Biological and Conference Opinion

on

The Fish and Wildlife Service Proposed Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit for the South Sacramento Habitat Conservation Plan

and

The Army Corps of Engineers Proposed Authorization and Implementation of a Clean Water Act Section 404 Permit Strategy Aligned With the South Sacramento Habitat Conservation Plan

April 30, 2019
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U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
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Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

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Mr. Michael Fris
Assistant Regional Director, Ecological Services
U.S. Fish and Wildlife Service, Pacific Southwest Region
2800 Cottage Way, Suite W2606
Sacramento California 95825

Mr. Michael S. Jewell
Chief, Regulatory Division
U.S. Army Corps of Engineers, Sacramento District
1325 J Street, Room 1480
Sacramento California 95814

Dear Messrs. Fris and Jewell:

This document transmits the U.S. Fish and Wildlife Service (Service or USFWS) biological opinion and conference opinion (Opinion) addressing: (1) the Service's proposed issuance of an Endangered Species Act (ESA) section 10(a)(1)(B) incidental take permit (ITP, Permit) to the County of Sacramento (County), the City of Galt, the City of Rancho Cordova, the Sacramento County Water Agency (SCWA), and the Southeast Connector Joint Powers Authority (Connector JPA) for implementation of the South Sacramento Habitat Conservation Plan (the SSHCP or Plan); and addressing (2) the U.S. Army Corps of Engineers' (USACE or Corps) proposed authorization and implementation of the *Clean Water Act (CWA) Section 404 Permit Strategy aligned with the SSHCP* (Final SSHCP CWA 404 Permit Strategy).

The five local agencies named above, plus the recently formed South Sacramento Conservation Agency or SSCA (the SSHCP Implementing Entity), are referred to as the "prospective SSHCP Permittees" in this Opinion. The prospective SSHCP Permittees have collectively prepared the SSHCP, have collectively applied for a Permit, and have requested a Permit Term of 50 years.

At issue are the effects of the proposed ITP, the effects of the proposed SSHCP, and the effects of the proposed SSHCP CWA 404 Permit Strategy on the SSHCP Covered Species listed in Section 2.1 of this Opinion. The Service's request for formal consultation is dated June 22, 2018[1]. The USACE request for formal consultation is dated July 16, 2018[2]. This Opinion was prepared in accordance

[1] We initiated an intra-Service formal consultation at the end of the required 30-day final public review of the SSHCP Final EIS/EIR, the Final SSHCP, and the SSHCP Implementing Agreement.

[2] In a letter dated July 16, 2018, the USACE designated the Service as the lead Federal agency for section 7 compliance of the USACE's proposed authorization and implementation of the SSHCP CWA 404 Permit Strategy. In a subsequent letter dated April 16, 2019 the USACE clarified that they are requesting consultation with the Service under section 7.

with the requirements of section 7 of the ESA (16 U.S.C. 1531 *et seq.*) and its implementing regulations at 50 CFR §402.

This Opinion was prepared using the following information, and portions are hereby incorporated by reference:

1. The February 2018, Final South Sacramento Habitat Conservation Plan (County of Sacramento et al. 2018), noticed in the Federal Register on May 15, 2018 (83 FR 22510);
2. The February 2018, South Sacramento Habitat Conservation Plan Joint Final Environmental Impact Statement/Environmental Impact Report (SSHCP Final EIS/EIR) (USFWS and Sacramento County 2018), noticed in the Federal Register on May 15, 2018 (83 FR 22510);
3. The February 2018, Final South Sacramento Final Aquatic Resources Program (Final SSHCP ARP);
4. The May 15, 2018,USACE Public Notice SPK-1995-00386, Proposed Section 404 Clean Water Act Permit Strategy Aligned with the South Sacramento Habitat Conservation Plan (Final Draft), Sacramento County, California (USACE May 15, 2018);
5. The May 18, 2018, USACE Public Notice SPK-1995-00386, Proposed South Sacramento Habitat Conservation Plan In-Lieu Fee Program, Sacramento County, California (USACE May 18, 2018);
6. The August 14, 2018, USACE Public Notice SPK-1995-00386, Proposed Section 404 Clean Water Act Regional General Permit for Section 404 Strategy Aligned with the South Sacramento Habitat Conservation Plan (USACE August 14, 2018);
7. Electronic mail correspondence, telephone conversations, site visits, and meetings between the Service and the prospective SSHCP Permittees between 2002-2018;
8. Corrections and errata to the February 2018, Final South Sacramento Habitat Conservation Plan, provided by the prospective SSHCP Permittees in 2018 and 2019 (County of Sacramento et al. 2019);
9. References cited in this Opinion; and
10. Other information available to the Service.

A complete decision record of this consultation is on file at the Sacramento Fish and Wildlife Office in Sacramento, California.

1.0 CONSULTATION HISTORY

The Service's and the USACE's involvement with the SSHCP planning process began in 1992, as part of a watershed study funded by the United States Environmental Protection Agency (EPA) to assess the ecosystem protection and restoration needs, flood risk management, watershed protection, water supply, and drought preparedness of the river basins and watersheds in south Sacramento County. In 1993, the Service and the California Department of Fish and Wildlife (CDFW) proposed shifting from a watershed study to a more comprehensive approach that would include additional terrestrial and aquatic natural resources, address growing concerns over the rapid pace of urban development in the County and the cumulative loss of habitat for several native species, and would provide a regional plan to protect the County's biological resources. After an initial assessment confirmed that a HCP would be politically, economically, and biologically feasible, further work was conducted by the County to identify possible strategies and economic constraints.

In 1995, the SSHCP Steering Committee was formed to provide public and private stakeholder input into the development of a HCP. The Steering Committee consisted of an equal number of members representing the regulatory, agricultural, development, and environmental stakeholders, Sacramento County agency representatives, as well as representatives from the federal and state environmental regulatory agencies, including the Service. In September 1996, the Steering Committee began to meet regularly. The Steering Committee formed Technical Advisory Sub-committees to address biological and economic technical issues. Representatives of the USACE and the Service participated in the SSHCP Steering Committee and the Technical Advisory Sub-committees. Local experts were also hired by the County as science advisors to provide information on existing conditions and background data needed to prepare the SSHCP. In February 1997, the County hired consulting firms to compile existing information, studies, available research, and assist in the development of a SSHCP. However, local funding was insufficient to fully develop a SSHCP, and work on the SSHCP halted in the late 1990s.

In March of 1999, the Service issued the Zone-40 Biological Opinion (USFWS 1999a) regarding water contracts for portions of Sacramento County under Public Law (P.L. 101-514). The 1999 Zone-40 Biological Opinion contains commitments by the U.S. Bureau of Reclamation, the San Juan Water District, Sacramento County, and the SCWA to implement various habitat conservation measures. One such measure requires the Bureau of Reclamation, the District, the County, and the SCWA to identify goals for habitat conservation in their respective jurisdictions that would conserve vernal pool species and associated upland habitats, a goal which could be achieved through the preparation of a regional HCP. The County committed to diligently pursue completion of an HCP to obtain an incidental take permit for future indirect effects of the water contracts on federally listed species.

In 2001, the County reassessed the SSHCP planning process and the available local funding. County staff took control of all aspects of SSHCP development, project management, and document preparation. In 2002, work began again on a habitat conservation plan, which provides the foundation of the current SSHCP. Technical experts on specific topics were also hired to assist the County in the preparation of specialized documents needed to inform the SSHCP's development and analysis.

Following the incorporation of the City of Rancho Cordova in 2003 and the earlier incorporation of the City of Elk Grove in 2000, the SSHCP conservation planning process changed again. It was recognized that the local agencies with land use authority (i.e. Sacramento County and the Cities of Galt, Rancho Cordova, and Elk Grove) would need better collaboration to successfully complete the HCP process. A committee consisting of these prospective SSHCP Permittees—the Local Agency Working Group (LAWG) — began meeting regularly to coordinate each local jurisdiction’s interests in an operational Plan. The focus of the LAWG was to guide work products and provide direction to committees, consultants, and County staff assisting with the preparation of the SSHCP. The SSHCP Steering Committee continued to meet. Several Sub-committees were formed to allow for agency and stakeholder input, including the Biological Subcommittee, Economic Subcommittee, the Technical Advisory Committee, as well as local Science Advisor experts. Representatives of the USACE and the Service continued to participate in the SSHCP Steering Committee and the different Sub-committees during this period. Work products approved by the LAWG were reviewed by the Regulatory Agency Working Group (RAWG), which included staff from the Service, USACE, CDFW, the EPA, the State Water Resources Control Board, the Regional Water Quality Control Board (RWQCB), and the prospective SSHCP Permittees.

In September of 2004, the County, the SCWA, the Sacramento Regional County Sanitation District (Regional San), and the Service signed a Memorandum of Agreement that set forth several agreements and courses of action that would allow future development projects in Sacramento County to proceed through construction permitting, including their federal ESA section 7 consultations, in a reasoned and legally permissible manner (County of Sacramento et al. 2004). The Memorandum of Agreement states that proposed new residential or commercial development projects within Zone-40 would result in direct and indirect effects under the federal ESA, and outlines the means by which those future species effects could be addressed. One MOA conservation measure is to expedite the completion of a regional HCP that would include regional conservation measures that could mitigate the indirect effects of providing Freeport Regional Water Project water to the new development planned within the Zone-40 area. The four parties signing the Memorandum of Agreement agreed that the most efficient means to address those future species effects would be the completion and implementation of the SSHCP.

In December of 2004, the Service issued the Freeport Regional Water Project BO (USFWS 2004a) to address the Bureau of Reclamation's (1) authorization for East Bay Municipal Utility District (EBMUD) and SCWA to use a new water diversion facility on the Sacramento River at the town of Freeport; (2) authorization for the Freeport Regional Water Agency and EBMUD to use the Folsom South Canal to convey EBMUD's Central Valley Project water; (3) the Bureau of Reclamation's fulfillment of EBMUD contract to complete federal ESA compliance before delivering any water to EBMUD; and (4) approval of an assignment of 30,000 acre-feet annually of water from the Sacramento Municipal Utilities District to the SCWA. The Freeport Regional Water Project BO also reinitiated ESA consultation on the Bureau of Reclamation's long-term Central Valley Project water contract with SCWA. The Freeport Regional Water Project BO heavily references both the 1999 Zone-40 BO and the 2004 Memorandum of Agreement, including the County commitment to complete a regional HCP. Under the Freeport Regional Water Project BO, new development projects that would receive water service provided through the new Freeport Regional Water Project facilities would need to show compliance comply with the federal ESA before the project receives entitlements from the County, and before water service is delivered. Therefore, the County committed to withhold approval of final maps, improvement plans, or building permits, and the SCWA will not issue a will-serve letter before the Project demonstrates compliance with the federal ESA. The County and SCWA determined that the most efficient means to comply with Freeport Regional Water Project BO and the Memorandum of Agreement was through the completion and implementation of the SSHCP.

By late 2006, preliminary draft SSHCP chapters had been completed and made available for LAWG, Steering Committee, RAWG, and stakeholder input. However, just before the release of the 2006 Preliminary Draft SSHCP, the Service released the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Vernal Pool Ecosystem Recovery Plan) (USFWS 2005a). The Vernal Pool Ecosystem Recovery Plan identified two important vernal pool species recovery Core Areas within the SSHCP Plan Area: the Mather Core Area (MCRA) located within the Urban Development Area (UDA)[3,] and the Cosumnes/Rancho-Seco Core Area located in the southeast portion of the Plan Area (USFWS 2005a). The information in the Vernal Pool Ecosystem Recovery Plan prompted the prospective SSHCP Permittees and stakeholder groups to change the focus of the SSHCP and to place greater conservation value on the vernal pools and other aquatic habitats located within the two Zone-1 vernal pool recovery Core Areas now designated within the Plan Area. During this period, the LAWG evaluated comments and recommendations received from the Steering

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[3] As discussed below in Section 2.1.1, the term Urban Development Area (UDA) is used by the SSHCP to discuss all lands where new urban development projects or activities could occur under the SSHCP. Therefore, the term "UDA" means all lands within the Sacramento County Urban Services Boundary that are also within the SSHCP Plan Area (this includes land within the Rancho Cordova city limits that are also within the Plan Area); and all lands within Galt's city limits and within the City of Galt's sphere of influence. See Final SSHCP Figure 1-1.

Committee, the RAWG, the stakeholder subcommittees, and the public. Scientific data on the ecology of the SSHCP Plan Area was updated. Through this process, the list of potential Covered Species was also revised.

In early 2008, the Service sent letters to the USACE, EPA, and CDFW requesting their participation as Cooperating Agencies in the Service's National Environmental Policy Act (NEPA) process for the SSHCP. On June 6, 2008, the USACE replied to identify their ongoing involvement in the development of the SSHCP, their active role in the SSHCP Steering Committee, their work toward a CWA Section 404 permitting program associated with the SSHCP, and to accept our request to be a NEPA Cooperating Agency in the preparation of an Environmental Impact Statement for the SSHCP.

On June 10, 2008 the Service published a Notice of Intent (NOI) to prepare a joint draft Environmental Impact Statement/Environmental Impact Report (SSHCP Draft EIS/EIR) to study the environmental effects of permitting a habitat conservation plan for south Sacramento County (USFWS 2008a). The USACE was identified as a NEPA Cooperating Agency in the NOI. Four public scoping meetings and workshops were held in July and August 2008. A total of 40 comment letters, cards, and emails were received on the initial NOI and at the meetings and workshops. Major issues identified in the 2008 scoping are summarized in the Final Scoping Report: South Sacramento Habitat Conservation Plan Environmental Impact Report/Environmental Impact Statement (see Appendix B in the SSHCP Final EIS/EIR; USFWS and Sacramento County 2018).

The LAWG evaluated recommendations received from the Steering Committee, the Sub-committees, the stakeholders, and the public comments received at scoping meetings and workshops in 2008 to resolve policy issues and refine the SSHCP concepts. In a July 2010 administrative draft SSHCP, the western border of the SSHCP Plan Area was expanded to help address stakeholder concerns about regional impacts and conservation of Swainson's Hawk, and the number of proposed covered species was reduced to 30.

In 2010, the County updated its General Plan to incorporate several policies that were designed to mirror objectives from the preliminary draft SSHCP, including, but not limited to, Policy CO-58, which ensures no-net-loss of wetlands, riparian woodlands, and oak woodlands, and Policy CO-65, which requires the creation of a network of Preserves linked by Wildlife Movement Corridors (County of Sacramento 2011). In 2010, the RAWG regulatory agencies (USFWS, USACE, EPA, CDFW, and RWQCB) also developed a map that identified areas of important aquatic resources and Vernal Pool habitat remaining inside and adjacent to the designated MCRA. This map of potential MCRA aquatic resource conservation was informally called the "blue line map", and identified 76% of remaining vernal pools in the MCRA for preservation. However, the 2001 "blue line map" of important aquatic resources did not address the feasibility of acquiring individual parcels with the most important resources.

In early 2012, the prospective SSHCP Permittees, the RAWG, and a group of local experts held a series of meetings to discuss how to best craft a feasible conservation strategy that would maximize preservation of the vernal pool ecosystem within and adjacent to the MCRA portion of the Urban Development Area (UDA). These meetings resulted in several "points of agreement" that set the foundation for the current SSHCP Conservation Strategy (S. McKinley *in litt.* 2012). The main 2012 "points of agreement" are summarized as follows:

- The approach to conservation within the UDA would be a hybrid approach with the combination of delineated hardline preserves in locations where preserves could be negotiated with existing landowners, coupled with a criteria-based process for selecting and locating other new preserves inside the UDA.

- Approximately 1,800 acres of hardline preserves were identified within five specific plan or master-plan project sites inside the UDAs (i.e. Arboretum Specific Plan, SunCreek Specific Plan, Cordova Hills Specific Plan, Excelsior Estates [now known as the Jackson Township Master Plan], and NewBridge Specific Plan) (Final SSHCP Figure 5-2).
- Criteria were established for locating future preserves within or adjacent to the MCRA. ("Adjacent" is defined as within 1 mile of the existing MCRA boundary.)
- In order to meet regulatory agency concerns that the combined hardline preserves and criteria-based preserves might not provide sufficient mitigation for anticipated take of vernal pool species, the SSHCP Conservation Strategy would include an additional 500 acres of "flexible" preserves that will be located within or adjacent to the MCRA.
- A large Landscape-size preserve in the Rancho-Seco Core Area would be increased from 10,000 acres to 10,500 acres.
- A local ordinance that provides assurances that incompatible practices do not irreparably harm potential resources (particularly Vernal Pool landscapes) would be drafted and circulated for public review concurrently with the joint SSHCP Draft EIS/EIR document.

On November 4, 2013, the Service published a revised Notice of Intent to prepare a joint Environmental Impact Statement/Environmental Impact Report for the SSHCP (USFWS 2013). The USACE was identified as a NEPA Cooperating Agency in the revised NOI. Two additional public scoping meetings were held in November 2013, and additional eight comment letters were received at those meetings. Issues identified in the 2013 scoping meetings are summarized in the Final Scoping Report: South Sacramento Habitat Conservation Plan Environmental Impact Report/Environmental Impact Statement (Appendix B in the SSHCP Final EIS/EIR; USFWS and Sacramento County 2018).

In 2014, the City of Elk Grove resigned from the LAWG and the SSHCP planning process, resulting in changes to the size and boundary of the SSHCP Plan Area. Consequently, the administrative draft SSHCP document was revised in September 2014 to reassess impact calculations, the conservation strategy, and the implementation plan for the SSHCP (Dudek 2014).

A final administrative Draft SSHCP document was prepared in January 2016 (County of Sacramento et al. 2016), which was used to prepare the description of the Proposed Action Alternative in the joint Draft EIS/EIR for the SSHCP (USFWS and Sacramento County 2017). The USACE contributed significantly to the aquatic resources elements of the SSHCP Conservation Strategy, including development of the SSHCP biological goals and objectives, and the Covered Activity avoidance and minimization measures (AMMs) for aquatic habitat and resources. The USACE actively worked with the prospective Permittees during these years to develop an Aquatic Resources Protection Program (ARP) for the SSHCP Plan Area.

In January 2017, the prospective SSHCP Permittees submitted applications for section 10(a)(1)(B) incidental take permits to the Service. The Service published a Notice of Availability of the public Draft SSHCP, the Draft EIS/EIR, and the draft SSHCP Implementing Agreement in the Federal Register on June 2, 2017 (USFWS 2017a). As discussed above, the all components of the Draft SSHCP, including the draft ARP and associated draft implementing ordinances, were included in the Proposed Action/Proposed Project Alternative studied in the public Draft EIS/EIR (USFWS and Sacramento County 2017). Public comments on the draft documents were accepted during a 90-day comment period, which ended on September 5, 2017. Public meetings on the Draft SSHCP and the

SSHCP Draft EIS/EIR were held at the Wilton Community on June 21, 2017, at the Rancho Cordova City Hall on June 26, 2017, at the Galt Community Center on July 6, 2017. In total, 26 comment letters, cards, and e-mails were received on the draft documents. A response to each public comment on the draft is presented in Chapter 19 of the SSHCP Final EIS/EIR (USFWS and Sacramento County 2018).

The USACE participated as a NEPA cooperating agency during the development of the draft SSHCP EIS/EIR, pursuant to 40 Code of Federal Regulation (CFR) § 1501.6. An outline of the USACE's proposed SSHCP CWA 404 Permit Strategy was described in the draft SSHCP, and the majority of the USACE's proposed SSHCP CWA 404 Permit Strategy was circulated for public review as Appendix C of the Service's draft South Sacramento Habitat Conservation Plan Joint Environmental Impact Statement/ Environmental Impact Report (USFWS and Sacramento County 2017). As discussed in Section 2.1.7 below, the proposed SSHCP CWA 404 Permit Strategy describes the USACE's process for issuing CWA 404 authorizations for future SSHCP Covered Activity projects and activities that discharge dredge or fill material into waters of the United States (WOUS), including wetlands. In June 2017 the USACE also issued a Public Notice on the Draft Section 404 Clean Water Act Permit Strategy Aligned with the SSHCP.

In February 2018, the prospective Permittees submitted the final SSHCP and the final SSHCP EIS/EIR to the Service. The Service published a Notice of Availability for the Final SSHCP, SSHCP Final EIS/EIR, and the SSHCP Implementing Agreement in the Federal Register on May 15, 2018 (USFWS 2018). Public comments on the final documents were accepted through June 21, 2018. In total, 4 comment letters were received on the final SSHCP documents. On May 15, 2018, the USACE released Public Notice SPK-1995-00386, *Proposed Section 404 Clean Water Act Permit Strategy Aligned with the South Sacramento Habitat Conservation Plan (Final Draft), Sacramento County CA* for a 30-day public comment period. On May 18, 2018, the USACE additionally issued Public Notice SPK-1995-00386, *Proposed South Sacramento Habitat Conservation Plan In-Lieu Fee Program, Sacramento County, CA* for a 30-day public comment period.

The Service initiated an intra-Service formal consultation under ESA section 7 on June 22, 2018, at the end of the required 30-day public review period for the Final SSHCP, SSHCP Final EIS/EIR, and the SSHCP Implementing Agreement.

In a letter dated July 16, 2018, the USACE asked to designate the Service's Sacramento Fish and Wildlife Office as the federal lead agency for USACE compliance with Section 7 of the ESA for the proposed USACE approval and implementation of *Clean Water Act Section 404 Permit Strategy Aligned with the SSHCP*.

On August 14, 2018, the USACE issued Public Notice SPK-1995-00386, *Proposed Section 404 Clean Water Act Regional General Permit for Section 404 Strategy Aligned with the South Sacramento Habitat Conservation Plan* for a 30-day public Review Period.

In a letter dated April 16, 2019 the USACE requested formal consultation under Section 7 for the USACE's proposed approval and implementation of *Clean Water Act Section 404 Permit Strategy Aligned with the SSHCP*.

In an electronic mail dated April 15, 2019, the prospective Permittees provided final clarifications and corrections to the February 2018, Final South Sacramento Habitat Conservation Plan.

The final SSHCP, the associated Resolutions to Establish Procedures and Requirements for Implementation of the South Sacramento Habitat Conservation Plan (Final SSHCP Implementing Resolutions), and the associated SSHCP Aquatic Resource Protection Ordinances (ARP Ordinances) were adopted by each of the prospective Permittees on the following dates:

County of Sacramento: September 11, 2018
City of Galt: October 16, 2018
City of Rancho Cordova: October 15, 2018
Sacramento County Water Agency (SCWA): March 12, 2019
Southeast Connector Joint Powers Authority: September 28, 2018
South Sacramento Conservation Agency: October 29, 2018

On April 23, 2019, the Sacramento County Treasury established a trust account for the SSHCP In-lieu Fee Program Account.

2.0 BIOLOGICAL OPINION AND CONFERENCE OPINION

This section presents our biological opinion on the effects of the proposed actions on the federally-listed Covered Species, and presents our conference opinion on the effects of the proposed actions on the non-listed Covered Species. Under certain conditions (see 5.0 below), the Service may adopt a conference opinion as a biological opinion after a non-listed Covered Species becomes listed or critical habitat is designated.

Organization. The organization of this Opinion generally follows the outline presented in Chapter 4.5 of the ESA Section 7 Handbook (USFWS and NMFS 1998), which places required content roughly in this order: (1) the *Description of the Action,* including conservation measures (see Section 2.1 below); (2) the identification of the *Action Area* (see Section 2.2 below); (3) the S*tatus of the Species* over its geographic range, (4) the *Environmental Baselin*e of the species within the Action Area, (5) the *Effects of the Action* on the species, (6) the *cumulative effects* on the species within the Action Area, and (7) our *Conclusion* for the species regarding jeopardy and regarding adverse modification, where applicable.

However, because of the large geographic scope of the Action Area, this Opinion also includes a general overview of the Action Area's environmental setting (see Section 2.3 below). This Opinion analyses each Covered Species separately and provides a separate *Conclusion* for each Covered Species. However, many of the SSHCP Covered Species share similar attributes, including similar life-histories, similar habitats, similar threats and similar recovery needs throughout their geographic ranges, and would be affected in similar ways by the SSHCP. To minimize repetition and redundancy, the organization of this Opinion will group and discuss similar Covered Species together. Accordingly, 11 Covered Species are grouped together as the "vernal pool Covered Species" (see Section 2.5 below), 4 Covered Species are grouped together as the "other aquatic Covered Species" (see Section 2.6 below), and 9 Covered Species are grouped together as the "avian Covered Species" (see Section 2.7 below). However, most attributes of the valley elderberry longhorn beetle, the American badger and the western red bat are not shared by other Covered Species, so those species are analyzed separately in Sections 2.8, Section 2.9, and Section 2.10, respectively.

2.1 Description of the Proposed Actions

Fish and Wildlife Service Proposed Action

The Service is proposing to issue a multi-species, 50-year incidental take permit (ITP, Permit) to the prospective SSHCP Permittees for implementation of the SSHCP. The SSHCP is a regional conservation plan developed by the prospective SSHCP Permittees. The SSHCP is intended to ensure the long-term viability of each Covered Species within the SSHCP Plan Area by mitigating the impacts of taking each Covered Species through implementation of the SSHCP Conservation Strategy (see Section 2.1.6 below). The content of the SSHCP was developed by the prospective SSHCP Permittees to achieve the permit issuance criteria presented in section 10(a)(1)(B) of the ESA, and to follow guidance provided in USFWS and NOAA Fisheries 1996 and 2016.

In addition to providing mitigation for the impacts of the taking of Covered Species, the SSHCP's Conservation Strategy may aid in the recovery of the listed Covered Species, and may help preclude the need to list additional species in the future through the preservation of habitat that benefits the unlisted Covered-Species. Because many of the SSHCP Covered Species live all or part of their lives in aquatic habitats, the SSHCP Conservation Strategy also includes avoidance and preservation of waters and wetlands, several measures that minimize impacts to waters and wetlands, and several measures that mitigate unavoidable impacts to wetlands and waters that are subject to regulation under the federal CWA, California's Porter-Cologne Water Quality Control Act, and the California Fish and Game Code.

The prospective SSHCP Permittees are requesting an ITP to incidentally take 20 wildlife species, and they seek assurances for 8 plant species, for a total of 28 species (the SSHCP Covered Species). Five of the wildlife Covered Species are currently listed as federally threatened (T) or endangered (E), and two of the plant Covered Species are currently listed as federally threatened (T) or endangered (E). In addition, five of the federally-listed Covered Species have Critical Habitat designated under the ESA (i.e. vernal pool fairy shrimp, vernal pool tadpole shrimp, the California tiger salamander central California distinct population segment [central California tiger salamander DPS], slender Orcutt grass, and Sacramento Orcutt grass). A list of the 28 SSHCP Covered Species is provided below:

1. Vernal pool tadpole shrimp (*Lepidurus packardi*) (E)
2. Vernal pool fairy shrimp (*Branchinecta lynchi)* (T)
3. Mid-valley fairy shrimp (*Branchinecta mesovallensis*)
4. Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)* (T)
5. Ricksecker's water scavenger beetle (*Hydrochara rickseckeri*)
6. California tiger salamander (*Ambystoma californiense*)(Central California Distinct Population Segment) (T)
7. Western spadefoot (*Spea hammondii*)
8. Western pond turtle (*Actinemys marmorata*)
9. Giant garter snake *(Thamnophis gigas*) (T)
10. Cooper's hawk (*Accipiter cooperii*)
11. Tricolored blackbird (*Agelaius tricolor)*
12. Western burrowing owl (*Athene cunicularia hypugaea*)
13. Ferruginous hawk (*Buteo regalis*)
14. Swainson's hawk (*Buteo swainsoni*)
15. Northern harrier (*Circus cyaneus*)
16. White-tailed kite (*Elanus leucurus*)

17. Greater sandhill crane (*Grus canadensis tabida)*
18. Loggerhead shrike (*Lanius ludovicianus*)
19. Western red bat (*Lasiurus blossevillii*)
20. American badger (*Taxidea taxus*)
21. Dwarf downingia (*Downingia pusilla)*
22. Boggs Lake hedge-hyssop (*Gratiola heterosepala)*
23. Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*)
24. Legenere (*Legenere limosa*)
25. Pincushion navarretia (*Navarretia myersii* ssp. *myersii*)
26. Slender Orcutt grass (*Orcuttia tenuis*) (T)
27. Sacramento Orcutt grass (*Orcuttia viscida*) (E)
28. Sanford's arrowhead (*Sagittaria sanfordii*)

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction or the destruction of endangered plants on non-Federal areas in violation of State law or regulation (e.g. Fish & Game Code §§2050-2085) or in the course of any violation of a State criminal trespass law (i.e. Penal Code §§ 594-625c). Therefore, although federally listed plants do not need to be included in an ESA incidental take permit, the 8 plant Covered Species will be included on the proposed ITP in recognition of the conservation benefits provided to the species by the SSHCP. In addition, the Service is still required to review the effects of its own actions on listed plants, and the Service's issuance of the ITP must comply with Section 7(a)(2) of the Act. Therefore, this intra-Service section 7 consultation also will determine if issuing the proposed Permit could "jeopardize the continued existence" of any federally listed plant. Assurances provided to the SSHCP Permittees under the Service's "No Surprises" rule at 50 CFR. §17.13, 17.22(b)(5) and 17.32(b)(5) extend to all 28 SSHCP Covered Species, including the plant Covered Species.

The 28 SSHCP Covered Species include 21 species that are not federally listed. The SSHCP has address each of the 21 non-listed Covered Species "as if" they were listed pursuant to section 4 of the ESA, and has included measures for each non-listed Covered Species that satisfy the permit-issuance criteria under section 10(a)(1)(B) of the ESA. Although take of non-listed species is not prohibited under the ESA, and therefore, non-listed species do not need to be included in an ESA incidental take permit, the non-listed SSHCP Covered Species will be included on the proposed ITP in recognition of the conservation benefits provided to the species under the SSHCP. The SSHCP Permittees will implement the SSHCP Conservation Strategy measures for all of the SSHCP Covered Species, regardless of their current listing status. When a non-listed Covered Species becomes listed under the ESA during the 50-year term of the proposed ITP, the ITP would become effective to authorize take of that species, as discussed below in Section 5.0 of this Opinion.

In addition, there are federally listed-species with the potential to exist in the Action Area that were not included by the SSHCP as Covered Species. The final list of 28 Covered Species for which the potential SSHCP Permittees are requesting incidental take was refined through the application of the following criteria, as fully described in SSHCP Chapter 1.2.4: (1) the species is known to occur or likely to occur within the SSHCP Plan Area; (2) the species is currently listed as threated or endangered under the ESA, or was judged to have a probability of being listed during the proposed 50-year Permit Term; (3) the species could be adversely affected by the SSHCP Covered Activities; and (4) sufficient data exists on the species' life history, habitat requirements, and occurrence within the SSHCP Plan Area to estimate the effects of the operational SSHCP on the species, and to identify conservation measures that would effectively minimize, avoid, and mitigate those effects within the SSHCP Plan Area. Species that did not meet each of these criteria were not included as SSHCP Covered Species by the potential SSHCP Permittees. The Service has reviewed the potential Permittees' list of SSHCP Covered Species, as well as a list of all federally-listed species that occur within or the Action Area. The effect of the Service's permit action, as a result of the SSHCP's implementation, was evaluated for the non-covered federally-listed species[4] by completing an Intra-Service Section 7 Biological Evaluation Form (USFWS and NMFS 1998). Based on our biological evaluations, the Service finds that the proposed action *may affect, but is not likely to adversely affect*, the following listed species and critical habitat:

- Fleshy owl's clover (*Castilleja campestris* var. *succulent*)
- Delta smelt (*Hypomesus transpacificus*) and critical habitat

If a future project or activity proposed within the SSHCP Plan Area is likely to adversely affect (pursuant to ESA section 7), or is reasonably certain to result in take (pursuant to ESA section 10), one or more non-covered but federally-listed species present in the Action Area, that individual project or activity is not covered by the SSHCP or by the Service's proposed ITP. That individual project or activity must be analyzed on a project-by-project basis by the Service via a separate section 7 consultation, or via a separate section 10 permit, as appropriate.

The SSHCP was developed by the prospective SSHCP Permittees to support their application for a federal ITP under section 10(a)(1)(B) of the ESA, and to support their application for a state ITP under section 2081 of the California Fish and Game code. In addition, because many of the SSHCP Covered Species live all or part of their lives in aquatic habitats, the prospective SSHCP Permittees used the SSHCP Conservation Strategy to prepare the SSHCP Aquatic Resources Program (ARP), which proposes a locally-based CWA 404 program for local permitting of future SSHCP Covered Activities that impact aquatic resources, including wetlands and other waters (see page 2-44 in the Final EIS/EIR). The SSHCP includes the implementation of the ARP by the SSHCP Land-Use Authority Permittees[5], inclusive of the implementation of local aquatic resource protection ordinances by each of the SSHCP Land-Use Authority Permittees (see Section 1.0 above). The SSHCP would allow the local Land-Use Authority SSHCP Permittees to manage anticipated urban growth and development while providing a coordinated and standardized process for permitting and mitigating for project impacts to species and species habitats, as an alternative to the current project-by-project permitting approach. All components of the SSHCP, including the ARP and associated implementing ordinances, were included in the Final SSHCP, and included in the Proposed Action/Proposed Project Alternative studied in the Final EIS/EIR (USFWS and Sacramento County 2018).

The SSHCP is a single plan that must be implemented as a whole by all of the future SSHCP Permittees, and the section 10(a)(1)(B) Permit will be issued on the basis of the whole SSHCP being implemented. The SSHCP includes measures to avoid or minimize impacts to each Covered Species and includes measures to conserve each Covered Species, whether or not they are currently listed.

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[4] The North American green sturgeon (*Acipenser medirostris*), the Central Valley steelhead (*Onchorhynchus mykiss* ssp. *irideus)*, and the Chinook salmon (*Oncorhynchus tshawytscha*) are federally listed, but as an anadromous species they are under the jurisdiction of the National Marine Fisheries Service. Therefore, they was not evaluated and not discussed in the Service's intra-Service biological evaluation or in this Opinion.

[5] Three of the six potential SSHCP Permittees (Sacramento County, the City of Rancho Cordova, and the City of Galt) are also local jurisdictions that have authority to permit or approve land use, projects, and activities within their jurisdictional boundary. The Final SSHCP refers to the three local jurisdictions as the "Land-Use authority Permittees."

Accordingly, should any of the non-listed Covered Species become listed during the Permit Term, additional conservation measures will not be required (Final SSHCP Chapter 11.2; County of Sacramento et al. 2018).

All parts of the SSHCP Conservation Strategy, including the proposed SSHCP Preserve System (Final SSHCP Chapter 7), are mitigation measures to offset Covered Activity impacts, and are required by the ITP. However, the land preservation and other actions proposed in SSHCP Appendix J are optional conservation actions that would be "above and beyond" the measures included in the SSHCP Conservation Strategy (Final SSHCP Chapter 7). Because the conservation actions discussed in SSHCP Appendix J are optional, may not be implemented, and are not proposed as mitigation for Covered Activity effects, they are not discussed or considered further in this Biological Opinion.

The components of the Final SSHCP are summarized below in Sections 2.1.1- 2.1.12 of this Opinion. Content of the Final SSHCP that is relevant to our effects analyses was incorporated in Section 2.5 to Section 2.9 of this Opinion.

Army Corps of Engineers Proposed Action

The USACE is proposing to approve and implement the SSHCP CWA 404 Permit Strategy. The response in this Opinion to the USACE request for consultation is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR § 402).

The proposed SSHCP CWA 404 Permit Strategy describes the USACE's process for issuing CWA 404 authorizations for SSHCP Covered Activity projects and activities that propose to discharge dredge or fill material into waters of the United States (WOUS), including wetlands. The proposed SSHCP CWA 404 Permit Strategy is intended to provide for better assurances for the regulated public and provide quicker authorization and permit decisions, while protecting aquatic resources to an equal or greater level in a manner consistent with existing regulations, policies, and processes.

The USACE's proposed CWA 404 Permit Strategy was described in the draft and the final SSHCP. The majority of the USACE's proposed CWA 404 Permit Strategy was circulated for public review as Appendix C of the Service's draft and final SSHCP joint EIS/EIR (USFWS and Sacramento County 2017, 2018). In addition, the proposed CWA 404 Permit Strategy from Appendix C of the SSHCP EIS/EIR was also circulated for public review in the USACE May 15, 2018, Public Notice SPK-1995-00386, *Proposed Section 404 Clean Water Act Permit Strategy Aligned with the South Sacramento Habitat Conservation Plan (Final Draft), Sacramento County CA* and the USACE May 15, 2018, Public Notice SPK-1995-00386, *Proposed South Sacramento Habitat Conservation Plan In-Lieu Fee Program, Sacramento County, CA*. Additional details of the proposed CWA 404 Permit Strategy were provided in the August 14, 2018 Public Notice SPK-1995-00386, *Proposed Section 404 Clean Water Act Regional General Permit for Section 404 Strategy Aligned with the South Sacramento Habitat Conservation Plan.*

Based on the final SSHCP ARP, the SSHCP Final EIS/EIR, and the local Aquatic Resource Protection Ordinances noted in Section 1.0 above, the USACE Sacramento District proposes to approve and implement a multi-tiered permitting-strategy under Section 404 of the CWA (the SSHCP CWA 404 Permit Strategy), which will address future SSHCP Covered Activities that involve discharges of dredged or fill material into waters of the U.S., and are consistent with all SSHCP requirements. The SSHCP CWA 404 Permit Strategy will rely, at each tier of the Permitting Strategy, on the SSHCP, including the SSHCP Conservation Strategy (as mirrored in the final

SSHCP ARP), to implement measures to avoid and minimize impacts to Action Area aquatic resources, and to address compensatory mitigation requirements (including ratios) for individual SSHCP Covered Activities with unavoidable impacts to aquatic resources.

The USACE's implementation of the proposed multi-tiered SSHCP CWA 404 Permit Strategy consists of the use of the following, which are described in further detail in the SSHCP Final EIS/EIR and mirrored in the USACE documents noted above and incorporated by reference into this Opinion. One element of the proposed SSHCP CWA 404 Permit Strategy described below (the RGP element) was developed by the USACE after the SSHCP Final EIS/EIS public inspection period was completed[6], as described in the USACE documents noted above and incorporated by reference into this Opinion. The SSHCP CWA 404 Permit Strategy contains several terms and conditions to distinguish appropriate Covered Activity use of permit types within the strategy, and to ensure compliance with the USACE's issuance and use of the following permit types:

- A programmatic general permit (PGP) founded on the SSHCP ARP, to be implemented through the aquatic resource protection ordinances, and designed to reduce duplication with that program for Covered Activities with minimal individual and cumulative effects on the aquatic environment;
- A regional general permit (RGP) premised on the approval of an activity by the USACE under the SSHCP In-lieu Fee (ILF) Program, and intended to expedite authorization under Section 404 of the Clean Water Act for establishment, re-establishment, enhancement, or rehabilitation activities that result in a net increase in aquatic resource functions and services.
- A procedure for issuing Letters of Permission (LOPs) for Covered Activities with more than minimal but less than significant effects on the human environment, including aquatic resources.
- An abbreviated process for issuing standard permits (Abbreviated SP Process) for the small number of Covered Activities that require a 404 permit and are consistent with the SSHCP, but may have a significant impact on the human environment, and require the preparation of an EIS under NEPA.

Implementation of on-the-ground compensatory mitigation projects would occur within the SSHCP Preserve System, and would be consistent with the SSHCP Conservation Strategy, including all SSHCP requirements regarding the re-establishment and establishment of aquatic resources. Key to satisfying CWA 404 compensatory mitigation requirements, project payments of development fees to the SSHCP are intended to fulfill requirements for a USACE-approved SSHCP In-lieu Fee (ILF) Program, which was proposed for establishment by the prospective SSHCP Permittees[7], and approved by the USACE in 2019.

2.1.1 SSHCP Plan Area

The SSHCP Plan Area includes 317,656 acres within south Sacramento County, including the City of Galt, the City of Galt's sphere of influence, and the portion of the City of Rancho Cordova that is located south of U.S. Highway 50 (see Final SSHCP Figure 1-1). The SSHCP Plan Area is defined as the area in which all SSHCP Covered Activities and Conservation Activities will be implemented,

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[6] See the August 14, 2018, USACE Public Notice SPK-1995-00386, *Proposed Section 404 Clean Water Act Regional General Permit for Section 404 Strategy Aligned with the South Sacramento Habitat Conservation Plan* (USACE August 14, 2018).
[7] See the May 18, 2018,USACE Public Notice SPK-1995-00386, *Proposed South Sacramento Habitat Conservation Plan in-Lieu Fee Program, Sacramento County, CA* (USACE May 18, 2018)

and where all incidental take will occur. The geographical boundaries of the SSHCP Plan Area are U.S. Highway 50 to the north, the Sacramento River levee and County Road J11 (Walnut Grove-Thornton Road) to the west, the Sacramento County line with El Dorado and Amador Counties to the east, and the San Joaquin County line to the south. The boundary of the SSHCP Plan Area was defined using political and ecological factors.

The SSHCP Plan Area excludes the northern portion of Sacramento County, the northern portions of the City of Rancho Cordova, the City of Sacramento, the City of Elk Grove, the City of Folsom, sovereign lands of the Miwok Tribe, and the Sacramento County community of Rancho Murieta (see Final SSHCP Figure 1-1). These areas were excluded from the SSHCP Plan Area because they were either already significantly built out, would not use the SSHCP, or were not likely to benefit from the SSHCP due to the absence of listed species or their habitats. The sovereign lands of the Miwok Tribe are not included because the tribe is not a prospective Permittee.

The SSHCP Plan Area has two components: inside and outside of defined Urban Development Areas (UDAs). The UDAs are the portions of the Plan Area where all proposed urbanization Covered Activities will occur, and therefore, where most incidental take will occur. The County of Sacramento has previously adopted an Urban Service Boundary (USB) to demarcate the ultimate extent to which the County would provide future urban services, such as sanitary sewer and water supply. Consequently, the portion of the Sacramento County USB that is within the SSHCP Planning Area is included in the SSHCP's UDA, and the portion of the Rancho Cordova's sphere of influence that is within the boundaries of the Plan Area is also part of the SSHCP UDA. In addition, on the southcentral border of the SSHCP Plan Area, all lands within the City of Galt and within Galt's sphere of influence are also within the SSHCP's UDA (Final SSHCP Figure 1-1). In total, approximately 67,618 acres of the Plan Area are within the UDA boundaries.

The component of the SSHCP Plan Area that is located outside of the UDA boundaries totals 250,038 acres. Any urban development that may occur outside of the UDA would not be a Covered Activity under the SSHCP. However, the prospective SSHCP Permittees are requesting a limited amount of incidental take outside of the UDA for specific Covered Activity infrastructure projects, and for Covered Activity species conservation activities that will occur in the proposed SSHCP Preserve System.

To assist with development of the SSHCP Conservation Strategy, the prospective Permittees further divided the SSHCP Plan Area into eight Preserve Planning Units (PPUs) based on the locations of existing landcovers and habitats that are important for different suites of the SSHCP Covered Species (see Final SSHCP Figure 1-1). PPUs 1, 2, 3, and 4 are located in the northern half of the Plan Area (north of the Cosumnes River). Most of PPU-1 and all of PPUs 2, 3, and 4 are within the UDA boundary. The vernal pool recovery Mather Core Area (MCRA) (USFWS 2005a) is also located within PPUs 1, 2 and 3 is inside the UDA. In addition, PPU-8, which is located on the on the southcentral border of the Plan Area, is also part of the SSHCP UDA. PPU-8 contains the City of Galt and the City of Galt's Sphere of Influence.

Outside the UDA, PPU-6 encompasses the western, southwestern, and south-center portions of the SSHCP Plan Area, and is dominated by farming landcovers that provide foraging habitat for many avian Covered Species. The large PPU-7 encompasses the southeastern quarter of the SSHCP Plan Area, and includes the vast majority of the extant Valley Grassland landcover and Vernal Pool Ecosystem that remain in the County (see definitions in Section 2.3.5.2 below). As discussed below in Section 2.5.2, much of the vernal pool Cosumnes/Rancho-Seco Core Area (USFWS 2005a) is located within PPU-7. As discussed below in Section 2.6.2.1, most of the central California tiger salamander's Rancho-Seco Management Unit (USFWS 2017b) is also located within PPU-7. A complete description of each PPU, including documented species occurrences and acres of each SSHCP landcover within each PPU, is presented in SSHCP Chapter 3.

2.1.2 Covered Species

The SSHCP Covered Species are listed on page 2 of this biological opinion. Covered Species are species included in a HCP, and together with HCP conservation measures that offset the impacts of the taking, and are species included on the incidental take permit.

2.1.3 Permit Term

The SSHCP Permittees are requesting a 50-year Permit Term. The Permit Term is the time period in which the SSHCP Permittees may receive incidental take authorization for Covered Activities under the SSHCP. The Permit Term is also the time in which all SSHCP conservation actions described in the SSHCP Conservation Strategy must be successfully completed to offset the effects of the Covered Activities. As described in SSHCP Chapter 1.2.3, the Permit Term of 50 years was proposed because it would allow for the full and successful implementation of the planned SSHCP Covered Activities and the proposed SSHCP Conservation Strategy, including the establishment of an interconnected SSHCP Preserve System in the Plan Area, and the development and implementation of the SSHCP Monitoring and Management Programs.

2.1.4 Covered Activities

Covered activities are defined as future activities and projects over which a prospective Permittee would have jurisdiction or another form of control, are reasonably certain to occur over the proposed term of the Permit, and are likely to result in incidental take of Covered Species (USFWS and NOAA Fisheries 2016). SSHCP Chapter 5 describes the activities and projects within the SSHCP Plan Area proposed for coverage. “Activities” are actions that would occur repeatedly, whereas “projects” are well-defined actions that would occur once in a specific location. Together, these activities and projects are referred to as “Covered Activities” for which incidental take authorization is being requested by the prospective SSHCP Permittees.

The SSHCP Covered Activities primarily consist of: 1) the construction, operation, and maintenance of new urban development projects inside the UDA portion of the SSHCP Plan Area; and 2) construction and operation of rural transportation projects and water recycling infrastructure projects outside the UD; and 3) land management actions and habitat creation on future habitat preserves located both inside and outside the UDA (Table 1 below).

SSHCP Covered Activities that would be implemented within the UDA include projects and activities related to urban development and associated infrastructure on lands that are zoned or ultimately planned/ contemplated for urban development by the adopted General Plans of Sacramento County, Galt, and Rancho Cordova. Urban development Covered Activities (Table 1 below) would not occur outside of the UDA boundaries. Covered Activities within the UDA also include the Capital Southeast Connector Project and other specific transportation, water, and wastewater development projects. Ongoing in-stream maintenance within the UDA, including vegetation and sediment removal, would also be a Covered Activity. Five large Urban Development Master Plans (i.e. Arboretum Specific Plan, SunCreek Specific Plan, Cordova Hills Specific Plan, Jackson Township Master Plan, and NewBridge Specific Plan) are proposed by Third Party Project Proponents within the UDA (Final SSHCP Figure 5-4).

Table 1a. Categories of SSHCP Covered Activities

Covered Activity Categories	Description[1]
	Urban Development Covered Activities Inside the UDA
Residential, Commercial, and Industrial Structures	Construction, use, and maintenance of urban, suburban, and agricultural housing, retail centers, office buildings, factories, warehouses, and associated infrastructure. Also includes public service and cultural facilities such as new police and fire stations, convention centers, theaters, museums, hospitals, schools, colleges, libraries, and parking lots. Maintenance activities include the inspection, cleaning, rehabilitation, repair, and/or replacement of buildings, structures, and facilities.
Urban Park and Recreation Facilities	Construction and maintenance of recreational facilities such as regional parks, neighborhood parks, sports fields and facilities, indoor/outdoor sports complexes, recreation trails, community trails, playgrounds, golf courses, campgrounds, nature centers, racetracks, and associated infrastructure, including roads, bridges, restrooms, and parking areas.
Urban Water Supply Facilities	Construction and installation of new potable and recycled water supply facilities (e.g., pumping stations; water treatment facilities; storage facilities; reclamation facilities; and groundwater wells, valves, gates, weirs, and pipelines), extension of existing water pipelines, and removal and maintenance of existing water supply facilities.
Public and Private Utilities	Construction, replacement, augmentation, and maintenance of electric transmission utilities including underground and aboveground electric transmission and distribution lines, substations, access road maintenance, telecommunications lines, natural gas distribution pipelines, and urban solar energy projects. Other energy-generating projects within the UDA may also be determined to be Covered Activities, provided they meet the criteria established for Covered Activities not specifically described in the SSHCP.
Solid Waste Management Facilities	Construction, operation, maintenance, and decommissioning of new transfer stations and operation of new recycling stations within the UDA. Operation and maintenance of existing groundwater extraction and monitoring wells at Kiefer Landfill, as well as the expansion and decommissioning of existing landfills. This Covered Activity would not include operation of landfills.
Wastewater Facilities	Construction, installation, operation, and maintenance of all wastewater facilities in the UDA (e.g., sewage force mains, pumping stations, access facilities, treatment facilities, pipelines, recharge ponds, pipelines, and storage facilities) and all activities that support the provision of wastewater services including collection, diversion, delivery, distribution, conveyance, storage, treatment, and discharge. The extension, removal, replacement, abandonment, and maintenance of existing facilities/pipelines are also included, as are recharge ponds, groundwater wells, and operation and maintenance of existing wastewater projects in the rural communities of Walnut Grove and Courtland outside of the UDA.
Urban Transportation	Construction, realignment, widening, extension, abandonment, and removal of public and private transportation infrastructure (e.g., roadways, railroads, culverts, bridges, bike paths, street lights, roadside drainage, intersections/interchanges, sidewalks, and traffic signals), as well as other activities necessary to implement adopted transportation or capital improvement plans of the SSHCP Permittees. In-stream activities for transportation improvements including bridges, culverts, or other stream-crossing facility construction, replacement, and repair.

