U.S. Fish and Wildlife Service 2005)**.** The blooming period for this species is from April through September (California Native Plant Society 2021).

San Joaquin Valley Orcutt grass is the only Orcutt grass restricted to the San Joaquin Valley. This grass was once common along the eastern margin of the Valley in Stanislaus, Merced, Fresno, Madera, and Tulare Counties. Most of the remaining occurrences of San Joaquin Valley Orcutt grass are concentrated in two small areas in eastern Merced County. San Joaquin Valley Orcutt grass grows in vernal pool ecosystems located in the San Joaquin Valley at elevations ranging from 98 to 2,477 feet (30 to 755 meters) (California Native Plant Society 2021). Vernal pools suitable for vernal pool fairly shrimp, California tiger salamander, and western spadefoot may also be suitable for San Joaquin Valley Orcutt grass. Therefore, actions that protect or enhance vernal pool complex natural communities or habitats for vernal pool fairy shrimp, California tiger salamander, and western spadefoot will also benefit San Joaquin Valley Orcutt grass.

San Joaquin Adobe Sunburst

San Joaquin Adobe sunburst (*Pseudobahia peorsonii*) is federally listed as threatened, state listed as endangered, and is a CNPS 1B.1 species. This species is an annual herb that grows in grassland and oak woodland habitats. The blooming period for this species is March and April.

San Joaquin adobe sunburst is endemic to California where it occurs in small populations along the southeastern side of the San Joaquin Valley and in the Sierra Nevada foothills. The species prefers heavy clay soils and occurs at elevations from 262 to 2,625 feet (80 to 800 meters) (California Native Plant Society 2021). Blue oak woodland habitat and grassland habitat suitable for striped adobe-lily and Kaweah brodiaea may also be suitable for San Joaquin adobe sunburst. Therefore, actions that protect or enhance blue oak woodland and grassland natural communities and habitat for striped adobe-lily and Kaweah brodiaea will also benefit Springville clarkia.

Keck’s Checkerbloom

Keck’s checkerbloom (*Sidalcea keckii*) is federally listed as endangered and is a CNPS 1B.1 species. This species is an annual herb that grows in grassland and oak woodland habitats. The blooming period for this species is April and May.

Keck’s checkerbloom is endemic to California where it grows in the northern California Coast Ranges and southern Sierra Nevada foothills. It was thought to be extirpated from the southern Sierra Nevada until it was rediscovered at a site in Tulare County. The site is located on private property and may have been lost to conversion for an orange grove (California Native Plant Society 2021). Blue oak woodland habitat and grassland habitat in the foothills suitable for striped adobe-lily and Kaweah brodiaea may also be suitable for Keck’s checkerbloom. Therefore, actions that protect or enhance blue oak woodland and grassland natural communities and habitat for striped adobe-lily and Kaweah brodiaea will also benefit Springville clarkia.

Greene’s Tuctoria

Green’s tuctoria (*Tuctoria greenei*) is federally listed as endangered and is a CNPS 1B.1 species. This species is an annual grass-like herb that grows in vernal pool habitats. The blooming period for this species is May through July (U.S. Fish and Wildlife Service 2005).

Green’s tuctoria is endemic to California where it grows in the Sacramento and San Joaquin Valleys. Its southernmost occurrence is located at the base of the foothills east of Visalia in the RCIS Area. This species is threatened by destruction of vernal pool habitat from conversion to agriculture, urban development, alteration of hydrology, overgrazing, and introduced species (U.S. Fish and Wildlife Service 2005, California Native Plant Society 2021). Vernal pools suitable for vernal pool fairy shrimp, California tiger salamander, and western spadefoot may also be suitable for Greene’s tuctoria. Therefore, actions that protect or enhance vernal pool complex natural communities or habitats for vernal pool fairy shrimp, California tiger salamander, and western spadefoot will also benefit Greene’s tuctoria.

Associations Between Non-Focal Species and Land Cover Types

Table F-1. Associations between Non-Focal Species and Land Cover Types[1]

	Grassland	Vernal pool complex	Scrub	Woodland	Chaparral	Riparian	Wetland	Open Water
Vernal pool tadpole shrimp	X	X	X					
Western pond turtle	X	X (uplands)		X	X	X	X	X
Northern California legless lizard	X	X	X	X	X	X		
American badger	X	X (uplands)	X	X	X			
Springville clarkia				X				
Hoover's spurge		X						
San Joaquin Valley Orcutt grass		X						
San Joaquin Adobe Sunburst	X	X (uplands)		X				
Keck's checkerbloom	X	X (uplands)		X				
Greene's tuctoria		X						

[1] This table shows the general relationships between species and land cover types. Most species select habitat based on characteristics at a finer scale than the land cover types presented here. In such cases, this table does not capture the full extent of a species' habitat relationships.

Associations Between Non-Focal Species and Focal Species

Table F-2. Associations between Non-Focal Species and Focal Species[2]

	Crotch bumble bee	Vernal pool fairy shrimp	California tiger salamander	Western spadefoot	Blunt-nosed leopard lizard	Swainson's hawk	Burrowing owl	Tricolored blackbird	Buena Vista Lake Ornate shrew	Pallid bat	Tipton kangaroo rat	San Joaquin kit fox	Kaweah brodiaea	Striped adobe-lily	Valley oak
Vernal pool tadpole shrimp		X	X	X											
Western pond turtle	X (upland habitat)		X	X			X (upland habitat)						X (upland habitat)	X (upland habitat)	X (upland habitat)
Northern California legless lizard			X (riparian)	X (riparian)	X	X	X	X			X	X			X
American badger	X	X (upland habitat)	X (upland habitat)	X (upland habitat)		X	X	X			X	X	X	X	
Springville clarkia			X (upland habitat)				X						X	X	
Hoover's spurge		X	X	X											
San Joaquin Valley Orcutt grass		X	X	X											

[2] This table shows general similarities in habitat use between non-focal species and focal species. Most species do not completely overlap habitat usage with other species. Furthermore, most species select habitat at finer scales than generalized here. As such, these tables do not precisely depict the overlap in habitat use between focal species and non-focal species.

	Crotch bumble bee	Vernal pool fairy shrimp	California tiger salamander	Western spadefoot	Blunt-nosed leopard lizard	Swainson's hawk	Burrowing owl	Tricolored blackbird	Buena Vista Lake Ornate shrew	Pallid bat	Tipton kangaroo rat	San Joaquin kit fox	Kaweah brodiaea	Striped adobe-lily	Valley oak
San Joaquin Adobe Sunburst													X	X	
Keck's checkerbloom			X (upland habitat)				X						X	X	
Greene's tuctoria		X	X	X											

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