Table 1a. Categories of SSHCP Covered Activities

Covered Activity Categories	Description[1]
Flood Control and Stormwater Management in the UDA	All activities that support flood control as described in water drainage, capital improvement, flood control, and storm drain master plans for Sacramento County and Galt and Rancho Cordova. Construction of new facilities and maintenance of new and existing facilities. Stormwater abatement and treatment facilities could include detention basins, stormwater channels, pumping stations, and natural or realigned stream channels. Operations and maintenance activities including vegetation control, silt/sedimentation removal, erosion control, and stream bank stabilization projects.
Stream Channel Modification	The permanent deepening, widening, and rerouting of existing stream channels during urban development, including that associated with construction of water supply, wastewater, and urban transportation infrastructure.
Master Plans Known at the Time of the SSHCP Preparation	Urban development associated with five development projects within the UDA (Arboretum Specific Plan, Cordova Hills Specific Plan, Jackson Township Master Plan, NewBridge Specific Plan, and SunCreek Specific Plan) that were preparing land use plans during SSHCP preparation. These five master plans were (or will be) designed to comply with SSHCP requirements, including compliance with the Covered Activity descriptions and the SSHCP AMMs.
Capital Southeast Connector	Construction, operation, and maintenance of the Capital Southeast Connector, including but not limited to initial vegetation clearing, grading of the project footprint, pouring of concrete or asphalt, excavation, staging of equipment and materials, compacting soil, and landscaping, as well as operation and maintenance. During construction it may be necessary to temporarily divert stream channels using appropriate measures to avoid or minimize impacts to stream habitat.
Mather Airport Master Plan Development Projects	Development projects at Mather Airport including the maintenance, replacement, and improvements of existing airfields (runway extensions, new taxiways, and aprons) and construction of new airfields, aircraft facilities (aircraft storage facilities, aircraft maintenance facilitates, and jet fuel storage and dispensary facilities), and commercial facilities.
Mining Covered Activities in the UDA	
Mining Projects	Mining activities including surface extraction of rock or mineral resources and construction of associated infrastructure, buildings, and facilities (e.g., surface mining pits, processing sites, and access roads), and construction and operation of detention basins. A total of five surface mines (500 acres total) are anticipated to occur within the UDA. The reclamation of previously mined land is also included as a Covered Activity.
Covered Activities Allowed in UDA Preserve Setbacks	
Trails	Construction, operation, and maintenance of paved bike/pedestrian trails may be sited within a Preserve Setback under certain conditions.
Low-velocity Bio-Retention Swales	Construction, operation, and maintenance of a bio-retention swale next to trails designed to hold and remove rainwater runoff from trails, which may be sited within a Preserve Setback under certain conditions.
Fencing	Installation of post and cable, split rail, or other open fencing adjacent to trails within the setback areas, which may be sited within a Preserve Setback under certain conditions.
Interpretive Signs and Kiosks	Construction, operation, and maintenance of safety and directional signs and kiosks intended to educate trail users about the benefits of the preserve and the importance of the setback to the resources that they are protecting.
Fire Breaks	Construction and maintenance of fire breaks, including shallow tilling or scraping vegetation if required by local fire regulations.

Table 1a. Categories of SSHCP Covered Activities

Covered Activity Categories	Description[1]
Benches, Shade Structures, and Shade Trees	Installation of benches, shade structures, and trash receptacles along trails if on the outer edge of the trail farthest from the preserve, which may be sited within a Preserve Setback under certain conditions.
Covered Activities Allowed in UDA Stream Setbacks	
Trails	Construction and maintenance of permeable or semi-permeable hiking trails, paved trails, and their associated infrastructure.
Low-Velocity Bio-Retention Swales	Construction, operation, and maintenance of small linear features (swales) located on one or both sides of allowed trails
Crossings Perpendicular to the Stream	New roads, bike/pedestrian trails, railroads, sewer/water pipelines, and public utility transmission lines that cross perpendicular to streams.
Stream Bank Stabilization Projects	Construction of in-stream structures for erosion control and bank stabilization.
Fencing	Installation of post and cable, split rail, or other open fencing along trails to keep users on the trail and out of the Stream Setbacks.
Benches, Shade Structures, and Shade Trees	Installation of benches, shade structures, and trash receptacles along trails if located on the outer edge of the trail farthest from the creek.
Interpretive Signs and Kiosks	Construction, operation, and maintenance of signs and kiosks.
Riparian Re-Establishment or Establishment	Actions associated with re-establishment or establishment of riparian vegetation.
Outfalls	Construction and operation of outfall structures that allow the discharge of stormwater into streams from adjacent urban areas.
Flood Control Structures and Stormwater Management	Construction of detention basins, bio-retention swales, and water quality facilities that are designed to be compatible with the habitat and wildlife values of the adjacent stream corridor.
Septic Systems	Existing subsurface sewage disposal systems. Note: The operation, maintenance, or replacement of entitled or currently existing subsurface sewage disposal systems are not Covered Activities.
Nonconforming Structures	Existing nonconforming structures and nonconforming uses of land subject to specific requirements (see Chapter 5 of the SSHCP).
Rural Transportation Project Covered Activities (Outside the UDA)	
General Activities	Transportation projects consistent with the Circulation Element of Sacramento County General Plan. Construction, operation, and maintenance of roadways are Covered Activities. See Chapter 5.2.3 of the SSHCP for a complete list of roadway projects.
Rural Collector Road Improvements (two-lane rural roads)	Roadway widening, increase of shoulder width, and drainage improvements.[2]
Arterial Road Improvements (four-lane roadways)	Roadway widening.[2]
Road Realignment Projects	Rerouting/constructing existing roadways to facilitate more direct or new road connections.
Road Interchange Projects	Construction of four planned interchange projects.
Recycled Water Project Covered Activities (Outside the UDA)	

Table 1a. Categories of SSHCP Covered Activities

Covered Activity Categories	Description[1]
Sacramento County Agriculture and Habitat Lands Recycled Water Project (South County Agricultural Program)	Construction and maintenance of facilities (e.g., pumping stations, pipelines, recycled water facilities, groundwater recharge facilities) associated with the South County Agricultural and Habitat Lands Recycled Water Project, plus a small section of pipeline that would provide recycled water to the existing Bartley-Cavanaugh Golf Course.
Covered Activities within SSHCP Preserves	
Preserve Management and Monitoring	Construction, maintenance, and use of facilities needed for preserve management and monitoring, including but not limited to roads, bridges, culverts, fences, gates, wells, stock tanks, and stock ponds.
Habitat Enhancement, Re-Establishment, and Establishment	Enhancement actions including but not limited to improvement of the hydrologic regime of a site to benefit a Covered Species, and vegetation management activities include installing perching poles and bat houses or other nesting/roosting improvements. Habitat re-establishment and establishment actions including but not limited to earth moving; regrading or recontouring of a site; restoring the past hydrologic regime or creating a hydrologic regime; and seeding or planting herbaceous vegetation, trees, shrubs, grasses, or other vegetation.
Species Surveys, Monitoring, Research, and Adaptive Management Activities	Species surveys conducted on preserve lands and on properties identified for potential acquisition, intensive management of habitat for research (e.g., new grazing regimes, controlled burns, cycling crop harvests), and other actions associated with adaptive management activities.
Water Supply for Livestock	New wells and associated infrastructure to provide water for livestock that are used to manage grassland vegetation as part of a preserve's management plan.
Groundwater Monitoring and Extraction Wells	Monitoring of existing and construction of new extraction wells for testing and treating existing contaminated groundwater on Kiefer Landfill Buffer lands.
Detention Basins	In limited situations, stormwater detention basins would be allowed on certain Linkage Preserves.
Low-Impact Nature Trails	Construction, maintenance, and improvement of a limited number of unpaved, low-impact nature trails within the Preserve System. Improvements include removal of upland vegetation, minor grading, directional and educational signs, and benches.

[1] Additional details of each SSHCP Covered Activity category are presented in Chapter 5.2 of the Final SSHCP.

[2] Additional details of rural collector roadway improvements and rural arterial roadway improvements are presented in Table 1b below.

Table 1b. Rural Transportation Covered Activities with Roadway Widening Improvements[1]

Rural Roadway and Project Location	Project Location	Existing Condition	Condition After Covered Activity Implementation	Length of Improvement
Twin Cities Road	Between SR 99 and I-5	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	8 miles
Dillard Road	Between SR-99 in the east and Jackson Highway in the west	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	14.5 miles
Green Road	Between Dillard Road and Wilton Road	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	2.5 miles
Franklin Boulevard	Between Hood Franklin Road and Twin Cities Road	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	6.0 miles
Hood Franklin Road	Between Franklin Boulevard and I-5	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	1.2 miles
Valensin Road	Between Arno Road and Colony Road	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	3.5 miles
Alta Mesa Road	Between Dillard Road in the north and Twin Cities Road in the south	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	8.5 miles
Wilton Road	Between Grant Line Road and Dillard Road	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	2.9 miles
Jackson Highway	From UDA boundary in PPU-1 to Rancho Murieta boundary in PPU-5	Two-lane collector	Four-lane arterial with center two-way turn lane or raised center median	4.8 miles
Extension of Valensin Road	From Valensin Road and Colony Roads, 1 mile east to Alta Mesa Road	No roadway	Four-lane arterial with center two-way turn lane or raised center median	1 mile
Borden Road	Between Twin Cities and Clay Station Road	Two-lane collector	Two-lane collector with drainage and shoulder improvements, little to no increase in width	4.5 miles
Clay Station Road	Between Dillard Road in the north and the San Joaquin County Line	Two-lane collector	Two-lane collector with drainage and shoulder improvements, little to no increase in width	12.9 miles
Ione Road	Between Jackson Highway and the Amador County line	Two-lane collector	Two-lane collector with drainage and shoulder improvements, little to no increase in width	10.5 miles
Scott Road	Between White Rock Road and Latrobe Road	Two-lane collector	Two-lane collector with drainage and shoulder improvements, little to no increase in width	7.9 miles
Hood Franklin Road	Between I-5 and River Road	Two-lane collector	Two-lane collector with drainage and shoulder improvements, little to no increase in width	2.4 miles
Twin Cities Road	Between I-5 and River Road	Two-lane collector	Two-lane collector with shoulder improvements, little to no increase in width	4.3 miles
New Hope Road	Between Christensen Road and San Joaquin County line	Two-lane collector	Two-lane collector with drainage and shoulder improvements, little to no increase in width	5.0 miles
Bruceville Road	Between Kammerer Road and Twin Cities Road	Two-lane collector	Two-lane collector with shoulder improvements, little to no increase in width	5.8 miles

[1] Additional details of other rural transportation Covered Activity projects are presented in Chapter 5.2.3 of the Final SSHCP.

These Urban Development Master Plans meet the definition of an Urban Development Covered Activity. The prospective SSHCP Permittees anticipate that builders purchasing large lots from an Urban Development Master Plan developer will use the SSHCP incidental take permits to obtain project-level authorization under the ESA and CESA, and will utilize the SSHCP CWA 404 Permitting Process to obtain individual project-level authorizations under CWA 404. These five Urban Development Master Plans were carefully designed, or are being carefully designed, to comply with all SSHCP requirements, including compliance with the SSHCP Conditions on Covered Activities and the SSHCP AMMs listed in SSHCP Chapter 5.3.

Covered Activities allowed outside the UDA are limited to planned infrastructure projects, including specific roadway improvements and widening, intersection improvements, construction of new recycled water pipelines, and maintenance of existing wastewater infrastructure that currently provide sewer service to existing communities outside of the UDA.

The SSHCP Covered Activities would be implemented by the prospective SSHCP Permittees, or could be implemented by third parties (e.g., private developers and other Third Party Project Proponents) that are subject to the jurisdiction and oversight of a SSHCP Permittee. SSHCP Covered Activities would also include activities associated with the implementation of the SSHCP Conservation Strategy (see Final SSHCP Chapter 5..2.7), including the management and monitoring of the proposed SSHCP Preserve System both inside and outside the UDA, and the re-establishment/establishment of aquatic resources within some SSHCP Preserves.

Table 1 (above) presents a list and a general description of the SSHCP Covered Activities. See Chapter 5 of the SSHCP for further information about each of the SSHCP Covered Activities.

2.1.5 Conditions on SSHCP Covered Activities

Chapter 5.4 of the Final SSHCP contains a detailed description of the Avoidance and Minimization Measures (AMMs) required of each SSHCP Covered Activity to avoid or minimize direct and indirect impacts to Covered Species and their habitats. An important part of the approval process for Third Party Project Proponents seeking coverage under the SSHCP is demonstrating that the SSHCP AMMs have been incorporated during the design and during the implementation of each Covered Activity. The Land-Use Authority Permittee with authority over a Covered Activity (i.e. the County of Sacramento, City of Rancho Cordova, City of Galt, or the SSHCP Implementing Entity) is responsible for reviewing and ensuring that all applicable AMMs are appropriately incorporated into project design, and is responsible for ensuring that the required AMMs are correctly applied by the Third Party Project Proponent during implementation of the Covered Activity. The SSHCP assumes that a certain level of take will still result from implementation of the Covered Activities, and that unavoidable effects will be mitigated through the SSHCP's Conservation Strategy.

The SSHCP AMMs are discussed as General AMMs that apply to most Covered Activities (Table 2 below), and Species-Specific AMMs (Table 3 below) that must be implemented by Covered Activities proposed near Covered Species modeled habitats (Section 2.3.6 below), and by Covered Activities when a Covered Species occurrence is in or near the project site.

Elements of the SSHCP AMMs that are relevant to the effects analysis of this Opinion are incorporated into the species-level analysis presented in Sections 2.5.4, 2.5.6, 2.7.4, 2.8.3, 2.9.3, and 2.10.3 below. For a comprehensive description of each SSHCP AMM, refer to SSHCP Chapter 5.4.

Table 2. SSHCP General Avoidance and Minimization Measures (Additional details of each SSHCP General AMM are presented in Chapter 5.4 of the Final SSHCP)

Condition 1. **Avoid and minimize urban development impacts to watershed hydrology and water quality**. This condition will require Covered Activity projects that occur at the parcel, subdivision, or master plan scale to include low-impact development (LID) drainage control measures in the project design, and include construction BMPs to ensure that runoff from developed lands will closely mimic the pre-development hydrograph and retain most pre-development hydrologic functions.
LID-1 (Stormwater Quality) Enforce site design stormwater management.
LID-2 (Groundwater Recharge) Consider groundwater recharge when siting preserves.
LID-3 (Natural Site Features) Incorporate natural aquatic features into project design.
Condition 2. Avoid and minimize urban development direct and indirect impacts to existing preserves and SSHCP Preserves. Condition 2 seeks to avoid or minimize Covered Activity environmental stressors that may result in direct and indirect impacts SSHCP Preserves. The Condition 2 AMMs apply to the design of all UDA Covered Activities that border an existing preserve or a planned SSHCP Preserve.
EDGE-1 (Compatible Land Uses) Locate compatible uses with less intensive human activity next to preserves.
EDGE-2 (Single-Loaded Streets) Streets adjacent to preserves should be single loaded (i.e., only be developed on one side so the preserve is visible from the street).
EDGE-3 (Preserve Setbacks) Set minimum 50-foot-wide setback outward from the boundary of any existing preserve or planned SSHCP Preserve. The effectiveness of the Preserve Setbacks in avoiding indirect effects to the vernal pool ecosystem within the SSHCP Preserves will be adaptively monitored by Special Studies (Final SSHCP Table 8-5).
EDGE-3a (Setback Recreational Trails) Set maximum 16-foot-wide trail on the side nearest development, with open fencing between setback and trail.
EDGE-3b (Setback Firebreaks) Set minimum legal firebreak width within Preserve Setbacks using trail as firebreak if possible.
EDGE-3c (Setback Shade Trees and Landscaping) Locate non-invasive, drought-tolerant landscaping between trail and adjacent urban development.
EDGE-4 (Locate Stormwater Control Outside Preserves) Direct urban stormwater away from preserve.
EDGE-5 (Stormwater Control in Preserve Setbacks) Locate within setback nearest development.
EDGE-6 (Detention Basins in Linkage Preserves) Design to minimize effects on species.
EDGE-7 (Hardpan/Duripan Protection) Avoid disruption or seal.
EDGE-8 (Outdoor Lighting) Direct lighting away from preserves.
EDGE-9 (Livestock Access to Preserves) Design pick-up delivery facilities to be available and safe and not alter preserve habitat significantly.
EDGE-10 (Prevent Invasive Species Spread)
Condition 3. Implement Construction Best Management Practices. The AMMs associated with Condition 3 must be applied to all Covered Activities implemented in the UDA.
BMP-1 (Construction Fencing)
BMP-2 (Erosion Control)
BMP-3 (Equipment Storage and Fueling)
BMP-4 (Erodible Materials)
BMP-5 (Dust Control)
BMP-6 (Construction Lighting)
BMP-7 (Biological Monitor)
BMP-8 (Training of Construction Staff)
BMP-9 (Soil Compaction)
BMP-10 (Revegetation)
BMP-11 (Speed Limit)
Condition 4. Avoid and Minimize Impacts that May Result from Implementation of Covered Transportation Projects. SSHCP Permittees and Third Party Project Proponents implementing Urban Development transportation or Rural Transportation Project Covered Activities must comply with the roadway siting, design, and construction AMMs described below.
ROAD-1 (Road Project Location)
ROAD-2 (Wildlife Crossing Structures)[1]
ROAD-3 (Roadside Pesticide Use)
Condition 5. Avoid and Minimize Impacts that Result from Public Use of a Limited Number of Low-Impact Nature Trails in UDA Preserves.

NATURE TRAIL-1 (Nature Trail Plan)
NATURE TRAIL- 2 (Nature Trail Protection of Duripan)
NATURE TRAIL- 3 (Nature Trail Location)
NATURE TRAIL- 4 (Biological Studies Prior to Nature Trail Design)
NATURE TRAIL- 5 (Monitoring of Nature Trail Impacts)
Condition 6. Avoid and Minimize Impacts When Re-Establishing or Establishing Wetlands on Preserves.
RE-ESTABLISHMENT/ ESTABLISHMENT -1 (Vernal Pool)
RE-ESTABLISHMENT/ ESTABLISHMENT -2 (Vernal Pool Inoculum Bank)[1]
RE-ESTABLISHMENT/ESTABLISHMENT-3 (Re-Establishment/Establishment Near Airports)
Condition 7. Avoid and Minimize Impacts to Streams and Creeks. AMMs associated with Condition 7 must be applied to all Covered Activities where a stream or creek is located within a project footprint.
STREAM -1 (Laguna Creek Wildlife Movement Corridor)
STREAM-2 (UDA Stream Setbacks)
STREAM-3 (Minor Tributaries to UDA Streams)
STREAM-4 (Minimize Effects from Temporary Channel Re-Routing)
STREAM-5 (Design for Stream Channel Re-Routing, Widening, or Deepening)
Condition 8. Avoid and Minimize Impacts to Covered Species from Utility and Utility Maintenance Covered Activities. AMMs associated with Condition 8 must be applied to all Covered Activities associated with construction and maintenance of infrastructure projects.
UTILITY-1 (Avian Collision Avoidance)
UTILITY-2 (Utility Maintenance on Preserves)
UTILITY-3 (Trenchless Construction Methods)
UTILITY-4 (Siting of Entry and Exit Location)
Condition 9. Avoid and Minimize Impacts That Might Result From Removing or Breaching Levees to Establish or Re-establish Riparian Habitat.
LEVEE-1 (Preparation of Hydrologic Analysis)
Condition 10. Avoid and Minimize Impacts That Might Result From Potential Residual Contamination of Preserves and Related Exposure of People to Such Hazardous Materials
HAZARDOUS MATERIALS-1 (Preparation of Phase I Environmental Site Assessment):
HAZARDOUS MATERIALS-2 (Contingency Plan in each PMP):

[1] Some details of AMM RE-ESTABLISHMENT/ESTABLISHMENT-2 and AMM ROAD-2 are clarified and revised in the 2019 Erratum to the Final SSHCP (County of Sacramento et al. 2019).

Table 3. SSHCP Species Avoidance and Minimization Measures (Additional details of each SSHCP General AMM are presented in Chapter 5.4 of the Final SSHCP)

AMMs for all Covered Species
SPECIES-1 (Litter Removal Program). A litter control program will be instituted for the entire project site.
SPECIES-2 (No Pets in Construction Areas). To avoid harm and harassment of native species, workers and visitors will not bring pets onto a project site.
SPECIES-3 (Take Report). If accidental injury or death of any Covered Species occurs
SPECIES-4 (Post-Construction Compliance Report).
Rare Plant AMMs
PLANT-1 (Rare Plant Surveys): If a Covered Activity project site contains modeled habitat for Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii)*, Bogg's Lake hedge-hyssop (*Gratiola heterosepala)*, dwarf downingia (*Downingia pusilla),* Legenere (*Legenere limosa*), pincushion navarretia (*Navarretia myersii),* or Sanford's arrowhead (*Sagittaria sanfordii*), the Covered Activity project site will be surveyed for the rare plant by an approved biologist and following the California Department of Fish and Wildlife (CDFW) rare plant survey protocols (CDFG 2009) or the most recent CDFW rare plant survey protocols. An approved biologist will conduct the field surveys and will identify and map plant species occurrences according to the protocols. See Final SSHCP Chapter 10 for the process to submit survey information to the SSHCP Permittee and the Permitting Agencies.
PLANT-2 (Rare Plant Protection): If a rare plant listed in AMM PLANT-1 is detected within an area proposed to be disturbed by a Covered Activity or is detected within 250 feet of the area proposed to be disturbed by a Covered Activity, the Implementing Entity will assure one unprotected occurrence of the species is protected within a SSHCP Preserve before any ground disturbance occurs at the project site.
ORCUTT-1 (Orcutt Grass Surveys):
ORCUTT-2 (Orcutt Grass Protection):

Central California Tiger Salamander AMMs
CTS-1 (California Tiger Salamander Daily Construction Schedule):
CTS-2 (California Tiger Salamander Exclusion Fencing):
CTS-3 (California Tiger Salamander Monitoring):
CTS-4 (Avoid California Tiger Salamander Entrapment):
CTS-5 (California Tiger Salamander Encounter Protocol):
CTS-6 (Erosion Control Materials in California Tiger Salamander Habitat):
CTS-7 (Rodent Control):
Western Spadefoot AMMs
WS-1 (Western Spadefoot Work Window)
WS-2 (Western Spadefoot Exclusion Fencing)
WS-3 (Western Spadefoot Monitoring)
WS-4 (Avoid Western Spadefoot Entrapment)
WS-5 (Erosion Control Materials in Western Spadefoot Habitat)
WS-6 (Western Spadefoot Encounter Protocol)
Giant Garter snake AMMs
GGS-1 (Giant Garter snake Surveys)
GGS-2 (Giant Garter snake Work Window)
GGS-3 (Giant Garter snake Monitoring)
GGS-4 (Giant Garter snake Habitat Dewatering and Exclusion)
GGS-5 (Avoid Giant Garter snake Entrapment)
GGS-6 (Erosion Control Materials in Giant Garter snake Habitat):
GGS-7 (Giant Garter snake Encounter Protocol):
GGS-8 (Giant Garter snake Post-Construction Restoration)
Western Pond Turtle AMMs[1]
WPT-1 (Western Pond Turtle Surveys)
WPT-2 (Western Pond Turtle Work Window)
WPT-3 (Western Pond Turtle Monitoring):
WPT-4 (Western Pond Turtle Habitat Dewatering and Exclusion):
WPT-5 (Avoid Western Pond Turtle Entrapment):
WPT-6 (Erosion Control Materials in Western Pond Turtle Habitat):
WPT-7 (Western Pond Turtle Modeled Habitat Speed Limit)
WPT-8 (Western Pond Turtle Encounter Protocol)
WPT-9 (Western Pond Turtle Post-Construction Restoration)
Tricolored Blackbird AMMs
TCB-1 (Tricolored Blackbird Surveys)
TCB-2 (Tricolored Blackbird Pre-Construction Surveys)
TCB-3 (Tricolored Blackbird Nest Buffer)
TCB-4 (Tricolored Blackbird Nest Buffer Monitoring)
TCB-5 (Timing of Pesticide Use and Harvest Timing on Agricultural Preserves)
Swainson's Hawk AMMs
SWHA-1 (Swainson's Hawk Surveys)
SWHA-2 (Swainson's Hawk Pre-Construction Surveys)
SWHA-3 (Swainson's Hawk Nest Buffer)
SWHA-4 (Swainson's Hawk Nest Buffer Monitoring)
Greater Sandhill Crane AMMs
GSC-1 (Greater Sandhill Crane Surveys)
GSC-2 (Greater Sandhill Crane Pre-Construction Surveys)
GSC-3 (Greater Sandhill Crane Roosting Buffer)
GSC-4 (Greater Sandhill Crane Visual Barrier)
GSC-5 (Greater Sandhill Crane Roosting Buffer Monitoring)
Western Burrowing Owl AMMs[1]
WBO-1 (Western Burrowing Owl Surveys)
WBO-2 (Western Burrowing Owl Pre-Construction Surveys)
WBO-3 (Burrowing Owl Avoidance)
WBO-4 (Burrowing Owl Construction Monitoring)

WBO-5 (Burrowing Owl Passive Relocation)
WBO-6 (Burrowing Owl Timing of Maintenance Activities)
WBO-7 (Rodent Control)
Cooper's hawk, Loggerhead Shrike, Northern Harrier, and White-tailed Kite AMMs.
RAPTOR-1 (Raptor Surveys)
RAPTOR-2 (Raptor Pre-Construction Surveys)
RAPTOR-3 (Raptor Nest/ Roost Buffer)
RAPTOR-4 (Raptor Nest/ Roost Buffer Monitoring)
Western Red Bat AMMs[1]
BAT-1 (Maternity Roost Surveys)
BAT-2 (Maternity Roost Pre-Construction Surveys)
BAT-3 (Maternity Roost Buffer)
BAT-4 (Bat Eviction Methods for Non-Maternity and Non-Hibernaculum)

[1] Some details of the SSHCP Avoidance and Minimization Measures for California tiger salamander, western pond turtle, valley elderberry longhorn beetle, western burrowing owl, and western red bat are clarified in the 2019 Erratum to the Final SSHCP.

2.1.6 SSHCP Conservation Strategy

A HCP conservation strategy defines what an HCP is trying to accomplish through specific biological goals, how the Permittees will measure and track progress through an HCP monitoring program, and how Permittees will adjust implementation of the HCP over time through adaptive management and addressing changed circumstances (USFWS and NOAA Fisheries 2016). The overall SSHCP Conservation Strategy includes the SSHCP AMMs (Final SSHCP Chapter 5.4), the SSHCP Biological Goals and Objectives (Final SSHCP Chapter 7.3), the SSHCP Monitoring and Management Programs (Final SSHCP Chapter 8), the SSHCP Changed Circumstances (Final SSHCP Chapter 11), and the SSHCP Funding Program (Final SSHCP Chapter 12). The SSHCP Conservation Strategy also includes an Aquatic Resources Program and a Cultural Resources Management Program, as discussed below in Section 2.1.7.

The SSHCP Conservation Strategy was designed by the future SSHCP Permittees to achieve specific landscape-level, natural community-level, and species-level Biological Goals and Biological Objectives for the SSHCP Plan Area (see Final SSHCP Chapter 7.3). The Biological Objectives are measurable standards that will achieve each of the SSHCP Biological Goals. Specific Conservation Actions were also formulated by the future SSHCP Permittees to achieve each of the measureable Biological Objectives. The SSHCP describes five broad Biological Goals for the Plan Area (Final SSHCP Chapter 7.3):

- Biological Goal 1: preserve and link intact landscapes that include the highest-quality habitat for Covered Species within the Plan Area.
- Biological Goal 2: maintain or improve physical, chemical, and biological functions of aquatic resources within the Plan Area.
- Biological Goal 3: preserve, re-establish, and establish natural landcovers (including cropland and irrigated pasture-grassland landcovers) that provide habitat for Covered Species.
- Biological Goal 4: maintain or improve habitat value of natural landcovers (including cropland and irrigated pasture-grassland landcovers) that are preserved within the Plan Area.
- Biological Goal 5: maintain or expand the existing distribution of each Covered Species within the Plan Area.

The measureable Biological Objectives and the Conservation Actions that will achieve each of the SSHCP Biological Goals are listed and described in SSHCP Table 7-1. How each of the SSHCP Covered Species will be conserved by the SSHCP Biological Goals, Objectives, and Conservation

Actions is described in SSHCP Chapter 7.6.2. The entire SSHCP Conservation Strategy provides mitigation for all unavoidable SSHCP Covered Activity effects, including all direct and indirect effects, temporary and permanent effects, and cumulative effects to Covered Species modeled habitats, and Covered Species individuals.

The SSHCP Conservation Strategy includes the following major components:

- Provide for the continued persistence of each Covered Species in the SSHCP Plan Area.
- Protect sections of the Laguna Creek Corridor (County of Sacramento 2011) that are located within the SSHCP Plan Area and are not already protected.
- Create an integrated and interconnected SSHCP Preserve System that conserves the highest-quality natural landcovers in the SSHCP Plan Area. The SSHCP Preserve System will preserve at least 34,495 acres of existing habitat and re-establish or establish 1,787 acres of aquatic, riparian, and blue oak woodland habitat for a total SSHCP Preserve System of 36,282 acres. The SSHCP Preserve System will be managed and monitored in perpetuity for the benefit of the SSHCP Covered Species, the natural communities, and the ecosystem functions of the SSHCP Plan Area (Final SSHCP Chapter 7.5).
- Of the 34,495 acres of habitat preservation in the SSHCP Preserve System, at least 6,941 acres of preservation will occur within the UDA portion of the SSHCP Plan Area to protect vernal pool grasslands within and near the Mather Core Area (Final SSHCP page ES-7).
- Each existing or planned preserve established within the UDA will include a minimum 50-foot wide Preserve Setback, which will remain in its natural state to function as a transition between preserved habitat and developed landcovers. Each Preserve Setback will be encumbered by an easement that gives the Sacramento County Conservation Agency (the SSHCP Implementing Entity) the ability to enforce restrictions and requirements, in perpetuity.
- The 36,282-acre interconnected SSHCP Preserve System will include:
    - A minimum 10,500-acre "landscape-scale preserve" located outside the UDA in PPU-7,
    - Three minimum 800-acre "core preserves" located in PPU-1, PPU-2, and PPU-3 inside the UDA, and three 250- to 800-acre "minor preserves" located in PPU-1 inside the UDA.
    - In addition, ten "satellite" preserves (11 to 160 acres in size) will be established in PPU-1, PPU-3, and PPU-4 to protect areas with important species populations or a particularly high concentration of sensitive biological resources (Final SSHCP Page 7-73, 7-93).
    - The SSHCP Preserve System also will include a minimum of 11 linear-shaped "linkage preserves." The nine linkage preserves inside the UDA will have a minimum width of 600 feet to add additional connectivity between UDA preserves for wildlife movement and, in many cases, to also maintain existing hydrological connections. Outside the UDA, Linkage Preserve L-6 will connect the SSHCP Preserves in PPU-3 and Laguna Creek Wildlife Movement Corridor Preserve to the Cosumnes River/Deer Creek Wildlife Movement Corridor Preserve in PPU-5. A wider Linkage Preserve L-11 will connect the large Landscape Preserve in PPU-7 to the Cosumnes River/Deer Creek Wildlife Movement Corridor in PPU-5 near the town of Sloughhouse (Final SSHCP page 7-76, page 7-90).
    - An additional 500 acres of existing Vernal Pool Ecosystem will be preserved in "flexible" preserves to assure that the operational SSHCP Preserve System is providing the conservation benefits to the Vernal Pool Ecosystem within the Mather Core Area anticipated at the time of SSHCP preparation. SSHCP Flexible Preserves will occur

within the Mather Core Area or within one mile of the Mather Core Area, and will be adjacent to a SSHCP Preserve or an existing preserve within PPU-1, PPU-2, or PPU-3 (Final SSHCP page 7-13).

- The large 10,500-acre "landscape-scale" preserve in PPU-7 will be located within the designated Cosumnes/Rancho-Seco Core Area, and will connect to and augment existing preserves in PPU-7 that are not part of the SSHCP Preserve System (Final SSHCP pages 7-106, 7-307).
- Covered Activity impacts occurring within or near the Mather Core Area or within or near the Cosumnes/Rancho-Seco Core Area will be mitigated by preservation of suitable habitat inside or near that recovery Core Area (see Section 2.5.2 below). This requirement of the SSHCP Conservation Strategy will focus SSHCP mitigation to areas identified as important for the recovery of the SSHCP vernal pool Covered Species (Biological Objective VP1b; Final SSHCP pages 7-124, 7-131, 7-241).
- Of the 34,495 acres persevered by the SSHCP, approximately 23,284 acres will be high-quality Vernal Pool Ecosystem landscapes (see Section 2.3.5.2 below).
- Of the 23,284 acres of Vernal Pool Ecosystem persevered by the SSHCP, a minimum of 5,494 acres of Vernal Pool Ecosystem will be preserved within the Mather Core Area.
- The SSHCP Preserve System will preserve the existing heterogeneity of the Vernal Pool Ecosystems present in the SSHCP Plan Area by (1) preserving Vernal Pool Ecosystems on each geologic formation/soil type in the Plan Area that support Vernal Pool Ecosystems; (2) by preserving Vernal Pool Ecosystems that include each of the existing vernal pool spatial patterns and surface connectivity (VWASI densities) present in the Plan Area, and (3) by preserving the heterogeneity of vernal pool types present in the Plan Area (e.g. seasonal hydrology, floristic community, water chemistry). By preserving vernal pool heterogeneity at these three scales, the SSHCP expects to conserve the existing range of physical and environmental conditions that currently provide habitat for vernal pool species in the Plan Area, and the SSHCP expects to maintain the existing genetic diversity and existing distribution of vernal pool species in the Plan Area (Final SSHCP pages 7-102, 7-106, and 7-307).
- The SSHCP Preserve System will include two long Wildlife Movement Corridors, each extending nearly across the width of the SSHCP Plan Area (Final SSHCP Chapter 7.5):
  - Approximately nine miles of the Laguna Creek Wildlife Movement Corridor will be preserved by the SSHCP inside the UDA. Except where prevented by existing development, the sections of the Laguna Creek Wildlife Movement Corridor preserved by the SSHCP will have an average minimum width of 600 feet.
  - The SSHCP's Cosumnes River/Deer Creek Wildlife Movement Corridor has no defined width, but the SSHCP estimates that the approximately 1,551 acres natural landcovers will be preserved along approximately 17 miles of the Cosumnes River/Deer Creek Wildlife Movement in PPU-5, and that 812 acres of natural landcovers will be preserved along the Cosumnes River/Deer Creek Wildlife Movement Corridor in PPU-6.
- The 36,282-acre SSHCP Preserve System will include approximately 8,465 acres of Cropland Preserves within PPU-6 to conserve and manage important foraging and roosting habitat for certain Covered Species, including Swainson's hawk, white-tailed kite, tricolored blackbird, and greater sandhill crane.
- The SSHCP includes a Preserve System Monitoring and Management Program, designed to improve the habitat value of lands protected within the SSHCP Preserve System for the benefit of the SSHCP Covered Species. The SSHCP expects that the preservation of high quality habitat within large Preserves, coupled with careful habitat management and monitoring will maintain or increase the number of Covered Specie individuals within the Plan Area (Final SSHCP Chapter 8.3).

- Stream Setbacks required by the SSHCP Conservation Strategy will help to protect remaining natural segments of Elder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, Sun Creek, and their first-order and second-order tributaries within the UDA portion of the SSHCP Plan Area (Final SSHCP page 5-86, Table 5-1), and these Stream Setbacks also will function as additional wildlife movement corridors inside the UDA. Lands within a Stream Setback will not be elements of the SSHCP Preserve System, but the lands will be permanently restricted by an easement held by the South Sacramento Conservation Agency (the SSHCP Implementing Entity) or another approved public or private land conservation organization that has the ability to provide adequate protection and to prevent adverse impacts within the setback.
- The SSHCP Conservation Strategy will re-establish or establish the Vernal Pool landcover as mitigation for loss of vernal pool Covered Species habitat, and to assure the SSHCP meets county, state, and federal requirements or guidelines for "no-net-loss" of waters and wetlands. Approximately 389 acres of Vernal Pools will be re-established and/or established under the SSHCP, with at least 50 acres of Vernal Pool re-established or established within or adjacent to the Mather Core Area. The species analyses in this Opinion anticipates that vernal pools re-established or established under the SSHCP Conservation Strategy will be occupied by one or more of the SSHCP vernal pool Covered Species, in perpetuity.
- The SSHCP Conservation strategy will re-establish and/or establish a minimum of 300 acres of functional Vernal Pool Ecosystem (i.e. Valley Grassland, Vernal Pool, and Swale landcovers) within the Mather Core Area, or within 1 mile of Mather Core Area to offset impacts to the vernal pool Covered Species. The analyses in this Opinion anticipate that species habitat re-established or established under the SSHCP Conservation Strategy will be occupied by one or more of the SSHCP Covered Species, in perpetuity.
- The SSHCP Conservation Strategy will re-establish or establish riparian and other aquatic landcover as mitigation for loss of riparian and aquatic Covered Species habitat, and to ensure the SSHCP meets County, state, and federal requirements or guidelines for "no-net-loss" of waters and wetland. The analyses in this Opinion anticipate that species habitat re-established or established under the SSHCP Conservation Strategy will be occupied by one or more of the SSHCP Covered Species, in perpetuity.
- The SSHCP Conservation Strategy will maintain existing watershed functions in the SSHCP Plan Area to benefit wetlands (aquatic landcovers) and to conserve aquatic Covered Species and their habitats.

All SSHCP Preserves will be preserved in perpetuity and would be acquired either as fee title or as conservation easements, although most of the SSHCP Preserve System will be established using conservation easements. As the SSHCP is implemented over the 50-Year Permit Term, the SSHCP Preserve System will be established in a manner that supplements, complements, and links together the existing preserves already present within the SSHCP Plan Area (see Final SSHCP Chapter 7.5). The SSHCP Implementing Entity will document the existing conditions of each land parcel proposed for inclusion in the SSHCP Preserve System in a pre-acquisition assessment and site inventory report (Final SSHCP Chapter 9.4.2). As described in SSHCP Chapter 9.4.2, to become part of the SSHCP Preserve System, land parcels must:

- Contribute to meeting one or more of the SSHCP Biological Goals and Measurable Objectives, as described in SSHCP Chapter 7.
- Meet multiple criteria in SSHCP Chapter 7 for specific landcovers, modeled species habitat, select Covered Species occupancy, and other land acquisition criteria;

- Be in the location, have the configuration, and have habitat quality that is consistent with the SSHCP Preserve design and assembly principles described in SSHCP Chapter 7;
- Provide biological functions and values that contribute to the SSCCP Conservation Strategy;
- Have no hazardous materials or property encumbrances that conflict with the SSHCP goals and objectives;
- Not be below sea level;
- Not be an existing mitigation site for a project or activity that is not covered by the SSHCP.
- Be approved by the SSHCP Implementing Entity, the Service, and CDFW;
- Be protected with a permanent conservation easement.

All preservation and the re-establishment or establishment of Covered Species modeled habitats by the SSHCP Conservation Strategy represents mitigation for the effects of the SSHCP Covered Activities on that Covered Species (see Final SSHCP Chapter 7.6.2). The SSHCP Conservation Strategy will re-establish or establish approximately 1,787 acres of aquatic, riparian, and blue oak woodland landcovers in the Plan Area. Habitat re-establishment/ establishment projects will be strategically located within the SSHCP Preserve System to provide maximum functional gain. The SSHCP Conservation Strategy emphasizes the re-establishment of SSHCP aquatic landcovers over the establishment of SSHCP aquatic landcovers; however, suitable sites where aquatic landcovers can be successfully re-established are limited in the Plan Area, and the establishment (creation) of aquatic landcovers will be necessary to achieve meet the SSHCP's minimum 1:1 compensatory mitigation ratio requirements for direct impacts to aquatic landcovers (Final SSHCP page 7-20). All habitat re-establishment or establishment will be on lands included in the SSHCP Preserve System, and will be monitored and managed consistent with the requirements of the SSHCP (see Section 2.1.9 below). Monitoring of all re-establishment or establishment projects also will be discussed in the SSHCP annual reports (see Section 2.1.9 below).

The SSHCP's "Jump Start" provision, and the SSHCP's "Stay-Ahead" provisions require that implementation of the SSHCP Conservation Strategy and progress toward assembling and managing the 36,282-acre SSHCP Preserve System will always stay ahead of Covered Activity effects (Final SSHCP Chapter 9.4.6). These provisions of the Conservation Strategy will avoid temporal impacts to Covered Species that could occur if there were a delay between the time of a Covered Activity effect and the time when benefits of the SSHCP Conservation Strategy become available to the affected Covered Species (e.g. environmental benefits that result from habitat management, habitat enhancement, and habitat re-establishment). Under the initial "Jump Start" provision, the future SSHCP Permittees will protect at least 5% of the total 34,495 acres of habitat preservation required by the SSHCP Conservation Strategy before incidental take permits are issued by the Service and CDFW (Final SSHCP Table 9-2). Under the "Stay-Ahead" provision, the SSHCP Permittees will assure that the current acreage of each SSHCP landcover group protected within the SSHCP Preserve System is at all times larger than the acres of mitigation still required for the permitted impacts to that landcover group, by an amount that is at least 2% of the remaining acres of landcover preservation still required to assemble the minimum 36,282-acre SSHCP Preserve System.

Before approving or authorizing a Covered Activity project, each SSHCP Permittee will verify that the acres of mitigation required to offset the effects of the project would not exceed the Stay Ahead provision (Final SSHCP Chapter 9.4.6.3). In this manner, the SSHCP will preserve habitat in advance of Covered Activity species effects. The SSHCP Implementing Entity will maintain the Stay-Ahead provision before additional Covered Activity effects are allowed. The stay-ahead provision also applies to the colonies of tricolored blackbird in the Plan Area, and to individual occurrences of five plant Covered Species (Bogg's Lake hedge-hyssop, dwarf downingia, legenere, pincushion navarretia, and Sanford's arrowhead) (Final SSHCP page 9-31). In addition, the Stay Ahead provision also will maintain an acreage "cushion" of re-established/established vernal pool Covered Species aquatic modeled habitats in advance of Covered Activity conversion and loss of those aquatic landcovers (Final SSHCP Page 9-30).

Elements of the SSHCP Conservation Strategy that are relevant to the effects analysis of this Opinion are incorporated into the species-level analysis presented in Sections 2.5.4, 2.5.6, 2.7.4, 2.8.3, 2.9.3, and 2.10.3 below. For a comprehensive description of the SSHCP Biological Goals, Objectives, and Conservation Measures, refer to SSHCP Chapter 7.

2.1.7 SSHCP Aquatic Resources Program

The Goals and Objectives of the SSHCP Conservation Strategy include the preservation of natural communities (including aquatic resources) and the preservation of native species (including the SSHCP Covered Species) in the Action Area. Because many of the SSHCP Covered Species live part or all of their lives in water bodies, the SSHCP Conservation Strategy also includes additional avoidance and minimization of Covered Activity direct and indirect impacts to wetlands, streams, and other aquatic resources, many of which are also subject to regulation under the CWA, the California Fish and Game Code, and California's Porter-Cologne Water Quality Control Act. An important component of the SSHCP Conservation Strategy is the SSHCP Aquatic Resources Program (ARP). As discussed in SSHCP Chapter 7, the SSHCP ARP describes how the SSHCP will avoid and minimize Covered Activity effects on the SSHCP's Riparian landcovers, Wetland landcovers, and Other-Water landcovers (see Table 4 below), and describes how the SSHCP will provide adequate compensatory mitigation for unavoidable Covered Activity impacts to those riparian and aquatic landcovers. The SSHCP ARP was developed by the SSHCP Land-Use Authority Permittees, and identifies, classifies, and ranks the Action Area's existing aquatic resources in terms of abundance, type, and condition as they occur in each Hydrologic Unit Code (HUC)-10 watershed present in the SSHCP Plan Area (Final SSHCP Figure 2-4). Under the ARP, the Land-Use Authority Permittees (County of Sacramento, City of Rancho Cordova, City of Galt, and the SSHCP Implementing Entity) would implement a locally based aquatic-resources permitting program that relies on the SSHCP Conservation Strategy and uses a systematic approach to avoid and minimize impacts to Action Area aquatic resources, watershed functions, watershed conditions, and to provide compensatory mitigation for unavoidable impacts to aquatic resources, in a manner that is consistent with the requirements set forth in the SSHCP. The ARP also includes an alternatives analysis that incentivizes avoidance of project site aquatic landcovers. The Final SSHCP ARP is presented in Appendix I of the SSHCP Final EIS/EIR (USFWS and Sacramento County 2018).

Elements of the SSHCP ARP and the proposed SSHCP CWA 404 Permit Strategy that are relevant to the effects analysis of this Opinion are incorporated into the species-level analysis presented in Sections 2.5.4, 2.5.6, 2.7.4, 2.8.3, 2.9.3, and 2.10.3 below. For a comprehensive description of the SSHCP Aquatic Resources Plan refer to Appendix I of the SSHCP Final EIS/EIR (USFWS and Sacramento County 2018). For a comprehensive description of the proposed CWA 404 Permit Strategy refer to Appendix C of the SSHCP Final EIS/EIR (USFWS and Sacramento County 2018), as well as the August 14, 2018, USACE Public Notice SPK-1995-00386 on The Proposed Section 404 Clean Water Act Regional General Permit for Section 404 Strategy Aligned with the South Sacramento Habitat Conservation Plan (USACE August 14, 2018).

2.1.8 SSHCP Monitoring and Management Programs

The SSHCP Monitoring and Management Program is described in SSHCP Chapter 8, and outlines the types of monitoring that will occur during implementation of the SSHCP over the Permit Term:

- SSHCP Compliance Monitoring (Final SSHCP Chapter 8.2.1) will track implementation of individual SSHCP Covered Activities and track implementation of the SSHCP Conservation Strategy, including the Conditions on Covered Activities (Final SSHCP Chapter 5.4), the SSHCP Biological Goals and Objectives (Final SSHCP Chapter 7), and the SSHCP Monitoring and Management Programs (Final SSHCP Chapter 8). SSHCP Compliance Monitoring will verify that the SSHCP Permittees are carrying out the commitments and requirements of the SSHCP and the ITPs—including financial responsibilities and obligations, program management responsibilities, and will track the level of incidental take of Covered Species.
- SSHCP AMM-Compliance Monitoring (Final SSHCP Chapter 8.2.2) will track and assure that required AMMs ware implemented at each Covered Activity project site, and were implemented correctly;
- SSHCP AMM Effectiveness Monitoring (Final SSHCP Chapter 8.2.3) will monitor the effectiveness of the AMMs implemented at each Covered Activity project site to assure that adverse effects of the project on the SSHCP landcovers, Covered Species modeled habitats, and Covered Species individuals are avoided or minimized to the extent assumed during the preparation of the SSHCP Conservation Strategy and the extent assumed in the SSHCP Effects Assessment (Final SSHCP Chapter 6).
- The SSHCP Preserve System Monitoring and Management Program (Final SSHCP Chapter 8.3) will monitor and assess the effectiveness of the SSHCP Preserve System and the other components of the operational SSHCP Conservation Strategy in achieving each of the broad Biological Goals of the SSHCP. The SSHCP Preserve System Monitoring and Management Program will integrate habitat monitoring and adaptive management into one cohesive program where monitoring will inform and change land management actions to continually improve outcomes for Covered Species and natural communities in the Preserve System.

Habitat monitoring and management will occur on all Preserves in the SSHCP Preserve System to ensure that habitats preserved for Covered Species do not become unsuitable over time because of factors such as altered hydrology, contamination, nonnative species invasions, and other factors that can degrade the functions and suitability of the preserved habitat. Effectiveness Monitoring (Final SSHCP Chapter 8.2.3) conducted under the "SSHCP Preserve System Monitoring and Management Program" will include monitoring the effectiveness of SSHCP Preserve habitat management activities. As indicated in SSHCP Chapter 8.3.3.5, specific targeted studies also will be conducted by the SSHCP to evaluate effectiveness of specific elements included in the SSHCP Conservation Strategy, including the effectiveness of the SSHCP Preserve Setbacks in protecting the existing hydrology of the Vernal Pool Ecosystem protected in the SSHCP UDA Preserves. The Service, CDFW, and the future SSHCP Technical Advisory Committee (TAC) will provide input and evaluate SSHCP monitoring and studies of SSHCP AMM effectiveness, and will provide input and evaluate the monitoring and studies of the overall effectiveness of the SSHCP Conservation Strategy (Final SSHCP Chapter 9.3).

Due to the programmatic nature of the SSHCP, it was not possible to develop individual Preserve Monitoring Plans prior to a Permit decision being made. Instead, SSHCP Chapter 8.3 provides a framework on which detailed monitoring and management plans for each SSHCP Preserve will be developed during implementation of the SSHCP and assembly of the SSHCP Preserve System.

Individual preserve management plans (PMPs) will be developed and submitted to the Service for review and approval. SSHCP Chapter 8, SSHCP Table 8-4, and SSHCP Appendix G-3 provides a framework of indicators, protocols, and sampling design that the future SSHCP Permittees will consider when developing the monitoring component of the individual Preserve Management Plans (PMPs). Each individual Preserve Monitoring and Management Plan (PMP) will be re-evaluated every five years. As discussed in SSHCP Chapter 9.9, SSHCP Preserve monitoring results will be incorporated into annual reports that will be prepared by the SSHCP Permittees and submitted to the Service and CDFW by March 15 each year. The available inventory of each Covered Species modeled habitats remaining in the Plan Area will be tracked and included in each annual and 5-year report. SSHCP Preserve management in response to the Changed Circumstances described in SSHCP Chapter 11 cannot be deferred.

Elements of the SSHCP Monitoring and Management Program that are relevant to the effects analysis of this Opinion are incorporated into the species-level analysis presented in Sections 2.5.4, 2.5.6, 2.7.4, 2.8.3, 2.9.3, and 2.10.3 below. For a comprehensive description of the SSHCP Monitoring and Management Program, refer to SSHCP Chapter 8.

2.1.9 SSHCP Changed Circumstances.

Changed circumstances are defined as "changes in circumstances affecting a species or HCP Plan Area that can reasonably be anticipated by the HCP developers and the Service, and responses can be planned in advance (50 CFR 17.3). Accordingly, the SSHCP identified anticipated changed circumstances as well as remedial measures that would be taken by the SSHCP Conservation Strategy to address those changed circumstances, should they occur during the SSHCP Permit Term (Final SSHCP Chapters 11.2 and 11.3). Changed Circumstances identified by the SSHCP include:

- Federal listing of a SSHCP Covered Species;
- Federal listing of a new species not covered by the SSHCP;
- Changing climate conditions resulting in more extreme or extended flooding;
- Changing climate conditions resulting in more extreme or extended drought;
- Changing conditions resulting in increased frequency or intensity of wildfire;
- New invasive plant species or expanded invasive plant species distribution;
- New invasive animal species or expanded invasive animal species distribution;
- Unusual outbreaks of disease or the introduction of new diseases that affect a Covered Species.

The costs and planned responses to these Changed Circumstances are part of the HCP's operating Conservation Strategy (USFWS and NOAA Fisheries 2016). The planned SSHCP responses to these Changed Circumstances are incorporated into the species-level analysis presented in Sections 2.5.4, 2.5.6, 2.7.4, 2.8.3, 2.9.3, and 2.10.3 below.

2.1.10 SSHCP Funding

SSHCP Chapter 12.4 discusses four key parameters for funding the implementation of the SSHCP, including implementation of the SSHCP Conservation Strategy:

- SSHCP Development Mitigation Fee Concept
- SSHCP Development Mitigation Fee Structure

- SSHCP Development Mitigation Fee Program and Schedule
- SSHCP Funding Assurances.

SSHCP Chapter 12.4.1 and SSHCP Table 12-5 describe how each of the SSHCP development fees were derived and how they will be assessed. The SSHCP includes two mechanisms to adjust fee levels to ensure adequate funding over the Permit Term: automatic adjustments to account for inflation, and periodic audits and adjustments. Both automatic adjustments and periodic assessments are described in SSHCP Chapter 12.4.3.2.

In addition, a SSHCP Permittee (or a private landowners under their jurisdiction), may own a parcel of land that would achieve one or more of the SSHCP biological goals and measureable objectives. In those cases, land dedication to establish a SSHCP Preserve may be used in in lieu of the SSHCP development fee, and fees could be reduced or eliminated by a land dedication (Final SSHCP Chapter 9.4.4, Chapter 10.7.2, and Chapter 12.4.3.1). The SSHCP Permittees or the Covered Activity project proponents that own land within a priority conservation area may transfer fee title or place a conservation easement on the portion of their property within the SSHCP Conservation Strategy's targeted conservation areas, if approved by the SSHCP Implementing Entity, the Permitting Agencies (i.e. USFWS, CDFW, USACE) and the SSHCP Technical Advisory Committee/Interagency Review Team (TAC/IRT) (Final SSHCP page 9-24, SSHCP page 9-19).

2.1.11 SSHCP Implementation

SSHCP Chapter 9 describes how the SSHCP will be implemented over the 50-year Permit Term, institutional arrangements, organizational structure, approval processes, land acquisition processes, and roles and responsibilities of signatories to the Implementing Agreement, the Permitting Agencies, and the other stakeholders. The summary that follows highlights aspects of Chapter 9 that are relevant to this Opinion.

Implementation of the SSHCP begins when the Service's section 10(a)(1)(B) incidental take permit becomes effective. The effective date of the Service's incidental take permit is contingent upon each of the prospective Permittees adopting the SSHCP Implementing Ordinance (i.e. the SSHCP Implementing Resolution), adopting the SSHCP Aquatic Resources Protection Ordinance, and adopting the SSHCP Implementing Agreement. These adoptions will allow the Permitting Agencies (including the Service, CDFW, and USACE) to make findings that the SSHCP will be adequately funded, and the future Permittees have provided assurances that the SSHCP will be implemented. The draft SSHCP Implementing Ordinance (aka Implementing Resolution) was provided in Appendix H of the Final SSHCP document.

Although the SSHCP Permittees are primarily responsible for implementing the SSHCP, other entities are responsible for implementing certain aspects of the SSHCP. The successful execution of the SSHCP Conservation Strategy, SSHCP monitoring program, Covered Activity approvals, and SSHCP annual reporting will require coordination among the SSHCP Permittees, the SSHCP Permitting Agencies (including the Service, CDFW, and USACE), public land managers, and the private sector. SSHCP Chapters 9.2 and 9.3 describe the roles of each entity during implementation of the SSHCP. The roles and responsibilities of each Permitting Agency during SSHCP implementation are described in Chapter 9.3 of the Final SSHCP. Specifically, the duties and responsibilities of Service and CDFW during implementation of the SSHCP will include the following:

- Participating on the SSHCP Technical Advisory Committee(TAC)
- Participating in the SSHCP Interagency Review Team (IRT);
- Reviewing and approving SSHCP species survey and species monitoring protocols, including appropriate reference sites;
- Reviewing and approving modifications to SSHCP AMMs;
- Ranking potential land or easement acquisitions for priority;
- Reviewing and approving SSHCP property transactions for satisfying the SSHCP Conservation Strategy, such as land or easement acquisitions, purchase of conservation or mitigation bank credits, land dedications, and gifts of land;
- Reviewing and approving individual Preserve Management Plans;
- Reviewing and approving individual Preserve Monitoring Plans;
- Reviewing and approving adaptive land management actions in SSHCP Preserves;
- Reviewing and approving upland habitat and aquatic habitat re-establishment/establishment plans;
- Reviewing and approving SSHCP success criteria for upland habitat and aquatic habitat re-establishment/establishment projects;
- Reviewing relevant new scientific studies and reports for applicability in SSHCP Preserve management;
- Advising on other scientific issues as identified by the SSHCP Executive Director;
- Attending regular coordination meetings;
- Reviewing SSHCP Annual Reports to confirm compliance with requirements of the SSHCP and the ITP;
- Reviewing individual Covered Activity project application-packages prior to SSHCP Permittee approvals of Covered Activity projects that border an existing Preserve, a SSHCP Preserve, or a planned SSHCP Preserve;
- Reviewing individual Covered Activity project application-packages prior to SSHCP Permittee approvals of Covered Activity projects that include a wildlife crossing structure.

The duties and responsibilities of the USACE during implementation of the SSHCP will include the following:

- Administering the SSHCP CWA 404 Permit Strategy
- Participating in the SSHCP TAC is necessary when the meeting agenda includes discussion of compensatory mitigation projects (i.e. In-lieu Fee projects);
- Participating in the SSHCP IRT, inclusive of administering the SSHCP In-lieu Fee Program, as guided by the approved In-lieu Fee Program's instrument and exhibits;
- Reviewing and approving all SSHCP aquatic habitat re-establishment/establishment plans;
- Reviewing and approving SSHCP monitoring protocols related to aquatic habitat re-establishment/establishment;
- Reviewing and approving modifications to SSHCP AMMs related to aquatic habitat re-establishment/establishment;
- Reviewing and approving SSHCP monitoring plans related to aquatic resources re-establishment/establishment;
- Reviewing SSHCP adaptive land management actions related to aquatic resources re-establishment/establishment.

To ensure the success of the SSHCP, the SSHCP Permittees will make progress on a variety of tasks simultaneously. Implementation schedule guidelines and specific milestones for SSHCP implementation, including progress towards species habitat preservation as well as aquatic landcover re-establishment and establishment, are established in SSHCP Chapter 9.11. SSHCP Table 9-2 lists implementation tasks with deadlines that are tied to ITP compliance.

The SSHCP includes several Special Studies and certain implementation-tasks that the future Permittees will initiate prior to Permit issuance (see Final SSHCP Table 8.3; SSHCP Table 8-5; SSHCP Chapter 9.11; and SSHCP Table 9-3). The Special Studies include initiating a study to verify assumptions included in the impact methodology used by the SSHCP to quantify indirect effects to Vernal Pools and the Vernal Pool Ecosystem (see Section 2.5.3 and 2.5.6 below), including the appropriate size of the size of the Preserve Setbacks. The framework for the SSHCP's Avoidance and Minimization Measure (AMM) Monitoring Program" and the "SSHCP Preserve System Monitoring and Management Program" will be developed within 18 months of Permit issuance (Final SSHCP Chapter 9.11).

As described in SSHCP Chapter 9.8, the SSHCP Permittees will develop and maintain a comprehensive data repository to track Permit compliance and all other aspects of the SSHCP. SSHCP Chapter 9.9 details the types of data that will be maintained by the SSHCP Permittees and included in each SSHCP Annual Report, and the longer SSHCP 5-year reports that will be provided to the Service and the other Permitting Agencies. SSHCP Chapter 9.9.2 also describes requirement for the two 20-year reviews that will be prepared during the 50-year Permit Term.

SSHCP Chapter 9.9 explains how preserve acquisition and habitat restoration actions will be tracked and credited during implementation of the SSHCP. The process for Covered Activity project proponents to receive authorization to use the SSHCP ITP is described in SSHCP Chapter 10.2. For Third Party Project Proponents, an application must be submitted to the appropriate Land-Use Authority Permittee (i.e. the County of Sacramento, City of Rancho Cordova, City of Galt, or the South Sacramento Conservation Agency) for review and approval in order to receive coverage under the SSHCP permits. For their own projects, each Permittees must submit an application package to the SSHCP Implementing Entity. These application packages will be critical in determining coverage, tracking effects, assessing fees, and ensuring all applicable Conditions and AMMs are implemented. The six required components of each Covered Activity project application-package are described in detail in SSHCP Chapter 10.2. Public entities, such as special districts or entities not subject to the jurisdiction of the Permittees, may wish to conduct Covered Activities within the SSHCP Plan Area that could affect listed species and may require take authorization from ESA or CESA. These public agencies, referred to as Participating Special Entities in the SSHCP, may be able to receive incidental take coverage through the process described in SSHCP Chapter 10.2.4.

The South Sacramento Conservation Agency is expected to exist in some form after the end of the 50-year Permit Term to manage the SSHCP Preserve System in perpetuity. Regardless, all of the future Permittees are obligated to continue to protect, manage, and maintain the SSHCP Preserve System after the end of the Permit Term. This includes habitat monitoring and adaptive management at a level sufficient to determine whether habitat management is effective. Before the end of the Permit Term, the SSHCP Permittees and the South Sacramento Conservation Agency will determine the administrative structure necessary to continue management of the Preserve System in perpetuity and meet the continuing obligations of the Permit. For example, management responsibility may be delegated to one of the Permittees to oversee in perpetuity. Alternatively, the

JPA for the South Sacramento Conservation Agency may extend its term to continue to oversee implementation of the SSHCP (Final SSHCP Chapter 9.11).

2.2 Action Area

The Action Area is defined in 50 CFR §402.02 as, "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The Action Area should be determined based on consideration of all direct and indirect effects of the proposed agency action (50 CFR 402.14(h)(2)).

The Service anticipates that the direct and the indirect effects of the SSHCP Covered Activities on Covered Species will be confined to the SSHCP Plan Area. Therefore, for our analysis we generally defined the Action Area to be the SSHCP Plan Area, which was previously described in Section 2.1.1 above.

2.3 Environmental Setting of the Action Area

Because of the large size of this Action Area and the landscape nature of the proposed action, this Opinion provides a general assessment of the existing habitat conditions in the Action Area, and the factors responsible for that condition. The *environmental baseline* of each SSHCP Covered Species and their habitats are provided below in Sections 2.5 to 2.9 of this biological opinion.

The current habitat conditions within the Action Area include areas that are extensively urbanized, areas of relatively undisturbed natural landscapes, areas of agricultural farming operations, and areas of rural residential development that contain a patchwork of developed landcovers and natural landcovers. The Action Area's current habitat conditions reflect the underlying landforms, physical characteristics, and biological characteristics of the Action Area's natural landscapes, as well as the history of human modification of those landscapes.

As discussed below, the Valley Grassland landcover is the most abundant landcover in the Action Area. In addition, the Valley Grassland landcover provides seasonal or permanent habitat for each SSHCP Covered Species, and also plays an essential role in the hydrology and the ecosystem functions of each Action Area aquatic landcover, including all vernal pools, surface swales, ephemeral drainages, creeks, and streams present in the Action Area. Therefore, this general assessment of the existing environmental conditions of the Action Area is framed around the characteristics of the Action Area's Valley Grassland landcovers.

2.3.1 Action Area Climate, Landforms, Geologic Formations, and Soils

The climate of Sacramento County is generally described as being Mediterranean. The total average rainfall in Sacramento County measures about 19 inches annually, with most rainfall occurring between November and February during the winter rainy season. The absence of major physiographic variations in Sacramento County results in a nearly uniform climate throughout the Action Area. Sacramento County experiences a great deal of sunshine throughout the year, which provides a 250-day growing season in the Action Area. Most of the Action Area is characterized by the nearly level to gently-rolling terrain of the California Great Valley physiographic region (Final SSHCP Figure 2-1). In addition, smaller areas of the Sierra Nevada Foothills physiographic region occur along the northeastern and southeastern borders of the Action Area (Final SSHCP Figure 2-1). The Sierra Nevada Foothill areas are characterized by the presence of rock outcroppings, undulating or hilly terrain, and increased elevation (Jones and Stokes 1990; USDA NRCS 1993; Smith D. and Verrill 1998).

The two physiographic regions in the Action Area include eight predominant landforms (Final SSHCP Figure 2-2). Landforms are physical attributes of the land formed by past geomorphological processes, including erosion and deposition. A landform is defined by its surface features (such as alluvial terraces and basins, volcanic mudflows and lava flows, berms, mounds, and hills), and also by surface attributes such as elevation, slope, orientation, rock exposure, and soil type. Within the Action Area, the dominant landforms of the California Great Valley physiographic region are low floodplains, high floodplains, drainageways, low terraces, high terraces, and ancient mudflows. The dominant landforms of the Sierra Nevada Foothills portion of the Action Areas are hills and foothills.

As discussed in SSHCP Chapter 2.3.3, the soils in the Action Area are highly variable because of the complexity of the Action Area's underlying geologic formations and surface landforms. Consequently, the Action Area's soils exhibit a wide range of characteristics that affect plant and animal communities, including depth to bedrock, parent material, clay content, soil chemistry, soil wetness, presence or absence of a restrictive soil horizon, and soil slope. Most of the soils found on the Action Area's low-terrace, high terrace, volcanic-mudflow, and drainageway landforms (Final SSHCP Figure 2-2) include an impermeable (restrictive) soil layer, which coincides with the occurrence of vernal pool grassland[8] in the Action Area. Depending on the nature of the underlying landform and geologic formation, and the pedogenic (soil forming) history of the soil, the restrictive soil layer in the Action Area's soils are located a few feet to just a few inches below the soil surface, and are composed of either a silica-cemented duripan (a hardpan), a claypan, or an ancient mudflow (bedrock). Hardpans and claypans both develop gradually over thousands of years, and can be a meter (yard) or more thick (Smith D. and Verrill 1998). During the winter rainy seasons, the portion of the soil profile that is located above the soil's restrictive layer becomes saturated with water, forming a seasonal "perched aquifer" that holds water throughout the winter and early spring (Hanes et al. 1990; Hanes and Stromberg 1998; Hanes and Stromberg 1998; Rains et al. 2006, 2008; Williamson et al. 2005). As discussed in Section 2.3.5 below, the seasonal development of this subsurface "perched aquifer" is essential to the annual hydrology and the ecological functions of the Action Area's vernal pools, surface swales, and ephemeral-drainages, as well as the majority of the Action Area's grasslands, creeks, and streams. The soils and parent material of vernal pools greatly influences hydrologic functioning and the species composition of the vernal pool (Hanes and Stromberg 1998; R. Holland and Jain 1981, 1988).

Much of the Action Area has a combination of environmental conditions that favored the development of vernal pools: soils with a relatively shallow restrictive layer; landforms that, at a broad scale, are shallowing sloping or nearly level; and a Mediterranean climate that provides a rainy season (when rainfall exceeds evaporation, filling the shallow pools), and provides a dry season when evaporation is greater (drying the shallow pools). Annual rainfall is relatively meager, so erosion by overflowing waters does not dissect the small topographic irregularities that form the vernal pool basins (Keeley and Zedler 1998). Since appropriate combinations of climate, soil, and topography often occur over continuous areas rather than in isolated spots, the Action Area's vernal pools, seasonal swales, and ephemeral drainages tend to be clustered at the landscape scale, often forming

[8] The term "vernal pool grassland" is a general term used to refer to natural grasslands that also support vernal pools and vernal pool complexes. Also see the definition of "Vernal Pool Ecosystem" presented in Section 2.3.5.2 below.

"vernal pool complexes" that are hydrologically connected below the soil surface by the seasonal perched aquifer, and are intermittently connected on the soil surface by the seasonal swales (Smith D. and Verrill 1998; Rains et al. 2006). Vernal pools within a complex are typically separated by a few meters in distance, and have dense, interconnected mosaics of small and large size vernal pools.

In the Action Area, landscapes that support vernal pools and vernal pool complexes are typically grasslands found on shallowly sloping to near level topography, with soils that include an impermeable layer. The physical attributes of a vernal pool— including its size, water depth, period of inundation, and water chemistry—largely determine the types and kinds of plant and animal species found in each vernal pool. A vernal pool's physical attributes, in turn, are largely determined by the characteristics of the pool's underlying landform, geologic formation, and soil type (USFWS 2005a). The physical characteristics of the vernal pool influence the life history characteristics of vernal pool species found in the pool, such as the speed with which a species can mature and reproduce, the amount of soil moisture required for germination of plant seeds or hatching of invertebrate eggs or cysts, as well as tolerance to turbidity, total dissolved solids, and other aspects of vernal pool water chemistry. As discussed below in Section 2.3.5, the parent material, and soils derived from the parent material, greatly influences species composition and hydrologic functioning of the vernal pool (Hanes and Stromberg 1998).

2.3.2 Action Area Background

The Action Area once supported a nearly contiguous expanse of grassland prairie dominated by native perennial bunch-grasses and forbs, and later dominated by the naturalized annual grasses and annual forbs that now characterize the Valley Grassland landcover. Most of the Action Area's historical expanse of grassland was interwoven with vernal pools, a type of ephemeral wetland that forms in shallow surface depressions that fill with water in the winter rainy season, but are completely dry by late spring or early summer. The hydrological regime of vernal pool inundation—too short and unpredictable to support most aquatic species but long enough to eliminate upland species—is what characterizes vernal pools, and also supports a unique assemblage of highly specialized vernal pool plants and animals that are adapted to the annual cycle of winter inundation and extreme summer drought (Solomeshch et al. 2007). As discussed below in Section 2.5, eleven of the SSHCP's 28 Covered Species require vernal pool habitat to complete all or part of their life cycle.

The grasslands found on the Action Area's eastern hill and foothill landforms (Final SSHCP Figures 2-1) had few vernal pools, but included large patches of oak-savannah and grassy oak woodlands (McDonald 1985; Sawyer and Keeler-Wolf 1995; Sawyer et. al 2009). On the floodplains along the southwestern and western border of the Action Area (Final SSHCP Figure 2-2), the Action Area's historical expanse of grassland blended into the mature riparian-woodlands and emergent wetlands that were once common on the wide Sacramento River floodplain and the narrower floodplains of the lower Cosumnes River and lower Mokelumne River (Final SSHCP Figure 2-2).

The existing environmental conditions in the Action Area reflect the history of human modification of the pre-settlement landscapes described above. From 1850 through the early twentieth century, the dominant human activity in the western half of the Action Area (PPUs 4 and 6) was the conversion of the Action Area's level floodplains and the nearly-level low-terrace landforms into agricultural row crops and housing, with a corresponding loss of native landcovers (Final SSHCP Figure 2-2). After the 1930's, the County also experienced several rapid increases in population with corresponding expansions of urban and suburban landcovers onto the farming landcovers in the center and western parts of the Action Area, primarily outside the cities of Sacramento, Florin, and Elk Grove (PPUs 4 and 6), Galt (PPU-8), and later Rancho Cordova (PPU-2). The Action Area's developed landcovers and farming landcovers are described in Sections 2.3.4 and 2.3.5 below.

However, on the high-terrace, mudflow, foothill, and hill landforms present in the eastern half of the Action Area (PPUs 1, 2, 3, 5, and 7), the topography was more rolling or hilly, reliable irrigation water was often lacking, and many soils were not arable (Final SSHCP Figure 2-2). Consequently, human activity in the eastern half of the Action Area through the early twentieth century was limited primarily to cattle grazing and ranching. Cattle grazing and ranching activities continue to dominate the eastern half of the Action Area, which has maintained large landscapes of intact vernal pool grassland. Likewise, grazing and ranching activities on the areas of Sierra Nevada foothill landform along the eastern border of the Action Area have helped to maintain much of the grassy oak-savanna and oak-woodland landcovers that were historically present in the Action Area (see Final SSHCP Figure 3-1).

2.3.3 SSHCP Landcover Mapping

A principal component of the Action Area's biological-resources baseline is the composition and distribution of landcovers present in the Action Area. The landcover classification system used by the SSHCP is a modification of the California Natural Communities classification system developed by the California Department of Fish and Wildlife (CDFW) (Sawyer and Keeler-Wolf 1995), and represents classifications of land surface interpreted from aerial photograph signatures. The SSHCP defined 25 landcovers in the Action Area.

Eight of the 25 SSHCP landcovers were classified as "developed/non-habitat landcovers," which provide minimal habitat value for native species. The other SSHCP landcovers were classified by the SSHCP as "natural landcovers," and include 13 native or naturalized landcovers, as well as 4 farming landcovers that provide habitat value for certain SSHCP Covered Species. The total acres of each SSHCP landcover within the Action Area are shown in Table 4 below. The distribution of each SSHCP landcover in the Action Area is presented in the SSHCP Landcover Baseline Map (Final SSHCP Figure 3-1). As discussed in Section 2.3.6 below, the SSHCP landcovers were used to define and model Covered Species suitable habitat within the Action Area.

Action Area landcover mapping occurred in several stages early in the planning and development of the SSHCP. As discussed in SSHCP Chapter 3.3 and SSHCP Appendix E, initial mapping of SSHCP landcovers was accomplished through interpretation of black-and-white aerial imagery dated March 2001 and mapped at a scale of 1 inch = 200 feet (1:2,400), and on color aerial imagery dated November 2002 and mapped at a scale of 1 inch = 400 feet (1:4,800). The mapping efforts for the Vernal Pool and the Swale landcovers were more intensive than other landcovers and included more field verification. The initial SSHCP landcover map has been periodically updated and refined over the years that the SSHCP was being developed—to reflect areas of landcover conversion, to expand the initial SSHCP Area boundaries, to consolidate riparian forest landcovers, and to verify aerial imagery interpretation based on field visits and other site specific information. Detailed spatial data from the National Hydrological Dataset was also added to refine mapping of streams, creeks, and other linear aquatic-landcovers in the Action Area.

Mapping some wetland landcovers was refined in 2012-2014 using 4 sets of color aerial photographs flown during the summer months of 2003, 2005, 2009, and 2010. If water or vegetation was present in an individual feature for at least three of the four aerial photo years, the SSHCP classified the feature as the Seasonal Wetland, Freshwater Marsh, or Open Water landcover. The Open Water classification was applied when at least half of the feature was observed to be inundated and rooted aquatic vegetation (e.g., tules, cattails) was not present. If an area was adjacent to Open Water or Stream/Creek and displayed rooted aquatic vegetation, the SSHCP classified the feature as Freshwater Marsh. When little or no water was present but vegetation was present (indicating that the feature did not completely dry down each summer), the SSHCP usually classified the feature as Seasonal Wetland. However, if the feature met the criteria for Seasonal Wetland and was located within one of the two vernal pool ecosystem recovery Core Areas (USFWS 2005a) designated within the Action Area (i.e. the Mather Core Area or the Cosumnes/Rancho-Seco Core Area), or was within 1 mile of these Core Areas, the SSHCP typically mapped the feature as the Vernal Pool landcover. This was done to assure that all occupied or suitable habitat for the vernal pool fairy shrimp and other SSHCP vernal pool Covered Species was included in the SSHCP analyses of habitat impact and habitat preservation.

If water or vegetation was not present in at least three of the four aerial photo years, then the SSHCP classified the feature as Vernal Pool, but with these three exceptions: (1) if woody vegetation was present around the perimeter or within the feature, then the feature was classified as Seasonal Wetland, Freshwater Marsh or Open Water; (2) if the feature was surrounded by an agricultural cover type or was located within topography dominated by mine tailings, the feature was classified as Seasonal Wetland, Freshwater Marsh, or Open Water; (3) if the feature was completely surrounded by a developed/non-habitat landcover, the feature was classified the same as the surrounding developed/non-habitat landcover. In this manner, seasonally wet impoundments and depressions that provide habitat for vernal pool crustacean Covered Species were mapped by the SSHCP as the Vernal Pool landcover.

Consequently, the final SSHCP map of Vernal Pool landcovers (Final SSHCP Figure 3-1) includes features and areas that provide suitable habitat for vernal pool Covered Species (see Opinion Section 2.5 below), but are lands that might not be delineated as *Waters Of the U.S.* under Section 404 of the Clean Water Act. See Appendix E1 of the Final SSHCP for more information on the process used by the SSHCP to map locations and amount of the Vernal Pool landcover in the Action Area.

2.3.3.1 Vernal Pool Micro-Watersheds

In addition to the types and the existing distribution of each SSHCP natural landcover, a second principal component of the Action Area's biological resources baseline is the delineation and mapping of the surface watershed of each vernal pool present inside the UDA portion of the Action Area. Outside the UDA, the SSHCP also delineated and mapped the surface watersheds of each vernal pool located within 250-feet of the proposed rural transportation Covered Activity projects, or within 250 feet of a recycled-water pipeline Covered Activity project.

The SSHCP mapped surface watersheds of individual vernal pools using the following five-step approach: 1) acquire high-resolution Light Detection and Ranging (LIDAR) topographic imagery data; 2) develop a digital terrain model (DTM) of the Urban Development Area (UDA); 3) use industry-standard hydrologic-assessment software tools to determine surface hydrologic characteristics of the UDA and map the hydrologic boundaries of the surface area that contributes to each vernal pool inside the UDA portion of the Action Area (see Final SSHCP Chapter 3.3.2, Chapter 6.4.2, and Appendix E). The SSHCP determined that some Action Area vernal pools have a substantial watershed that contributes to their seasonal water inputs; while a few Action Area vernal pools have watersheds as small as 16 square feet. The SSHCP determined that the median size of the vernal pool watersheds within the Action Area is approximately 36,150 square feet (0.8 acres) (M. Henry *in litt.* 2018).

As discussed below (Sections 2.5.3 and 2.5.5), digital maps of the individual vernal pool watersheds were used by the SSHCP to adjust the footprint of several proposed Covered Activity projects to maximize avoidance of indirect-impacts to vernal pools within existing preserves and planned SSHCP preserves. As discussed in Section 2.5.3 below, maps of the individual vernal pool watersheds were also used by the SSHCP to quantify indirect impacts of the SSHCP Covered Activities on Vernal Pools and the other Vernal Pool Ecosystem aquatic landcovers (see definitions in Section 2.3.5.2 below).

2.3.4 SSHCP Developed Landcovers in the Action Area.

Approximately 45,059 acres (14 %) of the Action Area is now a SSHCP developed landcover (i.e. is high-density development, low density development, landscaped recreational lands, mine tailings, roads, aqueducts, or the "other" disturbed landcover)(Table 4 below). Most of the existing Action Area developed landcovers are located inside the UDA, especially in the north part of PPU-1 and PPU-2, and in all of PPU-4 and PPU-8.

However, approximately 18,600 acres of the total 45,059 acres of developed landcovers is the low density development landcover (i.e. has relatively sparse residences and other structures, such as farm buildings, and small rural neighborhoods with large individual property sizes per house). The majority of the existing 18,600 acres of Low-Density Development are located outside the UDA, in rural-residential developments located in the southcentral part of the Action Area (in western PPU-5 near the town of Wilton, and in western PPU-7 south of Wilton). Approximately 5,306 acres of PPU-7 is Low-Density Development (Final SSHCP page 7-91). As discussed below, the Low-Density Development/rural-residential areas within PPU-5 and PPU-7 also include fragmented remnants of vernal pool grasslands and other natural landcovers.

2.3.5 SSHCP Natural Landcovers in the Action Area

The SSHCP "natural landcovers" include thirteen native or naturalized landcovers, as well as four farming landcovers that have habitat value for certain SSHCP Covered Species[9]. Of the thirteen native/naturalized landcovers, six are terrestrial landcovers and seven are aquatic landcovers (see Table 4 below). The 17 SSHCP natural landcovers total approximately 272,596 acres in the Action Area. Except for the Vineyard landcover, each of the 17 natural landcovers provide important habitat for several SSHCP Covered Species (Final SSHCP Table 3-1).

Of the approximately 272,596 acres of natural landcovers in the Action Area, approximately 64,500 acres (approximately 19% of the Action Area) are within existing preserves (Final SSHCP page 3-128). The Action Area's existing preserves include wildlife refuges, nature preserves, lands under conservation easements, mitigation banks, individual mitigation sites established by past projects, and other types of open spaces that are permanently protected to maintain their value for biological or ecological resources. Of the approximately 64,500 acres of existing preserves, approximately

[9] The SSHCP classifies the Vineyard landcover as a farming landcover; therefore the Vineyard landcover is included as one of the 17 "natural landcovers" defined and mapped by the SSHCP. However, the Vineyard landcover was not included in any of the Covered Species modeled habitats that are discussed and analyzed in the Final SSHCP.

3,170 acres are inside the UDAs and about 61,330 acres are outside the UDAs (Final SSHCP Figure 3-41).

2.3.5.1 Farming Landcovers

The four SSHCP farming landcovers (Cropland, Irrigated Pasture-Grassland, Orchard, and Vineyard) are classified as "natural landcovers" by the SSHCP. The SSHCP farming landcovers are currently found on approximately 98,190 acres (31%) of the Action Area, and are primarily located on the level floodplains and low-terrace landforms of the western half of the Action Area. Almost all of the SSHCP farming landcovers are found outside the UDA, throughout PPU-6 and in the western third of PPU-7 (i.e. the western and southwestern portions of the Action Area) (Final SSHCP page 7-91). However, fragmented parcels of cropland landcovers totaling 10,287 acres still occur inside the UDA (primarily in PPU-3, in eastern PPU-4, and around the City of Galt in PPU-8) (Final SSHCP Figures 2-1 and 3-1).

Although most conversion of native landcovers to farming landcovers had occurred in the more level western half of the Action Area, in the last decade more than 5,000 acres of vernal pool grassland located on high-terrace and ancient mudflow landforms in the southeastern part of the Action Area (PPU-7) have been converted to the Vineyard landcover (Final SSHCP Figure 3-1). In total approximately 20,695 aces of Vineyard and Cropland landcovers are present in the south and western portions of PPU-7 (Final SSHCP page 7-91). The conversion of native landcovers to Vineyard or Orchard landcovers requires "deep-ripping" of the soil, which removes the existing soil structure, including the restrictive soil layer that forms the "perched aquifer," which creates the seasonal hydrology of the Action Area's vernal pool grassland ecosystems.

In 2006, the portion of PPU-7 located south of Laguna Creek and east of the town of Herald was designated as part of the 70,000-acre Borden Ranch American Viticulture Area by the U.S. Department of the Treasury (see 27 CFR Part 9 and 71 FR 40414). This designation is expected to result in additional conversions of vernal pool grassland to the Vineyard landcover within this portion of the Action Area.

2.3.5.2 Native and Naturalized Landcovers

The SSHCP's 13 native or naturalized landcovers remain on approximately 174,409 acres (55%) of the Action Area. The SSHCP native/naturalized landcovers include 3 upland landcovers (Valley Grassland, Blue Oak Savanna, and Blue Oak Woodland), 3 riparian landcovers (Mixed Riparian Woodland, Mixed Riparian Scrub, and Mine Tailing Riparian Woodlands), and 7 wetland or waters landcovers (Vernal Pool, Swale, Stream/Creek with Vernal Pool Invertebrate Habitat (VPIH), Stream/Creek, Seasonal Wetland, Freshwater Marsh, and Open Water).

Valley Grassland Landcover

Valley Grassland is an herbaceous plant community characterized by naturalized annual grasses and forbs, including Italian wild rye (*Lolium multiflorum*) and Mediterranean barley (*Hordeum marinum* ssp, *gussoneanum*). Valley Grassland is the most abundant landcover of the Action Area, found on approximately 135,152 acres or 42.5% of the Action Area (Table 4 below). The plant community composition of Valley Grassland varies slightly with geographic, topographic, and land-use factors such as elevation, slope, aspect, grazing, and other herbivory (e.g., livestock, wildlife, rodent, and insect use). Some areas of Valley Grasslands along the eastern border of the Action Area also include native grasses and native forb species in addition to the naturalized annual grasses and forbs. As discussed above, large undisturbed landscapes of Valley Grassland still remain in the western half of the Action Area.

Of the total 135,152 acres of Valley Grassland, approximately 39,257 acres (28%) is located in the Sierra Nevada foothills and other parts of the Action Area that do not support vernal pool landcovers. In these foothill areas, the Valley Grassland plant community also forms the groundcover layer in the Blue Oak Savanna and Blue Oak Woodland landcovers.

The majority of the Action Area's 135,152 acres of Valley Grassland landcover (approximately 97,350 acres or 72%) occur on natural landscapes that remain hydrologically and ecologically connected to the seasonally wet vernal pools, intermittent swales, and ephemeral drainages that co-occur with Valley Grasslands in this Action Area.

Vernal Pool Ecosystem Aquatic-Landcovers (Vernal Pools, Swales, and Stream/Creek-VPIH)

Vernal Pools. Vernal pools are a unique type of wetland ecosystem. Central to their distinctive ecology is that they are vernal or ephemeral, occurring temporarily—typically during the spring following fall and winter rains—and then disappearing until the next year. They are wet long enough to be different in character and species composition from the surrounding upland habitats, and yet their prolonged annual dry phase prevents the establishment of species typical of more permanent wetlands (R. Holland and Jain 1981). In California, where extensive areas of vernal pool habitat developed over long periods of time, unique suites of species specially adapted to the unusual conditions of vernal pools have evolved in California. Fish and other predators are among the species excluded by vernal pools' annual drying, so vernal pool communities have developed and flourished in the absence of many predators. California vernal pools are also renowned for their showy displays of wildflowers, blooming in concentric rings about the pools in spring (USFWS 2003a). Vernal pool plant communities are able to resist invasion of upland species because of the severe ecological constraints on plants living in vernal pool environments

The SSHCP mapped approximately 4,536 acres of existing Vernal Pools within the Action Area using the assumptions and methodologies discussed in SSHCP Chapter 3.3 and SSHCP Appendix E. Approximately 934 acres (21%) of the Action Area's Vernal Pools are within the UDA portion of the Action Area, and approximately 3,600 acres (79%) are outside the UDA, with 2,221 acres (49%) in SSHCP PPU-7 alone. As discussed in Section 2.3.3 above, the SSHCP Vernal Pool landcover was mapped to include any aquatic feature where vernal pool crustacean reproduction has been observed, or where seasonal hydrology is adequate to allow reproduction of vernal pool crustaceans.

Hydrological studies in the Action Area show that Vernal Pools in the Action Area do not simply fill from direct precipitation, nor do they empty solely by evapo-transpiration. Instead, subsurface water movements within the seasonal perched aquifer impart a high degree of connectivity between uplands and vernal pools within the same landscape (Rains et al. 2006). Vernal pools in the Action Area begin to fill with the fall and winter rains. Before ponding occurs, there is a period during which the soil is wetted and the subsurface water table may rise. The subsurface perched aquifer allows rain that falls some distance from a vernal pool or vernal pool complex to be retained in the upper soil layers, and later move into the vernal pools. Within vernal pools and vernal pool complexes, water in the seasonal perched aquifer will move laterally from upland hillocks into vernal pools. Similarly, water will move laterally out of vernal pools and into hillocks as the vernal pool dries (Rains et al. 2006). These lateral subsurface flows stabilize the water level of vernal pools, causing Action Area vernal pools to be inundated for much longer periods than would be the case if the vernal pools were recharged only by rainfall (Rains et al. 2006). Consequently, essential ecological functions of the Action Area's Vernal Pools (including characteristics of the vernal pool's seasonal hydrologic cycle, water chemistry, nutrient cycling, food chain support, and species dispersal between vernal pools and between vernal pool complexes) are closely tied to the Valley Grasslands found in the uplands of each vernal pool's watershed.

As the Valley Grasslands uplands surrounding each vernal pool begin to grow and transpire each spring, the growth of the naturalized annual grasses pull water from the perched aquifer, causing water to move laterally out of vernal pools and into the perched aquifer (Rains et al. 2006). Unmanaged growth of naturalized annual grasses in the upland hillocks of vernal pool grasslands (e.g. no grazing, haying, or prescribed fire) will increase the rate of water movement out of the subsurface perched aquifer, and increase the rate that vernal pools in the same vernal pool grassland landscape will draw-down and dry. In addition, built-up thatch from naturalized annual grasses, forbs, and weedy species such as Medusa-head grass (*Taeniatherum caput-medusae*) also will decreases rainwater infiltration during the winter rainy season, slowing the formation of the perched aquifer, and reducing the overall size and persistence of the seasonal perched aquifer in that vernal pool grassland (Robins and Vollmar 2002).

Swales. In addition to water movements in the subsurface perched aquifer, water also moves between vernal pools in narrow surface swales (Solomeshch et al. 2007). Swales are seasonal wetlands that can remain saturated for much of the winter rainy wet season, but are not inundated long enough to develop strong vernal pool characteristics. The SSHCP mapped approximately 1,252 acres of the Swale landcover within the Action Area, with approximately 461 acres inside the UDA, and 792 acres outside the UDA. The SSHCP defines the Swale landcover as "shallow and ephemeral surface-drainages found in association with a vernal pool or a vernal pool complex, usually in flat to gently rolling Valley Grasslands on soils that include an impermeable layer." When precipitation from winter rains and from subsurface perched-aquifer lateral-flows fill vernal pools to capacity, water exits the vernal pools by outflows into one or more adjoining Swales, which conveys the water from up-gradient vernal pools to lower-gradient vernal pools, and ultimately conveys the water to a downslope seasonal stream (Rains et al. 2008). Each of the 1,252 acres of Swale landcovers mapped by the SSHCP is directly connected to one or more mapped Vernal Pools (see Final SSHCP Appendix E), sometimes forming complex reticulated networks within a vernal pool complex. Swales in the Action Area typically flow only during, and for short periods after, winter rainstorms. Because rainwater rapidly infiltrates into the upper pedon of soil types that have a hardpan (duripan) restrictive-layer, overland flows rarely occur on the surface of the Action Area's low-terrace and high-terrace landscapes, except for the intermittent flows that occur via surface swales (Rains et al. 2008).

As discussed in SSHCP Chapter 3, the SSHCP's Swale landcover supports several native plant species commonly found in vernal pools, and the Swale landcover often includes smaller shallow depressional features that may pond long enough during the rainy season to provide suitable reproductive habitat for some vernal pool crustacean Covered Species. As discussed above in Section 2.3.3, when the SSHCP landcover mapping process observed depressions within a Swale or a section of a Swale that could provide reproductive habitat for vernal pool crustaceans (based on their appearance in aerial imagery and/or through field verification), the SSHCP mapped those swale sections as the Vernal Pool landcover. All Swale landcovers provide intermittent conduits for the movement of individuals, seeds, and propagules of vernal pool species between vernal pools and to downslope ephemeral drainages and seasonal streams.

Stream/Creek VPIH. As discussed in SSHCP Chapter 3.2.1, the SSHCP Stream/Creek Vernal Pool Invertebrate Habitat landcover (the Stream/Creek-VPIH landcover) describes intermittent drainages located in the north half of the Action Area (i.e. parts of PPUs 1, 2, 3, and 4) that convey water after winter rain events (are ephemeral), and often have drainage features that pond water between winter storm events. The Stream/Creek-VPIH landcovers provide movement corridors for individuals, seeds, and propagules of the vernal pool Covered Species, and are known to provide suitable reproduction habitat for two vernal pool crustacean Covered Species, in most water years (i.e. mid-valley fairy shrimp and vernal pool fairy shrimp).

Unlike the SSHCP Swale landcover, the Stream/Creek-VPIH landcover is less likely to support plant species that are found in vernal pools. Vegetated portions of the Stream/Creek-VPIH landcover are dominated by Valley Grassland plant species. The SSHCP considers the Stream/Creek-VPIH landcover to provide habitat for the vernal pool crustacean Covered Species, but does not consider the Stream/Creek-VPIH landcover to be habitat for any of the vernal pool plant Covered Species. The Stream/Creek-VPIH landcover is found in the Action Area north of Dry Creek, is associated with large, relatively flat plateaus of "high terrace" vernal pool grasslands (see Final SSHCP Figure 2-2), and is associated with the California Valley physiographic region (see Final SSHCP Figure 2-1). Consequently, the SSHCP mapped Stream/Creek-VPIH landcovers primarily within the portions of PPUs 1, 2, 3, and 4 that are also within the UDA.

The assumptions used by the SSHCP to define and map the Stream/Creek VPIH landcover are discussed in Chapter 3 and Appendix E of the Final SSHCP, and in Erratum to the Final SSHCP. Similar to the mapping of other linear aquatic features in the Action Area (i.e. streams, creeks, drainages, waterways), the SSHCP used the average wetted area of each drainage to delineate the Stream/Creek-VPIH landcovers. The SSHCP mapped approximately 69 acres of Stream/Creek VPIH inside the UDA, and approximately 4 acres of Stream/Creek-VPIH outside the UDA. SSHCP Figure3-2 shows locations of the Stream/Creek-VPIH landcover in the Action Area.

The Vernal Pool Ecosystem

SSHCP recognized that the Action Area's Vernal Pool, Swale, and Stream/Creek VPIH landcovers cannot exist in isolation of the surrounding Valley Grassland uplands, which provide the seasonal hydrology, water chemistry, and related abiotic factors that can determine species diversity and abundance in a vernal pool or a vernal pool complex. Upland areas adjacent to vernal pools are function as part of the localized watershed and subsurface perched aquifer that are essential to maintaining the hydrological and ecological processes o vernal pools. Upland areas buffer the effects of varying rainfall patterns and establish patterns of surface and subsurface flow, which help determine the timing and duration of vernal pool ponding and drying. The timing and duration of the ponding and drying periods affects seed germination, and production of vernal pool plants, as well as the hatching and growth of vernal pool crustaceans. Upland areas also provide a major source of food, in the form of detritus, for vernal pool crustaceans; support pollinator populations for vernal pool plants; improve vernal pool water quality by filtering sediment and contaminants; and moderate vernal pool water temperature. Consequently, the SSHCP impact analysis and Conservation Strategy addresses these four landcovers together as a single Vernal Pool Ecosystem. The Action Area's 5,861 acres of Vernal Pool, Swale, and Stream/Creek VPIH landcovers together with the Action Area's 97,349 acres of ecologically and hydrologically-linked Valley Grassland currently provide approximately 103,210 acres of Vernal Pool Ecosystem within the Action Area, with approximately 31,808 acres (31%) located within the UDA portion of the Action Area, and approximately 71,512 acres (69%) outside the UDA. The existing acres of Vernal Pool Ecosystem are found almost entirely on the Action Area's high-terrace and mudflow landforms in the eastern PPUs (PPUs 1, 2, 3, 5, and especially PPU-7 (Final SSHCP Figure 2-1).

As discussed above, almost all of the historical Vernal Pool Ecosystem on the Action Area's low-terrace landforms have been converted to farmland, graded, heavily grazed, and/or developed because of their arable soils, proximity to reliable water, and more level topography (Final SSHCP Figures 2-2 and 3-1). However, a few scattered areas of low-terrace Verna Pool Ecosystem remain in the Action Area in PPU-6outside the UDA. These areas include the Cosumnes River Ecological Reserve located along the east border of the Cosumnes River floodplain, and the Stone Lake Mitigation Preserve located along I-5 (between Stone Lakes National Wildlife Refuge and Elk Grove). As discussed above in Section 2.3.1, the parent material, and soils derived from the parent material, greatly influences species composition and hydrologic functioning of the vernal pool (Hanes and Stromberg 1998).

Properly managed livestock grazing of Valley Grassland uplands can play a significant role in the maintenance and enhancement of Vernal Pool Ecosystems. Livestock grazing has three primary effects on vernal pools: consumption of upland vegetation, trampling, and nutrient input from urine and feces (Vollmar 2002). However, inappropriate levels of grazing, from undergrazing, overgrazing, or inappropriately timed grazing, can result in significant adverse effects to Vernal Pool Ecosystems. Excluding livestock and/or changing the grazing intensity and/or timing of grazing can also alter vernal pool hydrology. Standing dry or dead vegetation may reduce water infiltration to the seasonal perched aquifer during precipitation events via interception and direct evaporation. The removal of cattle grazing from vernal pool grasslands has been found to dramatically decrease the inundation period of vernal pools. Marty (2004) found that the removal of grazing led to a reduction in pool inundation to below the period of time necessary for successfully metamorphose by western spadefoot. In addition, changes in vernal pool hydrology resulting from livestock exclusion are correlated to the invasion of nonnative annual weed species (Robins and Vollmar 2002; USFWS 2005a). Bauder (1987) found a direct correlation between nonnative vegetation and reduced inundation period in vernal pools. Appropriate livestock grazing regimes reduce cover of weedy grasses and thatch, and open habitat at vernal pool margins by hoof-pocking. Robins and Vollmar (2002) found that vernal pools within livestock enclosures demonstrated a "simplification" of floral composition, with a shift towards dominance by Italian wild rye and Mediterranean barley. Uplands that are not grazed can shift in dominance towards Medusa-head grass and yellow-star thistle (*Centaurea solstitialis*) (Robins and Vollmar 2002; Dittes pers. obs.). Historically, native herbivores helped maintain appropriate inundation periods of vernal pools by limiting vegetation and duff accumulation and by sustaining soil conditions that create favorable vernal pool habitat (Barry 1995).

Seasonal Wetland Landcover

The SSHCP defines the Seasonal Wetland landcover as a wetland that ponds for an extended period during a portion of the year, generally filling during the rainy winter season, and drying relatively slowly—usually in the late summer or early fall. Seasonal Wetlands in this Action Area tend to be isolated wetlands that occur scattered on all landforms with the Valley Grassland landcover, and include excavated stock ponds, impounded drainages, and graded or excavated former vernal pools. In addition, moderate to large depressional features located along Action Area streams, creeks, and rivers and along the edges of the Open Water landcover can also be Seasonal Wetland.

Approximately 162 acres of Seasonal Wetland are within the UDA portion of the Action Area, and approximately 2,438 acres are located outside the UDA. The Seasonal Wetland plant community is often characterized by herbaceous annual and perennial species such as curly dock (*Rumex crispus*), sedges (*Carex* spp.), nutsedges (*Cyperus* spp.), spikerushes (*Eleocharis* spp), and occasionally cattail (*Typha* spp.). Approximately 2,600 acres of Seasonal Wetland is currently present in the Action Area. The SSHCP does not consider Seasonal Wetlands to be suitable habitat for vernal pool crustaceans (as discussed above, any seasonally wet depressions that could provide suitable habitat for vernal pool crustaceans or the obligate vernal pool plant-species were mapped by the SSHCP as the Vernal Pool landcover).

Freshwater Marsh Landcover

The SSHCP Freshwater Marsh landcover typically contains water year round, but may experience complete drawdown in drought years. Freshwater Marsh is dominated by perennial herbaceous plant species such as cattails, tules (*Scirpus* spp.), and other perennial plant species. In the Action Area, Freshwater Marsh is generally found along the edges of open-water in ponds, lakes, and rivers. The majority of 2,954 acres of Planning Area Freshwater Marsh (88%) occurs in PPU-6along the perennial Cosumnes River and Deer Creek (Final SSHCP page 7-90).

Stream/Creek Landcover

The Stream/Creek landcover includes intermittent and perennial linear water features such as rivers, streams, creeks, drainages, and roadside and irrigation ditches. The Stream/Creek landcover includes the Cosumnes River, streams such as Laguna Creek and Dry Creek, and the Action Area's smaller intermittent or perennial creeks and drainages. Of the 2,778 acres of Stream/Creek in the Action Area, 163 acres are located inside the UDA, and 2,616 acres are found in the south half of the Action Area outside the UDAs. Mapped polygons of the Stream/Creek landcover occur with the SSHCP Valley Grassland, Agriculture, Blue Oak Woodland, Blue Oak Savanna, and the Developed landcovers. As discussed above, the intermittent drainages in the northern portion of the Action Area that provide habitat for vernal pool crustacean species were mapped by the SSHCP as the Stream/Creek-VPIH landcover.

Open Water Landcover

Open Water is a perennial water feature with no vegetation, or with only non-rooted aquatic vegetation, such as algae, floating pondweeds, or other non-rooted aquatic plants. The Open Water landcover is found throughout the Action Area, and includes the Action Area's natural or constructed ponds, lakes, and reservoirs. Of the 2,344 acres of Open Water in the Action Area, 2,106 acres (90%) are found in the south half of the Action Area outside the UDA. The Action Area's Open Water features are largely unnamed with the exception of Blodgett Reservoir located inside the UDA (in PPU-1), and Rancho-Seco Lake located outside the UDA in PPU-7. Rooted or emergent aquatic vegetation may occur along the shorelines of some Open Water features, but those areas were mapped by the SSHCP as Freshwater Marsh landcovers.

Mixed Riparian Woodland Landcover and Mixed Riparian Shrub Landcover

The Action Area's woody riparian landcovers are typically associated with the Stream/Creek landcover, and occur in the zone between an active stream channel and the adjacent upland landcover, typically the Valley Grassland landcover. In some cases, the Action Area's riparian landcovers are also associated with the Open Water landcover, and occur between the un-vegetated open water and the adjacent uplands.

The Action Area includes 5,856 acres of Mixed Riparian Woodland and 1,454 acres of Mixed Riparian Scrub landcovers, with 96% and 83% of those acres located outside the UDA, respectively. The Mixed Riparian Woodland landcover typically includes an open canopy layer dominated by tall Fremont cottonwood trees. Beneath this open layer, a moderately dense midcanopy layer composed of tree species such as Oregon ash (*Fraxinus latifolia*), Goodding's willow (*Salix gooddingii*), walnut (*Juglans* spp.), and box elder (*Acer negundo*) is present in mature stands. In some areas, a subcanopy of dense Riparian Scrub dominated by willow species, including arroyo willow and sandbar willow, may also be present. A discontinuous shrub layer is usually present, and includes species such as blue elderberry (*Sambucus mexicana*), California wild grape (*Vitus californica)*, California blackberry (*Rubus ursinus*), Himalayan blackberry (*Rubus discolor*), coyote-brush (*Baccharis pilularis*), wild rose (*Rosa* spp), and western poison-oak (*Toxicondendron diversilobum*). The groundstory of the Mixed Riparian Woodland landcover is sparsely to densely vegetated with herbaceous species. Included in the SSHCP Mixed Riparian Woodland landcover are areas of valley oak riparian woodlands. Although valley oak riparian woodlands were not mapped as a separate landcover because of difficulty distinguishing them on aerial photos, they were once the dominate plant community on the Action Area's floodplains and perennial waterways. The remaining remnants of valley oak riparian woodlands incorporated into the Mixed Riparian Woodland landcover include valley oak (*Quercus lobata)*, and usually California sycamore (*Platanus racemosa*), walnut, and box elder.

Table 4. Total Acres of Each SSHCP Landcover in the Action Area

SSHCP Landcover	Acres Available in Action Area	Percentage of the 317,655-acre Action Area
Natural Landcovers		
Aquatic Landcovers		
Wetlands and Other Waters		
Vernal Pool*	4,536	1.4%
Swale*	1,252	0.4%
Stream/Creek - Vernal Pool Invertebrate Habitat (VPIH)*	73	0.02%
Seasonal Wetland*	2,600	0.8%
Stream/Creek*	2,778	0.9%
Open Water*	2,344	0.7%
Freshwater Marsh*	2,954	0.9%
Total Wetlands & Other Waters	**16,537**	*5.2%*
Riparian Landcovers		
Mixed Riparian Woodland*	5,856	1.8%
Mixed Riparian Scrub*	1,454	0.5%
Mine Tailing Riparian Woodland*	641	0.2%
Total Riparian	***7,951***	***2.5%***
Terrestrial Landcovers		
Native and Naturalized Upland Landcovers		
Valley Grassland	135,152	42.5%
Blue Oak Savannah*	5,637	1.8%
Blue Oak Woodland*	9,132	2.9%
Total Native and Naturalized Uplands	***149,921***	***47.2%***
Farmlands		
Cropland	51,829	16.3%
Orchard	3,907	1.2%
Vineyard	26,460	8.3%
Irrigated Pasture Grassland	15,991	5.0%
Total Farmlands	***98,187***	***30.9%***
Total Natural Landcovers	***272,596***	***86%***
Developed Landcovers		
Aqueduct	264	0.1%
Disturbed	6,288	2.0%
High-Density Development	13,073	4.1%
Low-Density Development	18,608	5.9%
Major Roads	2,764	0.9%
Mine Tailings	1,098	0.3%
Recreation/Landscaped	2,180	0.7%
Not Mapped	784	0.2%
Total Developed Lands	***45,059***	***14.2%***
Total Acres in Action Area	***317,655***	***100%***

Mine Tailing Riparian Woodland Landcovers

The Mine Tailings Riparian Woodland landcover type is distributed in networks of relatively narrow linear areas that naturally established on abandoned mine tailing surface deposits. The Action Area includes 641 aces of Mine Tailing Riparian Woodland. Approximately 220 acres (34%) are located in the UDA along the north boundary of PPU-1. Approximately 421 acres (66%) are located outside the UDA in an area of dredge tailings located south of the Rancho Murieta Airstrip between Dillard Road and Laguna Creek (in northern PPU-7and in southern PPU-5). Mine Tailing Riparian

Woodlands contain species commonly found in Riparian Woodlands and Riparian Scrub habitats, such as Fremont cottonwood, blue elderberry, willow, and coyote-brush. Mine Tailing Riparian Woodland can also intergrade with mixed riparian forest.

Blue Oak Savannah and Blue Oak Woodlands

The Action Area includes approximately 14,769 acres of Blue Oak Savanna and Blue Oak Woodland, which co-occur with the Valley Grassland landcover. Most of the Blue Oak Savanna and Blue Oak Woodland landcovers are within the Sierra Nevada Foothills physiographic region of the Action Area, and are located near the eastern border of the Action Area in PPU-7 and PPU-5, and in the northeast portion of the Action Area (which is outside the UDA and not within any PPU) (Final SSHCP Figures 2-1 and 3-1).

2.3.6 Species Modeled Habitat in the Action Area

As discussed in SSHCP Chapter 3.4, the SSHCP used the SSHCP Landcover Baseline Map (Final SSHCP Figure 3-1) to describe and model suitable habitat in the Action Area for each SSHCP Covered Species. The SSHCP worked with local species experts, the Service, and the California Department of Fish and Wildlife (CDFW) to compile best available information about the life history, reproductive needs, biology, habitat requirements, ecology, range, distribution, trends, threats, and existing data gaps for each Covered Species. The SSHCP also compiled information from all published and unpublished species-surveys known in the Action Area to identify site locations known to support the species, or where the species have been observed (see Final SSHCP Chapter 3, and SSHCP Appendix B).

Spatial data used in the SSHCP to develop the Covered Species habitat models include data from the Soil Survey Geologic Database (SSURGO) for Sacramento County (USDA NRCS 1993; USDA 2014); species occurrence records from the California Natural Diversity Database (CNDDB[10]); data from species surveys conducted in the Action Area by the wildlife agencies, consulting firms, and species experts; and data from other publicly available geographic datasets. The SSHCP compiled and analyzed the above data for each Covered Species to generate a map-based model of suitable habitat within the Action Area for each of the SSHCP Covered Species.

The SSHCP was conservative when determining whether the parameters for suitable-habitat were present within a mapped landcover, in an effort to account for model limitations (i.e. aerial photo mapping resolution, lack of species survey data, etc.). This approach may have overestimated the actual extent of suitable habitat for some Covered Species in the Action Area, but using this type of "conservative" methodology is consistent with conservation-planning practices when data are limited (Noss et al. 1997). Final SSHCP Chapter 3.4 describes and provides a map of Action Area modeled habitat for each Covered Species. Final SSHCP Table 3-2 lists the SSHCP landcovers known to provide breeding, feeding, or sheltering habitat for each SSHCP Covered Species. For three Covered Species (giant garter snake, Swainson's hawk, and greater sandhill crane) the SSHCP species habitat model also identifies locations of "high-value" habitat within the Action Area.

[10] The California Natural Diversity Database is an electronic inventory of the locations and status of each rare plant and animal in California, and is managed by the California Department of Fish and Wildlife (CDFW).

2.4 Analytical Framework for the Jeopardy and Adverse Modification Analysis

2.4.1 Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed Federal actions, and any cumulative effects, on the range-wide survival and recovery of the listed species. It relies on four components: (1) the *Status of the Species*, which describes the range-wide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the species.

2.4.2 Adverse Modification Determination

Section 7(a)(2) of the ESA requires that Federal agencies insure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification" (DAM) was published on February 11, 2016 (81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states:

"Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The DAM analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat,* which describes the range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, **primary constituent elements** (PCEs), or physical and biological features) that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the *Environmental Baseline,* which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and (4) *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

For purposes of making the DAM determination, the Service evaluates if the effects of the proposed Federal action, taken together with cumulative effects, are likely to impair or preclude the capacity of critical habitat in the action area to serve its intended conservation function to an extent that appreciably diminishes the range-wide value of critical habitat for the conservation of the listed species. The key to making that finding is understanding the value (i.e., the role) of the critical habitat in the action area for the conservation/recovery of the listed species based on the *Environmental Baseline* analysis.

2.5 Vernal Pool Species

For the purposes of this Opinion, obligate vernal pool species (species that require vernal pool habitat to complete their life cycle) are grouped together and identified as the "vernal pool Covered Species." Included in the group of vernal pool Covered Species are three branchiopod crustacean and one insect species (i.e., vernal pool tadpole shrimp, vernal pool fairy shrimp, mid-valley fairy shrimp, and Ricksecker's water scavenger beetle—the vernal pool arthropods), and seven plant species (i.e., dwarf downingia, Boggs Lake hedge-hyssop, Ahart's dwarf rush, legenere, pincushion navarretia, slender Orcutt grass, and Sacramento Orcutt grass—the vernal pool plant species).

At the time of preparation of this Opinion, 4 of the 11 vernal pool Covered Species are federally listed as threatened or endangered (i.e. vernal pool tadpole shrimp, vernal pool fairy shrimp, slender Orcutt grass, and Sacramento Orcutt grass).

Two other SSHCP Covered Species (central California tiger salamander and the western spadefoot) use vernal pools and other seasonal wetlands for reproduction, but spend the majority of their lives in underground upland habitats. Because the central California tiger salamander and the western spadefoot have biphasic lifecycles, and may use other aquatic habitats to complete their lifecycle, the central California tiger salamander and the western spadefoot are discussed below in *Section 2.6 Other-Aquatic Species*.

This Opinion will analyze each vernal pool Covered Species individually. For the purposes of streamlining the Opinion and minimizing repetition, the 11 vernal pool Covered Species are grouped together in the initial discussion presented in Section 2.5.1 *Status of the Vernal Pool Covered Species*, and in the initial discussion presented in Section 2.5.2 *Environmental Baseline of the Vernal Pool Covered Species*.

2.5.1 Overview of Vernal Pool Covered Species Status, and Overview of Critical Habitat

The status of the 11 individual SSHCP vernal pool Covered Species is discussed below in Sections 2.5.1.1 to 2.5.1.11. To minimize redundancy, this section of the Opinion (Section 2.5.1) discusses the species life history needs and ecological relationships that are common to all of the vernal pool Covered Species. This section of the Opinion also discusses factors that have affected the range-wide status of all vernal pool Covered Species, and provides new information about the current distribution and status of vernal pool grassland ecosystems that has become available since the publication of the last 5-year review for vernal pool fairy shrimp, vernal pool tadpole shrimp, slender Orcutt grass, and Sacramento Orcutt grass (USFWS 2007a, 2007b, 2008b, 2009).

The SSHCP vernal pool Covered Species are part of a unique suite of vernal pool plant and animals that have evolved over long periods of time to be especially adapted to the ephemeral nature and the extreme year-to-year environmental variability of vernal pools in California and southern Oregon. All of the vernal pool Covered Species have complicated live histories that include long-lived seeds, cysts, or eggs that persist in the soils of dry vernal pools, waiting to emerge in the next appropriate rainy season. While dormant, these tiny propagules resist extreme heat and drought, but are able to re-activate their metabolism and life cycle when water conditions and temperature become appropriate (USFWS 2005a). The presence of a persistent propagule "bank" in the soil of a vernal pool provides insurance against localized extirpation resulting from the unpredictable timing and unpredictable duration of appropriate habitat conditions in the vernal pool ecosystem. If species reproduction completely fails in a given year or set of years (failure to hatch or germinate, loss to late season flooding or fire, excessive grazing by livestock or grasshopper herbivory), additional stored propagules are available for another year's effort. The physical characteristics of an individual vernal pool (e.g. size, water depth, water chemistry, etc.) influences the type of species found in a pool, by triggering vernal pool species life history characteristics, such as the amount of soil moisture required for seed germination or the hatching of eggs or cysts, the speed with which a species must mature and reproduce, and tolerance to turbidity, total dissolved solids, and other aspects of vernal pool water chemistry.

Natural dispersal of vernal pool species (individuals, seeds, cysts, and eggs) occurs via flowing water, transport on feet and feathers of waterfowl, and in mud on hooves and legs of livestock. Historically, dispersal of each vernal pool species was likely a more frequent event when there were many more vernal pools grasslands, more interconnectivity between vernal pool complexes, much larger waterfowl migrations, unfenced roaming ungulates, and periodic large-scale flooding of the Central Valley (Griggs 1980).

The vernal pool plant Covered Species are "annual plants," which germinate, grow, set seed, and die in a single growing season. Most vernal pool plant species germinate during the vernal pool wet phase, sometimes under water, and then flower and set seed before the vernal pool's soil dries completely. This annual life cycle is an adaptation that allows the vernal pool plant species to complete their life cycles during the relatively short growing period provided during the inundation and drying phase of their vernal pool habitat, and is an adaptation to extreme variations in year-to-year rainfall. Another adaptation of each vernal pool plant is the production of dormant seeds that can remain viable in the soil for many years. This adaptation allows vernal pool plants to survive the dry, hot summer months and to survive low rainfall years. Not all of the dormant seeds will germinate in any given year. The number of plants present above ground can fluctuate dramatically from year to year due, with much of each plant population remaining as dormant seeds in the soil. This strategy reduces the probability of local extirpation if environmental conditions change—for example, if a vernal pool dries up prematurely. Tolerance to depth of inundation differs greatly among the vernal pool plant species (Zedler 1987). Species that are the least tolerant to inundation tend to grow along the margins of pools, while those that can tolerate extended periods of inundation tend to grow in the center of pools.

Similar to the seeds of vernal pool plants, the vernal pool crustacean Covered Species produce eggs coated with a protective protein layer (cysts) that withstand heat and lie dormant in the soil for years or decades, until a poorly-understood combination of environmental cues triggers them to hatch and begin their life cycle again. An important adaptation of the vernal pool crustaceans is their relatively short life span, which allows them to hatch, mature to adulthood, and reproduce during the short time period when a vernal pool contains water. Some vernal pool crustacean species may undergo more than one generation in a single wet season. Variation in environmental conditions such as precipitation amount, precipitation timing, and temperature, influence vernal pool crustaceans, including hatching and reproduction from year to year (USFWS 2003a).

As discussed in Section 2.5.1 to 2.5.11 below, the Action Area represents an important part of the known range of the 11 SSHCP vernal pool Covered Species. However, no comprehensive range-wide surveys of numbers or distribution have been conducted for any of the 11 vernal pool Covered Species. Where vernal pool species surveys have been conducted, most surveys were designed to determine just presence or absence of the federally-listed vernal pool species, most surveys did not extend beyond an individual development or infrastructure project site (or beyond a proposed conservation-bank or proposed preserve site), and most surveys did not collect information on numbers or abundance (USFWS *in litt.* 2013). In addition, surveys for the presence/absence of individuals are not always effective for documenting the presence of the vernal pool species, given each species' adaptations to yearly environmental fluctuations and ability to lie dormant for many years.

Most surveys for vernal pool species in the Central Valley have been conducted in urban expansion areas, particularly in and around the greater Sacramento region (USFWS in litt 2013; Witham et al. 2014). Consequently, occurrence records for most vernal pool species are often a reflection of where surveys have been conducted, rather than a delineation of species distribution and abundance. Furthermore, when the results of vernal pool species surveys are entered into the California Natural Diversity Data Bank (CNDDB), one occurrence record may represent a single puddle, a single vernal pool, multiple pools within a vernal pool complex, a parcel, or a substantial portion of a landscape. All species survey data compiled in the CNDDB has the following limitations: (1) the data are geographically biased toward areas that have received greater survey efforts; (2) the data are not confirmed by independent review and therefore is sometimes inaccurate; (3) the data are less well represented for rare or cryptic species; and (4) mapping precision for species occurrences varies from specific points (i.e. within an 80-meter radius) to non-specific (i.e. an area defined by a radius between 0.1 and 1.0 mile) (CNDDB 2018).

Despite these shortfalls, our Opinion discusses CNDDB occurrences records and other available species-survey records because they provide the best available information on Covered Species general distribution in California, and they provide information that informed our diagnoses of the current range-wide condition of each SSHCP Covered Species, the threats to those species, and trends in numbers.

Because adequate survey information is not available for the vernal pool Covered Species, this Opinion refers to current information and mapping of the remaining vernal pool grassland (vernal pool ecosystem) present in the California to help describe the current range-wide condition of each SSHCP vernal pool Covered Species, including the geography of species occurrences and suitable habitat, the current rates of loss, risks to the species, and impediments to the recovery of each vernal pool Covered Species. The Service has used vernal pool grassland complexes as the basis for determining populations of vernal pool crustaceans since vernal pool crustaceans were first proposed for listing. The final rule to list the two vernal pool crustaceans Covered Species states that "the genetic characteristics of fairy shrimp and vernal pool tadpole shrimp, as well as ecological conditions, such as watershed contiguity, indicate that populations of these animals are defined by pool complexes rather than by individual vernal pools…the most accurate indication of the current distribution and abundance of the vernal pool crustacean Covered Species is the number of inhabited vernal pool grassland complexes" (USFWS 1994). Therefore, the current status of vernal pool grasslands in California, summarized below, is used in this Opinion as an indicator of the acres of suitable and occupied habitat that has been destroyed over the range of each vernal pool Covered Species, as well as an indicator of loss in number of occurrences, number of individuals, and changes in the distribution of each vernal pool Covered Species. In a similar manner, vernal pool grassland (vernal pool ecosystem) will be used below in the Section 2.5.2 discussions of each vernal pool Covered Species *environmental baseline*, and in the Section 2.5.4 discussions of the *effects of the action* on each vernal pool Covered Species.

Except for Ricksecker's water scavenger beetle, dwarf downingia, and pincushion navarretia, each of the SSHCP vernal pool Covered Species are addressed in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Vernal Pool Ecosystem Recovery Plan) (USFWS 2005a). A recovery plan delineates, justifies, and schedules species-specific conservation actions, habitat management actions, and research actions (recovery criteria) necessary to support the recovery of a species. Recovery is the process by which the decline of a listed species is arrested or reversed and threats to its survival are neutralized, ensuring its long-term survival in the wild, and ensuring the species no longer requires protection under the ESA. All species addressed in the Vernal Pool Ecosystem Recovery Plan are threatened by habitat loss, habitat fragmentation, and habitat degradation. The Vernal Pool Ecosystem Recovery Plan describes species recovery criteria (downlisting and or delisting criteria), which focus on the protection and management of vernal pool species "suitable habitat" within vernal pool regions and recovery Core Areas.

The Vernal Pool Ecosystem Recovery Plan defines "suitable habitat" as habitat that contains the elements necessary for the continued existence of each individual vernal pool species address in the recovery plan, including the physical elements (vernal pool type, soil series, slope, pool dimensions, water quality, depth, duration and timing of inundation, elevation) that allow the vernal pool species to reach maturity and reproduce or set viable seed. In addition, an essential, inseparable part of "suitable habitat" is the watershed surrounding the vernal pools which collects and contributes water to the vernal pools (USFWS 2005a). Therefore, the SSHCP's definition of the Vernal Pool Ecosystem (see Section 2.3.5.2 above) is consistent with the Vernal Pool Ecosystem Recovery Plan's definition of vernal pool species "suitable habitat."

The Vernal Pool Ecosystem Recovery Plan utilized an ecosystem level approach because most vernal pool plant and animal species co-occur or overlap in distribution, and therefore, are generally threatened by the same human activities and share common conservation-needs. In a similar manner, the SSHCP modeled habitats for the vernal pool Covered Species overlap within the Action Area, and vernal pool Covered Species co-occur on the same vernal pool grassland landscapes. Therefore, the effects of future SSHCP Covered Activities on each of the vernal pool Covered-Species (discussed below in Section 2.5.5) are anticipated to be similar.

The Vernal Pool Ecosystem Recovery Plan describes the geographic distribution of vernal pool species in terms of the 17 vernal pool regions delineated in California (Keeler-Wolf et al. 1998). These geographic regions are delineated largely on the presence of endemic species and the characteristics of their soils and underlying geomorphology. Overall, the 17 vernal pool regions are representative of the range of the biotic and the abiotic features of the vernal pool ecosystem in California. The different vernal pool regions are important to conservation of vernal pool species because each vernal pool region contains unique biotic and abiotic attributes of the species' geographic distribution, such as genetic robustness, demographic robustness, important life history stages, or other features (USFWS 2005a). The Vernal Pool Ecosystem Recovery Plan identified 85 recovery Core Areas within the vernal pool regions of California. The vernal pool ecosystem recovery Core Areas are distinct areas of extant vernal pool grassland that provide the features, species populations, and distinct geographic and/or genetic diversity necessary to recover or conserve the listed and unlisted vernal pool species addressed in the Vernal Pool Recovery Plan. The Core Areas are the focus of the species habitat protection efforts, habitat management actions, and other species recovery actions identified in Vernal Pool Recovery Plan. Consequently, the range-wide trends in distribution and the current condition of each SSHCP vernal pool Covered Species (presented below in Sections 2.5.1.1 to Section 2.5.1.11) are also discussed in terms of the vernal pool regions and the recovery Core Areas that are described in the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a).

The amount of vernal pool grassland (vernal pool ecosystem) present in California and southern Oregon has been significantly reduced since the settlement period, primarily by agricultural development and mineral extraction, and more recently by urban expansion. Holland (1978) estimated that vernal pool grasslands once covered approximately 4.2 million acres, over 1/3 of the California Central Valley. The most recent analyses of Central Valley aerial imagery over a 20-year period determined that approximately 995,000 acres of vernal pool grasslands were present in 1997; that approximately 807,820 acres were present in 2005; and that approximately 764,868 acres of vernal pool grassland remained in 2012. In total, approximately 230,130 acres of Central Valley vernal pool grasslands was converted to a non-habitat landcover between 1997 and 2012 (R. Holland 1998, R. Holland 2009, Witham et al. 2013, Witham et al. 2014). In addition, only 43% of the approximate 764,868 acres of Central Valley vernal pool grassland remaining in 2012 (about 323,000 acres) had no human disturbance visible in aerial photographs (Witham et al. 2013; Witham et al. 2014).

Vernal pools are not distributed uniformly over the surviving vernal pool grasslands in the Central Valley. Central Valley vernal pool grasslands with a very low density of vernal pools (<2%) or a low density of vernal pools (2-5%) each cover about 320,000 acres, or collectively just over 80% of the remaining vernal pool grasslands; grasslands with a high density of vernal pools (5-10%) are found on approximately 107,000 acres or 14% of the remaining vernal pool grassland; and grasslands with very high density of vernal pools (>10%) is found on just over 16,000 acres, or about 2% of the remaining Central Valley vernal pool grasslands mapped in 2012 (Witham et al. 2014). Areas of high and very high density vernal pool grasslands still remain in Tehama, Yuba, Solano, Sacramento, and Madera Counties (R. Holland 1978, Witham et al. 2014). The highest quality habitat for most vernal pool species is provided in large, undisturbed grasslands with a high density of vernal pools that have a broad range of vernal pools sizes and shapes (Witham et al. 2014, Vollmar 2002).

The rate of vernal pool loss has been significant over the range of each vernal pool Covered Species. On average, between 1997 and 2005 (the year that the Vernal Pool Ecosystem Recovery Plan was published), approximately 11,770 acres of Central Valley vernal pool grasslands were converted per year to anthropogenic landcovers, indicating an approximate 1% rate of loss each year since 1997 (R. Holland 2008). Based on this observed rate of loss, Holland (2008) estimated that remaining vernal pool grasslands outside of preserves could be eliminated from the Central Valley by 2097. However, Witham et al. (2014) determined that the rate of loss had slowed in the years between 2005 and 2012, to approximately 6,758 acres of vernal pool grassland loss per year, on average.

Of note is not only the magnitude of vernal pool grassland lost between 1997 and 2012 over the range of each vernal pool Covered Species, but also where these losses have occurred. Habitat losses within the recovery Core Areas (USFWS 2005a) have been substantial. Of the 122,400 acres vernal pool grasslands loss in 19 Central Valley counties between 1997 and 2005, Holland (2009) identified that 35,472 acres (29%) of those losses had occurred within vernal pool recovery Core Areas. Between 2005 and 2012, an additional 47,306 acres of vernal pool grasslands were lost in the Central Valley, with approximately 17,651 acres (37.3%) of those losses occurring within vernal pool recovery Core Areas (Witham et al. 2014).

Although the trend of vernal pool habitat loss continues over the range of each vernal pool Covered Species, the rate of loss has been slowed somewhat in recent years by the establishment of habitat preserves, conservation easements, and mitigation or conservation banks on private land. In 2012, approximately 229,637 acres (30%) of all extant vernal pool grasslands in the California Central Valley were under some form of protection (Witham et al. 2014). Protection of vernal pool grasslands has also occurred within the 85 vernal pool recovery Core Areas—approximately 102,854 acres of Core Area (24% of total vernal pool recovery Core Area acres in the Central Valley) is currently under some form of permanent protection (Witham et al. 2013; Witham et al. 2014).

However, of the total 229,637 acres of Central Valley vernal pool grassland under some form of protection, approximately 40% of the protected vernal pool grassland acres have "medium" to "high" amount of disturbance (i.e. are between 5-25% to 50-99% disturbed), and approximately 75% of the protected vernal pool grasslands have "low" or "very low" or low densities of vernal pools (less than 5% density) (Witham et al. 2014). In addition, the protection of vernal pool habitats within mitigation banks and preserves may not adequately protect the rare landform types associated with specific vernal pool species, or meet the functional equivalence of the original vernal pool ecosystems. In the Southeastern Sacramento Valley Region, Wacker and Kelly (2004) found that the majority of project site characteristics were replicated at the corresponding conservation sites. However, when compared at the landscape-scale across all development projects, they found that both the relative percentage and area of relatively rarer pool types (such as Northern Volcanic Mudflow vernal pools), are decreasing, while the relative percentage and area of "Drainageway" vernal pools (a less specialized pool type with lower species richness), are becoming more common. Although development projects had occurred fairly equally on high terrace formation and low terrace formation sites in the Central Valley, the mitigation/compensation sites were established disproportionately at low terrace formation sites (Wacker and Kelly 2004).

In addition, in recent years, some losses of vernal pool grasslands have been partially off-set by the creation of new vernal pools grasslands in the form of mitigation banks (created vernal pool landscapes)—approximately 1,679 acres of new vernal pool grassland has been established in the Central Valley since 2005 (Witham et al. 2013; Witham et al. 2014).

The loss of vernal pool grasslands over the range of each vernal pool Covered Species has also resulted in the fragmentation of contiguous tracts of vernal pool grassland by new farmland, new development, new infrastructure rights-of-way, new roadways, and other anthropogenic landcovers. Consequently, a substantial amount of the extant vernal pool grasslands throughout the range of each vernal pool Covered Species are now adjacent to anthropogenic landcovers, and are chronically exposed to environmental stressors produced by anthropogenic landcovers—including agricultural and urban runoff, roadway runoff, pesticides and other contaminants, altered seasonal hydrology, increased sources of invasive plants and animals, human activities that occur on anthropogenic landcovers, and other environmental stressors. As discussed in Section 2.5.4 below, the environmental stressors produced by anthropogenic landcovers result in edge effects, which indirectly reduce or eliminate the habitat functions of the vernal pool grasslands exposed to the environmental stressors. Therefore, in addition to the total acres of vernal pool grassland habitat that have been converted to a non-habitat landcover, an unquantified amount of the remaining vernal pool grassland habitat has been indirectly affected by adjacent or nearby anthropogenic activities, and may no longer provide suitable habitat for the vernal pool Covered Species.

However, some relatively large areas of unfragmented vernal pool grassland still remain in the Central Valley, primarily within 10 of the 85 vernal pool ecosystem recovery Core Areas designated by the Service (USFWS 2005a). These 10 Core Areas are: Vina Plains (in the Northeastern Sacramento Valley vernal pool region), Beale, Western Placer County, Mather, and Cosumnes/Rancho-Seco (in the Southeastern Sacramento Valley vernal pool region), Grasslands Ecological Area (in the San Joaquin Valley vernal pool region), Madera and Fresno (in the Southern Sierra Foothills vernal pool region), Central Coast Ranges (in the Carrizo vernal pool region), and Fort Hunter Liggett (in the Central Cost vernal pool region) (USFWS 2005a, 2007a, 2007b). Two of these 10 vernal pool recovery Core Areas (the Mather Core Area and the Cosumnes/Rancho-Seco Core Area), are located within the Action Area (see Section 2.5.2 below).

USFWS published the Vernal Pool Ecosystem Recovery Plan in 2005 for 33 species (20 listed species and 13 species of concern), including eight of the SSHCP vernal pool Covered Species: Ahart's dwarf rush, Boggs Lake hedge-hyssop, legenere, Sacramento Orcutt grass, slender Orcutt grass, vernal pool fairy shrimp, mid-valley fairy shrimp, and pool tadpole shrimp (USFWS 2005a). The overall goal of the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) is to achieve and protect in perpetuity self-sustaining populations throughout the full ecological, geographical, and genetic range of each vernal pool species by ameliorating or eliminating the threats that caused the species decline (USFWS 2005a). Objectives of the Vernal Pool Ecosystem Recovery Plan include: (1) ameliorate or eliminate the threats that caused the species to become rare, and ameliorate any newly identified threats, and (2) promote natural ecosystem processes and functions by protecting and conserving intact vernal pools and vernal pool complexes to maintain self-sustaining, viable populations of listed vernal pool species and species of concern, and (3) prevent additional threats from emerging over time. Because habitat loss and fragmentation is the single largest threat to the survival and recovery of the vernal pool species, protection of vernal pool grasslands is the overarching objective of the Vernal Pool Recovery Plan.

While the Vernal Pool Ecosystem Recovery Plan identifies a strategy for obtaining recovery of each vernal pool species, the Recovery Plan also states that alternative strategies, such as development of regional Habitat Conservation Plans or other site-specific planning methods, may present opportunities to conserve species habitat and meet the recovery criteria described in the Recovery Plan (USFWS 2005a). The Vernal Pool Ecosystem Recovery Plan states that alternative conservation mechanisms proposed in a HCP may be deemed equivalent to the implementation of the Recovery Plan within the HCP's covered-area, if the HCP's conservation strategy contains the following six elements:

1) permanently-protected vernal pool ecosystem preserves within the area covered by the HCP, in large contiguous blocks of suitable habitat—to provide for greater species and physical diversities, less vulnerability of the species populations to outside influences, connectivity through land with natural habitat or with compatible uses that allows for movement of species between vernal pool complexes, and to minimize edge effects between natural and developed land;
2) protection of the entire genetic range of each listed species within the area covered by the Habitat Conservation Plan;
3) Protection of all populations of species with 25 or fewer total occurrences addressed in the Recovery Plan within the area covered by the HCP;

4) connectivity with other preserves within the area covered by the HCP;
5) adaptive management of the preserves within the area covered by the HCP to support the species addressed in the Recovery Plan; and
6) Sufficient funding for management, maintenance, and monitoring of the vernal pool preserves in perpetuity.

Overview of Critical Habitat for Listed Vernal Pool Covered Species

Under the ESA, a Critical Habitat designation establishes a geographic area that includes the physical and biological features (primary constituent elements) that are essential for the conservation of the threatened or endangered species, and may require special management considerations or protections. Primary constituent elements (PCEs) include, but are not limited to (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and, (5) habitats that are protected from disturbance or are representative of the historical geographical and ecological distributions of a species (USFWS 2003a).

Critical Habitat has been designated for each of the federally listed vernal pool Covered Species (i.e. vernal pool tadpole shrimp, vernal pool fairy shrimp, slender Orcutt grass, and Sacramento Orcutt grass). Areas designated as Critical Habitat for a federally listed vernal pool species are areas that available evidence clearly demonstrated were essential to the conservation of the species (USFWS 2006a). "Conservation" means the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which listing under the ESA is no longer necessary. Areas essential to the conservation of listed vernal pool species are those that are necessary to advance at least one of the following conservation criteria:

1) The conservation of areas representative of the geographic distribution of the vernal pool species. This is necessary because species that are protected across their ranges have lower chances of extinction. Maintenance of representative occurrences of a species throughout its geographic range helps ensure the conservation of regional adaptive differences and makes the species as a whole less susceptible to environmental variation or negative impacts associated with natural catastrophic events or human disturbances across the species' entire range at any one time (Primack 1993; Helm 1998; Redford and Richter 1999; Grosberg 2002).
2) The conservation of areas representative of the ecological distribution of the species. Vernal pool species are extremely adapted to the physical and chemical characteristics of the habitat in which they occur. Each vernal pool species is associated with various combinations of geomorphic surfaces (landforms), soil types, vernal pool water chemistry, and vegetation community associations. Maintaining the full range of varying vernal pool types and habitat characteristics for a species is essential because it would include the full extent of the physical and environmental conditions necessary for the species. Vernal pool species are extremely adapted to the physical and chemical characteristics of the habitat in which they occur (Zedler and Ebert 1979; Ikeda and Schlising 1990; Fugate 1992; Gonzales et al.1996; Fugate 1998; Platenkamp 1998; Noss et al. 2002a).
3) The conservation of areas necessary to allow movement of cysts, pollen, and seeds between areas that represent the geographic and ecological distribution of the species. Providing for dispersal within and between vernal pool complexes allows for gene flow and habitat availability that accommodate the natural processes of local extirpation and re-colonization

over time (Stacey and Taper 1992; Falk et al. 1996; Davies et al. 1997; Holt and Keitt 2000; Keymer et al. 2000; Donaldson et al. 2002).

4) The conservation of areas which possessed the largest unfragmented vernal pool complexes, or are large areas which already possess a measure of protection. Other criteria being equal, such areas are likely to contribute more to the conservation of the species because threats posed by habitat fragmentation are more easily minimized within them. Small, isolated habitat populations are more likely to be extirpated by direct or indirect natural or human impacts and are less likely to maintain the hydrological processes of pooling and drying on which the vernal pool species depend (Fahrig 1997; Debinski and Holt 2000; Grosberg 2002; Noss et al. 2002a).

Examples of special management actions that may be necessary to prevent further declines and loss of populations of species within designated Critical Habitat include the following:

1) **Actions to prevent or reduce competition of vernal pool plants with invasive species**. Many of the federally listed vernal pool species are threatened by invasion of nonnative species (USFWS 2003a). Special management actions can be taken to reduce the negative effects of such invasions. For example, livestock grazing can be effectively used to control a variety of upland exotic plants. However, the timing and intensity of livestock grazing is critical to its success as a management tool, and these factors should be closely monitored. Alternatively, inappropriate grazing can also pose a threat to many of the federally listed vernal pool plant species. Prescribed burning is another management tool that may be effective in controlling nonnative plant species (Pollack and Kan 1998). However, fire must be appropriately timed, and fire frequency is important. Other management techniques for control of invasive species include mowing, hand removal, and selective herbicide applications. Any technique employed must be carefully controlled and monitored to ensure that it does not negatively affect the vernal pool species.
2) **Actions to restore vernal pool hydrology**. Alteration of the seasonal perched aquifer and natural hydrology of vernal pool ecosystems threatens many of the federally listed vernal pool species addressed in this rule (USFWS 2003a). In many cases other threats, such as the invasion of nonnative species or contamination, are facilitated by alterations of natural vernal pool hydrology. Special management actions, such as the removal of dams or other structures that artificially increase the length of vernal pool inundation, the removal of ditches that artificially drain vernal pools, or the construction of berms or reconstruction of culverts to prevent water from flowing artificially into vernal pools from adjacent areas, may be needed to restore natural vernal pool hydrology. Modification of livestock grazing regimes may also restore natural vernal pool hydrology (Barry 1998). Monitoring of vernal pool hydrology after these actions is important to ensure that restoration action was successful.
3) **Actions to reduce human degradation of vernal pools**. Special management actions such as fencing, trail building, and posting signs can help to reduce human activities that threaten vernal pool species. These actions may reduce the damage resulting from off-road vehicle use, dumping, and vandalism that threatens many of the federally listed vernal pool species.
4) **Actions to restore severely degraded habitats**. Active restoration of highly degraded vernal habitats may be necessary in some areas. Such restoration may involve earth-moving activities designed to restore historical pool and swale topography and to reestablish natural vernal pool hydrology. These types of reestablishment or establishment actions are extremely complex, and require diligent planning and monitoring to ensure their success. Active restoration is only recommended for seriously degraded habitats that otherwise would not provide natural vernal pool ecosystem processes.

The PCEs and the status of designated Critical Habitat for vernal pool tadpole shrimp, vernal pool fairy shrimp, slender Orcutt grass, and Sacramento Orcutt grass are discussed below in Sections 2.5.1.1, 2.5.1.2, 2.5.1.10, and 2.5.1.11, respectively.

2.5.1.1 Status of Vernal Pool Fairy Shrimp/Critical Habitat

For the most recent comprehensive assessment of the species' biology and range-wide status, please refer to the *Vernal Pool Fairy Shrimp (Branchinecta lynchi) 5-Year Review: Summary and Evaluation* (USFWS 2007a). No change in the species' listing status was recommended in this species 5-year review. Threats evaluated and discussed in that review have continued to act on the species since the 2007 review was finalized, with the continued loss of vernal pool habitat being the most significant effect (R. Holland 2009, Witham et al. 2014). While there has been continued losses of vernal pool habitat in each of the vernal pool regions and each of the Core Areas identified in the Vernal Pool Recovery Plan (USFWS 2005a), and while vernal pool habitat losses have occurred within the Core Areas identified for the Vernal Pool Fairy Shrimp (including in the Mather Core Area present within this Action Area), to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for this species.

The vernal pool fairy shrimp has the widest geographic range of the federally-listed vernal pool species, with a range that extends from southern Oregon in the north, through the California Central Valley (from Shasta County to Tulare County), and includes the central and southern California coast ranges (from northern Solano County to Ventura County). Vernal pool fairy shrimp occurrences are concentrated on eight different landforms throughout its geographic range (low terrace, high terrace, stream terrace, volcanic mudflow, basin rim, valley floor, alkaline playa, and costal mountain). The soils and the vernal pool types associated with these landforms differ greatly across the geographic range of the species, and lead to different ecological conditions and different vernal pool plant and animal communities between occurrences of vernal pool fairy shrimp (USFWS 2003a). Although the remaining extant occurrences of vernal pool fairy shrimp are somewhat evenly distributed throughout its range, its habitat is highly fragmented and occurrences are generally uncommon and isolated from each other by varying degrees. Vernal pool fairy shrimp is seldom abundant where it does occur (USFWS 2007a).

The CNDDB currently reports a total of 753 extant occurrences of vernal pool fairy shrimp in California (CNDDB 2018). Vernal pool fairy shrimp are documented in the Klamath Mountains vernal pool region in southern Oregon, and in all 17 of the vernal pool regions designated in California (i.e. Northwestern Sacramento Valley, Northeastern Sacramento Valley, Southeastern Sacramento Valley, Southern Sierra Foothills, Lake-Napa, Livermore, Solano-Colusa, San Joaquin Valley, Central Coast, Carrizo, Santa Barbara, and Western Riverside vernal pool region)(USFWS 2005a). The Southeastern Sacramento vernal pool region contains the greatest number of documented occurrences of vernal pool fairy shrimp, primarily in scattered vernal pool complexes located in Yuba, Placer, Sacramento, and San Joaquin Counties (USFWS 2007a). The vernal pool fairy shrimp is known to occur in 45 of the 85 recovery Core Areas identified in the Vernal Pool Recovery Plan (USFWS 2007a). As described below in Section 2.5.2, three of the recovery Core Areas (i.e. the Mather, the Cosumnes/Rancho-Seco, and the Stone Lakes Core Area) are within the Action Area. The following 10 recovery Core Areas still have relatively large areas of extant vernal pool habitat where known records of the shrimp are located within or near to the Core Area: Vina Plains, Beale, Western Placer County, Mather, Cosumnes/Rancho-Seco, Grasslands Ecological Area, Madera, Fresno, Central Coast Ranges, and Fort Hunter Liggett (USFWS 2007a).

As discussed in Section 2.5.1 above, the most accurate indicator of the current distribution and trends in the numbers of vernal pool fairy shrimp occurrences and individuals is the amount and current distribution of undisturbed vernal pool grassland remaining within the historical range of the species. The primary factors responsible for the status of vernal pool grassland (vernal pool ecosystem) throughout the range of the vernal pool fairy shrimp were discussed above in Section 2.5.1, and are not repeated here.

Status of Critical Habitat for Vernal Pool Fairy Shrimp

The Service designated final Critical Habitat for vernal pool fairy shrimp on February 10, 2006 (USFWS 2006a). We identified Critical Habitat areas essential to the conservation of vernal pool fairy shrimp to reflect the species geographic distribution and varying habitat types and species associations across its range. Maintaining vernal pool fairy shrimp across their full geographic distribution in necessary to make the species less susceptible to environmental variation or negative impacts associated with human disturbances or natural catastrophic events across the species range at any one time (USFWS 2003a; USFWS 2006a). In determining which areas are critical habitat, the Service focus on areas with the principal physical and biological features essential to the conservation of the species (constituent elements), and that may require management consideration or protection. The Service (USFWS 2006a) identified these primary constituent elements (PCEs) for vernal pool fairy shrimp Critical Habitat:

1) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools (described in the paragraph below), providing for dispersal and promoting hydroperiods of adequate length in the pools;
2) Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands;
3) Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and
4) Structure within the pools described in the above paragraph, consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter.

A total of 35 Critical Habitat units encompassing are designated for the vernal pool fairy shrimp, which incorporate approximately 597,821 acres of vernal pool grassland habitat. Vernal pool fairy shrimp Critical Habitat units are located in Jackson County, Oregon, and in 24 California counties (Alameda, Amador, Butte, Contra Costa, Fresno, Kings, Madera, Mariposa, Merced, Monterey, Napa, Placer, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Shasta, Solano, Stanislaus, Tehama, Tulare, Ventura, and Yuba). Two vernal pool fairy shrimp Critical Habitat units are within Sacramento County (Unit-13 and Unit-14).

The following factors are responsible for the current condition of Vernal Pool Fairy Shrimp critical habitat:

- **Direct habitat loss and fragmentation.** Vernal pool grassland within several Critical Habitat units has been converted to farming and developed landcovers.
 Indirect habitat loss. Adjacent land uses, especially urban development, has indirectly impaired or degraded the habitat functions provided by vernal pools within some units of Critical Habitat.
- **Vegetation management.** Both overgrazing and under grazing of vernal pool grasslands have been identified as threats to the species habitat (USFWS 2007a). Appropriate grazing regimes reduce standing biomass of naturalized annual grasslands in the Vernal Pool Ecosystem—springtime grazing of the vernal pool ecosystem's uplands reduces grassland plant transpiration, slowing the drying of the seasonal perched aquifer, and therefore, slowing the drying of vernal pools within that ecosystem.
- **Nonnative invasive plant species.** Invasive, nonnative plants have adversely affected some units of Critical Habitat. Unchecked growth of non-native plant species will reduce the duration of ponding in vernal pools by impairing rainwater infiltration that forms the seasonal perched aquifer, and by prematurely drying the perched aquifer as they grow and transpire in the spring and early summer. Invasive, nonnative plants also compete with vernal pool plant species for light, water, nutrients, and space. Mannagrass (*Glyceria* spp.) is an especially problematic invasive grass in vernal pool ecosystems because it can grow in vernal pools, unlike most invasive plant species that inhabit vernal pool margins or the uplands of vernal pool ecosystems.

2.5.1.2 Status of Vernal Pool Tadpole Shrimp/Critical Habitat

For the most recent comprehensive assessment of the species' biology and range-wide status, please refer to the *Vernal Pool Tadpole Shrimp (Lepidurus packardi) 5-Year Review; Summary and Evaluation* (USFWS 2007b). No change in the species' listing status was recommended in this 5-year review. Threats evaluated and discussed in that review have continued to act on the species since the 2007 review was finalized, with the continued loss of vernal pool habitat being the most significant (R. Holland 2009, Witham et al. 2014). While there has been continued losses of vernal pool habitat in each of the vernal pool regions and in the Core Areas identified in the Vernal Pool Recovery Plan, and while vernal pool habitat losses have occurred within the Core Areas identified for this species (including the Mather Core Area in this Action Area), to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for this species.

The tadpole shrimp is patchily distributed across a broad geographic range in the Central Valley of California, from Shasta County in the north to Tulare County in the south, but with largest numbers occurring in Sacramento, Merced, and Solano counties. Vernal pool tadpole shrimp often inhabit only one or a few vernal pools in more widespread vernal pool complexes (Rogers 2001). Vernal pool tadpole shrimp are distributed in 7 of the 17 California vernal pool regions (Central Coast, Northeastern Sacramento Valley, Northwestern Sacramento Valley, San Joaquin Valley, Solano-Colusa, Southeastern Sacramento Valley, and Southern Sierra Foothills). The Southeastern Sacramento Valley vernal pool region supports the largest concentration of the extant occurrences for vernal pool tadpole shrimp.

The vernal pool tadpole shrimp has been documented in 24 of the 85 vernal pool recovery Core Areas (USFWS 2005a). The high terrace landforms found in Mather Core Area of Sacramento County contains possibly the highest density of vernal pool tadpole shrimp occurrences within the range of the species. The significance of and dependence on the old terrace ecosystems in southeastern Sacramento County by vernal pool tadpole shrimp has been well established in reports and published literature (R. Holland 1978; Keeler-Wolf et al. 1998; Service 2005a), and this area is well known for its vernal pools of exceptional quality, as measured by depth, size, density, and diversity (Rogers 2006; USFWS 2007b). Surveys within the Mather Core Area report that at least 50 percent of vernal pools are occupied by vernal pool tadpole shrimp. In comparison, Helm (1998) found vernal pool tadpole shrimp in only 17 percent of vernal pools he sampled across 27 counties; Sugnet and Associates (1993), using a non-random sampling methodology, found vernal pool tadpole shrimp in only 11 percent of 3,092 locations sampled in the Central Valley, and NatureServe (2008) estimated that vernal pool tadpole shrimp are found in approximately 33 percent of all seasonal wetlands in the Central Valley.

The CNDDB (2018) currently reports a total of 316 extant occurrences of vernal pool tadpole shrimp from 19 California counties. However, 10 of the 19 counties from which the species has been documented have five or fewer occurrences. Because of its broad geographic range, the types of vernal pools, soils, and geological formations associated with occurrences of vernal pool tadpole shrimp differ greatly across the range of the species, and these differences lead to different species compositions and different environmental conditions between vernal pool tadpole shrimp occurrences over the range of the species (USFWS 2003a).

Although the vernal pool tadpole shrimp is found on a variety of geologic formations and soil types, Helm (1998) found that, throughout its range, more than 50 percent of vernal pool tadpole shrimp occurrences were on High Terrace (i.e., old terrace) landforms and Redding and Corning soils. Although development projects have occurred fairly equally on high and low terrace sites in the Central Valley, vernal pool compensation sites have been established disproportionately on low terrace formations (Wacker and Kelly 2004). Such shifts in availability of landform types could have negative consequences for persistence of the vernal pool tadpole shrimp because of the demonstrated importance of high-terrace formations to this species (R. Holland 1978; Keeler-Wolf et al. 1998; Service 2005a, Service 2007b). Therefore, species recovery needs for vernal pool tadpole shrimp include protecting additional vernal pool habitat, particularly on the high-terrace landform areas that are currently disproportionately under-represented in Central Valley vernal pool grassland preserves. Species recovery needs also include establishing connective corridors between preserves to restore and maintain relatively contiguous vernal pool landscapes within recovery Core Areas, in order to support population dynamics of vernal pool tadpole shrimp (USFWS 2005a, 2007b).

As discussed in Section 2.5.1 above, the most accurate indicator of the current distribution and trends in the numbers of vernal pool tadpole shrimp occurrences and individuals is the amount and current distribution of undisturbed vernal pool grassland remaining within the historical range of the species. The primary factors responsible for the status of vernal pool grassland (vernal pool ecosystem) throughout the range of the vernal pool tadpole shrimp were discussed above in Section 2.5.1, and are not repeated here.

Status of Critical Habitat for Vernal Pool Tadpole Shrimp

The Service designated final Critical Habitat for this species on February 10, 2006 (USFWS 2006a). We identified Critical Habitat areas essential to the conservation of vernal pool tadpole shrimp to maintain vernal pool tadpole shrimp range and distribution and to include the different kinds of vernal pool habitats in which the species is known to occur, including but not limited to vernal pools on Redding and Corning soils on high terrace landforms. Maintaining vernal pool tadpole shrimp across their full geographic distribution in necessary to make the species less susceptible to environmental variation or negative impacts associated with human disturbances or natural catastrophic events across the species range at any one time (USFWS 2002; USFWS 2003a). In determining which areas are critical habitat, the Service focus on areas with the principal physical and biological features essential to the conservation of the species (constituent elements), and that may require management consideration or protection. The Service (USFWS 2006a) identified these primary constituent elements (PCEs) for vernal pool tadpole shrimp Critical Habitat:

- Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools (described in the paragraph below), providing for dispersal and promoting hydroperiods of adequate length in the pools;
- Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 41 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands;
- Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and
- Structure within the pools described in the above paragraph, consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter.

A total of 18 critical habitat units have been designated for the vernal pool tadpole shrimp, incorporating a total of 228,785 acres of vernal pool grassland. Vernal pool tadpole shrimp Critical habitat units are located in 17 California counties (Alameda, Amador, Butte, Colusa, Fresno, Kings, Madera, Mariposa, Merced, Sacramento, Shasta, Solano, Stanislaus, Tehama, Tulare, Yolo, and Yuba counties). Of these, two critical habitat units are located in Sacramento County (Critical Habitat Unit-8 and Unit-9). All vernal pool tadpole shrimp critical habitat units were occupied at the time of critical habitat listing.

The following factors are responsible for the current condition of vernal pool tadpole shrimp critical habitat:

- **Direct habitat loss and fragmentation.** Vernal pool grassland within several Critical Habitat units has been converted to farming and developed landcovers.
- **Indirect habitat loss**. Adjacent land uses, especially urban development, has indirectly impaired or degraded the habitat functions provided by vernal pools within some units of Critical Habitat.
- **Vegetation management.** Both overgrazing and under grazing of vernal pool grasslands have been identified as threats to the species (USFWS 2007b). Appropriate grazing regimes reduce standing biomass of naturalized annual grasslands in the Vernal Pool Ecosystem—springtime grazing of the vernal pool ecosystem's uplands reduces grassland plant transpiration, slowing the drying of the seasonal perched aquifer, and therefore, slowing the drying of vernal pools within that ecosystem.
- **Nonnative invasive plant species.** Invasive, nonnative plants have adversely affected some units of Critical Habitat. Unchecked growth of non-native plant species will reduce the duration of ponding in vernal pools by impairing rainwater infiltration that forms the

seasonal perched aquifer, and by prematurely drying the perched aquifer as they grow and transpire in the spring and early summer. Invasive, nonnative plants also compete with vernal pool plant species for light, water, nutrients, and space. Mannagrass (*Glyceria* spp.) is an especially problematic invasive grass in vernal pool ecosystems because it can grow in vernal pools, unlike most invasive plant species that inhabit vernal pool margins or the uplands of vernal pool ecosystems.

2.5.1.3 Status of Mid-Valley Fairy Shrimp

The mid-valley fairy shrimp is not currently listed under the ESA, nor does it have designated critical habitat.

A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The mid-valley fairy shrimp is found in California from southern Sacramento County, west to Solano and Contra Costa Counties, and south along the east side of the Central Valley south to Fresno County (Eriksen and Belk 1999; Rogers 2002). The entire range of this species is within the central part of the California Central Valley, with the species' distribution apparently limited to three vernal pool regions: the Southeastern Sacramento vernal pool region, the Southern Sierra Foothill vernal pool region, and the San Joaquin Valley vernal pool region (USFWS 2003b; USFWS 2005a).

The CNDDB currently reports a total of 125 extant occurrences of mid-valley fairy shrimp in California, with 30 (24%) of those occurrences in Sacramento County (CNDDB 2018). The earliest collections of the mid-valley fairy shrimp were made in the late 1960's at the former Mather Air Force Base (Mather Field), located in the Action Area. Known occurrences include: scattered occurrences from the Mather Field area and south through Galt in Sacramento County; Jepson Prairie, Travis Air Force Base and Vacaville areas in Solano County: from Lodi north to the county border in San Joaquin County; the Byron Airport in Contra Costa County; the Virginia Smith Trust (Haystack Mountain) and Arena Plains National Wildlife Reserve in Merced County; one location in central Madera County; and one in northern Fresno County (Erickson and Belk 1999; Belk and Fugate 2000; CNDDB 2018).

The mid-valley fairy shrimp is found in small, short-lived vernal pools and grass-bottomed swales ranging from 4 to 663 square feet in area and averaging less than 4 inches in depth (Helm 1998). As with other vernal pool crustaceans, the cysts of mid-valley fairy shrimp lay dormant in the substrate until the dry vernal pool re-inundates after winter rains. Beyond inundation, the specific cues for cyst hatching are unknown although water temperature and conductivity are believed to play a large role for this species. The maturation rates of the mid-valley fairy shrimp vary extensively depending upon water temperature and vernal pool type. The mid-valley fairy shrimp can reach maturity in as little as four days (Helm 1998; Eriksen and Belk 1999; Rogers in review). The mid-valley fairy shrimp is typically univoltine (i.e., one generation per year); however, animals of different ages may be present if a vernal pool partially inundates allowing some cysts to hatch, and then later increases in volume, hydrating cysts that were further up-slope (Anderson 1968a; Bowen et al. 1988; Broch 1969, 1988; Brown and Carpelan 1971; Brown 1972; Hall 1959; Belk 1977; Al-Tikrity and Grainger 1990; Belk and Nelson 1995; Helm 1998; Eriksen and Belk 1999; Rogers in review).

Although the historical distribution of the mid-valley fairy shrimp is unknown, vernal pool habitats in the regions where it is currently known to occur have been dramatically reduced since pre-agricultural times (R. Holland 1998; CBD 2001). The habitat of the mid-valley fairy shrimp may have been even more severely reduced than other vernal pool habitats since it can occur in swales and short lived pools that may escape detection in dry years or during the dry season (Helm 1998; Belk and Fugate 2000).The primary factors responsible for the current range-wide condition of suitable habitat for the mid-valley fairy shrimp were discussed above in Section 2.5.1, and are not be repeated here.

2.5.1.4 Status of Ricksecker's Water Scavenger Beetle

Ricksecker's water scavenger beetle is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The CNDDB currently reports a total of only 13 extant occurrences of Ricksecker's water scavenger beetle in California, mostly located in the San Francisco Bay area (Alameda, Marin, San Mateo, and Sonoma counties). Other known occurrences are in Solano County (the Jepson Prairie), one occurrence in Placer County, and three occurrences (23%) in Sacramento County. In Sacramento County, two of the three CNDDB occurrences are from the Action Area, and one is from Blue Ravine in Folsom (CNDDB 2018). The primary factors responsible for the current range-wide condition of Ricksecker's water scavenger beetle were discussed above in Section 2.5.1, and are not be repeated here.

Ricksecker's water scavenger beetle is dependent on seasonal aquatic habitat, as neither larvae nor adults have been found in similar habitat in nearby permanent waters. Ricksecker's water scavenger beetle is a component of the benthic community of a vernal pool. Collection records suggest that the Ricksecker's water scavenger beetle is not sensitive to the size of vernal pools, and uses both vernal pools and swales, as well as constructed vernal pools (Final SSHCP Appendix B). Ricksecker's water scavenger beetle is predatory as aquatic larvae and omnivorous as adults. Larvae indiscriminately attack anything their size or smaller, and attempt to consume it, including other insects, crustaceans, amphibian larvae, and other Ricksecker's larvae (Final SSHCP Appendix B). Ricksecker's water scavenger beetle is univoltine. Early instar larvae appear in vernal pools three to four weeks after the pools first fill. When water temperatures begin to rise (typically March) the late instar larvae leave the pool, and construct a burrow at the water line or in the adjacent uplands, typically where the soil is slightly moist, and pupate there. Pupation lasts two to four days, depending upon temperature. Upon emergence, the adults fly to a different vernal pool and mate. The adults may die after mating and oviposition, as dead adults have been found as the pools are drying (Rogers 1998). It is probable that, like other vernal pool insects, the larvae, pupae, or adults may over-summer in burrows at or above the vernal pool water line, or the eggs may be desiccation-resistant and lay dormant in the pool bottom.

Optimal Ricksecker's water scavenger beetle aquatic habitat seems to be neutral to slightly alkaline, clear vernal pools, low in dissolved salts, dominated with vernal pool plants, and with a complex vernal pool crustacean community (Rogers 1998).

2.5.1.5 Status of Dwarf Downingia

Dwarf downingia is not currently listed under the ESA nor does it have designated critical habitat. A detailed summary of its current legal status, physical characteristics, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The CNDDB currently reports a total of 118 extant occurrences of dwarf downingia in California with nine (7.6%) of those occurrences in Sacramento County (CNDDB 2018). Dwarf downingia occurs on a variety of landforms and soil associations over its range. Dwarf downingia occurrences are associated mainly with northern claypan vernal pools in central Sacramento County, with northern hardpan vernal pools in the foothills of the Sierra Nevada, and with vernal pools of the Interior Valleys of the Coast Range in Napa and Sonoma Counties (CNDDB 2018).

Dwarf downingia typically occupies more commonly occurring, smaller, and/or shallower vernal pools with comparatively more "flashy" hydrology, but is also known to occupy the margins of larger or deeper vernal pools. The primary factors responsible for the current condition of vernal pool grassland suitable habitat throughout the range of dwarf downingia were discussed above in Section 2.5.1, and are not be repeated here.

As with other endemic vernal pool plants, dwarf downingia is an annual plant that will germinate, grow, set seed, and die in a single growing season. Seeds can lie dormant in the soil, sometimes for many years or decades, until a poorly-understood combination of environmental cues triggers them to germinate and begin their life cycle again. The specific timing of the germination of dwarf downingia seeds relative to the timing of the vernal pool inundation cycle has not been studied or described in detail. In general, Downingia seeds germinate during the early stages of vernal pool inundation (Zedler 1987). After germination, seedlings and young plants growing under water produce spongy stems that hold the plant vertical in the water column, and narrow linear leaves without a waxy cuticle (Weiler 1962). As the vernal pool dries in the spring, stems produced in the terrestrial phase become thinner, and leaves become wider with a waxy cuticle. Dwarf downingia flowers set seeds during the dry-down and the terrestrial phase of the vernal pool seasonal hydrology cycle, typically during March through May (CNPS 2010).

The very small, reduced flowers reflect a self-fertilizing reproduction system for dwarf downingia, in contrast to outcrossing fertilization in almost all other *Downingia* (Weiler 1962; Zedler 1987; Thorp 1990). Given the limited number of occurrences, the scattered geographical distribution, and the self-fertilizing reproduction, all intra-pool dwarf downingia populations are likely unique, and for the purposes of species conservation, important genetic entities (Elam 1998).

2.5.1.6 Status of Boggs Lake Hedge-hyssop

Boggs Lake hedge-hyssop is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, physical characteristics, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

CNDDB currently reports a total of 94 extant occurrences of Boggs Lake hedge-hyssop in California, with 9 (9.5%) of those occurrences in Sacramento County (CNDDB 2018). Bogg's Lake hedge-hyssop is associated with vernal pools located on ancient weathered alluvial terraces of the

Laguna Geologic formation, with soils of the Redding, Red Bluff, and related Series. Soils of the Redding Series tend to be strongly acidic (indication of age and weathering) and are generally gravelly with cobble.

In the Central Valley, Bogg's Lake hedge-hyssop occurs among five roughly defined population centers. The southernmost of these, comprising four CNNDB occurrences, is located along the eastern edge of the Central Valley near the Fresno and Madera County lines. The next population center to the northwest, comprised of a single occurrence, is located approximately 45 miles away in eastern Merced County. A third population center is located 75 miles to the north and is comprised of 18 occurrences. These occurrences extend approximately 45 miles north-to-south along the eastern edge of the Central Valley from northern San Joaquin County north through Sacramento County, to western Placer County. A fourth population center, comprised of six occurrences, is located approximately 30 miles to the west, in Solano County. The northernmost Central Valley population center, comprised of four occurrences, is located in southern Tehama County, approximately 75 miles north of the northernmost Placer County occurrence. Another Tehama County population center, comprised of 13 additional occurrences, is located approximately 20 miles further northeast at higher elevations east of the Great Central Valley. In Sacramento County, the CNDDB reports 7 occurrences of Boggs Lake hedge-hyssop in the Mather Core Area, and no occurrences in the Cosumnes/Rancho-Seco core recovery area. The primary factors responsible for the current range-wide condition of Boggs Lake hedge-hyssop were discussed above in Section 2.5.1, and are not be repeated here.

As with other endemic vernal pool plants, Boggs Lake hedge-hyssop is an annual plant that will germinate, grow, set seed, and die in a single growing season. Seeds can lie dormant in the soil, sometimes for many years or decades, until a poorly-understood combination of environmental cues triggers them to germinate and begin their life cycle again. The specific timing of germination of Bogg's Lake hedge-hyssop seeds relative to the timing of the vernal pool inundation cycle has not been described in detail. Observations indicate that Bogg's Lake hedge-hyssop seeds germinate and begin growth under water (Kaye et al. 1990; Corbin et al. 1994). A single pollinator exclusion experiment indicates that Bogg's Lake hedge-hyssop is completely self-compatible (Kaye et al. 1990). Bogg's Lake hedge-hyssop flowers and sets seeds during the dry-down phase of the vernal pool hydrologic cycle, typically while in shallow water up to two to five inches deep remains in the pool basin (Corbin et al. 1994). Bogg's Lake hedge-hyssop is completely self-compatible as indicated by pollinator exclusion experiments (Kaye et al. 1990). Given the limited number of occurrences, the scattered geographical distribution, and the self-fertilizing reproduction, all intra-pool Boggs Lake hedge hyssop populations are likely unique, and for the purposes of species conservation, important genetic entities (Elam 1998).

Boggs Lake hedge-hyssop is reported to grow in well-developed, large, or deep vernal pools that exhibit longer inundation, and often grows in comparatively barren areas within deeper portions of vernal pools, sometimes in barren openings with common spikerush (*Eleocharis macrostachya*) (Corbin et al. 1994). The primary factors responsible for the current condition of vernal pool grassland suitable habitat throughout the range of Bogg's Lake hedge-hyssop were discussed above in Section 2.5.1, and are not be repeated here.

2.5.1.7 Status of Ahart's dwarf rush.

Ahart's dwarf rush is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, physical characteristics, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The CNDDB currently reports only 13 occurrences of Ahart's dwarf rush in California, located in Tehama, Butte, Yuba, Placer, Sacramento, and Calaveras counties. The two Sacramento County occurrences of Ahart's dwarf rush are located in the Action Area (CNDDB 2018). All occurrences are in either the Northeastern Sacramento Valley or the Southeastern Sacramento Valley vernal pool regions (USFWS 2005a). Ahart's dwarf rush has been found in the Northern Basalt Flow, Northern Claypan, Northern Hardpan, and Northern Volcanic Mudflow vernal pool types over its range (Sawyer and Keeler-Wolf 1995). The primary factors responsible for the current condition of vernal pool grassland suitable habitat throughout the range of Ahart's dwarf rush were discussed above in Section 2.5.1, and are not be repeated here.

Ahart's dwarf rush occupies the more "flashy" hydrology of shallow vernal pools, swales and vernal pool margins where less-extreme inundation occurs. Microhabitats from which the plants have been reported are the edges of vernal pools and bottoms of intermittent drainages (USFWS 2005a).

As with other endemic vernal pool plants, the species is an annual plant that will germinate, grow, set seed, and die in a single growing season. Seeds can lie dormant in the soil, sometimes for many years or decades, until a poorly-understood combination of environmental cues triggers them to germinate and begin their life cycle again. The specific timing of the germination of Ahart's dwarf rush seeds relative to the timing of the vernal pool inundation cycle has not been studied or described. Based on the preference of Ahart's dwarf rush for the outer margins of larger vernal pools, the margins of shallow vernal pools, and shallow swales and its relatively early flowering date (late March), it is believed to germinate relatively early in the hydrological season during the wetting phase or early inundated-phase, in saturated, as opposed to inundated soil (Keeley and Zedler 1998; Dittes and Guardino, as cited in SSHCP Appendix B).

Given the limited number of occurrences and widely scattered geographical distribution, all intra-pool Ahart's dwarf rush populations are likely unique, and for the purposes of species conservation, important genetic entities (Elam 1998).

2.5.1.8 Status of Legenere

Legenere is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, physical characteristics, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The CNDDB currently reports a total of 74 extant occurrences of legenere in California, with 32 (43%) of those occurrences in Sacramento County. Over its range, legenere grows in vernal pools and playa lakes, as well as along the seasonally fluctuating margins of more permanent water bodies (small lakes, ponds, stock ponds, seasonal wetlands). The primary factors responsible for the current condition of vernal pool grassland suitable habitat throughout the range of legenere were discussed above in Section 2.5.1, and are not be repeated here.

As with other endemic vernal pool plants, the species is an annual plant that will germinate, grow, set seed, and die in a single growing season. Seeds can lie dormant in the soil, sometimes for many years or decades, until a poorly-understood combination of environmental cues triggers them to germinate and begin their life cycle again. Legenere seeds are reported to germinate under water in late February to April (R. Holland 1983). Legenere flowers and sets seeds during the dry-down phase of the vernal pool hydrologic cycle, sometimes while shallow water or inundated soil remains in the deepest parts of the pool basin (Dittes pers. obs.). Flowering and fruit maturation occurs from April through June (CNPS 2010).

Although pollination and breeding experiments have not been carried out for legenere, the reduced white flowers and flowers without corollas suggest a self-pollinating breeding system. Given the limited number of occurrences, the scattered geographical distribution, and the self-fertilizing reproduction, all intra-pool legenere populations are likely unique, and for the purposes of species conservation, important genetic entities (Elam 1998).

2.5.1.9 Status of Pincushion Navarretia

Pincushion navarretia is not currently listed under the ESA nor does it have designated critical habitat. A detailed summary of its current legal status, physical characteristics, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The CNDDB currently reports a total of 14 occurrences of pincushion navarretia in California. Pincushion navarretia is distributed in a narrow swath of the Central Valley, from Placer County in the north to Merced County in the south, with 6 of the occurrences (43%) in Sacramento County (CNDDB 2018). All 14 pincushion navarretia CNDDB occurrences are extant.

Pincushion navarretia occupies the commonly occurring, smaller, and/or shallower vernal pools with comparatively more “flashy” hydrology (i.e. pools that do not exhibit extreme inundation periods) (Dittes and Guardino, as cited in SSHCP Appendix B). Pincushion navarretia is documented as occurring in small to medium size vernal pools that range from 16 to 283 square meters (0.004 to 0.07 acres) in area and from 12.7 to 25.4 centimeters (five to 10 inches) in depth (Dittes and Guardino, as cited in SSHCP Appendix B). Occurrences of pincushion navarretia are associated with high-terrace geologic formations possessing acidic soils, primarily Ione, and to a lesser extent, Red Bluff over the range of the species. The primary factors responsible for the current condition of vernal pool grassland suitable habitat throughout the range of pincushion navarretia were discussed above in Section 2.5.1, and are not be repeated here.

As with other endemic vernal pool plants, pincushion navarretia is an annual plant that will germinate, grow, set seed, and die in a single growing season. Seeds can lie dormant in the soil, sometimes for many years or decades, until a poorly-understood combination of environmental cues triggers them to germinate and begin their life cycle again. Pincushion navarretia flowers and sets seeds during the terrestrial phase of the vernal pool hydrologic cycle, typically in May (CNPS 2010).

The floral morphology (large flowers, long flower tubes, and exerted stamens and stigmas) indicate an outcrossing breeding strategy and a pollinator relationship. Considering the unusually long white flowers, a specific co-evolved insect pollinator of pincushion navarretia may exist, although this has not been investigated. Given the highly limited number of occurrences and the scattered geographical distribution, all intra-pool pincushion navarretia populations should be considered unique, and for the purposes of conservation, important genetic entities. (Elam 1998).

2.5.1.10 Status of Slender Orcutt Grass/Critical Habitat

For the most recent comprehensive assessment of the species' biology and range-wide status, please refer to the *Slender Orcutt Grass (Orcuttia tenuis) 5-Year Review: Summary and Evaluation* (USFWS 2009). No change in the species' listing status was recommended in this species 5-year review. Threats evaluated and discussed in that review have continued to act on the species since the 2009 review was finalized, with the continued loss of vernal pool habitat being the most significant effect (Witham 2013, Witham et al. 2013). While there have been continued losses of vernal pool habitat throughout the various vernal pool regions identified in the Vernal Pool Ecosystem Recovery Plan, including the Mather Core Area and the Cosumnes/Rancho-Seco Core Area, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the species.

CNDDB currently reports a total of 93 extant occurrences of slender Orcutt grass in California, with 49 occurrences located outside the Central Valley and 44 occurrences within the Central Valley (Witham 2013; CNDDB 2018). Slender Orcutt grass occurrences are uncommon, and are distributed in five areas of concentration among five of the geographic sub-regions of California, ranging from the Modoc Plateau in the north, south to southern Sacramento County, and west to Lake County. The primary area of concentration for slender Orcutt grass is in the vicinity of Dales in Tehama County. A secondary area of concentration for slender Orcutt grass is the Modoc Plateau Vernal Pool Region in Lassen, Plumas, Shasta, and Siskiyou counties. Additional occurrences of the species are found in Shasta, Lake, and Sacramento counties. The Sacramento County occurrences are somewhat disjunct from the rest of the slender Orcutt grass range.

Most vernal pools in which slender Orcutt grass grows are classified as Northern Volcanic Ashflow and Northern Volcanic Mudflow vernal pools, and occur on a wide range of soils and elevations that correspond to the species' broad geological range. Upland plant communities in which the occupied pools occur are also diverse, ranging from grassland and oak woodland to mixed conifer forest, silver sagebrush (*Artemisia cana*) flats, and sedge meadows (USFWS 2003a).

As with other endemic vernal pool plants, the slender Orcutt grass is an annual plant that germinates, grows, sets seed, and dies in a single growing season. Seeds can lie dormant in the soil, sometimes for many years or decades, until a poorly-understood combination of environmental cues triggers them to germinate and begin their life cycle again. The seeds can remain dormant for an undetermined length of time, but at least for 3 or 4 years, and germinate underwater after they have been immersed for prolonged periods (Crampton 1976; Griggs 1980; Keeley 1998).

Slender Orcutt grass is strongly adapted to the hydrologic cycle encountered in the deeper spectrum of vernal pool types, e.g., they are typically associated with larger or deeper vernal pools that tend to possess more extreme regimes of inundation (Crampton 1959; Griggs 1974, 1976). Larger vernal pools that retain water until May or June provide optimal conditions for Orcuttieae grasses. Typically, Orcuttieae grasses form patches within large, dry vernal pools that are essentially devoid of other plant species (Crampton 1959; Crampton 1976; Griggs 1981; Griggs and Jain 1983).

As with other Orcuttia grasses, the seeds germinate and grow as submerged aquatic plants for several weeks to 3 months, and the plants flower relatively late in the summer months after vernal pools and the surrounding uplands are dry (Keeley 1998). Germination of slender Orcutt grass seeds can continue after cessation of winter rains and as the water in the pool begins to warm and recede

(Griggs 1974; R. Holland 1987; Stone et al. 1988). The presence of a symbiotic aquatic fungus (*Alternaria* sp., *Curvilaria* sp.) has been determined necessary for Orcutt grass seed germination (Griggs 1980, 1981; Keeley 1988). Slender Orcutt grass has been observed to be more likely than other Orcutt grasses to germinate during years of below average rainfall, although seedling mortality can be high during such years (Griggs 1981; Witham 2013). Similar to other vernal pool plants, the number of individual plants within an occurrence have been observed to vary by one to four orders of magnitude among successive years and return to previous levels even after 3 to 5 consecutive years when no mature plants were present (Griggs 1980; Griggs and Jain 1983; R. Holland 1987). Thus, many years of observation are necessary to determine whether any occurrence of slender Orcutt grass is increasing, stable, or declining (USFWS 2003a).

Status of Critical Habitat for Slender Orcutt Grass

The Service designated final Critical Habitat for slender Orcutt grass on February 10, 2006 (USFWS 2006a).
We identified Critical Habitat areas across the range of slender Orcutt grass that are essential to the conservation of the species and may require special management. Six critical habitat units (with 19 subunits) totaling 94,213 acres have been designated in Siskiyou, Modoc, Shasta, Lassen, Plumas, Tehama, Lake, and Sacramento Counties.

The primary constituent elements of critical habitat for slender Orcutt grass are those habitat components that are essential for the primary biological needs of germination, growth, reproduction, and dispersal. These primary constituent elements are found in areas that support vernal pools, swales, or other ephemeral ponds and depressions and their associated uplands. The two primary constituent elements for slender Orcutt grass Critical Habitat are habitat components that provide:

- Topographic features characterized by isolated mound and intermound complex within a matrix of surrounding uplands that result in continuously, or intermittently, flowing surface water in the depressional features including swales connecting the vernal pools, providing for dispersal and promoting hydroperiods of adequate length in the pools; and
- Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water or whose soils are saturated for a period long enough to promote germination, flowering, and seed production of predominantly annual native vernal pool wetland species and typically exclude both native and nonnative upland plant species in all but the driest years. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands.

The following factors are responsible for the current condition of slender Orcutt grass critical habitat:

- **Direct habitat loss and fragmentation.** Vernal pool grassland within several Critical Habitat units has been converted to farming and developed landcovers.
- **Indirect habitat loss**. Adjacent land uses, especially urban development, has indirectly impaired or degraded the habitat functions provided by vernal pools within some units of Critical Habitat.
- **Vegetation management.** Both overgrazing and under grazing of vernal pool grasslands have been identified as threats to the species (USFWS 2009). Appropriate grazing regimes reduce standing biomass of naturalized annual grasslands in the Vernal Pool Ecosystem—

springtime grazing of the vernal pool ecosystem's uplands reduces grassland plant transpiration, slowing the drying of the seasonal perched aquifer, and therefore, slowing the drying of vernal pools within that ecosystem.

- **Nonnative invasive plant species.** Invasive, nonnative plants have adversely affected some units of Critical Habitat. Unchecked growth of non-native plant species will reduce the duration of ponding in vernal pools by impairing rainwater infiltration that forms the seasonal perched aquifer, and by prematurely drying the perched aquifer as they grow and transpire in the spring and early summer. Invasive, nonnative plants also compete with vernal pool plant species for light, water, nutrients, and space. Mannagrass (*Glyceria* spp.) is an especially problematic invasive grass in vernal pool ecosystems because it forms large, dense mats of vegetation and can grow in vernal pools, unlike most invasive plant species that inhabit vernal pool margins or the uplands of vernal pool ecosystems.

2.5.1.11 Status of Sacramento Orcutt Grass/Critical Habitat

For the most recent comprehensive assessment of the species' range-wide status, please refer to the *Orcuttia viscida (Sacramento Orcutt Grass) 5-Year Review: Summary and Evaluation* (USFWS 2008b). No change in the species' listing status was recommended in the 5-year review. Threats evaluated during that review and discussed in the final document have continued to act on the species since the 2008 review was finalized (Witham 2013; Witham et al. 2013) While there have been continued losses of vernal pool habitat throughout the various vernal pool regions identified in the Vernal Pool Recovery Plan, including the Mather Core Area and the Cosumnes/Rancho-Seco Core Area, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the species.

Sacramento Orcutt grass is endemic to Sacramento County, occurring in vernal pool grasslands on a narrow band of high-terrace landforms that occur at the juncture of the Sierra Nevada foothills and eastern edge of the Sacramento Valley (USFWS 2003a; USFWS 2008b; CNDDB 2018). Sacramento Orcutt grass is found in scattered vernal pool complexes in Sacramento County, California, and is the most geographically restricted Orcuttieae species.

Occurrences of Sacramento Orcutt grass are restricted to the older and more weathered high terrace landform in the Laguna geological formation (Final SSHCP Appendix B). Soils associated with Sacramento Orcutt grass vernal pools tend to be strongly acidic, an indication of age and weathering (SCS 1993). Natural restriction of Sacramento Orcutt grass to high terrace landforms and their associated soil series may reflect the propensity of these soils and landforms to develop suitably large vernal pools with appropriate hydrological regimes (R. Holland and Dains 1990). Vernal pools occupied by Sacramento Orcutt grass range in size from 0.25 acre to 2.03 acres, with a median pool size of 0.69 acre (Stone et al. 1988), and are typically Northern Hardpan or Northern Volcanic Mudflow vernal pools (Sawyer and Keeler-Wolf 1995). Upslope watershed area (area of drainage) associated with occupied pools was reported by Stone et al. (1988) to range from 0.5 to 123 acres.

The CNDDB currently reports a total of 10 extant occurrences and 2 extirpated occurrences of Sacramento Orcutt grass (Witham 2013; CNDDB 2018). Witham (2013) describes three distribution-clusters of Sacramento Orcutt grass, all in Sacramento County.

The northernmost Sacramento Orcutt grass population center is located on an alluvial terrace north of State Highway 50 and the American River, and is approximately 5-miles north of the SSHCP Action Area. The northern Sacramento Orcutt grass population center includes one extirpated occurrence near the city of Orangevale, and two extant occurrences permanently protected within in the existing Phoenix Park/Phoenix Field. The population in Orangevale has been known to be extirpated since the 1990s. The two extant populations occur in the Phoenix Field and Phoenix Parks sites. The Phoenix Field site is a natural occurrence, persistently occupying two to several vernal pools owned by the Department of Fish and Wildlife. The Phoenix Park site is an introduced occurrence that has persisted for over 30 years in an open space area managed by the City of Fair Oaks (Witham 2013). The occupied pools in the uplands surrounding the Phoenix Park/Phoenix Field occupied vernal pools are dominated by blue oak woodland and annual grassland.

The central Sacramento Orcutt grass population center includes seven extant occurrences and one extirpated occurrence located within an approximate seven-mile by four-mile area of high-terrace landscapes located south of Highway 50, east of Bradshaw Boulevard, north of Deer Creek, and west of Scott Road in south Sacramento County (CNDDB 2018; Witham 2013). As discussed in Section 2.5.2.11 below, the central population center is within the SSHCP UDA, with all but one occurrence located in PPU-1. The uplands surrounding occupied vernal pools in the central population center are dominated by annual grassland. As measured by the number of CNDDB occurrences, number of occupied pools and past estimates of the number of individuals, the central population center comprises the core of the Sacramento Orcutt grass known distribution (Stone pers. comm. 2002). Most plants and the highest density of occupied vernal pools in the central population are located on the Kiefer Landfill Wetland Preserve.

The southernmost Sacramento Orcutt grass population center is located south of the Cosumnes River and east of Clay Station Road in southeastern Sacramento County. The south population center is comprised of just one occurrence near Rancho-Seco Lake (CNDDB occurrence #16), which is comprised of two vernal pools. The species is somewhat persistent in one of the pools and occasionally observed in the other pool. The southernmost occurrence near Rancho-Seco Lake is under conservation easement and managed for conservation values. However, Witham (2013) reports that this occurrence is now known to have been introduced to the site in 1975.

As with other endemic vernal pool plants, Sacramento Orcutt grass is an annual plant that will germinate, grow, set seed, and die in a single growing season. Seeds can lie dormant in the soil, sometimes for many years or decades, until a poorly-understood combination of environmental cues triggers them to germinate and begin their life cycle again. All members of the Orcuttieae tribe have large soil seed banks that may be 50 times (or more) larger in numbers than the aboveground population in any given year. Thus, many years of observation are necessary to determine whether any occurrence of Sacramento Orcutt grass is increasing, stable, or declining (USFWS 2003a).

Of all the Orcuttiae grasses, the Sacramento Orcutt grass tends to occupy the larger, more hydrologic-extreme pools encountered in the spectrum of vernal pool types (e.g., they are typically associated with larger or deeper vernal pools that tend to possess more extreme regimes of inundation) (Crampton 1959; Griggs 1974). Ponding must be of sufficient duration and under the appropriate seasonal temperature regime to release the seeds from dormancy through decomposition of maternal floral structures in the presence of a symbiotic aquatic fungus (Griggs 1980; Griggs and Jain 1983; Keeley 1988). Larger vernal pools that retain water until May or June provide optimal conditions for Orcuttieae grasses. As with other Orcuttia grasses, the seeds germinate and grow as submerged aquatic plants for several weeks to 3 months, and the plants flower relatively late in the summer months after vernal pools and the surrounding uplands are dry (Keeley 1998).

Typically, Sacramento Orcutt grass forms patches within large, dry vernal pools that are essentially devoid of other plant species (Crampton 1959; Crampton 1976; Griggs 1981; Griggs and Jain 1983). The depth and duration of pool inundation are not only critical for germination of Sacramento Orcutt grass, but likely exclude other less-specialized vernal pool plant species from the barren micro-sites in the deeper parts of pools inhabited by the species.

Status of Critical Habitat for Sacramento Orcutt Grass

The Service designated final Critical Habitat for Sacramento Orcutt grass on February 10, 2006 (USFWS 2006a). We identified Critical Habitat areas essential to the conservation of the species and may require special management. Three critical habitat units totaling 33,273 acres have been designated within Sacramento and Amador counties (USFWS 2006a).

The 26-acre Critical Habitat Unit-1 encompasses the northern population center of Sacramento Orcutt grass (at Phoenix Park and Phoenix Field). Critical Habitat Unit-1 includes one occurrence at the Phoenix Field Ecological Reserve, and the introduced occurrence at Phoenix Park.

The 1,161-acre Critical Habitat Unit-2 is contained within the central population center of Sacramento Orcutt grass, and was occupied at the time of listing. Critical Habitat Unit-2 is within the Action Area, and is discussed further in Section 2.5.2.11 below.

The large 32,086-acre critical habitat Unit-3 is located in both Sacramento County and Amador County and includes the area of the southern population center of Sacramento Orcutt grass. Unit-3 was occupied at the time of listing. Critical Habitat Unit-3 is within the Action Area, and is discussed further in Section 2.5.2.11 below.

The primary constituent elements of critical habitat for Sacramento Orcutt grass are those habitat components that are essential for the primary biological needs of germination, growth, reproduction, and dispersal. These primary constituent elements are found in areas that support vernal pools, swales, or other ephemeral ponds and depressions and their associated uplands. The two primary constituent elements for Sacramento Orcutt grass Critical Habitat are habitat components that provide:

- topographic features characterized by isolated mound and intermound complex within a matrix of surrounding uplands that result in continuously, or intermittently, flowing surface water in the depressional features including swales connecting the vernal pools, providing for dispersal and promoting hydroperiods of adequate length in the pools; and
- depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water or whose soils are saturated for a period long enough to promote germination, flowering, and seed production of predominantly annual native vernal pool wetland species and typically exclude both native and nonnative upland plant species in all but the driest years. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands.

The following factors are responsible for the current condition of Sacramento Orcutt grass critical habitat:

- **Direct habitat loss and fragmentation.** Vernal pool grassland within several Critical Habitat units has been converted to farming and developed landcovers.
- **Indirect habitat loss**. Adjacent land uses, especially urban development, has indirectly impaired or degraded the habitat functions provided by vernal pools within some units of Critical Habitat.
- **Vegetation management.** Both overgrazing and under grazing of vernal pool grasslands have been identified as threats to the species (USFWS 2008b). Appropriate grazing regimes reduce standing biomass of naturalized annual grasslands in the Vernal Pool Ecosystem—springtime grazing of the vernal pool ecosystem's uplands reduces grassland plant transpiration, slowing the drying of the seasonal perched aquifer, and therefore, slowing the drying of vernal pools within that ecosystem.
- **Nonnative invasive plant species.** Invasive, nonnative plants have adversely affected some units of Critical Habitat. Unchecked growth of non-native plant species will reduce the duration of ponding in vernal pools by impairing rainwater infiltration that forms the seasonal perched aquifer, and by prematurely drying the perched aquifer as they grow and transpire in the spring and early summer. Invasive, nonnative plants also compete with vernal pool plant species for light, water, nutrients, and space. Mannagrass (*Glyceria* spp.) is an especially problematic invasive grass in vernal pool ecosystems because it forms large, dense mats of vegetation and can grow in vernal pools; unlike most invasive plant species that inhabit vernal pool margins or the uplands of vernal pool ecosystems.

2.5.2 Environmental Baseline of the Vernal Pool Covered Species

The *environmental baseline* describes the current condition of a species and their habitat within an action area. The environmental baseline includes the past and ongoing effects of all State, tribal, local, and private actions and other human activities in the action area, as well as the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early ESA section 7 consultation, and the impact of State and private actions in the action area that are contemporaneous with this consultation (50 CFR §402.02). The individual species baseline discussions in Sections 2.5.2.1 to 2.5.2.11 below discuss the importance of the Action Area to each vernal pool Covered Species, including any variations in the species genetic, life history, or ecological relationships that may be present in the Action Area.

As in the *species status* discussions above, the environmental baselines of vernal pool species in the Action Area are initially discussed in terms of the vernal pool regions described in the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a). All of the Action Area is within the Southeastern Sacramento Valley vernal pool region, except the floodplains present along western and southwestern border of the Action Area (see Section 2.3.2 above), which are not included in any vernal pool region. The Southeastern Sacramento Valley vernal pool region also includes most of Sacramento County and Placer County, and smaller portions of Yuba, Nevada, Eldorado, Amador, San Joaquin, and Calaveras Counties (USFWS 2005a). The portion of the Southeastern Sacramento Valley vernal pool region that is within the Action Area includes two Zone-1 Core Areas (Mather and Cosumnes/Rancho-Seco), which are discussed below (USFWS 2005a).

In the early 1990's the Southeastern Sacramento Valley vernal pool region contained approximately 15% of the California vernal pools grasslands remaining at that time (Keeler-Wolf et al. 1998). Between 1993 and 2005, the Southeastern Sacramento Valley region's total acres of vernal pool grasslands decreased by 20%, which Holland (2009) attributed mostly to rapid urbanization on 17,113 acres of Placer County vernal pool grasslands over those 12 years. In comparison, 6,598 acres

(12%) of Sacramento County vernal pool grasslands were lost from 1993 to 2005, which is the same rate of vernal pool grassland loss that occurred over the entire Central Valley during those 12 years (R. Holland 2009). Between 2005 and 2012, an additional 2,748 acres (4%) of vernal pool grassland were lost in Sacramento County, indicating a total of approximately 9,346 acres of Sacramento County vernal pool grassland lost since 1993.

Of the 2,748 acres lost in Sacramento County in the 7 years between 2005 and 2012, approximately 1,886 acres were converted to bare (plowed) agricultural lands (primarily within the Cosumnes/Rancho-Seco Core Area, in Action Area PPU-7); approximately 610 acres were converted to urban landcovers (the majority located within the Sunrise Douglas portion of the SSHCP UDA and the Mather Core Area); approximately 194 acres were converted to orchard or vineyards (the majority outside the UDA), and approximately 60 acres were converted to low density agricultural-residential development (the majority located outside the UDA)(Witham et al. 2013, 2014). The 2,748-acre loss of Sacramento County vernal pool grassland in this 7-year period was partially offset by the creation of new vernal pools in Sacramento County during that period. Between 2005 and 2012, approximately 728 acres of Sacramento County extant vernal pool grasslands were preserved in mitigation banks, and then converted from low-density vernal pool landscapes to high-density vernal pool landscapes (primarily within the Cosumnes/Rancho-Seco Core Area, in SSHCP PPU-7). In addition, 708 acres of new vernal pool grasslands were created in the Action Area inside or adjacent to the Cosumnes/Rancho-Seco Core Area (in SSHCP PPU-7) on annual grassland acres not previously mapped as having vernal pool habitat (Witham et al. 2013, 2014). Under their mapping methods, Witham et al. (2014) estimated that in 2012 approximately 60,762 acres of extant vernal pool grassland and approximately 1,436 acres of modified or created vernal pool grasslands (62,197 acres total) remained in Sacramento County.

A USACE study of projects in the Action Area that obtained CWA permits between 1979 and January 2013 found that during this 34-year time period, 991 acres of wetlands and other waters of the United States (including vernal pools, marshes, other wetlands, streams, creeks, and other aquatic resources) were filled (lost) (USACE 2014; see Final SSHCP EIS/EIR Appendix A). Consistent with the findings of Witham et al. (2013, 2014), most losses of the Action Area aquatic resources authorized by CWA permits between 1979 and 2013 occurred inside the UDA (829 acres), and 162 acres of loss occurred outside the UDA. Therefore, aquatic resources within the UDA, including vernal pools, have experienced great direct losses, and many of the aquatic resources that remain in the UDA are now exposed to adverse effects from close proximity to development, such as decreased water quality resulting from urban runoff, changes in hydrologic regime, and reductions in habitat quality (USACE 2014).

As stated in the Final SSHCP (pages 5-3, 6-32, 6-55), several properties within the UDA portion of the Action Area have already obtained local entitlements and have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations from the CDFW, the Service, and the USACE. These UDA properties total 21,413 acres, and include several small lots in PPU-8, several small lots located west of Excelsior Road (PPU-3 and PPU-4), properties in the Rio Del Oro Specific Plan area (PPU-1), properties in the Sunridge Specific Plan area (PPU-1), and properties within the Mather Field Specific Plan area (PPU-2). These properties are part of the 317,656-acre Action Area. However, because planned urban development on these properties have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations, these properties were not included in the SSHCP Chapter 6 effects analyses. Where planned urban development has already obtained (or is close to obtaining) ESA authorizations, this Opinion addresses the authorized loss of habitat and loss of species individuals as part of the Environmental Baseline of each vernal pool Covered Species.

In December 2016, the Service issued a biological opinion to the USACE for the 2,668-acre Cordova Hills Specific Planning Area Project (Cordova Hills Specific Plan) (USFWS 2016), located east of Grant Line Road in SSHCP PPU-1. The 2016 biological opinion describes a "SSHCP on-ramp" process that will enable the Cordova Hills Specific Plan to proceed through their Clean Water Act section 404 and Endangered Species Act compliance processes prior to the issuance of an ESA section 10 incidental take permit for the SSHCP, and will provide a process for the Cordova Hills Specific Plan to participate in the operational SSHCP after the SSHCP is permitted under ESA section 10. In anticipation of the future ESA section 10 incidental take permit for the SSHCP, the Cordova Hills Specific Plan proposed a mitigation strategy designed to be fully consistent with the SSHCP Conservation Strategy, while also meeting project review and permitting standards under the Endangered Species Act section 7, as if the Cordova Hills Specific Plan were a stand-alone project. The "SSHCP on-ramp" process relied on a project description that is consistent with the SSHCP Conservation Strategy, consistent with all SSHCP Avoidance and Minimization Measures (AMMs), and is also permittable as a stand-alone project under ESA section 7 (USFWS 2016). The SSHCP includes the Cordova Hills Specific Plan as a SSHCP Covered Activity, and incorporates the Cordova Hills Specific Plan's impacts and take of SSHCP Covered Species (see Chapter 5.5 and Appendix K of the Final SSHCP). The USACE issued authorization under CWA 404 to the Cordova Hills Specific Plan in February 2017.

The environmental baseline of each vernal pool Covered Species and their modeled habitats are described in the individual vernal pool Covered Species environmental-baseline sections below (Section 2.5.2.1 to 2.5.2.11). As discussed below, SSHCP modeled habitat for each vernal pool Covered Species includes all landcovers included in the Vernal Pool Ecosystem. Because the ecology and physical characteristics if the Action Area's Vernal Pools, Swales, and Stream/Creek VPIH landcovers are entirely dependent on the surrounding Valley Grassland uplands (see Section 2.3.5.2 above), the SSHCP considers all Valley Grassland landcovers that are hydrologically connected to any Vernal Pool, Swale, or Stream/Creek (VPIH) landcover to also be suitable habitat for the vernal pool Covered-Species.

Each vernal pool Covered Species is dependent on the Vernal Pool landcover for the aquatic environment required for cyst and seed incubation, hatching and germination, growth and maturation, reproduction, feeding, and sheltering, and the appropriate periods of desiccation for cyst and seed dormancy and to eliminate upland plant and animal species. The Swale and the Stream/Creek (VPIH) landcovers provide ecosystem and habitat connectivity and allow movement and transport of genetic material from one vernal pool or vernal pool complex to another, and as discussed in the individual species sections below, the Swales and Stream/Creek VPIH landcovers may also provide suitable breeding and feeding habitat for some vernal pool crustacean Covered Species in some water years. In addition, numerous studies have correlated the distribution of vernal pool endemic species with specific geologic formations and their associated soils (Vollmar 2002; R. Holland and Dains 1990; Vollmar et al. 2013). Therefore, suitable habitat for some vernal pool Covered-Species was more narrowly defined by the SSHCP to include only specific Action Area soil types. The criteria and process used by SSHCP to define and model suitable habitat for each of the vernal pool Covered-Species is discussed in SSHCP Chapter 3.4 and above in Section 2.3.6.

Using the methods discussed above in Section 2.3.5, the SSHCP mapped approximately 103,210 acres of available Vernal Pool Ecosystem within the Action Area, with approximately 31,808 acres

(31%) of the Vernal Pool Ecosystem inside the UDA, and approximately 71,512 acres (69%) outside the UDA. While mapping SSHCP landcovers, the SSHCP counted a total of 63,730 individual vernal pools within the Action Area, with 13,058 of the individual vernal pools (20%) inside the UDA, and 50,672 of the individual vernal pools (80%) located outside the UDA.

As discussed in Section 2.3.5.2 above, the properly managed livestock grazing of Valley Grassland uplands can play a significant role in the maintenance and enhancement of vernal pool ecosystems. However, inappropriate levels of grazing, from undergrazing, overgrazing, or inappropriately timed grazing, can result in significant adverse effects to vernal pool ecosystems. The 103,320 acres of Vernal Pool Ecosystem (vernal pool grasslands) present in the Action Area include 37,619 acres within existing preserves. Most of the 37,619 acres of existing preserves are presumed to administer managed livestock grazing and other land management actions for the benefit of Vernal Pool Ecosystem functions or certain vernal pool species. The other 65,701 acres of Vernal Pool Ecosystem present in the Action Area are not currently managed for conservation value or the benefit of vernal pool species.

The Action Area includes 3 of the 85 vernal pool recovery Core Areas delineated by the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a)—two Zone-1 Core Areas (Mather and Cosumnes/Rancho-Seco), and one Zone-2 Core Area (Stone Lakes). The small 116-acre Stone Lakes Core Area is located in PPU-4 on property managed by Sacramento County Regional Sanitation (Regional San). However, no SSHCP Covered Activities are anticipated within the boundaries of Stone Lakes Core Area, including activities associated with the SSHCP Conservation Strategy.

Mather Core Area Existing Conditions

Approximately 24,245 acres of the 24,335-acre Mather Core Area are within the Action Area, located within PPU-1, PPU-2, and PPU-3 (inside the SSHCP's northern UDA). The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) designated the Mather Core Area as a Zone-1 (Priority 1) recovery area because it supports occurrences of the narrowly endemic (geographically restricted) Sacramento Orcutt grass, as well a high number of other rare vernal pool species. Occurrences of four vernal pool plants addressed in the Vernal Pool Ecosystem Recovery Plan (slender Orcutt grass, Boggs Lake hedge-hyssop, Ahart's dwarf rush, and legenere), and three of the vernal pool crustaceans addressed in the Vernal Pool Ecosystem Recovery Plan (vernal pool fairy shrimp, vernal pool tadpole shrimp, are mid-valley fairy shrimp) have been documented in the Mather Core Area. The Vernal Pool Recovery Plan describes Zone-1 Core Areas as necessary to prevent the extinction or irreversible decline of one or more vernal pool species (USFWS 2005a).

In an analysis of vernal pool grasslands within Core Areas, Witham et al. (2014) concluded that the acres of suitable habitat and the number of occurrences of federally-listed vernal pool species within the Mather Core Area is declining, due to a number of human-caused activities, primarily the conversion of habitat to urban land uses. In their seven-year study period (between 2005 and 2012), Witham et al. (2014) determined that an additional 378 acres of vernal pool grassland habitat had been removed in the Mather Core Area over that period. In total, the prospective Permittees' mapping of the SSHCP Landcovers determined that approximately 2,593 acres (11%) of the 24,335-acre Mather Core Area are now farmland landcovers, developed landcovers, and other anthropogenic landcovers that do not provide suitable habitat for vernal pool species.

The prospective Permittees' mapping of the SSHCP Landcovers also determined that approximately 22,656 acres of SSHCP native and naturalized landcovers currently remain in the Mather Core Area, including 21,193 acres of Vernal Pool Ecosystem landcovers (i.e. 806 acres of Vernal Pool, 360 acres of Swale, 70 acres of Stream/Creek-VPIH landcovers, and 19,957 acres of hydrologically-linked Valley Grassland). Therefore, approximately 87% (21,193 acres) of the 24,335-acre Mather Core Area currently provides suitable habitat for the vernal pool species. The existing 21,193 acres of Vernal Pool Ecosystem within the Mather Core Area represents approximately 21% of the total 103,210 acres of existing Vernal Pool Ecosystem mapped in the Action Area. The prospective Permittees' mapping of the SSHCP Landcovers also determined that approximately 10,530 individual vernal pool features are currently present within the Mather Core Area

Several vernal pool grassland preserves have been established within the Mather Core Area, including Mather Regional Park, the Sunrise-Douglas Conservation Bank, the Arroyo Seco Conservation Bank, Churchill Downs mitigation area, and Teichert mitigation areas (USFWS 2005a). The SSHCP landcover mapping identified 4,608 acres of preserved land within the boundaries of the Mather Core Area, including the current 1,342-acre Mather Field Wetland Preserve located in PPU-2 (Final SSHCP page 7-80). The largest group of existing preserves in the Action Area is in an area of PPU-3 south of Jackson Highway and north of Grant Line Road, between Excelsior and Eagles Nest roads. These preserves are located within a larger area of vernal pool grassland that has been termed the "Sacramento Prairie Vernal Pool Area" by the Sacramento Valley Conservancy, and represents the largest intact vernal pool grassland landscape remaining within the western half of the Mather Core Area. The existing preserves in the "Sacramento Prairie Vernal Pool Area" include lands under conservation easement or owned by the Sacramento Valley Conservancy, two conservation banks for vernal pools (Arroyo Seco, and Bryte Ranch), and other sites that provide mitigation for vernal pool habitat. In addition, several vernal pool conservation banks and conservation set-asides are scattered throughout the Mather Core Area, with concentrations occurring along Laguna Creek in southwestern PPU-3, and concentrations at the Kiefer Landfill Wetland Preserve in southeastern PPU-1 (see Final SSHCP Figure 3-40). The 4,608 acres of existing preserves represent approximately 19% of the total Mather Core Area acres within the Action Area. Most of the 4,608 acres of existing preserves in the Mather Core Area are presumed to administer managed livestock grazing and other land management actions for the benefit of Vernal Pool Ecosystem functions or certain vernal pool species. Therefore, approximately 16,585 acres of existing Vernal Pool Ecosystem within the Mather Core Area are not currently managed for conservation value.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identifies species-specific recovery criteria, which if met, would prevent the extinction or irreversible decline of the species in the wild, and would assure the species no longer requires protection under the ESA. As discussed above in Section 2.5.1, the Vernal Pool Ecosystem Recovery Plan discusses recovery criteria for each vernal pool species in terms of the recovery Core Areas (USFWS 2005a). Species-specific recovery criteria include the protection of documented species occurrences and the protection of suitable vernal pool ecosystem habitat, the monitoring, and management of vernal pool ecosystem habitat, species-specific research actions, and species status surveys. The Vernal Pool Ecosystem Recovery Plan identified species-specific recovery criteria in the Mather Core Area for eight SSHCP Covered Species. The Mather Core Area recovery criteria for vernal pool fairy shrimp, vernal pool tadpole shrimp, mid-valley fairy shrimp, Boggs Lake hedge-hyssop, Ahart's dwarf rush, legenere, slender Orcutt grass, and Sacramento Orcutt grass are discussed in the individual species environmental baseline sections below (Section 2.5.2.1 to Section 2.5.2.11).

Cosumnes/Rancho-Seco Core Area Existing Conditions

Approximately 44,388 acres (95%) of the total 46,599-acre Cosumnes/Rancho-Seco Core Area are in the southeastern portion of the Action Area, within PPU-7 (outside the SSHCP UDAs). Approximately 2,211 acres of the Cosumnes/Rancho-Seco Core Area extend into Amador County, and are outside of the Action Area. The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) designated the Cosumnes/Rancho-Seco Core Area as Zone-1 (i.e. Priority 1) recovery area because it supports an occurrences of the very narrowly endemic Sacramento Orcutt grass, as well occurrences of several plants addressed in the Vernal Pool Ecosystem Recovery Plan (slender Orcutt grass, Boggs Lake hedge-hyssop, Ahart's dwarf rush, and legenere), and three of the vernal pool crustaceans addressed in the Vernal Pool Ecosystem Recovery Plan (vernal pool fairy shrimp, vernal pool tadpole shrimp, are mid-valley fairy shrimp).

In an analysis of vernal pool grassland within Core Areas, Witham et al. (2014) concluded that the acres of suitable habitat and the number of occurrences of federally-listed vernal pool species are declining in the Cosumnes/Rancho-Seco Core Area due to human-caused activities, primarily due to conversion of vernal pool grasslands to various farmland landcovers. In their seven-year study period (between 2005a and 2012), Witham et al. (2014) determined that an additional 989 acres of vernal pool grassland habitat had been removed from the Cosumnes/Rancho-Seco Core Area. In total, the prospective Permittees' mapping of the SSHCP Landcovers determined that approximately 2,964 acres (7%) of the 44,388 acres of the Cosumnes/Rancho-Seco Core Area within the Action Area are now farmland landcovers, developed landcovers, and other anthropogenic landcovers that do not provide habitat for vernal pool species, including 1,116 acres of vineyards.

The prospective Permittees' mapping of the SSHCP Landcovers also determined that approximately 41,419 acres of SSHCP native and naturalized landcovers currently remain in the Cosumnes/Rancho-Seco Core Area, including 38,510 acres of the Vernal Pool Ecosystem landcovers (i.e. 1,754 acres of Vernal Pool, 416 acres of Swale, and 36,340 acres of hydrologically-linked Valley Grassland). Therefore, approximately 93% of the Cosumnes/Rancho-Seco Core Area in the Action Area currently provides suitable habitat for vernal pool species. The 38,510 acres of Vernal Pool Ecosystem present within the Cosumnes/Rancho-Seco Core Area represents approximately 37% of the total 103,210 acres of existing Vernal Pool Ecosystem in the Action Area. The prospective Permittees' mapping of the SSHCP Landcovers also determined that approximately 32,604 individual vernal pools are currently present within the portion of the Cosumnes/Rancho-Seco Core Area that is within the Action Area.

Several vernal pool grassland preserves have been established within the Cosumnes/Rancho-Seco Core Area, including Valensin Ranch, Clay Station Conservation Bank, the 1,255-acre Borden Ranch, the 283-acre Laguna Terrace Conservation Bank, the 1,995-acre Gill Ranch Conservation Bank, the 1,253-acre Sacramento Municipal Utilities District (SMUD) mitigation bank preserve, the 2,088-acre Bleecher Ranch, parts of the Cosumnes River Preserve, and a 9,189 section of the Nature Conservancy's Howard (Chance) Ranch (see Final SSHCP Figure 3-40). The SSHCP landcover mapping identified a total of 19,237 acres of preserved land within the boundaries of the Cosumnes/Rancho-Seco Core Area in the Action Area. The 19,237 acres of existing preservers in the Cosumnes/Rancho-Seco Core Area in the Action Area contain approximately 43% of the native and naturalized landcover acres present within the portion of the Cosumnes/Rancho-Seco Core Area that is within the Action Area.

Most of the 19,237 acres of existing preserves in the Cosumnes/Rancho-Seco Core Area are presumed to administer managed livestock grazing and other land management actions for the benefit of Vernal Pool Ecosystem functions, certain vernal pool species, and Valley Grassland habitat functions. Therefore, approximately 22,182 acres of native and naturalized landcovers within the Cosumnes/Rancho-Seco Core Area are not being managed for conservation value.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identifies species-specific recovery criteria, which if met, would prevent the extinction or irreversible decline of the species in the wild, and would assure the species no longer requires protection under the ESA. As discussed above in Section 2.5.1, the Vernal Pool Ecosystem Recovery Plan discusses recovery criteria for each vernal pool species in terms of the recovery Core Areas (USFWS 2005a). Species-specific recovery criteria include the protection of documented species occurrences and the protection of vernal pool ecosystem habitat, the monitoring, and management of vernal pool ecosystem habitat, species-specific research actions, and species status surveys. The Vernal Pool Ecosystem Recovery Plan identified species-specific recovery criteria in the Cosumnes/Rancho-Seco Core Area for five SSHCP Covered Species. The Cosumnes/Rancho-Seco Core Area recovery criteria for vernal pool fairy shrimp, vernal pool tadpole shrimp, mid-valley fairy shrimp, Sacramento Orcutt grass, and legenere are discussed in the individual species environmental baseline sections below (Section 2.5.2.1 to Section 2.5.2.11).

2.5.2.1 Vernal Pool Fairy Shrimp Environmental Baseline

Vernal pool fairy shrimp are documented to be widely distributed throughout the Action Area. However, as discussed above in Section 2.5.1, most surveys for vernal pool fairy shrimp in the Action Area have been limited to parcels proposed for urban development, or sites proposed as mitigation for urban development. Most of the vernal pools present in the Action Area have not been surveyed for vernal pool fairy shrimp, and the number of occupied vernal pools is unknown. The CNDDB reports only 120 extant occurrences and 10 extirpated occurrences of vernal pool fairy shrimp in Sacramento County (CNDDB 2018). However, the SSHCP's extensive compilation of species-surveys conducted within the Action Area was able to document 581 aquatic features where vernal pool fairy shrimp are known to occur in the Action Area (Final SSHCP Table 3-6). Of the 581 features with documented occurrences of vernal pool fairy shrimp, 388 are located outside of the UDA portion of the Action Area, primarily within the Cosumnes/Rancho-Seco Core Area in PPU-7, and approximately 193 are located inside the UDA portion of the Action Area, primarily within the Mather Core Area (in PPU-1, PPU-2, and PPU-3). The SSHCP's review of CNDDB records and past Action Area species-surveys indicates that vernal pool fairy shrimp are more common in vernal pools located outside the UDA, and relatively less common inside the UDA portion of the Action Area. SSHCP Figure 3-14 shows the 581 documented locations of vernal pool fairy shrimp in the Action Area.

The Action Area is within the center potion of the vernal pool fairy shrimp geographical range along the eastern edge of the Central Valley (see Section 2.5.1.1). Occurrences of vernal pool fairy shrimp are known for all of the vernal pool types found in the Action Area (i.e. vernal pools found on different soils, geological formations, and elevations in the Action Area).

Due to the limitations of existing survey data and due to the programmatic nature of the SSHCP, the environmental baseline for the vernal pool fairy shrimp in the Action Area relies heavily on the habitat model for vernal pool fairy shrimp described in SSHCP Chapter 3.4.2. The SSHCP determined that suitable habitat for the vernal pool fairy shrimp is present in all 103,210 acres of

Vernal Pool Ecosystem that remain in the Action Area. Therefore, the SSHCP modeled habitat for vernal pool fairy shrimp includes all 5,861 acres of Vernal Pool, Swale, and Stream/Creek VPIH aquatic-landcovers, and all 97,349 acres of ecologically and hydrologically-linked Valley Grassland present in the Action Area (see Final SSHCP Figure 3-14). The SSHCP assumed that all Vernal Pools, Swales, and Stream/Creek VPIH landcovers included in the species modeled habitat could be occupied by individuals or dormant cysts of vernal pool fairy shrimp. The primary factors responsible for the condition of the vernal pool grasslands and the vernal pool fairy shrimp modeled habitat in the Action Area were discussed above in Section 2.5.2.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified vernal pool fairy shrimp recovery criteria for the Action Area. Recovery criteria include the permanent protection of most acres of vernal pool fairy shrimp suitable habitat (Vernal Pool Ecosystem) in the Mather Core Area; permanent protection of most acres of vernal pool fairy shrimp suitable habitat (Vernal Pool Ecosystem) in the Cosumnes/Rancho-Seco Core Area; habitat management on all lands within those Core Areas, and the reintroduction of vernal pool fairy shrimp to sites where the species has been extirpated (USFWS 2005a).

Vernal Pool Fairy Shrimp Critical Habitat Environmental Baseline

All of the vernal pool fairy shrimp Critical Habitat Units designated in Sacramento County (i.e. vernal pool fairy shrimp Critical Habitat Units 13, 14A and 14 B) (USFWS 2006a) are within the Action Area boundary. All vernal pool fairy shrimp Critical Habitat units in Sacramento County were occupied at the time of critical habitat listing (USFWS 2006a).

As discussed in Section 2.3.5.2 above, SSHCP recognized that the SSHCP Vernal Pool, Swale, and Stream/Creek-VPIH landcovers cannot exist in isolation of the surrounding Valley Grassland uplands, which provide the seasonal hydrology, water chemistry, and related abiotic factors that provide habitat functions for vernal pool species. Consequently, the SSHCP addresses these four landcovers together as a single Vernal Pool Ecosystem. The SSHCP's definition of the Vernal Pool Ecosystem describes the same physical and biological features (primary constituent elements) that are essential for the conservation of the species, and were the basis for determining vernal pool fairy shrimp habitat to critical (see Section 2.5.1.1 above). The four PCEs specific for vernal pool fairy shrimp Critical Habitat are:

1) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools, providing for dispersal and promoting hydroperiods of adequate length in the pools. PCE#1 is describing the same physical features present in the hydrologically and ecologically connected Valley Grasslands, Swales, Vernal Pools, and Stream/Creek-VPIH) landcovers that the SSHCP analyzed together as the Vernal Pool Ecosystem.
2) Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands. PCE#2 is describing the same physical and biological features present in the hydrologically and ecologically connected Valley Grasslands and depressional

features (Vernal Pools, Swales, and Stream/Creek-VPIH) that the SSHCP analyzed together as the Vernal Pool Ecosystem.

3) Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and
4) Structure within the pools described in the above paragraph, consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter. PCEs #3 and #4 are describing the same physical and biological features that are present in the hydrologically and ecologically connected Valley Grasslands, Swales, Vernal Pools, and Stream/Creek-VPIH) landcovers that the SSHCP analyzed together as the Vernal Pool Ecosystem.

Critical Habitat Unit-13 (Mather Unit). The 2,450-acre vernal pool fairy shrimp Critical Habitat Unit-13 is within the boundaries of SSHCP PPU-2, inside the SSHCP UDAs. The 2,450-acre Critical Habitat Unit-13 is also within the 24,335-acre Mather Core Area (discussed in Section 2.5.2 above). Critical Habitat Unit-13 was designated as critical habitat for several reasons. Unit-13 contains vernal pool habitats that sustain the necessary timing and length of inundation required for the species to hatch, mature, reproduce, disperse, and enter dormancy. Vernal pool fairy shrimp in Unit-13 occur within a diversity of vernal pool habitats, including vernal pools on the low terrace Riverbank geologic formation and vernal pools on the high terrace Laguna and Arroyo Seco geologic formations (USFWS 2003a). The boundaries of the unit were delineated to include the interconnected pools, swales, and associated uplands that contribute to the filling and drying of the vernal pools where vernal pool fairy shrimp occur, and which maintain suitable periods of pool inundation, water quality, and soil moisture for vernal pool fairy shrimp hatching, growth, reproduction, and dispersal. This unit has large areas of intact vernal pool grasslands within Sacramento County that support a diverse community of vernal pool endemic plants and animals (USFWS 2003a). Vernal pool fairy shrimp Critical Habitat Unit-13 also represents Critical Habitat Unit-8 for vernal pool tadpole shrimp (see Section 2.5.2.1 below), and contains Critical Habitat Unit-6 for slender Orcutt grass (see Section 2.5.2.10) and contains Critical Habitat Unit-2 for Sacramento Orcutt grass (see Section 2.5.2.11). In addition to these species, Critical Habitat Unit-13 contains occurrences of other rare vernal pool species, including mid-valley fairy shrimp, Bogg's Lake hedge-hyssop, western spadefoot, legenere, California linderiella (*Linderiella occidentalis*), and Ahart's paronychia (*Pyronychia ahartii*) (USFWS 2003a).

In SSHCP PPU-2, vernal pool fairy shrimp Critical Habitat Unit-13 is bisected by an existing road (Kiefer Boulevard). North of Kiefer Boulevard, much of PPU-2 is within the Mather Field Specific Plan project boundaries[11] (Final SSHCP page 7-80). Approximately 1,010 acres (41%) of vernal pool fairy shrimp Critical Habitat Unit-13 is within the existing 1,342-acre Mather Field Wetlands Preserve, which is part of the Mather Field Specific Plan project (Final SSHCP Figures 3-40 and 6-3). Special management actions or protection of the physical and biological features (primary constituent elements) that are essential for the conservation of vernal pool fairy shrimp at Mather

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[11] The Mather Field Specific Plan project is pursuing its own Endangered Species Act (ESA) consultation with the U.S. Fish and Wildlife Service and its own Clean Water Act Section 404 authorizations from the U.S. Army Corps of Engineers; therefore, landcover acreages presented in SSHCP tables in SSHCP Chapters 3, SSHCP Chapter 6, and SSHCP Chapter 7 treat parcels within the boundary of the Mather Field Specific Plan the same as other Action Area parcels that have existing ESA incidental take authorization and other entitlements.

Field Wetlands Preserve will be provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

Since the final designation of vernal pool fairy shrimp Critical Habitat (USFWS 2006a), urban development projects have been implemented within the boundaries of Critical Habitat Unit-13. SSHCP landcover mapping determined that approximately 120 acres (5%) of Critical Habitat Unit-13 is now a developed landcover, a farmland landcover, or another anthropogenic landcover that does not possess the physical and biological features (primary constituent elements) essential to the conservation of vernal pool fairy shrimp (see Section 2.5.1.1 above). SSHCP landcover mapping also determined that approximately 2,330 acres (95%) of the 2,450-acre Critical Habitat Unit-13 are Vernal Pool Ecosystem landcovers, on which are found those physical and biological features (primary constituent elements) essential to the conservation of vernal pool fairy shrimp, and were the basis for determining the habitat to critical.

Of the existing 2,330 acres of Vernal Pool Ecosystem landcovers in Critical Habitat Unit-13, approximately 985 acres (42%) are protected in the existing Mather Field Wetland Preserve and managed with prescriptive livestock grazing and other land management actions that benefit Vernal Pool Ecosystem functions and benefit vernal pool species. Therefore, approximately 1,345 acres of existing Vernal Pool Ecosystem within Unit-13 are currently not managed for the protection or consideration of the physical and biological features essential for the conservation of vernal pool fairy shrimp.

Critical Habitat Unit-14 (Unit-14A and Unit-14B). Most of the large 37,093-acre vernal pool fairy shrimp Critical Habitat Unit-14 is located within the boundaries of SSHCP PPU-7, outside the SSHCP UDAs. The 37,093-acre Critical Habitat Unit-14 is also within the 46,599-acre Cosumnes/Rancho-Seco Core Area (discussed in Section 2.5.2 above). Critical Habitat Unit-14 was designated as Critical Habitat for vernal pool fairy shrimp because it supports occurrences of the species and vernal pool habitats, including several large vernal pool complexes and numerous individual vernal pools. Together, these represent some of the largest remaining vernal pool complexes in the Sacramento Valley that provide the necessary timing and duration of inundation for vernal pool fairy shrimp hatching, growth, and reproduction. Vernal pool fairy shrimp within this unit are known to occur in a diversity of pool types, including Northern Volcanic Mudflow vernal pool type on Pentz soils, vernal pools occurring on low terrace geologic formations with San Joaquin soils, and vernal pools occurring on high terrace geologic formations with Redding and Corning soils (UFWS 2003). These different vernal pool types provide a diversity of habitats for vernal pool fairy shrimp.

The large vernal pool complexes found within Unit-14 provide relatively undisturbed, hydrologically intact vernal pool grassland that support natural vernal pool ecosystem processes and maintain suitable habitat conditions for vernal pool fairy shrimp. In addition, because several areas within this unit include created vernal pools that support occurrences of vernal pool fairy shrimp, this Unit-14 was also designated to encourage special management actions be taken to assure that created or restored pools continue to provide the necessary timing and length of inundation for vernal pool fairy shrimp survival. In many cases, the special management action necessary will simply be to monitor vernal pool hydrology to verify the success of the creation effort. Unit-14 also contains state and federally owned land, as well as private properties. Portions of the Cosumnes River Preserve occur within this unit. Several large, diverse, vernal pool grassland landscapes protected within Unit-14 include Howard (Chase) Ranch and Valensin Ranch. The Clay Station Mitigation

Bank, Laguna Creek Mitigation Bank, and the Borden Ranch Mitigation site are included in Unit-14, as well as a number of smaller conservation areas including the Rancho-Seco Preserve.

Vernal pool fairy shrimp Critical Habitat Unit-14 also coincides with Critical Habitat Unit-9 for vernal pool tadpole shrimp (Section 2.5.2.2), and contains Critical Habitat Unit-3 for Sacramento Orcutt grass (Section 2.5.2.11). In addition to these species, this Critical Habitat Unit-14 contains occurrences of other rare, endemic vernal pool species including Bogg's Lake hedge-hyssop, western spadefoot, legenere, California linderiella, central California tiger salamander, Ahart's paronychia, Henderson's bent grass (*Agrostis hendersonii*), Sanford's arrowhead, pincushion navarretia, and dwarf downingia (USFWS 2003a).

Most of the 37,093-acre vernal pool fairy shrimp Critical Habitat Unit-14 is located in the southeastern portion of the Action Area, in SSHCP PPU-7. However, a 2,306-acre portion of vernal pool fairy shrimp Critical Habitat Unit-14A extends into Amador County, and is outside of the Action Area. In addition, the smaller 96-acre Critical Habitat Unit-14B is also located in SSHCP PPU-7, adjacent to Unit-14A. In total, 34,883 acres of vernal pool fairy shrimp Critical Habitat Unit-14 are within the Action Area (Final SSHCP Figure 6-2). Of the total 34,883 acres of Critical habitat Unit-14 within the Action Area, the SSHCP has determined that approximately 15,802 acres (45%) are already protected within existing preserves that are located in SSHCP PPU-7 (Final SSHCP Figures 3-41 and 6-3).

Since the final designation of Critical Habitat for vernal pool fairy shrimp (USFWS 2006a), areas of vernal pool grasslands within the boundaries of Critical Habitat Unit-14 have been converted to vineyards, development, irrigated pasture, or other anthropogenic landcovers. SSHCP landcover mapping determined that approximately 2,504 acres (7%) of the 34,787-acres of Critical Habitat Unit-14 located in the Action Area are now anthropogenic landcovers that do not possess the physical and biological features that are essential to the conservation of vernal pool fairy shrimp (see Section 2.5.1.1 above). In addition, approximately 2,842 acres of Blue Oak Savanna and other native landcovers present in Critical Habitat Unit-14A does not possess the physical and biological features that are essential to the conservation of vernal pool fairy shrimp.

SSHCP landcover mapping also determined that approximately 29,537 acres of Vernal Pool Ecosystem are present in the 34,883 acres of Critical Habitat Unit-14 that are within the Action Area. Therefore, approximately 85% of the lands within Critical Habitat Unit-14 and the Action Area are lands which possess the physical and biological features (primary constituent elements) essential to the conservation of vernal pool fairy shrimp, and were the basis for determining the habitat to critical.

Of the total 29,537acres of Vernal Pool Ecosystem landcovers present in Critical Habitat Unit-14 and the Action Area, the SSHCP has determined that approximately 14,203 acres (48%) are protected within the existing preserves discussed above. Most of the 14,203 acres of existing preserves in Critical Habitat Unit-14 are presumed to administer managed livestock grazing and other land management actions that benefit the physical and biological features (primary constituent elements) that are essential for the conservation of vernal pool fairy shrimp. Therefore, approximately 15,334 acres (52%) of the Vernal Pool Ecosystem within vernal pool fairy shrimp Critical Habitat Unit-14 and the Action Area currently are not managed for conservation values and the protection of physical and biological features essential for the conservation of vernal pool fairy shrimp.

2.5.2.2 Vernal Pool Tadpole Shrimp Environmental Baseline

Vernal pool tadpole shrimp are known to be widely distributed throughout the Action Area. However, as discussed above in Section 2.5.1, most surveys for vernal pool tadpole shrimp in the Action Area have been limited to parcels proposed for urban development, or sites proposed as mitigation for urban development, and most of the vernal pools present in the Action Area have not been surveyed for vernal pool tadpole shrimp. Consequently, the number of occupied vernal pools in the Action Area is unknown.

The CNDDB currently reports a total of 316 extant occurrences of vernal pool tadpole shrimp over the range of the species, with almost one-third of those known occurrences found in Sacramento County. The majority of the Sacramento County occurrences reported by the CNDDB occur in a 36 square mile area that is bordered by Jackson Highway in the south and Douglas Boulevard in the north (USFWS *in litt.* 2013). The vernal pool grassland habitat within this area of Sacramento County is believed to represent high quality habitat for tadpole shrimp populations because of the occurrence of several large, nearly contiguous areas of relatively undisturbed vernal pool habitat on high terrace landforms, soils dominated by Redding, Corning, and Red Bluff soils, and a large proportion of vernal pools that pond for sufficient duration to support tadpole shrimp reproduction (USFWS *in litt.* 2013).

The CNDDB (2018) reports only 95 extant occurrences in Sacramento County. However, the SSHCP's extensive compilation of records and species-surveys conducted within the Action Area was able to document 851 aquatic features where vernal pool tadpole shrimp are known to occur in the Action Area (Final SSHCP Table 3-6). Of the 851 features with documented occurrences of vernal pool tadpole shrimp in the Action Area, 587 are within the UDA, primarily within the Mather Core Area (in PPU-1, PPU-2, and PPU-3), and approximately 264 are located outside the UDA, primarily within the Cosumnes/Rancho-Seco Core Area (PPU-7)(see Final SSHCP page 3-73). The SSHCP's review of CNDDB records and past Action Area species-surveys indicates that vernal pool tadpole shrimp are more common in the vernal pools found inside the UDA, and relatively less common in vernal pools outside the UDA. SSHCP Figure 3-15 shows the 851 documented locations of vernal pool tadpole shrimp in the Action Area

Due to the limitations of existing survey data and the programmatic nature of the SSHCP, the environmental baseline for the vernal pool tadpole shrimp in the Action Area relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.2. The SSHCP determined that suitable habitat for the vernal pool tadpole shrimp is present in all 103,210 acres of Vernal Pool Ecosystem that remain in the Action Area. Therefore, the SSHCP modeled habitat for vernal pool tadpole shrimp includes all 5,861 acres of Vernal Pool, Swale, and Stream/Creek VPIH aquatic-landcovers, and all 97,349 acres of ecologically and hydrologically-linked Valley Grassland present in the Action Area (see Final SSHCP Figure 3-15). The SSHCP assumed that all Vernal Pools, Swales, and Stream/Creek VPIH landcovers included in the species modeled habitat could be occupied by individuals or dormant cysts of vernal pool tadpole shrimp. The primary factors responsible for the condition of the vernal pool grasslands and vernal pool tadpole shrimp modeled habitat in the Action Area were discussed above in Section 2.5.2.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified vernal pool tadpole shrimp recovery criteria for the Action Area. Recovery criteria include the permanent protection of most species suitable habitat (i.e. Vernal Pool Ecosystem) in the Mather Core Area; the permanent protection of most acres of vernal pool tadpole shrimp suitable habitat (Vernal Pool Ecosystem) in the Cosumnes/Rancho-Seco Core Area; habitat management on all lands within those Zone-1 Core Areas; and the reintroduction of vernal pool tadpole shrimp to sites where the species has been extirpated (USFWS 2005a).

Vernal Pool Tadpole Shrimp Critical Habitat Environmental Baseline

All of the vernal pool tadpole shrimp Critical Habitat Units designated in Sacramento County (i.e. Critical Habitat Unit-8 and Critical Habitat Unit-9) are within the Action Area boundary (USFWS 2006a). All vernal pool tadpole shrimp Critical Habitat units in Sacramento County were occupied at the time of critical habitat listing (USFWS 2006a).

As discussed in Section 2.3.5.2 above, SSHCP recognized that the SSHCP Vernal Pool, Swale, and Stream/Creek-VPIH landcovers cannot exist in isolation of the surrounding Valley Grassland uplands, which provide the seasonal hydrology, water chemistry, and related abiotic factors that provide habitat functions for vernal pool species. Consequently, the SSHCP addresses these four landcovers together as a single Vernal Pool Ecosystem. The SSHCP's definition of the Vernal Pool Ecosystem describes the same physical and biological features (primary constituent elements) that are essential for the conservation of the species, and were the basis for determining vernal pool tadpole shrimp habitat to critical (see Section 2.5.1.2 above). The four PCEs specific for vernal pool tadpole shrimp Critical Habitat are:

1) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools, providing for dispersal and promoting hydroperiods of adequate length in the pools. PCE#1 is describing the same physical features present in the hydrologically and ecologically connected Valley Grasslands, Swales, Vernal Pools, and Stream/Creek-VPIH) landcovers that the SSHCP analyzed together as the Vernal Pool Ecosystem.
2) Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 41 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands. PCE#2 is describing the same physical and biological features present in the hydrologically and ecologically connected Valley Grasslands and depressional features (Vernal Pools, Swales, and Stream/Creek-VPIH) that the SSHCP analyzed together as the Vernal Pool Ecosystem.
3) Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding; and
4) Structure within the pools described in the above paragraph, consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter. PCEs #3 and #4 are describing the same physical and biological features that are present in the hydrologically and ecologically connected Valley Grasslands, Swales, Vernal Pools, and Stream/Creek-VPIH) landcovers that the SSHCP analyzed together as the Vernal Pool Ecosystem.

Critical Habitat Unit-8. The 2,450-acre vernal pool tadpole shrimp Critical Habitat Unit-8 is within the boundaries of SSHCP PPU-2, inside the SSHCP UDAs. The 2,450-acre Critical Habitat Unit-8 is also within the 24,335-acre Mather Core Area (discussed in Section 2.5.2 above). Critical Habitat Unit-8 was designated as critical habitat for vernal pool tadpole shrimp because it contains a large percent of the known occurrences of the species and contains vernal pools of appropriate sizes and depths for vernal pool tadpole to complete their life cycle. This unit has excellent examples of vernal pool grasslands, and is known to support a rich and diverse community of vernal pool endemic plants and animals including vernal pool tadpole shrimp (USFWS 2003a). This unit supports a diversity of vernal pool habitats, including low terrace vernal pools on the Riverbank Formation, high terrace vernal pools on the Laguna and Arroyo Seco geologic formations. Critical Habitat Unit-8 is one of the few remaining areas where vernal pool tadpole shrimp occur on low terrace landforms on the eastern side of the Central Valley, and is important to maintain a diversity of habitats for the species (USFWS 2002). The boundaries of this unit were delineated to include the interconnected pools, swales, and associated uplands that contribute to the filling and drying of the vernal pools where vernal pool tadpole shrimp occur, and maintain suitable periods of pool inundation, water quality, and soil moisture for vernal pool tadpole shrimp to hatch, mature, and produce cysts (USFWS 2002). Vernal pool tadpole shrimp Critical Habitat Unit-8 also represents Critical Habitat Unit-8 for vernal pool tadpole shrimp, contains Critical Habitat Unit-6 for slender Orcutt grass, and contains Critical Habitat Unit-2 for the Sacramento Orcutt grass. In addition, Unit-8 contains occurrences of other rare endemic vernal pool species including mid-valley fairy shrimp, legenere, Bogg's Lake hedge-hyssop, Ahart's dwarf rush, western spadefoot, and California linderiella (USFWS 2002).

In SSHCP PPU-2, vernal pool tadpole shrimp Critical Habitat Unit-8 is bisected by an existing road (Kiefer Boulevard). North of Kiefer Boulevard, much of PPU-2 is within the Mather Field Specific Plan project boundaries[12] (Final SSHCP page 7-80). Approximately 1,010 acres (41%) of vernal pool tadpole shrimp Critical Habitat Unit-8 is within the existing 1,342-acre Mather Field Wetlands Preserve, which is part of the Mather Field Specific Plan project (Final SSHCP Figures 3-40 and 6-3). Special management actions or protection of the physical and biological features (primary constituent elements) that are essential for the conservation of vernal pool tadpole shrimp at Mather Field Wetlands Preserve will be provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

Since the final designation of vernal pool tadpole shrimp Critical Habitat (USFWS 2006a), urban development projects have been implemented within the boundaries of Critical Habitat Unit-8. SSHCP landcover mapping determined that approximately 120 acres (5%) of Critical Habitat Unit-8 is a developed landcover, a farmland landcover, or another landcover that does not possess the physical and biological features (primary constituent elements) essential to the conservation of vernal pool tadpole shrimp (see Section 2.5.1.2 above). SSHCP landcover mapping also determined that approximately 2,330 acres (95%) of the 2,450-acre Critical Habitat Unit-8 are Vernal Pool Ecosystem landcovers, on which are found those physical and biological features (primary constituent elements) essential to the conservation of vernal pool tadpole shrimp, and were the basis

[12] The Mather Field Specific Plan project is pursuing its own Endangered Species Act (ESA) consultation with the U.S. Fish and Wildlife Service and its own Clean Water Act Section 404 authorizations from the U.S. Army Corps of Engineers; therefore, landcover acreages presented in SSHCP tables in SSHCP Chapters 3, SSHCP Chapter 6, and SSHCP Chapter 7 treat parcels within the boundary of the Mather Field Specific Plan the same as other Action Area parcels that have existing ESA incidental take authorization and other entitlements.

for determining the habitat to critical (constituent elements) essential to the conservation of vernal pool tadpole shrimp, and were the basis for determining the habitat to critical.

Of the existing 2,330 acres of Vernal Pool Ecosystem landcovers in Critical Habitat Unit-8, approximately 985 acres (42%) are protected in the existing Mather Field Wetland Preserve and managed with prescriptive livestock grazing and other land management actions that benefit of Vernal Pool Ecosystem functions and vernal pool species. Therefore, approximately 1,345 acres of existing Vernal Pool Ecosystem within Unit-8 are currently not managed for the protection or consideration of the physical and biological features essential for the conservation of vernal pool tadpole shrimp.

Critical Habitat Unit-9 (Unit-9A and Unit-9B). Most of the large 37,093-acre vernal pool tadpole shrimp Critical Habitat Unit-9 is located within the boundaries of SSHCP PPU-7, outside the SSHCP UDAs. The 37,093-acre Critical Habitat Unit-9 is also within the 46,599-acre Cosumnes/Rancho-Seco Core Area (discussed in Section 2.5.2 above). Unit-9 was designated as Critical Habitat for vernal pool tadpole shrimp because it contains the primary constituent elements necessary for the species survival, including over 30 percent of the remaining vernal pool grassland habitat in the southern Sacramento Valley area at the time of its designation (USFWS 2006a). These include habitats that provide the necessary timing, length, and frequency of inundation necessary for the survival of vernal pool tadpole shrimp, and this unit supports numerous occurrences of the species. Unit-9 provides excellent examples of large vernal pool grasslands, which support rich and diverse communities of vernal pool endemic plants and animals within Sacramento County (USFWS 2003a). Vernal pool tadpole shrimp within this unit occur in a diversity of pool types, including Northern Volcanic Mudflow vernal pools on the Mehrten and Valley Springs geologic formation with Pardee and Pentz soils, vernal pools occurring on low terrace landforms with San Joaquin soils, and high terrace landforms with Redding and Corning soils (USFWS 2002). King (1996) found that vernal pool tadpole shrimp within this unit were genetically most similar to occurrences in Stanislaus County. However, vernal pool tadpole shrimp within this unit were generally different from occurrences at other sites sampled throughout the species range, and were very different from vernal pool tadpole shrimp sampled at sites found further to the west on the floor of the Central Valley, for example at Jepson Prairie or Kesterson National Wildlife Refuge (King 1996). The boundaries of this unit were delineated to include the interconnected pools, swales, and associated uplands that contribute to the filling and drying of the vernal pools where vernal pool tadpole shrimp occur, and maintain suitable periods of pool inundation, water quality, and soil moisture for vernal pool tadpole shrimp to complete their life cycles. Unit-9 also contains state and federally owned preserves, as well as private vernal pool habitat mitigation and conservation banks established to compensate for the loss of thousands of acres of vernal pool grassland habitats throughout the Southeastern Sacramento Valley vernal pool region (USFWS 2002).

Vernal pool tadpole shrimp Critical Habitat Unit-9 coincides with Critical Habitat Unit-14 for vernal pool fairy shrimp, and incorporates Critical Habitat Unit-3 for Sacramento Orcutt grass. Other sensitive species found within Critical Habitat Unit-9 include Bogg's Lake hedge-hyssop, Ahart's dwarf rush, Henderson's bent grass, legenere, Sanford's arrowhead, pincushion navarretia, dwarf downingia, central California tiger salamander, western spadefoot toad, and California linderiella (USFWS 2002).

Most of the large 37,093-acre vernal pool tadpole shrimp Critical Habitat Unit-9 is located in the southeastern portion of the Action Area, in SSHCP PPU-7. However, a 2,306-acre portion of vernal pool tadpole shrimp Critical Habitat Unit-9A extends into Amador County, and is outside of the

Action Area. In addition, the smaller 96-acre Critical Habitat Unit-9B is also located in SSHCP PPU-7, adjacent to Unit-9A. In total, 34,883 acres of vernal pool tadpole shrimp Critical Habitat Unit-9 are within the Action Area (Final SSHCP Figure 6-2).Of the total 34,883 acres of Critical habitat Unit-9 within the Action Area, the SSHCP has determined that approximately 15,802 acres (45%) are already protected within existing preserves that are located in SSHCP PPU-7 (Final SSHCP Figures 3-41 and 6-4).

Since the final designation of Critical Habitat for vernal pool tadpole shrimp (USFWS 2006a), areas of vernal pool grasslands within the boundaries of Critical Habitat Unit-9 have been converted to vineyards, low-density development, irrigated pasture, or other anthropogenic landcovers that do not possess the physical and biological features that are essential to the conservation of vernal pool tadpole shrimp (see Section 2.5.1.2 above). SSHCP landcover mapping determined that approximately 2,504 acres (7%) of the 34,787-acres of Critical Habitat Unit-9 located in the Action Area are now anthropogenic landcovers. In addition, approximately 2,842 acres of Blue Oak Savanna and other native landcovers present in Critical Habitat Unit-9A do not possess the physical and biological features essential to the conservation of the vernal pool tadpole shrimp (see Section 2.5.1.2 above)

SSHCP landcover mapping also determined that approximately 29,537 acres of Vernal Pool Ecosystem are present in the 34,883 acres of Critical Habitat Unit-9 that are within the Action Area. Therefore, approximately 85% of the lands within Critical Habitat Unit-9 and the Action Area are lands on which are found the physical and biological features (primary constituent elements) essential to the conservation of vernal pool tadpole shrimp and were the basis for determining the habitat to critical.

Of the total 29,537acres of Vernal Pool Ecosystem landcovers present in Critical Habitat Unit-9 and the Action Area, the SSHCP has determined that approximately 14,203 acres (48%) are protected within the existing preserves discussed above. Most of the 14,203 acres of existing preserves in Critical Habitat Unit-9 are presumed to administer managed livestock grazing and other land management actions for the benefit of Vernal Pool Ecosystem functions and vernal pool species. Therefore, approximately 15,334 acres (53%) of Vernal Pool Ecosystem within vernal pool tadpole shrimp Critical Habitat Unit-9 and the Action Area currently are not managed for conservation values and the protection of physical and biological features essential to the conservation of vernal pool tadpole shrimp.

2.5.2.3 Mid-Valley Fairy Shrimp Environmental Baseline

The mid-valley fairy shrimp is uncommon but widely distributed in the Action Area, primarily in vernal pools remaining on the low-terrace and high-terrace landforms in the Action Area. The original species description for the mid-valley fairy shrimp came from specimens collected in the Action Area, at the former Mather Air Force Base (Mather Field) in SSHCP PPU-2. The occurrences of mid-valley fairy shrimp in SSHCP PPU-2 of represent the northernmost occurrences of the species throughout its range.

The SSHCP's extensive compilation of records and species-surveys conducted within the Action Area was able to document 37 separate features where mid-valley fairy shrimp have been documented on in the Action Area. Twenty-two are located within the SSHCP UDA (10 in PPU-2, 9 in PPU-3, 2 in PPU-8, and 1 that is not within a PPU) and 15 documented occurrences are located outside of the UDA (9 in PPU-6 and six within PPU-7) (Final SSHCP Table 3-6). Occurrences are primarily associated with the Laguna Formation inside the UDA, and the Riverbank Formation outside the UDA (see Final SSHCP Figures 5-2 and 3-11). However, much of the Action Area has not been surveyed for the mid-valley fairy shrimp, and the total number of occupied vernal pools is unknown.

The Action Area is located SSHCP within the northern portion of the mid-valley fairy shrimp's geographical range along the eastern edge of the Central Valley (see Section 2.5.1.3.). Occurrences of mid-valley fairy shrimp are found within different vernal pool types, soils, and geological formations, which support different physical and environmental conditions, species compositions, and ecological conditions.

Due to the limitations of the existing survey data and due to the programmatic nature of the SSHCP, the environmental baseline for the mid-valley fairy shrimp relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.2. Studies over the range of mid-valley fairy shrimp indicate that the species tends to occur in smaller vernal pools with abbreviated hydroperiods, and have clear water with neutral to slightly alkaline and low in dissolved salts, abundant vernal pool plants, and a complex vernal pool crustacean community (Eriksen and Belk 1999; Rogers 1998). The SSHCP modeled habitat for mid-valley fairy shrimp is all Vernal Pool, Swale, and Valley Grassland landcovers associated with Bruella sandy loam, 0 to 2% slopes; Capay clay loam, 0 to 2% slopes, occasionally flooded; Clear Lake clay, hardpan substratum, drained, 0 to 1% slopes; Clear Lake clay, partially drained, 0 to 2% slopes; frequently flooded; Creviscreek sandy loam, 0 to 3% slopes; Durixeralfs-Gat complex, 0 to 2% slopes; Durixeralfs, 0 to 1% slopes; Fiddyment fine sandy loam, 1% to 8% slopes; Galt clay, 0 to 2% slopes; Hedge loam, 0 to 2% slopes; Hicksville loam, 0 to 2% slopes occasionally flooded; Kimball-silt loam, 0 to 2% slopes; Madera loam, 0% to 2% slopes; Natomas loam, 0 to 2 percent slopes; Red Bluff-Redding complex, 0 to 5% slopes; Red Bluff-Xerarents complex, 0 to 2% slopes; Red Bluff loam, 0 to 2% slopes; Red Bluff loam, 2 to 5% slopes; Redding gravelly loam, 0 to 8% slopes; Sailboat silt loam, drained, 0 to 2% slopes, occasionally flooded; San Joaquin-Durixeralfs complex, 0 to 1% slopes; San Joaquin-Galt complex, 0 to 3% slopes; San Joaquin-Galt complex, leveled, 0 to 1% slopes; San Joaquin-Xerarents complex, leveled, 0 to 1% slopes; San Joaquin silt loam, 0 to 3% slopes; San Joaquin silt loam, 3% to 8% slopes; San Joaquin silt loam, leveled, 0 to 1% slopes; Vleck gravelly loam, 2% to 15% slopes; Xerarents-Redding complex, 0 to 2% slopes; Xerarents-San Joaquin complex, 0 to 1% slopes throughout the Action Area.

The SSHCP estimates that 53,638 acres of mid-valley fairy shrimp modeled habitat are available in the Action Area. SSHCP Figure 3-11 illustrates the locations and area of mid-valley fairy shrimp modeled habitat in the Action Area. The SSHCP assumes that the Vernal Pool Ecosystem aquatic-landcovers included in the species modeled habitat could be occupied by individuals or cysts of the mid-valley fairy shrimp.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified mid-valley fairy shrimp recovery criteria for the Action Area. Recovery criteria for mid-valley fairy shrimp include the permanent protection and management of most acres of mid-valley fairy shrimp suitable habitat (Vernal Pool Ecosystem) in the Mather Core Area, and the permanent protection and management of most acres of mid-valley fairy shrimp suitable habitat (Vernal Pool Ecosystem) in the Cosumnes/Rancho-Seco Core Area (USFWS 2005a).

2.5.2.4 Ricksecker's Water Scavenger Beetle Environmental Baseline.

Ricksecker's water scavenger beetle is uncommon. The SSHCP's extensive compilation of records and species-surveys conducted within the Action Area was able to document 8 features where Ricksecker's water scavenger beetle has been documented in the Action Area (Final SSHCP Table 3-6). Four occurrences are within the UDA, at the existing 1,342-acre Mather Field Preserve (in PPU-2), and four occurrences are located outside of the UDA. Outside the UDA, one occurrence is in PPU-6 near the existing Cosumnes River Ecological Preserve, and three occurrences are in PPU-7 (two occurrences at the Howard Ranch Preserve, and one occurrence at the Rancho-Seco Lake Preserve). However, much of the Action Area has not been surveyed for the species, and the total number of occupied vernal pools is unknown. SSHCP Figure 3-12 shows the locations of the known occurrences in the Action Area.

Due to the programmatic nature of the SSHCP, the environmental baseline for the species relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.2. Ricksecker's water scavenger beetle is not sensitive to the size or type of vernal pool. SSHCP modeled habitat for Ricksecker's water scavenger beetle was identified as all Vernal Pool, Swale, and hydrologically-linked Valley Grassland landcovers within the Action Area. Approximately 103,137 acres of modeled habitat for Ricksecker's water scavenger beetle modeled habitat are available in the Action Area. The SSHCP assumes that all Vernal Pools and Swale landcovers within the Action Area could be occupied by dormant eggs, pupa, or dormant adults of Ricksecker's water scavenger beetle.

2.5.2.5 Dwarf Downingia Environmental Baseline

The species is uncommon in the Action Area. The SSHCP's extensive compilation of records and species-surveys conducted within the Action Area identified 10 individual features where dwarf downingia has been documented in the Action Area (Final SSHCP Table 3-6). The 10 occurrences are widely scattered over the south half of the Action Area, outside the UDAs. Eight of the occurrences are in PPU-6 (on the Stone Lakes National Wildlife Refuge and the Cosumnes Preserve), and two occurrences in PPU-7 (near the Howard Ranch preserve). However, much of the Action Area has not been surveyed for the species, and the total number of occupied vernal pools is unknown. SSHCP Figure 3-5 shows the locations of known occurrences in the Action Area.

Due to the programmatic nature of the SSHCP, the environmental baseline for the species relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.2. In the Action Area, dwarf downingia occurs primarily on the high-terrace Laguna formation and the low-terrace Riverbank formation. SSHCP analysis of documented occurrences in the region suggests that dwarf downingia occurrences are associated with soils in the Amador-Gillender complex, Clear Lake clay, Corning complex, Hadselville-Pentz complex, Redding gravelly loam, San Joaquin silt loam, and San Joaquin-Galt complex soil types. SSHCP landcovers that provide suitable aquatic habitat based on the species life history description are the Vernal Pool and Swale landcovers. Vernal pools are their primary habitat in the Action Area, but Swales may also provide suitable habitat as dwarf downingia prefers short periods of inundation (see Section 2.5.1.5). Because Vernal Pools and Swales are dependent on surrounding uplands, the Valley Grassland landcover is also considered suitable habitat for this species. Therefore, modeled habitat for dwarf downingia is considered to be all Vernal Pool, Swale, and Valley Grassland-Vernal Pool Ecosystem landcovers on Amador-Gillender complex, 2% to 15% slopes; Clear Lake clay, partially drained, 0 to 2% slopes, frequently flooded; Corning complex, 0 to 8% slopes; Durixeralfs-Galt complex, 0 to 2% slopes; San Joaquin silt loam, 0 to 3% slopes; and San Joaquin-Galt complex, 0 to 3% slopes. In total, approximately 24,261 acres of modeled habitat for dwarf downingia are available in the Action Area. SSHCP Figure 3-5 illustrates the locations of dwarf downingia modeled habitat within the Action Area. The SSHCP assumes that all Vernal Pool Ecosystem aquatic-landcovers included in the species modeled habitat could be occupied by plants or dormant seeds of dwarf downingia. The primary factors responsible for the condition of the vernal pool grasslands and the dwarf downingia modeled habitat in the Action Area were discussed above in Section 2.5.2.

2.5.2.6 Boggs Lake Hedge-Hyssop Environmental Baseline

The SSHCP's extensive compilation of records and species-surveys conducted within the Action Area identified 30 features where Boggs Lake hedge-hyssop has been documented in the Action Area, all located within the UDA portion of the Action Area, or bordering the UDA portion of the Action Area (Final SSHCP page 6-88). Fourteen of these documented occurrences are in PPU-1, primary within existing preserves. There is one occurrence each in PPUs 2 and 3, and two occurrences in PPU-4. Twelve occurrences are located just outside the UDA boundary in the Kiefer Landfill Wetland Preserve. All of the documented occurrences of Boggs Lake hedge-hyssop located in PPUs 1, 2, 3, and in the Kiefer Landfill Wetland Preserve are also within the Mather Core Area (Final SSHCP Table 3-6). The locations and numbers of Boggs Lake hedge-hyssop documented occurrences shown in SSHCP Figure 3-4 reflects the more frequent sampling of vernal pools within existing mitigation preserves. However, most of the vernal pools and seasonal wetlands in the Action Area have not been surveyed for Boggs Lake hedge-hyssop, and the total number of occupied vernal pools in the Action Area is unknown. SSHCP Figure 3-4 shows the locations of the 30 documented occurrences of Boggs Lake hedge-hyssop within the Action Area.

Due to the programmatic nature of the SSHCP, the environmental baseline for the species relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.1. Boggs Lake hedge-hyssop is known to grow in well-developed, deeper vernal pools, playa lakes, as well as along the seasonally fluctuating margins of more permanent water bodies (small lakes, reservoirs, stock ponds, seasonally saturated clay flats in meadows) (Dittes and Guardino, as cited in SSHCP Appendix B). The SSHCP analysis of documented occurrences suggest that occurrences in this region are associated with Red Bluff loam, Red Bluff-Redding complex, Red Bluff-Xerarents complex, Redding gravelly loam, San Joaquin silt loam, San Joaquin-Durixeralfs complex, and Vleck gravelly-loam soil types. SSHCP aquatic landcovers that provide suitable aquatic habitat based on life history of Boggs Lake hedge-hyssop are Vernal Pool and Seasonal Wetland (Final SSHCP Table 3-2). Because the hydrology and ecology of Vernal Pools and Seasonal Wetlands are dependent on surrounding uplands, the Valley Grassland landcover is also considered suitable habitat for this species. Therefore, SSHCP Modeled habitat for Boggs Lake hedge-hyssop is all Vernal Pool, Seasonal Wetland, and hydrologically-connected Valley Grassland landcovers located on Red Bluff loam, 2% to 5% slopes; Red Bluff-Redding complex, 0 to 5% slopes; Red Bluff-Xerarents complex, 0 to 2% slopes; Redding gravelly loam, 0 to 8% slopes; San Joaquin silt loam, 0 to 3% slopes; San Joaquin-Durixeralfs complex, 0 to 1% slopes; Sailboat silt loam, drained, 0 to 2% slopes; occasionally flooded, and Vleck gravelly loam, 2% to 15% slopes. SSHCP Figure 3-4 illustrates the locations of Boggs Lake hedge-hyssop modeled habitat within the Action Area. The SSHCP assumes that all aquatic-landcovers included in the Boggs Lake hedge-hyssop modeled habitat may be occupied by dormant seeds of the species.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified Boggs Lake hedge-hyssop recovery criteria for the Action Area. Recovery criteria include the permanent protection of most acres of Boggs Lake hedge-hyssop suitable habitat present in the Mather Core Area; habitat management on all lands in the Mather Core Area, the reintroduction of Boggs lake hedge-hyssop to sites with soil types from which the species has been extirpated, and the collection of seeds from each population for seed banking (USFWS 2005a).

2.5.2.7 Ahart's Dwarf Rush Environmental Baseline

There are two occurrences of Ahart's dwarf rush in the Action Area; one extant occurrence in PPU-2, and one possibly extirpated occurrence in PPU-1 (CNDDB 2018). The extant occurrence is located in the existing 1,342-acre Mather Field Wetland Preserve that is north of Kiefer Boulevard in PPU-2. The possibly extirpated occurrence is southeast of the intersection of Kiefer Boulevard and Sunrise Boulevard in PPU-1. SSHCP Figure 3-3 shows the location of the extant occurrence in PPU-2. The occurrence of Ahart's dwarf rush is the only extant occurrence in Sacramento County, and one of only 13 disjunct occurrences of the species. However, much of the Action Area has not been surveyed for the species. Because of its small stature, presence in vernal pool margins and swales, its early flowering season, and the amount of un-surveyed or partially surveyed suitable-habitat, a moderate to high potential exists for discovery of additional populations of Ahart's dwarf rush within the Action Area.

Due to the limitations of existing survey data and the programmatic nature of the SSHCP, the environmental baseline for the species relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.1. Ahart's dwarf rush is known to occupy shallow vernal pools, the margins of large vernal pools, and swales. SSHCP analysis of occurrences suggests that in the Action Area, Ahart's dwarf rush is associated with the Red Bluff loam, Red Bluff-Redding complex and Redding gravelly Loam soil types. SSHCP aquatic landcovers that provide suitable habitat based on life history of Ahart's dwarf rush are Vernal Pool and Swale. Because the hydrology and ecology Vernal Pools and Swales are dependent on surrounding uplands, the Valley Grassland landcover is also considered suitable habitat for this species. Therefore, modeled habitat for Ahart's dwarf rush is all of the Vernal Pool, Swale, and Valley Grassland landcovers located on Fiddyment fine sandy loam, 1% to 8% slopes; Red Bluff-Redding complex, 0 to 5% slopes; and Redding gravelly loam, 0 to 8% slopes. SSHCP Figure 3-3 illustrates the locations and area of modeled habitat within the Action Area. The SSHCP assumes that all Vernal Pool Ecosystem aquatic-landcovers included in the Ahart's dwarf rush modeled habitat could be occupied by dormant seeds of the species.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified Ahart's dwarf rush recovery criteria for the Action Area. Recovery criteria include the permanent protection of most acres of Ahart's dwarf rush suitable habitat present within the Mather Core Area; habitat management on all lands within in the Mather Core Areas, the reintroduction of Ahart's dwarf rush to sites with soil types from which the species has been extirpated, and the collection of seeds for seed banking (USFWS 2005a).

2.5.2.8 Legenere Environmental Baseline

The species is relatively uncommon, but is widely distributed throughout the Action Area. The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 62 features where legenere have been documented in the Action Area (Final SSHCP Table 3-6). Thirty-six documented occurrences are located within the UDA, including 20 occurrences within PPU-1, seven in PPU-2, seven in PPU-3, one in PPU-4 at the existing Beach Lake Mitigation Site, and one is in the UDA but not within any PPU. There are also 26 documented occurrences outside of the UDA, including 1 in PPU-5, 16 in PPU-6, and 9 in PPU-7. However, much of the Action Area has not been surveyed for the species, and the total number of occupied vernal pools is unknown. Legenere is an inconspicuous species that easily escapes the notice; it lacks showy flowers, and it most frequently grows clambering and mixed with the stems of more common vernal pool plant species. Given these considerations and the amount of un-surveyed or partially surveyed suitable habitat in the Action Area, additional occurrences may be present. SSHCP Figure 3-6 shows the locations of known occurrences in the Action Area.

Due to the programmatic nature of the SSHCP, the environmental baseline for the species relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.1. Legenere is known to grow in well-developed vernal pools and playa lakes, as well as along the seasonally fluctuating margins of more permanent water bodies (small lakes, ponds, stock ponds), and basins within seasonal drainages (R. Holland 1983). Topographical position within pools and associated plant species indicate tolerance of, or preference for, the more extreme (longer-duration) inundation regimes encountered in vernal wetlands. SSHCP analysis of documented occurrences in the region suggests that legenere occurrences are associated with Clear Lake clay, Corning complex, Creviscreek sandy loam, Dierssen sandy clay loam, Dierssen clay loam, Fiddyment fine sandy loam, Hadselville-Pentz complex, Hedge loam, Hicksville loam, Hicksville gravelly loam, Liveoak sandy clay loam, Madera loam, Natomas loam, Red Bluff loam, Red Bluff-Redding complex, Redding gravelly loam, San Joaquin silt loam, San Joaquin-Galt complex, Xerorthents, and dredge tailings. SSHCP landcovers that provide suitable habitat based on life history descriptions are Vernal Pool and Seasonal Wetland (Final SSHCP Table 3-2). Because Vernal Pools and Seasonal Wetlands are dependent on surrounding uplands, the Valley Grassland landcover is also considered suitable habitat for this species. Therefore, modeled habitat for legenere is considered to be all Vernal Pool, Seasonal Wetland, and Valley Grassland landcovers on Clear Lake clay, partially drained, 0 to 2% slopes; frequently flooded, Corning complex, 0 to 8% slopes; Creviscreek sandy loam, 0 to 3% slopes; Dierssen sandy clay loam, drained, 0 to 2% slopes; Fiddyment fine sandy loam, 1 to 8% slopes; Hedge loam, 0 to 2% slopes; Madera-Galt complex, 0 to 2% slopes; Red Bluff loam, 0 to 2% slopes; Red Bluff loam, 2% to 5% slopes; Red Bluff-Redding complex, 0 to 5% slopes; Redding gravelly loam, 0 to 8% slopes; San Joaquin silt loam, 0 to 3% slopes; and San Joaquin-Galt complex, 0 to 3% slopes. SSHCP Figure 3-6 illustrates the locations and area of modeled habitat within the Action Area. The SSHCP assumes that all Vernal Pool Ecosystem aquatic-landcovers included in the modeled habitat for legenere could be occupied by dormant seeds of the species.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified legenere recovery criteria for the Action Area. Recovery criteria include the permanent protection of most acres of legenere suitable habitat (i.e. Vernal Pool Ecosystem) in the Mather Core Area, the permanent protection of most suitable habitat (i.e. Vernal Pool Ecosystem) in the Cosumnes/Rancho-Seco Core Area; habitat management on all lands in those two Zone-1 Core Areas, the reintroduction of legenere to sites with soil types from which the species has been extirpated, and the collection of seeds from at least one population for seed banking (USFWS 2005a).

2.5.2.9 Pincushion Navarretia Environmental Baseline

Of the total 14 range-wide occurrences of pincushion navarretia, six occurrences (43%) are within in the Action Area. The species is uncommon and narrowly distributed in the Action Area. All occurrences of pincushion navarretia are outside the UDA in the southeast portion of the Action Area (PPU-7)]. Most of the Action Area occurrences are within the 12,500-acre Howard Ranch Preserve, which is managed by The Nature Conservancy as part of the Cosumnes River Watershed Project.

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 48 vernal pools or swales where pincushion navarretia has been documented in the Action Area. All 48 locations for pincushion navarretia are located within in the southeast corner of the Action Area in PPU-7 (Final SSHCP Table 3-6 and SSHCP Figure 3-7). However, much of the Action Area has not been surveyed for the species, and the total number of occupied vernal pool and swales is unknown. Because of its small stature, presence in small to medium sized vernal pools, and the amount of unsurvey or partially surveyed suitable-habitat, a moderate to high potential exists for discovery of additional populations of pincushion navarretia within the Action Area.

Due to the programmatic nature of the SSHCP, the environmental baseline for the species relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.2. Pincushion navarretia occupies smaller and/or shallower vernal pools on high-terrace geologic formations possessing acidic soils. In Sacramento County and the Action Area, pincushion navarretia is associated primarily with the Mehrten, Valley Springs, and Ione geological formations (Final SSHCP Figures 2-3 and 3-7). The SSHCP analysis of occurrences in the region suggests that pincushion navarretia occurrences in the Action Area are associated with Amador-Gillender complex, Corning complex, Corning-Redding complex, Creviscreek sandy loam, Hadselville-Pentz complex, Hicksville sandy clay loam, Pardee-Rancho-Seco complex, Pentz-Lithic Xerorthents complex, and Redding gravelly loam soil types. SSHCP landcovers that provide suitable habitat based on life history of pincushion navarretia are Vernal Pool and Swale. Vernal pools are their primary habitat in the Action Area, but Swales may also provide suitable habitat as pincushion navarretia appears to prefer short inundation periods. Because Vernal Pools and Swales are dependent on surrounding uplands, the Valley Grassland landcover is also considered suitable habitat for this species. Therefore, modeled habitat for pincushion navarretia is considered to be all Vernal Pool, Swale, and Valley Grassland landcovers on Amador-Gillender complex, 2% to 15% slopes; Corning complex, 0 to 8% slopes; Corning-Redding complex, 8% to 30% slopes; Creviscreek sandy loam, 0 to 3% slopes; Hadselville-Pentz complex, 2% to 30% slopes; Hicksville sandy clay loam 0 to 2% slopes; Pardee-Ranchoseco complex, 3% to 15% slopes; Pentz-Lithic Xerorthents complex, 30% to 50% slopes; and Redding gravelly loam, 0 to 8% slopes. SSHCP Figure 3-7 illustrates the locations of modeled habitat and occurrences of pincushion navarretia within the Action Area. The SSHCP assumes that all Vernal Pools and Swales included in modeled habitat for pincushion navarretia could be occupied by individuals or dormant seeds of the species.

2.5.2.10 Slender Orcutt Grass Environmental Baseline

Three occurrences of slender Orcutt grass are documented in Sacramento County (CNDDB 2018), all within the SSHCP UDA portion of the Action Area. The Sacramento County occurrences are disjunct from the rest of the slender Orcutt grass range. The occurrences in the Action Area represent an outlier population, where species evolution is often active (Fugate 1992; Fugate 1998; Gonzales et al.1996; Ikeda and Schlising 1990). In other parts of its range, slender Orcutt grass is found primarily on substrates of volcanic origin (USFWS 2003a), but in Sacramento County slender Orcutt grass is associated with the high alluvial terraces of the Laguna geologic formation and with Redding soils, which are unique landforms and soils for this species (see Final SSHCP Figures 3-9, 5-2, and 5-3). Therefore, the Action Area population of slender Orcutt grass may be essential to ensuring the genetic and geographic distribution of the species, and may be necessary for its long-term conservation

The SSHCP's review of records and species-surveys conducted within the Action Area identified four vernal pool features occupied by slender Orcutt grass. One occupied vernal pool is in PPU-1 (in the small Montelena Wetland Preserve), and three occupied vernal pools are in PPU-3 (on parcels of vernal pool grassland located east of Excelsior and north of Calvine Roads). All of the Action Area occurrences are also within the Mather Core Area. SSHCP Figure 3-9 shows locations of the four document occurrences in the Action Area. However, many of the Action Area's vernal pools have not been surveyed for slender Orcutt grass, and the total number of occupied vernal pools is unknown.

Due to the programmatic nature of the proposed action, the environmental baseline for slender Orcutt grass in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.1. Slender Orcutt grass is a vernal pool endemic and is strongly adapted to the hydrologic cycles encountered in the deeper spectrum of vernal pools. Slender Orcutt grass is associated with larger, or deeper vernal pools that tend to possess more extreme regimes of inundation (Crampton 1959; Griggs 1974). Within Sacramento County, slender Orcutt grass is associated with soils in the Redding soil series, which are found on the high alluvial terraces of the Laguna geologic formation. The SSHCP landcover that provides suitable aquatic habitat for slender Orcutt grass is the Vernal Pool landcover. Because Vernal Pool hydrology and ecology are dependent on surrounding uplands, the hydrologically connected Valley Grasslands are also considered suitable habitat for this species. Therefore, SSHCP modeled habitat for slender Orcutt grass is all Vernal Pool and Valley Grassland landcovers found on Redding gravelly loam, 0 to 8% slopes. SSHCP Figure 3-9 illustrates the locations of modeled habitat for slender Orcutt grass within the Action Area. The SSHCP assumes that all Vernal Pools in the modeled habitat for slender Orcutt grass could be occupied by individuals or dormant seeds of the species. The primary factors responsible for the condition of the modeled habitat in the Action Area were discussed above in Section 2.5.2.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified slender Orcutt grass recovery criteria for the Action Area. Species recovery criteria include the permanent protection of most acres of slender Orcutt grass suitable habitat (i.e. Vernal Pool Ecosystem) in the Mather Core Area; habitat management on all lands in the Mather Core Areas, the reintroduction of slender Orcutt grass to sites with soil types from which the species has been extirpated, and the collection of seeds from each Mather Core Area population for seed banking (USFWS 2005a).

<u>Slender Orcutt Grass Critical Habitat Environmental Baseline</u>

One slender Orcutt grass Critical Habitat Unit, Unit-6, is present in the Action Area. The 1,161-acre Critical Habitat Unit-6 is within the boundaries of SSHCP PPU-2, inside the SSHCP UDA. The 1,161-acre Critical Habitat Unit-6 is also within the 24,335-acre Mather Core Area (discussed in Section 2.5.2 above). Critical habitat Unit-6 is the only slender Orcutt grass critical habitat unit located within in Sacramento County. Slender Orcutt grass Critical Habitat Unit-6 was not occupied at the time of listing (USFWS 2006a).

As discussed in Section 2.3.5.2 above, SSHCP recognized that the SSHCP Vernal Pool, Swale, and Stream/Creek-VPIH landcovers cannot exist in isolation of the surrounding Valley Grassland uplands, which provide the seasonal hydrology, water chemistry, and related abiotic factors that provide habitat functions for vernal pool species. Consequently, the SSHCP addresses these four landcovers together as a single Vernal Pool Ecosystem. The SSHCP's definition of the Vernal Pool Ecosystem describes the same physical and biological features essential for the conservation of slender Orcutt grass (primary constituent elements, or PCEs) that were the basis for determining the habitat to critical (see Section 2.5.1.10 above). The two PCEs specific for slender Orcutt grass Critical Habitat are:

1) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the vernal pools, providing for dispersal and promoting hydroperiods of adequate length in the pools. PCE#1 is describing the same physical features present in the hydrologically and ecologically connected Valley Grasslands, Swales, Vernal Pools, and Stream/Creek-VPIH) landcovers that the SSHCP analyzed together as the Vernal Pool Ecosystem.
2) Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water or whose soils are saturated for a period long enough to promote germination, flowering, and seed production of predominantly annual native vernal pool wetland species and typically exclude both native and nonnative upland plant species in all but the driest years. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands. PCE#2 is describing the same physical and biological features present in the hydrologically and ecologically connected Valley Grasslands and depressional features (including Vernal Pools, Swales, and Stream/Creek-VPIH) that the SSHCP analyzed together as the Vernal Pool Ecosystem.

Critical Habitat Unit-6 was designated as critical habitat for slender Orcutt grass because it supports the physical and biological features essential for the conservation of the species and is at the southern extent of the species range (CNDDB 2018). Critical Habitat Unit-6 is over 105 miles from the nearest Critical Habitat units to the north, and 62 miles from the nearest Critical Habitat Unit to the west. The isolated and peripheral populations, such as the slender Orcutt grass occurrences found in the Action Area near Critical Habitat Unit-6, may be different from more central populations, and have genetic characteristics essential to the overall long-term conservation of the species (Lesica and Allendorf 1995). The boundaries of Unit-6 were delineated to include the interconnected pools, swales, and associated uplands that contribute to the filling and drying of the vernal pools where the species occur, and to maintain suitable periods of pool inundation, water quality, and soil moisture for slender Orcutt grass germination and reproduction (USFWS 2003a).

Slender Orcutt grass Critical Habitat Unit-6 is located within Critical Habitat Unit-8 for vernal pool tadpole shrimp and Critical Habitat Unit-13 for vernal pool fairy shrimp, and coincides with Critical Habitat Unit-2 for Sacramento Orcutt grass. Other sensitive vernal pool species present within slender Orcutt grass Critical Habitat Unit-6 include California linderiella, legenere, Bogg’s Lake hedge-hyssop, Ahart’s dwarf rush, and western spadefoot toad.

The north portion of slender Orcutt grass Critical Habitat Unit-6 is divided by an existing road (Kiefer Boulevard). North of Kiefer Boulevard, approximately 99 acres (9%) of slender Orcutt grass Critical Habitat Unit-6 is within the existing 1,342-acre Mather Field Wetlands Preserve (Final SSHCP Figures 6-2 and 7-3). Within the Mather Field Wetlands Preserve, special management of the physical and biological features (primary constituent elements) that are essential for the conservation of slender Orcutt grass will be provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

Since the designation of slender Orcutt grass Critical Habitat (USFWS 2006a), urban development projects have been implemented within the boundaries of Critical Habitat Unit-6. SSHCP landcover mapping determined that approximately 40 acres (3%) of Critical Habitat Unit-6 is currently a developed landcover, a farmland landcover, or another landcovers that does not possess the physical and biological features (primary constituent elements) essential to the conservation of slender Orcutt grass (see above).

SSHCP landcover mapping also determined that approximately 1,121 acres (97%) of the 1,161-acre Critical Habitat Unit-6 are Vernal Pool Ecosystem landcovers, on which are found the physical and biological features (primary constituent elements) essential to the conservation of slender Orcutt grass, and were the basis for determining the habitat to critical.

Of the 1,121 acres of Vernal Pool Ecosystem within in Critical Habitat Unit-6, approximately 99 acres (9%) are protected in the existing 1,342-acre Mather Field Wetland Preserve. The 99 acres of existing preserves in Critical Habitat Unit-6 are presumed to be managed with prescriptive livestock grazing and other land management actions that benefit of Vernal Pool Ecosystem functions and vernal pool species. Therefore, approximately 1,022 acres (91%) of the 1,121 acres of Vernal Pool Ecosystem present in Critical Habitat Unit-6 are currently not managed for the protection or management of the physical and biological features essential for the conservation of slender Orcutt grass.

2.5.2.11 Sacramento Orcutt Grass Environmental Baseline

Sacramento Orcutt grass is endemic to Sacramento County. The SSHCP Action Area supports 8 of the total 12 known occurrences for Sacramento Orcutt grass (CNDDB 2018). All but one of the eight Action Area known occurrences are in the north half of the Action Area, within the SSHCP UDA (Witham 2013; CNDDB 2018).

Within SSHCP PPU-1 (in the eastern half of the north UDA), Sacramento Orcutt grass occurrences are known from four general areas. The most individual plants and highest density of occupied vernal pools occur on the Kiefer Landfill Wetland Preserve and bufferlands, which is protected and managed for conservation values (CNDDB occurrence numbers # 1 and #6). The second area is the Anatolia Preserve, where two Sacramento Orcutt grass occurrences are protected and managed for conservation value (CNDDB numbers #17 and #18). The third area is located east of Grant Line Road, and is within the footprint of the Cordova Hills Specific Plan[13] (see Final SSHCP Appendix K) (CNDDB occurrence numbers #19 and #21). The fourth area is on the northern border of PPU-1 near White Rock Road, and is within the planned Heritage Falls development (CNDDB number #22).

Within SSHCP PPU-3 (near the center of the north SSHCP UDA), a single occurrence of Sacramento Orcutt grass was known from the Arroyo Seco Preserve, a wetlands mitigation bank (CNDDB occurrence #20). This occurrence is now extirpated from unseasonal urban-runoff and flooding from a nearby nursery (Witham 2013).

[13] As noted in section 1.0 of this Opinion, the Service issued a "SSHCP on-ramp" biological opinion for the Cordova Hills Specific Plan in December 2016, and the USACE issued CWA 404 authorization to the Cordova Hills Specific Plan in February 2017.

Outside the UDA portions of the Action Area, Sacramento Orcutt grass is known from one occurrence in PPU-7, which is protected by a temporary conservation easement on the Rancho-Seco Lake Preserve (CNDDB #16). This occurrences is owned and managed for conservation value by the Sacramento Municipal Utility District. Witham (2013) states that the occurrence at the Rancho-Seco Lake Preserve is now known to be an introduction.

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 40 individual Action Area vernal pool features where Sacramento Orcutt grass has been documented (including both extant and extirpated occurrences)(Final SSHCP Table 3-6). These records include 10 vernal pools within the UDA boundary (8 occupied pools within PPU-1 and 2 extirpated pools within PPU-3). The SSHCP identified 30 vernal pools just outside the UDA boundary with records for Sacramento Orcutt grass, including 28 vernal pools within PPU-1 (i.e. vernal pools in the Kiefer Landfill Wetland Preserve with extant or extirpated occurrences). Outside the UDAs, Sacramento Orcutt grass is documented in two vernal pools at the Rancho-Seco Lake Preserve in PPU-7. However, many of the Action Area's vernal pools have not been surveyed for Sacramento Orcutt grass, and the total number of occupied vernal pools is unknown.

Due to the programmatic nature of the proposed SSHCP, the environmental baseline for Sacramento Orcutt grass in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.1. Sacramento Orcutt grass appears to be the most specific of the genus Orcuttia with regard to niche breadth, and is restricted to large vernal pools (Stone et al. 1988). SSHCP analysis of occupied vernal pools suggests that Sacramento Orcutt grass is associated with specific Sacramento County soils, including the Corning complex; Hicksville sandy clay loam; Red Bluff-Redding complex; and Redding gravelly loam. Based on Sacramento Orcutt grass life history, the only SSHCP aquatic landcover that provides suitable habitat is the Vernal Pool landcover. Because Vernal Pools are dependent on surrounding uplands, the Valley Grassland landcover is also considered suitable habitat for this species. Therefore, SSHCP modeled habitat for Sacramento Orcutt grass is all Vernal Pools and hydrologically-linked Valley Grassland landcovers that are present on the Corning complex 0 to 8% slopes; Hicksville sandy clay loam 0 to 2% slopes; Red Bluff-Redding complex 0 to 5% slopes; and Redding gravelly loam 0 to 8% slopes soil-types. SSHCP Figure 3-8 illustrates the location and areas of modeled habitat for Sacramento Orcutt grass within the Action Area. The SSHCP assumes that all of the Vernal Pool landcovers included in modeled habitat for Sacramento Orcutt grass could be occupied by dormant seeds of the species.

The Vernal Pool Ecosystem Recovery Plan (USFWS 2005a) identified Sacramento Orcutt grass recovery criteria for the Action Area. Species recovery criteria include the permanent protection of most acres of Sacramento Orcutt grass suitable habitat (Vernal Pool Ecosystem) in the Mather Core Area; the permanent protection of most acres of Sacramento Orcutt grass suitable habitat (Vernal Pool Ecosystem) in the Cosumnes/Rancho-Seco Core Area, habitat management on all lands in the Mather Core Area and the Cosumnes/Rancho-Seco Core Area, and the collection of seeds from each Sacramento Count population for seed banking (USFWS 2005a).

Sacramento Orcutt Grass Critical Habitat Environmental Baseline

As discussed in Section 2.5.11 above, three critical habitat units for Sacramento Orcutt grass were established within the very limited range of the species (USFWS 2006a). Sacramento Orcutt grass Critical Habitat Unit-2 and Critical Habitat Unit-3 are within the Action Area.

As discussed in Section 2.3.5.2 above, SSHCP recognized that the SSHCP Vernal Pool, Swale, and Stream/Creek-VPIH landcovers cannot exist in isolation of the surrounding Valley Grassland uplands, which provide the seasonal hydrology, water chemistry, and related abiotic factors that provide habitat functions for vernal pool species. Consequently, the SSHCP addresses these four landcovers together as a single Vernal Pool Ecosystem. The SSHCP's definition of the Vernal Pool Ecosystem describes the same physical and biological features described by the primary constituent elements (PCEs) that were the basis for determining Sacramento Orcutt grass habitat to critical, and are essential for the conservation of the species (see Section 2.5.1.11 above). The two PCEs specific for Sacramento Orcutt grass Critical Habitat are:

1) Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the vernal pools, providing for dispersal and promoting hydroperiods of adequate length in the pools. PCE#1 is describing the same physical features present in the hydrologically and ecologically connected Valley Grasslands, Swales, Vernal Pools, and Stream/Creek-VPIH landcovers that the SSHCP analyzed together as the Vernal Pool Ecosystem.
2) Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water or whose soils are saturated for a period long enough to promote germination, flowering, and seed production of predominantly annual native vernal pool wetland species and typically exclude both native and nonnative upland plant species in all but the driest years. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands. PCE#2 is describing the same physical and biological features present in the hydrologically and ecologically connected Valley Grasslands and depressional features (including Vernal Pools, Swales, and Stream/Creek-VPIH) that the SSHCP analyzed together as the Vernal Pool Ecosystem.

Critical Habitat Unit-2. The 1,161-acre Sacramento Grass Critical Habitat Unit-2 is within the boundaries of SSHCP PPU-2, inside the SSHCP UDA. The 1,161-acre Critical Habitat Unit-2 is also within the 24,335-acre Mather Core Area (discussed in Section 2.5.2 above). The boundaries of Critical Habitat Unit-2 are within the central-population center of Sacramento Orcutt grass defined by Witham 2013 (see Section 2.5.1.11 above), but Unit-2 was not occupied at the time of critical habitat listing.

Critical Habitat Unit-2 was designated as critical habitat for Sacramento Orcutt grass because it includes relatively undisturbed, hydrologically intact vernal pool habitats on Redbluff and Redding soils that could continue to support natural vernal pool ecosystem processes and maintain suitable habitat conditions for Sacramento Orcutt grass to complete germination and reproduction. The boundaries of Critical Habitat Unit-2 were delineated to include the interconnected pools, swales, and associated uplands that contribute to the filling and drying of the vernal pools, and maintain suitable periods of pool inundation, water quality, and soil moisture for Sacramento Orcutt grass germination and reproduction. The vernal pool grassland habitats within and near Critical Habitat Unit-2 area have been identified by the Sacramento Valley Open Space Conservancy, the California Native Plant Society, and The Nature Conservancy as excellent examples of vernal pool grassland habitat, supporting a rich and diverse community of vernal pool endemic plants and animals within Sacramento County (USFWS 2003a).

Sacramento Orcutt grass Critical Habitat Unit-2 is within Critical Habitat Unit-8 for vernal pool tadpole shrimp and Critical Habitat Unit-13 for vernal pool fairy shrimp, and coincides with Critical Habitat Unit-6 for Sacramento Orcutt grass. Other sensitive vernal pool species located within Sacramento Orcutt grass Critical Habitat Unit-2 include California linderiella, legenere, Bogg's Lake hedge-hyssop, Ahart's dwarf rush, and western spadefoot toad.
The north portion of Sacramento Orcutt grass Critical Habitat Unit-2 is divided by an existing road (Kiefer Boulevard). North of Kiefer Boulevard, approximately 99 acres (9%) of Sacramento Orcutt grass Critical Habitat Unit-2 is within the existing 1,342-acre Mather Field Wetlands Preserve (Final SSHCP Figures 3-41, 6-1, and 7-3). Within the Mather Field Wetlands Preserve, special management of the physical and biological features (primary constituent elements) that are essential for the conservation of Sacramento Orcutt grass will be provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

Since the designation of Sacramento Orcutt grass Critical Habitat (USFWS 2006a), urban development projects have been implemented within the boundaries of Critical Habitat Unit-2. SSHCP landcover mapping determined that approximately 40 acres (3%) of Critical Habitat Unit-2 is currently a developed landcover, a farmland landcover, or another landcovers that does not possess the physical and biological features (primary constituent elements) essential to the conservation of Sacramento Orcutt grass (see above).

SSHCP landcover mapping also determined that approximately 1,121 acres (97%) of the 1,161-acre Critical Habitat Unit-2 are Vernal Pool Ecosystem landcovers, on which are found the physical and biological features (primary constituent elements) essential to the conservation of Sacramento Orcutt grass, and were the basis for determining the habitat to critical.

Of the 1,121 acres of Vernal Pool Ecosystem within in Critical Habitat Unit-2, approximately 99 acres (9%) are protected in the existing 1,342-acre Mather Field Wetland Preserve. Vernal pool grasslands within the Mather Field Wetlands Preserve (including the 99 acres that are within Critical Habitat Unit-2) are managed with prescriptive livestock grazing and other land management actions, as described in the South Mather Wetlands Management Plan (County of Sacramento 2014).

Approximately 1,022 acres (91%) of the 1,121 acres of Vernal Pool Ecosystem present in Critical Habitat Unit-2 are not preserved, and currently are not managed for the protection or consideration of the physical and biological features essential for the conservation of Sacramento Orcutt grass.

Critical Habitat Unit-3. The large 32,086-acre Sacramento Orcutt grass Critical Habitat Unit-3 is located in Amador County and in the southeastern portion of the Action Area in Sacramento County. Sacramento Orcutt grass Critical Habitat Unit-3 was designated as critical habitat for Sacramento Orcutt grass, in part, because it represents one of only three areas where this species occurs over its limited geographic range, and represents the southern extent of the species geographic range. The Sacramento Orcutt grass occurrences in Critical Habitat Unit-3 also occur in a relatively undisturbed high-terrace vernal pool complexes on Corning and Redding soils; Corning soils are not present in the other two critical habitat units for Sacramento Orcutt grass (USFWS 2002). Vernal pool complexes present in Critical Habitat Unit-3 also occur on relatively undisturbed, hydrologically intact landscapes with the natural vernal pool ecosystem processes that maintain suitable habitat conditions for the species, and provide vernal pools with the necessary timing and frequency of ponding that allow Sacramento Orcutt grass to germinate and reproduce (USFWS 2003a). The majority of lands within Critical Habitat Unit-3 are privately owned. Much of Sacramento Orcutt grass Critical Habitat Unit-3 is protected in existing preserves, including the

Schneider property and in the large Howard (Chase) Ranch Preserve, which are being managed for conservation value. The Clay Station Mitigation Bank and the Borden Ranch mitigation site are also located within Unit-3, as well as a number of smaller conservation areas, including the Rancho-Seco Lake Preserve and the L.V. Island Preserve (USFWS 2008b).
The 32,086-acre Sacramento Orcutt grass Critical Habitat Unit-3 is contained within the 37,093-acre Critical Habitat Unit-9 and Critical Habitat Unit-14 for vernal pool tadpole shrimp and vernal pool fairy shrimp, respectively. Other sensitive species found within Sacramento Orcutt grass Critical Habitat Unit-3 include Bogg's Lake hedge-hyssop, Ahart's dwarf rush, Henderson's bent grass, legenere, Sanford's arrowhead, pincushion navarretia, dwarf downingia, central California tiger salamander, western spadefoot toad, and California linderiella.

Most of the 32,086-acre Sacramento Orcutt grass Critical Habitat Unit-3 is located within the Action Area. However, a 2,210-acre portion of Sacramento Orcutt Critical Habitat Unit-3 extends into Amador County, and is outside of the Action Area. Therefore, only 29,876 acres (93%) of the total 32,086-acre Critical habitat Unit-3 is located in SSHCP PPU-7 and the Action Area. Of the total 29,876 acres of Sacramento Orcutt grass Critical Habitat Unit-3 present in the Action Area, the SSHCP has determined that approximately 14,154 acres (47%) are already protected within the existing preserves (Final SSHCP Figures 3-4, 6-1, and 7-3). Since the designation of Sacramento Orcutt critical habitat (USFWS 2006a), some vernal pool grasslands in Critical Habitat Unit-3 have been converted to vineyards, low-density development, irrigated pasture, and other anthropogenic landcovers that do not possess the physical and biological features essential to the conservation of Sacramento Orcutt grass (described above). SSHCP landcover mapping within the 29,876-acre portion of Critical Habitat Unit-3 that is in the Action Area identified approximately 1,780 acres of cropland, vineyards, development, and other anthropogenic landcovers. In addition, SSHCP landcover mapping identified approximately 2,420 acres of Blue Oak Savanna, Blue Oak Woodlands, Open Water, Streams/Creeks, and other natural landcovers within the portion of Critical Habitat Unit-3 that is in the Action AreUnit-3. In total, approximately 4,200 acres of Sacramento Orcutt grass not possess the physical and biological features essential to the conservation of Sacramento Orcutt grass. SSHCP landcover mapping identified approximately 25,675 acres of Vernal Pool Ecosystem landcovers within the 29,876-acre portion of Critical Habitat Unit-3 that is in the Action Area (85%). Of the existing 25,675 acres of Vernal Pool Ecosystem landcovers in Critical Habitat Unit-3 and the Action Area, the SSHCP has determined that approximately 11,724 acres (46%) are already protected within existing preserves located in SSHCP PPU-7 (Final SSHCP Figures 3-4, 6-1, and 7-3).

Most of the 11,724 acres of existing vernal pool grassland preserves in Critical Habitat Unit-3 are presumed to administer managed livestock grazing and other land management actions for the benefit of Vernal Pool Ecosystem functions, and certain vernal pool species. Therefore, approximately 13,951 acres of vernal pool grasslands within Critical Habitat Unit-3 are not currently managed for conservation value or to manage the physical and biological features essential for the conservation of Sacramento Orcutt grass.

2.5.3 SSHCP Effects Analysis Development

Because details of most individual Covered Activity projects are not known at the time of SSHCP preparation, and because Covered Activity projects and activities will be implemented over a 50-year Permit Term and in a large geographical area, the SSHCP programmatically estimated the adverse effects of all future SSHCP Covered Activities on SSHCP landcovers and Covered Species modeled habitats within the Action Area. Effects were not presented according to each category of SSHCP Covered Activity, but rather by the acres of each SSHCP natural landcover that will be affected.

Permanent Effects

Most Covered Activity effects to natural landcovers and species modeled habitats were identified by the SSHCP as permanent effects. A *permanent effect* will result when an area of natural landcover is converted to a developed landcover (removed/lost), or when an area of natural landcover is altered such that the habitat value of the landcover is removed for one year or more after completion of the Covered Activity. As discussed in SSHCP Chapter 6.2, permanent effects of Covered Activities include both direct and indirect effects to natural landcovers. ***Direct effects*** are the immediate effects caused by implementation of a Covered Activity. ***Indirect effect***s are caused by (or will result from) Covered Activities later in time, but are still reasonably certain to occur. Therefore, all SSHCP discussions of *permanent effects* also include the indirect effects expected to occur after Covered Activities are implemented, such as indirect changes to the wetland and habitat functions of vernal pools and other aquatic landcovers, or changes to ambient light and noise conditions within avoided species habitat. Most indirect effects of SSHCP Covered Activities (see Section 2.5.4 below are difficult to quantify, but are known to occur and are acknowledged by the SSHCP. Many of the SSHCP AMMs (see Section 2.1.5 above) were developed by the SSHCP to minimize the extent and severity of Covered Activity indirect effects.

To estimate permanent effects to natural landcovers and species modeled habitats in the UDAs, the SSHCP effects analysis assumed that all currently undeveloped lands that are zoned for urban development, or are ultimately planned/contemplated for future urban development by an adopted General Plan, will become developed over the 50-year Permit Term (i.e. the UDAs will be "fully built-out"). Consequently, the SSHCP effects analysis did not attempt to discern the effects of individual Covered Activity projects inside the UDA portions of the SSHCP Action Area, but assumed that all natural landcovers currently present inside the UDAs would be converted to a developed landcover(removed/lost)—except for natural landcovers located in: 1) existing UDAs preserves; 2) in SSHCP planned preserve; 3) in SSHCP planned Preserve Setbacks and Stream Setbacks; and 4) in the approximately 8,660 acres of fragmented natural landcovers within already-subdivided UDA parcels (defined as large-lot sizes of 0.5 to 4.5 acres, and located primarily west of Excelsior Road). However, to estimate permanent effects to natural landcovers outside the UDAs, the SSHCP effects analysis was able to spatially map the locations and the construction-footprints of the individual rural-transportation Covered Activity projects and the individual recycled-water pipeline Covered Activity projects listed in SSHCP Chapters 5.2.3 and 5.2.4.

The SSHCP quantified Covered Activity direct effects (i.e. expected conversion and loss of modeled habitats) using aerial photography and GIS technology to create digital maps of existing SSHCP landcovers in the Action Area (refer to Section 2.3.3 above), digital maps of modeled habitat for each Covered Species (refer to Section 2.3.6 above), digital maps of future urban-development areas inside the UDA, and digital maps of rural transportation and recycled-water projects outside the UDA. The SSHCP used GIS software to overlay and compare the digital maps, and to quantify the acres and locations of existing natural landcover and species habitat that will be directly impacted by the SSHCP Covered Activities. If the footprint of a future Covered Activity touched or overlaid any portion of an aquatic landcover, the SSHCP considered the entire area of that aquatic feature to be directly impacted.

In addition, the SSHCP effects analysis assumed that all Vernal Pool, Swale, and Stream/Creek-VPIH landcovers present within the SSHCP Stream Setbacks (established along Laguna Creek (North), Elder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, Sun Creek, and their first- and second-order tributaries) would be directly impacted during implementation of the UDA Covered Activities described in Chapter 5.2.1 of the Final SSHCP. However, the SSHCP effects analysis assumed that all Vernal Pool, Swale, and Stream/Creek-VPIH landcovers present in the minimum 50-foot wide Preserve Setbacks would not be directly or indirectly impacted by UDA Covered Activities, unless a trail or another Preserve Setback Covered Activity described in Chapter 5.2.5 of the Final SSHCP would be implemented inside a Preserve Setback. The SSHCP considered non-impacted upland landcovers within the future Preserve Setbacks and Stream Setbacks to be neither impacted nor preserved. SSHCP Chapter 6.4.2 provides a summary of the key assumptions used by the SSHCP effects analysis to quantify permanent direct-effects to Action Area natural landcovers and species modeled habitats.

Most direct effects to Action Area natural landcovers and species modeled habitats will occur inside the UDA from implementation of the urban development Covered Activities. Up to 32,054 acres of natural landcovers and species modeled habitat will be directly affected in the UDA, and up to 1,443 acres of natural landcovers and species modeled habitat will be directly affected outside the UDA portions of the Action Area (Final SSHCP page 6-63).

Most indirect effects to Action Area natural landcovers and species modeled habitats also will occur within the UDA, primarily where future urban development Covered Activities will abut natural landcovers and species modeled habitat inside existing UDA preserves and inside future SSHCP Preserves in the UDA. However, most types of indirect effects that could result from SSHCP Covered Activities (see Section 2.5.4 below) cannot be quantified using digitized aerial photography and GIS methodologies. Consequently, the SSHCP effects analysis provides descriptions and qualitative analyses of most indirect effects to natural landcovers (Final SSHCP Table 6-6). Nonetheless, the SSHCP was able to quantify acres of Vernal Pool, Swale, and Stream/Creek-VPIH landcovers (i.e. the Vernal Pool Ecosystem aquatic-landcovers) that would be indirectly affected by the implementation of SSHCP Covered Activities on hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem.

To quantify indirect effects of UDA Covered Activities on the existing hydrology of the Vernal Pool Ecosystem aquatic landcovers, the SSHCP first obtained Light Detection and Ranging (LiDAR) topographic imagery data, and utilized existing ArcGIS software (see Section 2.3.3.1 above) to delineate the surface micro-watersheds (i.e. the micro-watershed boundary) of vernal pools in existing UDA preserves, of vernal pools in planned UDA Preserves, and all vernal pools located within 250 feet of a rural transportation Covered Activity or a recycled water Covered Activity outside the UDA (see Final SSHCP Chapter 3.3.2, Chapter 6.3.1, Chapter 6.4.2, and Appendix E). Using the methodology discussed in Section 2.3.3.1 above), the SSHCP delineated approximately 6,089 individual vernal pool micro-watersheds inside the UDA and approximately 1,100 vernal pool micro-watersheds outside the UDA. In general, vernal pools located on the relatively flat "high-terrace plateaus" had smaller micro-watersheds (less surface area), while vernal pools located on slopes or lower on the landscape had larger micro-watersheds with larger surface areas. In addition, the micro-watersheds of individual vernal pools in lower positions on a landscape frequently encompassed (i.e. overlapped or "nested") the smaller micro-watersheds of vernal pools located higher in the same landscape. The size of a typical vernal pool micro-watershed delineated in the Action Area was approximately 0.83 acres in size. The SSHCP used GIS methodology and digital maps and identify where footprints of future Covered Activities would occur inside the delineated micro-watershed of an individual vernal pool. The SSHCP determined that where future Covered Activities would overlap (intersect) 10% or more of a vernal pool surface watershed (i.e. 10% or more of a vernal pool micro-watershed), the hydrology and ecology of the Vernal Pool Ecosystem in that micro-watershed would change, resulting in permanent indirect effects to the existing habitat functions of the individual Vernal Pool. In addition, the SSHCP effects analysis determined that each Swale or each Stream/Creek VPIH feature that intersects or touches an indirectly-impacted Vernal Pool would also be indirectly-impacted (see Final SSHCP Chapter 6.4.2.2 and Appendix E).

The map of delineated vernal pool micro-watersheds also will be used during SSHCP implementation to help plan individual Covered Activity projects and minimize indirect impacts to Vernal Pool Ecosystem aquatic landcovers and habitats. In addition, the boundaries of SSHCP Preserves planned in the UDA will be established outside the delineated micro-watersheds of most vernal pools protected in UDA Preserves (Final SSHCP page 3-24; Chapter 3.3.2; SSHCP Chapter 7). As discussed above in Section 2.1.6, the SSHCP Conservation Strategy also will require minimum 50-foot wide setbacks between Preserve boundaries and adjacent urban development Covered Activities. The permanent Preserve Setbacks will remain in a natural state and function as a transition area between new urban development and preserved vernal pool grasslands (AMM EDGE-3). However, specific Covered Activities that have minimal ground disturbance may be allowed within SSHCP Preserve Setbacks (e.g. community trails, benches, shade structures, fencing, signs, Kiosks, low-velocity bio-retention swales, firebreaks, and some outdoor lighting), as specified in Final SSHCP Chapter 5.2.5. The SSHCP effects analysis also includes the assumption that placing SSHCP Preserve boundaries outside the delineated vernal pool micro-watersheds will avoid potential indirect effects of the adjacent urban-development Covered Activities on the existing seasonal hydrology of the Vernal Pool Ecosystem landcovers within UDA preserves, even without the required Preserve Setback buffers (see Final SSHCP page 7-106).

The SSHCP effects analysis assumes that each of the Covered Activity projects and activities implemented over the 50-year Permit Term will consistently and correctly implement the SSHCP AMMs required for that Covered Activity category and AMM required for the natural landcovers, species, and species modeled habitats that are within or near the Covered Activity project site, as described in SSHCP Chapter 5.4. The total acres of direct and indirect effects to each SSHCP landcover (presented in SSHCP Chapter 6 and Table 5 below) represent the conservative maximum ("worst-case") loss of each SSHCP natural landcover expected from implementing SSHCP Covered Activities over the Permit Term, and also represent the maximum acres of loss allowable to each SSHCP landcover.

Most effects to natural landcovers and species modeled habitats will result from urban development Covered Activities inside the UDA, and to a smaller extent from the transportation project and recycled water project Covered Activities located outside the UDA. Implementation of the SSHCP Conservation Strategy, including implementation of the Preserve System Covered Activities (Final SSHCP Chapter 5.2.7) will have few permanent effects on landcovers and modeled habitats. However, some Preserve System Covered Activities, especially the re-establishment or establishment of 1,787 acres of aquatic, riparian, and blue-oak woodland habitat may convert one natural landcover to a different natural landcover within the SSHCP Preserve System. However, there will be no net loss of natural landcovers in the Action Area from implementing the SSHCP Conservation Strategy and the Preserve System Covered Activities.

The limits on loss of each SSHCP natural landcover (Table 5 above) also describe and quantify the maximum acres of each Covered Species modeled habitat that can be converted to an unsuitable landcover (i.e. removed/lost) over the Permit Term. These limits on loss also define limits allowed within the recovery Core Areas designated in the Action Area (including the Mather Core Area and the Cosumnes/Rancho-Seco Core Area), and define limits allowed within designated Critical Habitat in the Action Area (i.e. critical habitat units designated for vernal pool fairy shrimp, vernal pool tadpole shrimp, Sacramento Orcutt grass, slender Orcutt grass, and central California tiger salamander). These maximum amounts of SSHCP landcover and species modeled habitat loss will be taken into consideration when assessing a jeopardy determination, as discussed above in Section 2.4.1, and when assessing an adverse modification determination, as discussed above in Section 2.4.2.

Table 5. Permanent Loss of SSHCP Natural Landcovers in the Action Area (acres)

Landcover	Direct Effects	Indirect Effects	Total Acres Affected	Acres Available in Action Area	Percent
Aquatic Landcovers					
Vernal Pool	389	94	483	4,536	11%
Swale	234	44	278	1,252	22%
Seasonal Wetland	105	Qualitative[a]	105	2,600	4%
Freshwater Marsh	127	Qualitative	127	2,954	4%
Streams/Creeks (VPIH)	22	4	26	73	36%
Streams/Creeks	117	Qualitative	117	2,778	4%
Open Water	155	Qualitative	155	2,344	7%
Mixed Riparian Woodland	184	Qualitative	184	5,856	3%
Mixed Riparian Scrub	189	Qualitative	189	1,454	13%
Mine Tailing Riparian Woodland	218	Qualitative	218	641	34%
Valley Grassland (in Vernal Pool Ecosystem)	16,472	Qualitative	16,472	97,349	17%
Terrestrial Landcovers					
Valley Grassland (Outside of Vernal Pool Ecosystem)	5,542	Qualitative	5,542	37,803	15%
Blue Oak Woodland	9	Qualitative	9	9,132	0.1%
Blue Oak Savanna	38	Qualitative	38	5,637	1%
Cropland	5,285	Qualitative	5,285	51,829	10%
Irrigated Pasture-Grassland	2,749	Qualitative	2,749	15,991	17%
Orchards	207	Qualitative	207	3,907	5%
Vineyards	1,455	Qualitative	1,455	26,460	6%
Grand Total	33,497	142	33,639	272,596	12%

[a] most indirect effects could not be quantified using the GIS-based methods. Therefore, the SSHCP qualitatively described and assessed Covered Activity indirect effects to most landcovers. The SSHCP methodologies for assessing indirect effects to the existing hydrology of Vernal Pool Ecosystem landcovers is discussed in Sections 2.3.3.1 and 2.5.3 of this Opinion.

Temporary Effects

The SSHCP defined "temporary effects" of Covered Activities as effects that directly disturb or alter a natural landcover for less than one year, with habitat conditions in the disturbed area recovering, or being restored to, pre-project conditions within one year of completing the ground disturbance. Temporary environmental stressors associated with construction of Covered Activities (Final SSHCP Chapter 6.3.2) have the potential to directly affect natural landcovers located outside the footprint of a Covered Activity project site. However, no acres of temporary effects were quantified by the SSHCP because the SSHCP effects analysis assumed that: (1) all temporary ground disturbance (equipment movement, staging areas, etc.) would occur within the footprint of areas that the SSHCP determined would be permanently affected over the Permit Term; and (2) the extent of other temporary construction disturbances (e.g. noise and dust) would be effectively contained by the SSHCP AMMs, such that natural landcovers within adjacent preserves and other open-spaces would not be affected (Final SSHCP Table 6-7). Similarly, the SSHCP assumed that future operation and maintenance of SSHCP Covered Activities would only occur within the footprints of areas already permanently affected, and would not result in additional disturbance to natural landcovers or Covered Species modeled habitat. Consequently, the SSHCP did not quantify or analyze Covered Activity temporary-effects separately from the Covered Activity permanent-effects presented in Final SSHCP Table 6-4, and repeated as Table 5 of the Opinion:

2.5.4 General Effects of the Actions on All Covered Species

The effects of the Service's proposed action (the issuance of an ITP for implementation of the SSHCP) and the effects of the USACE's proposed action (the authorization and implementation of the SSHCP CWA 404 Permit Strategy) are inherent in the scope of effects that will result from the prospective Permittees' implementation of the SSHCP. Therefore, the effects of Service's federal action and the effects of the USACE's federal action are combined in this ESA section 7 consultation.

To minimize repetition in this Opinion, we use a three-tiered approach to describe the effects of the SSHCP on each Covered Species. Each tier of analysis builds upon the previous tier. This Section (Section 2.5.4) represents the broadest level of the effects analysis. Section 2.5.4 provides an overview of the methods by which SSHCP Covered Activities will adversely affect all SSHCP Covered Species, including the different physical, chemical, and biotic environmental stressors that will be generated by Covered Activities. Section 2.5.4 also provides overviews of the avoidance measures, minimization measures, and environmental subsidies that will be implemented at a regional level by the SSHCP Conservation Strategy, for the benefit all SSHCP Covered Species.

The second tier of our effects analysis focuses on general effects of the SSHCP Covered Activities and Conservation Strategy on the different groups of Covered Species addressed in this Opinion (see Section 2.0 above). General effects of the SSHCP on the vernal pool Covered Species group are presented in Section 2.5.5 below; general effects on the aquatic Covered Species group are presented in Section 2.6.3 below, and general effects on the avian Covered Species group are discussed in Section 2.7.3 below.

The third and most focused level of our effects analysis is at the level of the individual Covered Species. Each Covered Activity environmental stressor will affect Covered Species differently, and the intensity, spatial distribution, frequency, and temporal distribution of each environmental stressor will vary within the Action Area boundaries. The implementation of the SSHCP Conservation Strategy within the Action Area also will benefit Covered Species differently. We measured SSHCP effects on individual Covered Species by assessing the probable exposure of each species to the different environmental stressors and the different environmental subsidies generated by the SSHCP, and then determine the probable response of each Covered Species to those exposures. The effects of the Action on the10 individual vernal pool Covered Species is presented in in Section 2.5.6 below; the effects of the Action on the 5 individual aquatic Covered Species is presented in Section 2.6.4 below; and the effects of the Action on the 9 avian Covered Species is presented in in Section 2.7.4 below. In addition, the effects of the Action on valley elderberry longhorn beetle, American badger, and western red bat are presented below in Sections 2.8.3, 2.9.4, and 2.10.3, respectively. To avoid repetition, the general manner in which the SSHCP will affect all Covered Species (described next in Sections 2.5.4.1 and 2.5.4.2), are not be repeated in the effects analysis of the individual SSHCP Covered Species.

2.5.4.1 Covered Activity Environmental Stressors (Effect Mechanisms)

As the SSHCP Covered Activities (see Section 2.1.4 above and Final SSHCP Chapter 5.2) are implemented (constructed, maintained, and operated) in the Action Area, the Covered Activities will generate physical, chemical, and biotic environmental stressors. The environmental stressors generated by each of the eight categories of SSHCP Covered Activities could directly or indirectly result in the death, injury, or harm of SSHCP Covered Species. A list of the different environmental stressors generated by each category SSHCP Covered Activities is presented in SSHCP Table 6-1, and SSHCP Chapter 6.3.

The SSHCP Conservation Strategy includes 50 General AMMs and 67 Species AMMs (see Section 2.1.5 above and Final SSHCP Chapter 5.4). Most General AMMs were developed by the SSHCP to avoid or minimize direct and indirect effects of Covered Activity environmental stressors on natural landcovers and Covered Species habitats at the landscape or regional scale. Because most General AMMs apply to all SSHCP Covered Activities and provide benefits to all SSHCP Covered Species, many of the General AMMs are discussed here in Section 2.5.4. The Species AMMs developed by the SSHCP will be implemented at individual Covered Activity project sites when Covered Species modeled habitat is present. Because the SSHCP Species AMMs will be implemented at the scale of an individual project, most Species AMMs are not be discussed here in Section 2.5.4.

Conversion of Natural Landcovers and Species Habitat

A primary effect of all urban development Covered Activities (inside the UDA) and a primary effect of all rural transportation Covered Activities (outside the UDA) will be the direct conversion of existing natural landcovers to a developed landcover (Final SSHCP Chapter 6). Ground disturbance during the conversion of natural landcovers to developed landcovers will be the primary cause of death, injury, and harm of the SSHCP Covered Species. Covered Species individuals could be crushed, buried, exposed, injured, killed, or displaced by earthmoving equipment and activities. Covered Species individuals could be directly harmed by the removal of active foraging, breeding, and sheltering resources, or removal of lands used for movement, migration, or dispersal. In total, approximately 33,497 acres, or 12%, of the 272,596 acres of Action Area existing natural landcovers would be converted to a developed landcover (removed) over the proposed 50-year Permit Term. This includes approximately 32,054 acres of natural landcovers lost inside the UDAs, and approximately 1,443 acres of natural landcovers lost outside the UDAs (Final SSHCP page 6-63). Because all urban development Covered Activities will occur inside the UDA portions of the Action

Area, most acres of natural landcover conversion will occur inside the UDAs. Many of the SSHCP General AMMs will reduce the acres of natural landcovers converted to developed landcovers inside the UDAs.

A broad goal of the SSHCP is to preserve as much of the remaining UDA natural landcovers as possible, while still accommodating an amount of planned future growth, infrastructure, and economic development that is consistent with local General Plans (Final SSHCP Chapter 1.1). During the development of the SSHCP, the prospective Permittees reviewed Sacramento County planning documents to identify proposed locations of future water, wastewater, and recycled water supply pipelines planned in the UDA. The prospective Permittees worked with the County to relocate the planned pipeline alignments so that new pipelines will be built within an existing roadway footprint, or within areas that will not impact natural landcovers and Covered Species habitats (Final SSHCP page 5-6). The prospective Permittees also reviewed planning documents prepared by the Southeast Connector project and by the Sacramento County Department of Transportation to identify the proposed locations of future roadways inside the UDAs, and locations of rural transportation projects outside the UDAs. The alignment of urban roadways inside the UDAs and rural transportation Covered Activities outside the UDA were adjusted to shifted the roadway's footprint to reduce project impacts to natural landcovers and species modeled habitat.

The prospective Permittees also worked closely with the proponents of the five large Urban Development Master Plans planned inside the UDA (see Section 2.1.4 above) to adjust project designs and reduce loss of natural landcovers, to incorporate the relevant SSHCP General AMMs into the Urban Development Master Plan designs, and to maximize the size and ecological functions of the future SSHCP Preserves that will be adjacent to new development in the Master Plan site. The General AMM design refinements incorporated into the five large Urban Development Master Plans include:

- Use of trenchless methods to install sewer and water lines under preserves and sensitive natural landcovers to avoid loss of natural landcovers and species modeled habitat (AMM UTILITY-3, UTILITY-4).
- Locating road projects in the least environmentally sensitive areas, to avoid impacts on natural landcovers, Covered Species habitat, and waters of the United States. Transportation Covered Activity project alignments will follow existing roads, road easements, and rights-of-way, or be sited in disturbed areas to minimize habitat loss and additional habitat fragmentation (AMM ROAD-1).
- Placing construction staging sites inside the impact footprint of the Covered Activity to minimize loss of natural landcovers and Covered species habitat (AMM EDGE-4, AMM BMP-3).
- Requiring each Covered Activity to implement construction best management practices (AMM BMPs), including installation of construction fencing to ensure that Covered Activity ground disturbance does not extend beyond the boundary of each project footprint (AMM BMP-1).
- Requiring construction site biological monitors to assure that AMMs are correctly implemented (AMM BMP-7).
- Requiring training of construction staff (AMM BMP-8).
- Incorporating existing aquatic landcovers into the project design (AMM LID-3);
- Locating open spaces and on-site preserves in the project design to benefit to groundwater recharge (AMM LID-2);

- Designing livestock access in urban development next to planned SSHCP Preserves (AMM EDGE-9);
- Placing stormwater management facilities inside the project development area, and away from SSHCP Preserves (AMM EDGE-5).
- Using existing roads for access to Covered Activity sites (AMM EDGE-11).
- Minimizing human activity and disturbance on preserved natural landcovers (AMM NATURE TRAIL 3-5).

Fragmentation of Natural Landcovers and Species Habitat

The conversion of approximately 32,054 acres of natural landcovers inside the UDAs, and the conversion of approximately 1,443 acres of natural landcovers outside the UDAs to developed landcovers will further fragment the natural landcovers and Covered Species modeled habitat present in the Action Area. Habitat fragmentation is a discontinuity in the spatial distribution of resources and conditions present in an area. Habitat fragments are smaller than the whole, and thus have diminished resources and conditions to sustain viable populations of native species (Franklin et al. 2002). Inside the UDA, existing landscapes of natural landcovers will become fragmented by large areas of new urban development, new roadways, and the widening and improvement of existing roadways. Outside the UDAs, fragmentation of natural landscapes will increase slightly by the improvement and widening of sections of existing rural roadways, and the minor extension of one roadway (See Section 2.1.4 above).

Habitat fragmentation can affect native species several ways. Habitat fragmentation can adversely affect or block the movement and dispersal of individuals, as well as limiting or preventing the dispersal of seeds, plant pollinators, cysts, eggs, and other propagules within and between populations. Unoccupied habitat fragments that are separated from a source population are less likely to be repopulated, which has the potential to reduce the distribution and range of a native species.

Small and/or isolated habitat fragments typically support small, isolated populations of flora and fauna and are thus more vulnerable to stochastic events and extirpation. Populations of plant species or wildlife species can become isolated on a single habitat fragment, making the population vulnerable to negative demographic trends, including genetic bottlenecks, genetic drift, and inbreeding depression. In addition, isolated populations are more susceptible to stochastic (chance) events and environmental disturbance, when compared to populations located in larger, intact natural landcovers. If extirpation occurs, isolation of the habitat fragment prevents recolonization of the suitable habitat.

For these reasons, further habitat fragmentation in the Action Area would create smaller patches of modeled habitat that are less suitable for breeding, feeding, or sheltering of some SSHCP Covered Species. However, minimizing fragmentation of natural landcovers and habitats was a guiding principle of the SSHCP (Final SSHCP Chapter 7.1). The SSHCP Conservation Strategy will minimize habitat fragmentation and by maximizing the size of individual SSHCP Preserves, by preserving habitat connectivity between new and existing preserves throughout the SSHCP Action Area, and by locating SSHCP preserves on high-quality habitat between or adjoining existing preserves, which increases the habitat value of the individual SSHCP preserves. As summarized in Section 2.1.6 of this biological opinion, the minimum 36,282-acre interconnected SSHCP Preserve System will include a large 10,500-acre "Landscape Preserve" located outside the UDA. Inside the UDA, the Preserve System will include three interconnected "Core Preserves", each a minimum of

800 acres, and three large interconnected 250- to 800-acre "Minor Preserves." An additional 500 acres of existing Vernal Pool Ecosystem will preserved in or near the Mather Core Area as "flexible preserves," which connect to UDA's Core and Minor Preserves. In addition, ten "Satellite" preserves (11 to 160 acres in size) will be established inside the UDA to protect areas with important species populations or a particularly high concentration of sensitive biological resources (Final SSHCP Chapter 7.2.2, Chapter 7.5). The SSHCP Preserve System also will include eleven minimum 600-foot wide "Linkage Preserves," which will provide additional connectivity between preserves for wildlife movement and, in many cases, also maintain existing hydrological connections (Final SSHCP Chapter 7.5). As discussed in Section 2.1.6 above, the proposed SSHCP Preserve System also includes the Laguna Creek Wildlife Movement Corridor preserve, which will preserve habitat connectivity and wildlife movement across the width of the northern UDA. Outside the UDAs, The Cosumnes River Wildlife Movement Corridor will be established along the length of the Consumes River in PPU-5 to maintain habitat connectivity, wildlife movement, and hydrological connectivity between natural landcovers and preserves in eastern PPU-6, in PPU-5, in northeastern PPU-7and in southeastern PPU-1. The SSHCP Preserve Management and Monitoring Program (Final SSHCP Chapter 8) will maintain habitat quality and functions on each SSHCP Preserve using adaptive management processes.

New roadways inside the UDA, improvements to existing UDA roadways (including the Capital SouthEast Connector), and rural transportation Covered Activities outside the UDA have the potential to create new barriers and new hazards to wildlife movement and dispersal in the Action Area. Wildlife Covered Species that are able to cross existing two-lane, low-density, and lower-speed rural roadways with relative safety may not be able to cross improved roadways after the addition of traffic lanes, center medians, raised medians, or curbs. In addition, increased traffic capacity and traffic speeds on improved roads have the potential to increase vehicle strikes of wildlife species, resulting in death or injury of individuals. In general, risk of vehicle collisions are highest where wildlife attempt to cross new or improved roadways in areas used for wildlife movement before the road was constructed or improved (Dodd et al. 2004). Factors known to affect the type of wildlife species and number of individuals struck by vehicles include increased vehicle speed, increases in traffic volume, traffic pulses, changes in accessibility to vegetative cover, changes to the structure of the road (e.g., whether the road is raised or at grade level with the surrounding environment), the addition of barrier walls that prevent access to the roadway, and the availability of alternative crossing sites, such as bridges and culverts (Dodd et al. 2004). Therefore, an increased risk of vehicle collisions could occur for certain wildlife Covered Species where new roads are constructed, or where existing two lane roadways will be improved to four or six lanes, resulting in increased traffic densities and increased vehicle speeds (see Table 1b above). The General AMM design refinements for Covered Activities include an adequate number, adequate type, and adequate size of wildlife crossing structures in appropriate locations to provide continued dispersal and movement of native wildlife throughout the SSHCP Action Area (AMM ROAD-2, SSHCP Figure 5-10, and SSHCP Chapter 5.4.1).

The conversion and fragmentation of natural landcovers also affects the habitat functions of the remaining natural landcovers. As the patch-size of the intact natural landcover become smaller in size, the ratio of vulnerable edge area to interior-area increases in the habitat patch, especially within narrow or irregularly shaped patches. As the ratio of edge area increases, habitats and individuals in the interior-area become closer to and more exposed to the different environmental stressors generated by the urban development and other anthropogenic landcovers outside the habitat patch. Adverse effects to species individuals or species habitat functions in the edge area of a habitat patch are discussed as "edge effects" in this Opinion.

The SSHCP Conservation Strategy will minimize the amount of edge area in the SSHCP Preserve System by maximizing the size of individual SSHCP Preserves, by preserving habitat connectivity between new and existing preserves throughout the SSHCP Action Area, and by locating SSHCP preserves on high-quality habitat between or adjoining existing preserves to increase the habitat value of individual SSHCP preserve. The SSHCP General AMM design refinements incorporated into the urban development Covered Activities and rural transportation Covered Activities to minimize the amount of edge in the SSHCP Preserve System, and to and to minimize edge effects include:

- Urban development Covered Activity located adjacent to new or existing UDA preserves will include design features that reduce edge effects on preserved habitat, including locating compatible land uses (e.g. open spaces such as parks and ball fields, stormwater detention basins, and other land uses with less intensive human activity) next to any existing or planned habitat preserves (EDGE-1)
- Placing single-loaded streets between urban development and planned SSHCP Preserves (AMM EDGE-2);
- All urban development Covered Activity projects will include minimum 50-foot setbacks outward from the boundary of any existing or planned habitat Preserve. This minimum 50-foot wide Preserve Setback will provide space between preserved species habitat and the anthropogenic stressors that result from urban development. All Preserve Setbacks must be managed to maintain the natural landcover found on the adjacent habitat preserve. As much of the Preserve Setback as possible will remain as the same landcover and vegetation as the preserve (EDGE-3). The assumptions and the effectiveness of the SSHCP Preserve Setbacks will be tested and monitored in a Special Study (Final SSHCP Table 8-5).
- Activities that have the potential to cut into, disrupt, or remove the soil's restrictive layer (hardpan or duripan) will not occur within Preserves or Preserve Setbacks (EDGE-8).
- When an existing stream or creek is present in the footprint of a Covered Activity project, the project must include a 150-foot wide, a 100-foot wide, or a 25-foot wide setback measured outward from the top of the stream bank, as indicated in STREAM-1, STREAM-2, and STREAM-3 in SSHCP Chapter 5.4.1. These SSHCP Stream Setbacks will provide additional wildlife movement and dispersal corridors inside the UDA and maintain existing hydrologic connectivity.
- The SSHCP monitoring and mitigation program (Final SSHCP Chapter 8) will monitor SSHCP preserves in the UDA for edge effects, and preserve management will take corrective actions when edge effects are observed.

Environmental stressors generated by SSHCP Covered Activities may cause edge effects in the SSHCP Preserves, in existing preserves, and in other natural landcovers that border SSHCP Covered Activity sites. Potential edge effects from the SSHCP Covered Activities are discussed below, including increased colonization of invasive plants and animals, increased ambient noise, ground vibration, night time lighting, increased human presences and disturbance, increased wildfire frequency, changes to surface water runoff, increased sources of non-point pollution and exposure to pesticides, and changes to water quality. The SSHCP developed several General AMMs to avoid or minimize these Covered Activity edge effects to preserved or avoided natural landcovers, as discussed below.

Nonnative Invasive Plants

Ground disturbance from urban development, roadway projects, and water pipeline projects provide areas for colonization by non-native invasive plant species, which then can invade adjacent or nearby natural landcovers. Invasive plant species can outcompete and displace native plants, can displace native wildlife by removing habitat or by providing refuge for non-native animals, and can alter the ecosystem processes of natural landcovers, such as nutrient cycling, soil hydrology, and frequency of wildfires (Bossard et al. 2000). Because invasive plants frequently colonize lands adjacent to urban development, they are often described as an edge effect of development activities. However, invasive species can colonize any area, including road shoulders, utility easements, trails, fire breaks, burn areas, over-grazed lands, and under-grazed lands (Kleinschmidt Associates 2008). Disturbed landcovers are of special concern as they tend to harbor and facilitate the spread of invasive plant species.

A number of plant invasive species are already present and common within the Action Area. The SSHCP will maintain or improve habitat value of natural landcovers preserved in the Action Area by developing and implementing an Early Detection and Eradication Program for invasive species in the Action Area (SSHCP Objective HAB-4, Objective HAB-5). The SSHCP invasive species program will include regular weed assessment and mapping within the UDA, and a comprehensive weed detection and abatement plan for the Action Area, including roadside monitoring and removal of invasive plants in the Action Area and training of road crews to identify and report weed infestations.

As discussed further in Section 2.5.5 below, several invasive plant species with potential to affect vernal pools grasslands have been identified in the Action Area, including mannagrass (*Glyceria* ssp), barbed goatgrass (*Aegilops triuncialis*), Italian thistle (*Carduus pycnocephalus*), stinkwort (*Dittrichia graveolens*), Klamath weed (common St. Johnswort) (*Hypericum perforatum*), yellow glandweed (*Parentucellia viscosa*), Bermuda grass (*Cynodon dactylon*) and paradox canary grass (*Phalaris paradoxa*) (Sacramento County Department of Economic Development 2013). Vernal pool plant communities are able to resist invasion of nonnative plants in the portion of the pool that experiences prolonged inundation, where plants are severely constrained by the extreme wet and dry environmental conditions with which nonnative plants have not evolved (see Section 2.3.5 above). However, when nonnative grasses in the uplands are ungrazed for several years, vernal pool margins and swales experience microhabitat conversion, due primarily to shading from build-up of thatch. The thatch inhibits the germination of native annual plants, but has very little or no effect on the germination or growth of exotic grasses and forbs.

The SSHCP requires an invasive species management component for each Preserve Management Plan (PMP). For each SSHCP Preserve, an invasive plant species baseline condition will be established for each parcel as it is acquired and incorporated into the SSHCP Preserve System (Final SSHCP pages 11-35 and 11-36). Each Preserve PMP will include appropriate management tools for eradicating or controlling invasive plants and animals in that Preserve. Invasive plant eradication or control strategies may include site-specific grazing regimes, controlled burning protocols, and mowing/mechanical maintenance guidelines consistent with native plant re-establishment needs, invasive plant and wildlife removal, and consideration of endemic plant and wildlife species population needs (Final SSHCP Table 7-1). The long-term monitoring and the adaptive management of SSHCP Preserves will include grazing management to control thatch build-up and identification and control of invasive weeds. Quarterly weed assessments will be conducted on individual SSHCP Preserves so that new invasions are identified quickly, and are controlled or eradicated (Final SSHCP Tables 8-1, 8-3, 8-4), and weed assessments will be included in the SSHCP Annual reporting. The Service expects that all SSHCP Preserves located within the UDAs will be intensively monitored and managed to identify and address new or increased invasive weed infestations in the edge areas of the Preserves.

Each element of the SSHCP Conservation Strategy that minimizes loss and fragmentation of natural landcovers and minimizes edge effects also will minimize spread of invasive plant species in the Action Area. In addition, the following SSHCP General AMMs will further avoid or reduce the effect of invasive plants on natural landcovers and Covered Species modeled habitats:

- Any landscaping in or adjacent to Preserve Setbacks and Stream Setbacks will not include invasive plant species listed in the California Invasive Plant Council's (Cal-IPC) California Invasive Plant Inventory Database or listed in the Cal-IPC California Invasive Plant Watch List (AMM EDGE-3C).
- Before bringing any equipment onto an SSHCP Preserve, Preserve Setback, or Stream Setback, the equipment must be free of mud, dirt, and plant material. Equipment cleaning will occur outside the preserved area in an already infested area, or in another appropriate location as approved by a Plan Permittee (AMM EDGE-10).
- Any mowing in a completed Covered Activity (including roads) will begin the mowing rotation in un-infested areas and then move to any infested areas (AMM EDGE-10).
- Invasive plant prevention techniques will be incorporated into many Covered Activity maintenance plans (AMM EDGE-10.)
- The SSHCP Conservation Strategy includes roadside monitoring and removal of invasive plants in the Action Area. The SSHCP prospective Permittees will survey road shoulders, ditches, and rights-of-way that border SSHCP Preserves regularly for invasive weeds or other exotic plant species. Where roadside weed infestations have reached a critical control point, the appropriate SSHCP Permittee will apply the appropriate manual, mechanical, or chemical treatment (AMM EDGE-10). In addition, the appropriate SSHCP Permittees will post signs along road shoulders adjacent to sensitive areas that are within the SSHCP Preserve System to identify pesticide use restrictions and other roadside maintenance restrictions (AMM ROAD-3).
- Urban development projects that include on-site SSHCP Preserves will include in their design an adequate number of access points and facilities for delivery and pick up of grazing animals (livestock), which will minimize landcover disturbance at the access point, and minimize potential for invasive plant colonization (AMM EDGE-9).
- Fiber rolls and seed mixtures used for erosion control during implementation of ground disturbing Covered Activities will be certified as free of viable noxious weed seed (AMM BMP-2).
- SSHCP Permittees and Third Party Project Proponents implementing ground disturbing Covered Activities will revegetate disturbed areas and any cut-and-fill slopes with native or existing non-invasive, non-native plants (e.g., non-native grasses) suitable for the altered soil conditions (AMM BMP-10).
- Use of trenchless methods to install sewer and water lines under preserves and sensitive natural landcovers will avoid ground disturbance where invasive plants could become established (UTILITY-3, UTILITY-4).
- Project post-construction compliance report will be submitted to the prospective SSHCP Permittees within 30 calendar days of completion of construction activities. This report will

detail effectiveness of the measures used to avoid and minimize colonization or spread of invasive plants at the construction site.

Invasive plant species are a greater threat to the existing and future UDA preserves because these preserves will eventually be surrounded by urban development, and some UDA preserves will be bisected by a new or existing roadway. Because a number of invasive plant species are already present and common within the Action Area, it is unlikely that the invasive plant species can be wholly eradicated from all SSHCP Preserves, even with implementation of the SSHCP AMMs, SSHCP Objectives, and the Preserve monitoring and management measures described above. Existing nonnative invasive plant species likely will spread in the Action Area, and new nonnative invasive species may become introduced to SSHCP Preserves during the Permit Term. Therefore, the proposed SSHCP Permittees included nonnative invasive species as a potential Changed Circumstance for which the Permittees will fund remedial measures, as described in SSHCP Chapter 11.4.3. The proposed SSHCP Permittees did not identify any Unforeseen Circumstances for invasive plant species in the Action Area. Therefore, the SSHCP Permittees will address all invasive plant species establishment or population expansions that may occur in the SSHCP Preserve System (Final SSHCP Chapter 11.4.3.4).

In summary, although the spread of nonnative invasive plant species is likely in the Action Area, the implementation of the SSHCP's Conservation Strategy, the Conditions on Covered Activities, SSHCP AMMs, and remedial measures for Changed Circumstances will reduce the effect of invasive plant species such that obtaining each of the SSHCP Biological Goals and Biological Objectives would not be compromised. The effects of invasive plant species on individual SSHCP Covered Species are discussed in the species-specific effect discussions of this Biological Opinion (see Sections 2.5.6, 2.6.4, 2.7.4, 2.8.3 below).

Invasive Animals

The indirect consequences of habitat fragmentation can include increases in urban-adapted or urban-tolerant non-native and native wildlife species in the remaining natural landcovers, including increased populations of "mesopredators" such as raccoons (*Procyon lotor*) and skunks (*Mephitis mephitis*), along with non-native species (e.g., opossums (*Didelphimorphia*), rats *(Rattus spp.*), house mice (*Mus musculus*), bullfrogs (*Lithobates catesbeiana*), rock pigeons (*Columbia livia*), and feral cats and dogs (*Felis catus, Canis lupus familiaris).* These types of species can thrive in fragmented, disturbed, or otherwise marginal habitats, which may increase disease rates, predation rates, or they may out-compete smaller native species for resources, all of which can reduce population size and distribution of native species.

The SSHCP urban development Covered Activities will increase the number of pet cats and dogs in the UDAs, and increase the potential for stray and feral animals in the Action Area (Final SSHCP Chapter 6). Feral cats and unconstrained pets at the interface between habitat preserves and residential developments are known to be a serious predation threat to native birds, native rodents, reptiles, and amphibians (Churcher and Lawton 1987, Kelly and Rotenberry 1993), and lost or abandoned pets may penetrate even farther into preserves and open space areas in search of food or refugia, including native prey. Increases in "mesopredator" species in fragmented natural habitats are considered an edge effect, but some species can penetrate long distances into natural habitats (Soulé et al. 1988, Crooks and Soulé 1999, Prugh et al. 2009). Urban development may also increase the risk of disease transmission from domestic cats and dogs to native wildlife. Native wildlife in the Action Area, including American badger and coyote (*Canis latrans*), are at risk of contracting canine distemper (Deem et al. 2000). Diseases transmitted from humans and pets also may affect raptors, such as Cooper's hawk (*Accipiter cooperii*). Boal and Mannan (1999) found that mortality of nestling Cooper's hawks in urban settings primarily was from trichomoniasis, which is caused by the parasitic protozoan *Trichomonas gallinae* that occurs in the digestive and urogenital tracts of many animals and humans. An important vector of trichomoniasis in urban areas may be rock pigeons, which are preyed on by native hawks and falcons (Stabler 1941). West Nile virus has been identified as a potential factor in loggerhead shrike (*Lanius ludovicianus*) declines in the Central Valley (Pandolfino 2008).

Each element of the SSHCP Conservation Strategy that will minimize fragmentation of natural landcovers and provides setbacks between SSHCP Covered Activities and natural landcovers will help to minimize access of invasive animals to the interior of the SSHCP preserves. In addition, SSHCP Biological Objective HAB-4 includes the development and implementation of a detection and eradication program for invasive wildlife species in the Action Area. The baseline conditions of invasive wildlife species will be established for each SSHCP Preserve when the land is acquired, and each Preserve Management Plan will include an invasive-species management component that includes strategies for the removal of invasive wildlife species that may adversely affect SSHCP Covered Species. When indicated by Preserve monitoring, an individual Preserve Management Plan will be adaptively revised to include control measures for the invasive animal species (e.g., bullfrogs, crayfish, and non-native fish). These measures shall be conducted in perpetuity on the SSHCP Preserve, and shall include at least annual surveys to visually assess and identify new invasions (Final SSHCP Chapter 8.3.4.2). In addition, the following SSHCP requirement will further avoid or reduce the effect of invasive plants on Covered Species habitats:

- Setbacks required between urban development Covered Activities and preserved habitat (EDGE-3, STREAM-1, STREAM -2, STREAM-3) will place space between the developed landcovers and the natural landcovers in the Preserve, decreasing interactions between venerable wildlife Covered Species in the Preserves and feral pets and invasive species.
- To avoid harm and harassment of native species, workers and visitors will not bring pets onto a Covered Activity project site (SPECIES-2).
- Pet dogs, cats, and other pets must remain on leash at all times, when on public roadways adjacent to SSHCP Preserves, on trails adjacent to SSHCP Preserves, or on community trails located in setbacks or in a Preserve (Final SSHCP Appendix G3.4).

Despite the implementation of the SSHCP Conservation Strategy and the avoidance and minimization measures described above, a number of invasive animal species are already present and common within the Action Area (see Section 6.6.1), and it is unlikely that many of these species can be wholly eradicated in the future. Invasive wildlife species will be more likely to occur in the existing and future UDA preserves because these preserves will eventually be surrounded by urban development, and several UDA preserves will be bisected by an existing roadway, or bisected by a new roadway or bicycle trail, which can increase invasive species access to the interior of those Preserves. Therefore, invasive species are identified as a Changed Circumstance for which the Permittees will fund remedial measures, as described in SSHCP Chapter 11.4.3.

In summary although the spread of invasive animals is likely, the implementation of the SSHCP's Conservation Strategy, the Conditions on Covered Activities, and remedial measures for changed circumstances will reduce the effect of invasive species such that the long term viability of each Covered Species would not be compromised. The effects of invasive animal species on individual SSHCP Covered Species are discussed in the species-specific effect discussions of this Biological Opinion (sections 2.6.6, 2.7.4, 2.8.4 below).

Noise and Ground Vibration

Edge effects can result from temporary and permanent increases in noise and ground vibration. Equipment use and other construction activities often result in ground vibration and increased ambient noise during the weeks or months of project construction. As discussed in Section 2.5.3 above, the SSHCP effects analysis assumes the temporary ground vibration from construction activities would not extend beyond the boundaries of areas delineated as "permanently affected," and potential effects of temporary construction noise on each Covered Species will be avoided by the SSHCP AMMs. See discussions of the SSHCP Species AMMs (e.g. seasonal restrictions, species surveys, and exclusion zones) in Sections 2.6.4, 2.7.4, 2.9.3, and 2.10.3 below.

Chronic increases in noise and ground vibration related to new urban development Covered Activities will primarily result from increased traffic volumes at all hours. Other urban development-related increases noise or ground vibration are more sporadic, such as regular equipment and machinery use by commercial and industrial businesses, operation of landscape maintenance equipment and tools (e.g., mowers, blowers, etc.), human recreation at parks (particularly at night), loud music from residences, and moving vehicles. Some noise and vibration sources, such as traffic noise, are relatively constant (although with daily cycles related to peak traffic periods), and certain wildlife species may habituate to the chronic ambient noise or vibration levels, while other species may avoid those areas. The rural transportation Covered Activities will result in temporary construction noise, but also will result in increased vehicle traffic after some 2-lane rural roadways are widened to 4-lanes (see Table 1b above), and the current 2-lane Grant Line Road is expand inside the UDA to become the four-lane and six-lane Capital Southeast Connector (Final SSHCP Chapter 5.2). Both chronic and sporadic increases in noise and ground vibration render the adjacent habitat less suitable.

Noise can affect wildlife in several ways that change their both their behavior and physiology in interactive ways, including startling, raising of stress levels, interrupting sleep and rest, interfering with prey detection, and interfering with the ability to detect important species-specific acoustic communications, such as warning or mating calls (Francis and Barber 2013, Dooling and Popper 2007, Dooling 2006; Barrass and Cohn 1984; Brattstrom and Bondello 1983). Habituation to noise can also reduce the species' natural defense responses and thus make them vulnerable to predators, collection, injury, or death. For example, animals that habituate to traffic noise are more likely to be stuck by vehicles (Bowles 1995).

Although increases in noise and ground vibration are likely, especially inside the UDAs, the implementation of the SSHCP's Conservation Strategy, including the Conditions on Covered Activities that establish setbacks and buffers, will reduce the effect noise and vibration on each Covered Species. Species responses to noise likely will vary depending on multiple factors, including, but not limited to season, reproductive strategy, ambient noise, and habituation. The effects of noise and ground vibration resulting from Covered Activities on individual Covered Species are further discussed in the species-specific effect discussions of this Biological Opinion (see sections 2.6.4, 2.7.4, 2.9.3, and 2.10.3 below).

Lighting

Urban development Covered Activities will eventually result in the full buildout of the remaining rural areas of the UDAs, which will permanently increase nighttime ambient light from numerous streetlights, lighted buildings, security lights, parks and ballfields. Exposure to light from vehicles inside and outside the UDAs will be both chronic and unexpected (Final SSHCP Chapter 6.3). Temporary lighting of nighttime construction or maintenance Covered Activities inside and outside the UDAs would primarily occur during concrete and asphalt pouring, and typically involve high-intensity lighting systems that may have very wide light-sheds and high glare values. However, temporary security lighting at construction equipment staging areas may extend for several months or more (Final SSHCP Chapter 6.3).

New sources of light in formerly unpopulated areas could directly and indirectly affect Covered Species, especially birds, amphibians, and insects. Disorientation is known to occur in nocturnal species whose visual systems and behaviors are adapted to low light levels. Attraction to lights especially affects birds and insect species, which may suffer injury or mortality due to collisions with permanent lighted structures. Lighting can increase the risk of predation of both nocturnal and diurnal species because they may be more detectable to nocturnal predators. Many insects are attracted to light sources, resulting in high numbers being taken by nocturnal insectivores, such as bats. Some species, such as amphibians, may be attracted to light because insect prey may congregate around light sources, which may in turn increases the risk of the amphibians being preyed upon (Le Corre et al. 2002; Longcore and Rich 2004). Repulsion of nocturnal wildlife by lights is also common, and may cause them to avoid lighted areas of suitable habitat in their normal home ranges. Many small wildlife species, such as rodents, rabbits, snakes, and some bats are known to forage at lower rates in areas of high illumination levels. Species groups that normally partition their foraging periods in relation to light level may compete under artificial light conditions, and chronic light pollution may favor light-tolerant crepuscular species over strictly nocturnal species, which normally forage in the darkest part of the night (Lima and Dill 1990; Bird et al. 2004; Longcore and Rich 2004).

The elements of the SSHCP Conservation Strategy that increases preserve size and minimize fragmentation of natural landcovers (described above), and elements that provide setbacks between Covered Activities and natural landcovers (e.g. EDGE-1, EDGE-2, EDGE-3) also will minimize effects of increased ambient light. The design of urban development Covered Activities that include lighting AMMs that will minimize light pollution into existing or planed preserves, with some exceptions for public safety. During construction and maintenance activities, Covered Activities will be required to direct all temporary lighting away from adjacent natural landcovers. The following SSHCP requirement will further avoid or reduce the effect of artificial lighting:

- All outdoor lighting in Urban Development Covered Activity projects will be designed to minimize light pollution into existing and planned Preserves. However, exceptions may be allowed where a Land-Use Authority Permittee determines lighting near a preserve is necessary for public safety or security. Minimization measures may include light fixture placement (e.g., as low to the ground as possible), lamp designs (e.g., shielding, low glare, or no lighting), directing light away from Preserves, or other means to avoid or minimize light pollution. The Land-Use Authority Permittee and their Third Party Project Proponent will use the best information available at the time of project design to minimize the development project's light pollution effects on adjacent Preserves and on target SSHCP Covered Species (e.g., western spadefoot, Valley elderberry longhorn beetle, and Ricksecker's water scavenger beetle) (EDGE-8).
- Outdoor lighting is not allowed in Preserve Setbacks. However, where a Land-Use Authority Permittee determines lighting is necessary for public safety or security, limited lighting may be allowed. Minimization measures may include light fixture placement (e.g., as low to the

ground as possible), lamp designs (e.g., shielding, low glare, or no lighting), directing light away from Preserves, or other means to avoid or minimize light pollution (Final SSHCP Chapter 5.2.6).

- SSHCP Permittees and their Third Party Project Proponents implementing ground disturbing Covered Activities will direct all temporary construction lighting (e.g., lighting used for security or nighttime equipment maintenance) away from adjacent natural habitats, and particularly riparian and wetland landcovers and wildlife-movement areas (BMP-6).

Despite the implementation of the avoidance and minimization measures described above, some increase in nighttime ambient light is expected to occur on areas of the SSHCP Preserves located inside the UDAs. The implementation of the SSHCP's Conservation Strategy, including the Conditions on Covered Activities will reduce the effect of increased light levels on sensitive SSHCP Covered Species. The effects increased ambient light on individual SSHCP Covered Species are discussed in the species-specific effect discussions of this Biological Opinion (sections 2.5.6, 2.6.4, 2.7.4, 28.4, 2.9.4 below).

Increased Human Activity and Increased Wildfires

Urban development in the UDAs will result in permanent increases in human presence near remaining UDA natural landcovers. Similar to noise and lighting effects, permanent increases in human activity from adjacent urban development are known to disturb animals, disrupt their normal biological rhythms, raise the level of stress hormones, and affect behaviors. Human presence and human activities can flush animals from nests, dens, and other refuges, increasing their risk of injury or mortality from predation, and increasing collisions with vehicles. Disturbance of nesting birds increases risks to eggs, nestlings, and other dependent young. Increases in human activity along the natural landcover–urban interface may also result in trampling of vegetation and compaction of soils, adversely affecting the quality of plant and wildlife habitat.

Increased human presence and activity also increases the potential for wildfires, especially where urban development shares a common boundary with preserved natural landcovers. Human activities that can result in wildfire includes accidental ignitions from sparking equipment (e.g., mowers striking rocks), cigarettes, children playing with matches, arching power lines, etc., as well as intentional ignitions (i.e., arson). Increased risk of fire is also associated with increased human activity along roadways (i.e., cars catching on fire, accidents, discarded cigarettes, etc.). Under natural conditions, periodic fires are known to improve habitat for native species that inhabit natural landcovers that evolved with fire, including the Valley Grassland, Vernal Pools, Oak Savannah, and Oak Woodland landcovers. In these fire-adapted natural landcovers, periodic fires are known to reduce invasive non-native plant cover, reduce thatch, thin understory vegetation layers, and create opening in tree canopies, which can allow native plant species to emerge or regenerate. Conversely, unnaturally large, intense, and/or frequent fires may adversely affect native landcovers and adversely affect native species by injuring or killing individuals and by temporarily or permanently removing suitable habitat.

Within the UDAs, 18 categories of Covered Activities have potential to increase frequency of wildfires in the Action Area (Final SSHCP Table 6-1). Most wildfires on UDA preserves and other UDA natural landcovers are expected to be quickly suppressed by the local jurisdiction, for public safety and to protect property (Final SSHCP Chapter 6.3). The primary effects to UDA natural landcovers, Covered Species, and Covered Species habitat from increased rates of wildfires is expected to result from the fire suppression activities. Ground disturbing fire suppression activities, such as grading of fire breaks and equipment use, can crush or burry Covered Species individual, and may result in permanent impacts to Covered Species modeled habitat. As discussed in SSHCP Chapter 6.6, use of fire retardants in natural landcovers and in the SSHCP Preserves might directly or indirectly kill or injure Covered Species.

Effects of wildfire suppression on Covered Species and Covered Species modeled habitats inside the UDA will be minimized through implementation of the SSHCP Preserve System Management Program, which includes a commitment for the SSHCP prospective Permittees to develop a memoranda of agreement with each local fire agency that may report to a wildfire on a SSHCP Preserve (Final SSHCP Chapter 6.5, Chapter 6.6, and Chapter 11.4).

Elements of the SSHCP Conservation Strategy the minimize the amount of edge in the SSHCP Preserve System, provide setbacks between urban development and preserved land, and control public access within the SSHCP Preserve System will reduce the risk of increased wildfires in the UDA Preserves, especially: EDGE-1 (Compatible Land Uses), EDGE-2 (Single-Loaded Streets), EDGE-3 (Preserve Setbacks), EDGE-3b (Setbacks as Firebreaks), EDGE-10 (Prevent Invasive Species Spread), ROAD-1 (Road Project Location), NATURE TRAIL-1 (Nature Trail Plan), NATURE TRAIL-5 (Monitoring of Nature Trails). The SSHCP Preserve Monitoring and Management Program (Final SSHCP Chapter 8) will control thatch and reduce potential ignition sources in and adjacent to SSHCP Preserves.

Despite the Covered Activity compliance with the SSHCP the avoidance and minimization measures described above, wildfires, especially grassland wildfires, are historically a common occurrence in the Action Area, and it is likely that wildfires will occur in the SSHCP Preserves over the 50-year implementation of the SSHCP. Therefore, wildfires in the SSHCP Preserve System were identified as a Changed Circumstance in the Final SSHCP, for which the Permittees will fund wildfire remedial measures on SSHCP Preserves, as described in SSHCP Chapter 11.4.3. Any fires in the SSHCP Preserve System affecting a vernal pool or riparian enhancement, re-establishment, or establishment sites, regardless of the number of burned acres, will be remediated by the prospective SSHCP Permittees as a changed circumstance. Individual Preserve Management Plans will identify appropriate wildfire prevention, fuel-load reduction, and habitat protection actions. Each Preserve Management Plan will incorporate a public-awareness program to reduce fire risk on preserve edges, in Preserve Setbacks, on any nature trails, and along the Community Trail planned in UDA Core Preserve-1.

The SSHCP assumes that wildfires on the grasslands dominant SSHCP Preserves could not reach the level of intensity to fully remove a natural landcover or damage soils. If a fire occurs of such intensity that aerial application of chemical fire retardants is used, that level of fire intensity would be an Unforeseen Circumstance that was not anticipated at the time of the SSHCP development. The effects of increased human activity and increased wildfire on individual Covered Species are discussed below in the species-specific effect discussions of this Biological Opinion (sections 2.6.6, 2.7.4, and 2.8.4 below).

Changes to Runoff, Water Quality, and Non-point Pollution

Increases in impermeable surfaces associated with urban development and roadways can increase rates of rainwater runoff, which has the potential to change existing hydrographs of local creeks and streams, resulting in increased sediment load, greater levels of scour and/or incision of local creeks, alterations of downstream aquatic habitat, and decreased groundwater recharge. In addition, urban development may release non-point pollutants (chemicals, pesticides, fertilizers, nutrients, and windblown trash), which can be transported in rainwater runoff. Pesticide uses in urbanized areas include uses in landscaping, lawn maintenance, roadside weed maintenance, pest control, and mosquito abatement activities. Contaminants from automobiles that collect on roadways, parking lots, and driveways (oil, fuel, brake dust, lubricants, etc.) are also be transported in rainwater runoff. The physical effects and chemical characteristics of increased rainwater runoff rates have the potential to adversely affect the terrestrial and aquatic habitats near the urban development and adversely affect downstream aquatic habitats. Increased nutrient additions to vernal pools have significant negative effects on the richness and cover of vernal pool plant species, and result in delayed germination and growth (Kneitel and Lessing 2010).

Implementation of the SSHCP rural transportation Covered Activities will result in small increases to the impermeable surface-area of some existing roadways outside the UDAs, and will result in increased traffic on those improved roadways. Within the UDAs, the implementation of the SSHCP urban development Covered Activities will significantly increase the amount and area of impermeable surfaces over most of the UDAs, and will significantly increase potential sources of urban non-point pollutants in the UDAs. In addition, many urban development Covered Activity projects also will include the permanent rerouting or straitening of existing drainages, creeks, and streams in individual project sites (Final SSHCP Chapter 5.2.1).

The SSHCP Conditions on Covered Activities are designed to maintain natural hydrographs and existing runoff conditions, and comply with all State Water Resources Control Board requirements. SSHCP Conditions on Covered Activities also will conserve and/or rehabilitate creeks and streams within Covered-Activity project-sites. SSHCP Condition 1 will require BMPs and low-impact development (LID) drainage control measures to ensure that runoff from developed lands will closely mimic the pre-development hydrograph, and will retain most pre-development hydrologic functions (LID-1, LID-2, LID-3, and BMP-2, BMP-3, BMP-4, BMP-5, BMP-9). SSHCP Condition 2 requires urban development Covered Activities adjacent to existing or planned preserves to implement measures that avoid direct and indirect impacts to the natural landcovers lower in the watershed, and downstream aquatic habitat resources. Water runoff from urban development and from roadways surfaces will be directed away from UDA preserves, and landscaping and landscaping irrigation near preserves will be limited [EDGE-1 (Compatible Land Uses), EDGE-2 (Single-Loaded Streets), EDGE-3 (Preserve Setbacks), EDGE-4 (Locate Stormwater Control Outside Preserves), EDGE-5 (Stormwater Control in Preserve Setbacks)].

SSHCP Condition 7 (Chapter 5.4.1) will be applied to all UDA Covered Activities to avoid or minimize potential indirect and direct impacts to streams and creeks by establishing minimum 100-footwide Stream Setbacks (measured from the top of the bank on both sides) on the following streams within the UDAs: Elder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, Sun Creek, and the Laguna Creek Wildlife Corridor (STREAM-1, STREAM-2, STREAM-3). For each Stream Setback, an easement will be granted that gives the SSHCP the ability to enforce the requirements of the SSHCP Stream Setback easement in perpetuity. When an Urban Development Covered Activity re-routes a stream, creek, or drainage, the re-routing must be completed in a manner that minimizes impacts to species habitat and beneficial uses, and the re-routing will employ measures to minimize disturbances and avoid adverse effect to water quality (STREAM-4). The potential effects of increased rainwater runoff on individual Covered Species are further discussed in the species-specific effect discussions of this Biological Opinion (see Sections 2.6.6, 2.7.4, 2.8.4 below).

2.5.4.2 Benefits of SSHCP Habitat Preservation and Management

The regional conservation strategy provided by the SSHCP (summarized in Section 2.1.6 above) will provide species benefits and aquatic resource benefits that cannot be achieved by individual mitigation or habitat conservation projects in the Action Area. The SSHCP will assemble the 36,282-acre SSHCP Preserve System in locations with the highest quality natural landcovers and species habitat within the Action Area, especially focusing habitat preservation in the Action Area locations identified as species recovery Core Areas by the Service. In addition to preserving the highest quality habitat remaining in the Action Area, the SSHCP will preserve larger blocks of habitat, resulting in more interior-area and less edge area within in the total SSHCP Preserve System. Large preserves also facilitate use of appropriate land management activities to improve habitat functionality, including use of prescribed livestock grazing and prescribed burning. The establishment of the large and interconnected SSHCP Preserve System also will maintain the existing integrity of watersheds throughout the Action Area.

Except for the 1,800 acres of SSHCP "hardline preserves" already proposed inside the UDAs (Final SSHCP Chapter 7.4.1), the exact locations of Covered Species modeled habitat and Covered Species individuals that would be preserved by the 36,282-acre SSHCP Preserve System (Final SSHCP Chapter 7.5) are not yet known. Assembly of the complete SSHCP Preserve System will follow the process and meet the requirements described in SSHCP Chapters 7.4 and 7.5. Progress toward preserving Covered Species habitat and assembling the interconnected 36,282-acre SSHCP Preserve System will stay ahead of Covered Activity effects to Covered Species at all times, as discussed above in Section 2.1.6.

Most SSHCP Preserves will be established adjacent to and contiguous with existing habitat preserves within the Action Area, increasing the effective (functional) size of each Preserve in the SSHCP Preserve System. By locating the new SSHCP Preserves next to existing preserves, the SSHCP Preserve System also will provide habitat connectivity between the existing 61,364-acre patchwork of noncontiguous preserves located outside the UDAs, and will provide habitat connectivity between the 3,171-acres of isolated and mostly small preserves inside the UDAs, which were established under past project permit-requirements (Final SSHCP Table 7-2). By connecting new SSHCP Preserves and existing preserves, and by establishing the Laguna Creek Wildlife Movement Corridor inside the north UDA and establishing the Cosumnes River Wildlife Movement Corridor outside the UDAs, the SSHCP Preserve System will maintain habitat connectivity and opportunities for wildlife movement and dispersal into and out of species habitat preserved inside the UDAs. The habitat connectivity provided by the SSHCP Preserve System will allow continued movement and dispersal of native wildlife species throughout the Action Area, and also provide opportunities for the dispersal of Covered Species seeds, eggs, and cysts via wildlife movement into and out of the UDAs. In addition, because many of the existing preserves located outside the UDA are contiguous with natural landcovers and species habitat present outside the Action Area, the SSHCP Preserve System also will allow continued movement and dispersal of native wildlife species into and out of the Action Area.

Additional habitat connectivity also will be provided inside the UDA portions of the Action Area in the Stream Setbacks that will be established by the urban development Covered Activities (see AMMs STREAM-1, STREAM-2, and STREAM-3 in SSHCP Chapter 5.4). The Stream Setback AMMs are intended to protect existing water quality in the UDAs, but also will facilitate wildlife movement and dispersal of Covered Species seeds, eggs, and cysts via water flow and wildlife movement. The entity that owns the property within a Stream Setbacks will be responsible for managing and maintaining the habitat in the setback, but an easement must be granted to the SSHCP Implementing Entity that gives the SSHCP the ability to enforce the conditions of the easement in perpetuity. All UDA Stream Setbacks will be preserved in perpetuity, but are not part of the SSHCP Preserve System.

Natural landcovers, aquatic resources, and species habitats within all SSHCP Preserves also will be monitored and managed in perpetuity to maximize benefits to Covered Species and their habitats, as described the SSHCP Preserve System Monitoring and Management Program (Final SSHCP Chapter 8). This habitat management program will provide commonality and consistency in the management of Covered Species habitats throughout the Action Area. Because the SSHCP Preserve System will be comprised of many connected but individual parcels, individual Preserves will be managed individually because of differences in historical land uses, soils, species presence, and other factors. Therefore, an individual Preserve Management Plan (PMP) will be developed for each SSHCP Preserve in the SSHCP Preserve System, which will be tailored to maximize conservation benefits of the individual Preserve (Final SSHCP Chapter 8.3.4.2). The intensity and type of habitat monitoring and management on each SSHCP Preserve will take into account the activities and land uses that are occurring on lands surrounding the Preserve boundary that could indirectly affect species and species habitats within the Preserve boundaries. Changes in adjacent land uses near each SSHCP Preserve will be documented in each SSHCP annual report (Final SSHCP Chapter 9.9), and land uses adjacent to SSHCP Preserves will be considered when individual Preserve Management Plans are reviewed and updated every 3-5 years.

The SSHCP Conservation Strategy will protect and manage the streams, creeks, riparian, and other aquatic landcovers in the Preserve System, and will provide opportunities for the enhancement of streams, creeks, riparian, and other aquatic landcovers in the SSHCP Preserve System. These SSHCP activities will act to maintain or improve the physical, chemical, and biological functions and services of the aquatic resources in the Action Area, and will help to maintain water quality throughout the region. The aquatic resources protected within the SSHCP Preserve System will be monitored over the Permit Term to using rapid assessment methods to track trends in condition and to assess the condition of Action Area aquatic resources at a watershed scale (see Final SSHCP Table 8-4).

Preserve monitoring and management will be more intensive on the edges of each SSHCP Preserves, and will be more intensive in the smaller SSHCP Preserves that border urban development (i.e., the Satellite Preserves, Linkage Preserves, and Minor Preserves inside the UDA) (Final SSHCP page 8-108). Preserve monitoring and management also will be more intensive where a Core Preserve is divided by a roadway, or divided by a community trail. Preserve management actions will be prescribed to address weed infestations, human trespass, or other Preserve edge issues identified in the intensive monitoring of Preserve edges, consistent with the PMP for the individual Preserve. SSHCP Objective HAB5 assures that each SSHCP Preserve will monitor for edge effects, including weeds, noise, hydrology changes, and litter, etc.

The SSHCP Preserve System Monitoring and Management Program will integrate preserve monitoring and land management actions on each Preserve into a single cohesive adaptive-management program, such that habitat monitoring will inform (and change) species and land management-actions and continually improve habitat for the Covered Species (Final SSHCP Chapter 8.3.4). Adaptive management will promote more informed and efficacious management of the SSHCP Preserve System to benefit the Covered Species. Over the Permit Term, the Preserve System Monitoring and Management Program also will conduct required Effectiveness Monitoring of the SSHCP Preserve System to determine if the Preserve System and the SSHCP Conservation

Strategy are achieving the stated Biological Goals and Objectives for each SSHCP Covered Species (Final SSHCP Chapter 8.3.3). Several of the SSHCP Biological Measurable Objectives require the SSHCP to monitor the status of certain Covered Species in the Preserve System and identify trends in abundance and distribution on individual Preserves and across the SSHCP Preserve System.

In addition to monitoring Covered Activity compliance with SSHCP AMMs, the SSHCP will monitor the effectiveness of each SSHCP AMM implemented, including the EDGE AMMs. If monitoring indicates that the effectiveness of an AMM in minimizing or avoiding effects to a Covered Species is not consistent with the predictions and assumptions made when the SSHCP was developed, the AMM will be modified, to increase avoidance or minimization to the level assumed in the SSHCP effects analysis and used in this Opinion.

The SSHCP also will conduct several studies that measure the pre-project and post-project habitat conditions on SSHCP Preserves located inside the UDA (Final SSHCP Chapter 8.3.3.5). These Special Studies will assess assumptions used in the SSHCP effects analysis (see Section 2.5.3 above), including the effectiveness of the SSHCP AMMs (including the 50-foot Preserve Setbacks) in ameliorating the edge effects that could change the existing physical and biological functions of habitat in the UDA preserves. If an individual SSHCP Preserve is not meeting habitat success-standards (Final SSHCP Chapter 9.3.4), modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding acreage) will be implemented (SSHCP Objective HAB-2.1).

The SSHCP Conservation Strategy (including the SSHCP Preserve System), is intended to offset the amount and the significance of all unavoidable impacts of the SSHCP Covered Activities on individual SSHCP Covered Species, including the potential indirect-impacts to Covered Species that are identified in SSHCP Chapter 7 as "qualitatively described and analyzed."

2.5.5 General Effects of the Action on Vernal Pool Ecosystem Habitat

To minimize repetition, mechanisms by which SSHCP Covered Activities could affect all vernal pool Covered Species are discussed here in Section 2.5.5. However, the anticipated effects of the SSHCP on each vernal pool Covered Species are discussed below in Section 2.5.6. The general effects of the action on all Covered Species, previously described in Section 2.5.4 above, are not repeated here.

Covered Activities will have both direct and indirect effects on existing modeled habitat for each of the vernal pool Covered Species. Most direct impacts to the Vernal Pool Ecosystem landcovers will result from the construction of urban development Covered Activities inside the UDAs (16,795 acres), with a relatively small amount of direct loss from rural transportation Covered Activity projects outside the UDAs (322 acres). In total, 17,116 acres of existing Vernal Pool Ecosystem in the Action Area will be converted to a developed landcover, including 645 acres of Vernal Pool, Swale, and Stream/Creek (VPIH) landcovers and 16,472 acres of ecologically-connected Valley Grassland landcover (Table 6 below). The removal/conversion of Vernal Pool Ecosystem landcovers will be a direct cause of death and injury to vernal pool Covered Species individuals, as discussed below in Section 2.5.6.

Using the methods described above in Section 2.5.3, the SSHCP also quantified the acres of Vernal Pool Ecosystem aquatic landcovers (Vernal Pool, Swale, and Stream/Creek-VPIH) that will remain on the landscape, but would be indirectly affected by Covered Activities implemented in Valley

Grassland uplands of the Vernal Pool Ecosystem. Construction of Covered Activities in the uplands of a Vernal Pool Ecosystem decreases the area of soil surface where winter rainwater can infiltrate, which slows the formation and the extent of the subsurface perched aquifer in the Vernal Pool Ecosystem. Grading and other ground disturbance in the uplands of the Vernal Pool Ecosystem also disrupts, removes, or punctures the soil restrictive layer, which can eliminate formation of the perched aquifer, or reduce the extent of the perched-aquifer by allowing subsurface water to infiltrate into soil layers below the restrictive layer.
Changes to the existing conditions of the seasonal perched aquifer would change the existing hydrology and ecology of that Vernal Pool Ecosystem, including decreased subsurface-connectivity between vernal pools, decreased surface-connectivity through swale flows, resulting in changes in the timing of vernal pool filling, the duration of vernal pool inundation, decreased pool water-depth, and decreased connectivity to downslope drainages, creeks, streams. Changes to these physical characteristics of a Vernal Pool Ecosystem will change the existing ecological process and the existing habitat-functions of the Vernal Pools, Swales, and Stream/Creek VPIH landcovers in that Vernal Pool Ecosystem. Vernal pool species are especially vulnerable to alterations in the existing hydrology of a Vernal Pool Ecosystem, because the timing, water depth, and period of vernal pool inundation determines which vernal pool plants, crustaceans, and insect species are able to reproduce and persist in a given vernal pool. For example, indirect alterations to the hydrology of a Vernal Pool Ecosystem can result in too little soil moisture for the germination of plant seeds or hatching of eggs and cysts. Indirect alterations to the hydrology of a Vernal Pool Ecosystem may also cause vernal pools to dry too fast, or cause vernal pool water temperatures to increase too soon for a vernal pool species to complete its lifecycle and reproduce in some (or all) water-years. The volume and depth of a vernal pool is important in determining habitat for vernal pool species because each species is adapted to a specific inundation period, water depth, and position in the vernal pool. Altered hydrology may also allow the invasion of vernal pool habitat by adjacent upland plants leading to the extirpation of the vernal pool species (USFWS 2002).

Changes to the hydrology of a vernal pool ecosystem may also result in contamination. Toxic chemicals, such as petroleum products, pesticides, herbicides, adjuvants, fertilizers, and soap may wash into vernal pools from adjacent parks and recreation areas, irrigated agricultural lands, or landscaped residential areas (Petrovic 1990). Vernal pools may also become contaminated from contaminants in roadway surface runoff (*e.g.*, grease, oil, and heavy metals). Vernal pool crustaceans, in particular are highly sensitive to the water chemistry of their vernal pool habitats, and contamination of vernal pools may injure or kill them (Belk 1977, Eng et al. 1990; Gonzalez et al. 1996). The SSHCP calculated that Covered Activities will indirectly affect the existing hydrology of 142 acres of Vernal Pool, Swale, and Stream/Creek (VPIH) within the Action Area, permanently removing suitable-habitat for vernal pool Covered Species from those acres (Table 6 below).

Fragmentation of Vernal Pool Ecosystem landscapes decreases populations of native upland species that perform crucial roles in vernal pool ecosystems. Pollinator species that nest in uplands may decrease due to loss of vernal pool grassland uplands, which would affect the reproduction of the vernal pool plant species that rely on those pollinators. Wildlife access, movement, and use of Vernal Pool Ecosystem uplands can be reduced or eliminated on the fragmented patches of remaining habitat, reducing dispersal of vernal pool species (cysts, eggs, seeds and individuals) carried on the feet of animals. Fragmentation of also reduces the potential for dispersal of cysts, eggs, and seeds through surface flows and by wind. Vernal pool species in smaller habitat patches are also more vulnerable to extirpation from random fluctuations in demographic factors, such as reproduction rated and death rates (Lesica and Allendorf 1995). In all of these ways, the fragmentation of vernal pool complexes could contribute to the loss of genetic diversity among vernal pool species and reduce the likelihood of recolonization events following a population extinction by limiting opportunities for dispersal (King 1996; Fugate 1998). In addition, as the patch size of a vernal pool grassland becomes smaller, cattle grazing used to maintain the Vernal Pool Ecosystem becomes less efficient, and inappropriate grazing management (undergrazing, overgrazing, or inappropriately timed grazing) occur more frequently.

The SSHCP determined that the potential for indirect effects to Vernal Pool Ecosystem landcover will be greatest in the UDA's ten Satellite Preserves, the UDA's ten Linkage Preserves, and in the UDA's Laguna Wildlife Movement Corridor, because they will be relatively narrow habitat corridors and will be located between adjacent urban land uses. The SSHCP expects that size of the large 10,500-acre SSHCP Landscape Preserve (outside the UDA), the sizes of the three Core Preserves (inside the UDA), and the sizes of the three Minor Preserves (inside the UDA) will be large enough to protect the interior of those preserves from potential edge effects. However, the planned 839-acre Core-1 Preserve (proposed in PPU-1) will be bisected by an existing rural roadway (Glory Lane). In addition, the Cordova Hills Specific Plan (see Final SSHCP Appendix K)[14] will construct two new arterial-size roadways that also will bisect the SSHCP Core-1 Preserve (i.e. the North Loop Road and the University Road), and the Cordova Hill Specific Plan will construct a 20-foot wide community bicycle trail through the south portion of the SSHCP Core-1 Preserve. Similarly, the 522-acre SSHCP Core-2 Preserve (proposed in PPU-2) will be bisected by the existing Kiefer Boulevard in the north, and Eagle's Nest Road in the east (Final SSHCP Figure 7-3). These roadways and the proposed community trail have the potential to reduce the functional size of the large SSHCP Core-1 and Core-2 Preserves, and have the potential to reduce habitat functions by introducing edge effects into the interior of those Core Preserves (including invasive weed species, trash accumulation, human disturbance, and contaminants in rainwater run-off from the roads and trails as discussed in Section 2.5.4 above). Therefore, the SSHCP Preserve Monitoring and Management Program will include more intensive surveys the areas of each SSHCP Preserve that border roadways or community trails for edge effects (EDGE -10), and will implement appropriate preserve management actions that will maintain the habitat functions of the Vernal Pool Ecosystem landcovers in the UDA Preserves.

The excavation and installation of new wastewater (sewer) pipelines to support new urban development in the UDAs will occur under the existing rural roadways that currently bisect the Core-3 Preserve in PPU-3, and will occur under the new roadways that will be constructed through the Core-1 Preserve in PPU-1 (Final SSHCP Figure 5-2). The installation of these long wastewater-pipelines approximately 10 to 40 feet underground could act as barriers that eliminate the existing subsurface hydrologic-connectivity occurring between the vernal pool complexes present on either side of the roadways. However, the SSHCP will require the wastewater pipeline Covered Activities to implement AMM UTILITY-3 (Trenchless Pipeline Construction Methods) where sections of the pipelines cross SSHCP Preserves or cross between SSHCP Preserves. AMM UTILITY-3 requires wastewater pipelines, other pipelines, and underground conduits be installed under the duripan (hardpan) layer of the soil profile, to maintain the soil-restrictive layer and maintain the upper soil profile that allows the seasonal perched-aquifer to form.

[14] As noted in section 1.0 of this Opinion, the Service issued a "SSHCP on-ramp" biological opinion to the Cordova Hills Specific Plan in December 2016, and the USACE issued CWA 404 authorization to the Cordova Hills Specific Plan in February 2017.

In total, the SSHCP determined that 17,259 acres of Vernal Pool Ecosystem currently present in the Action Area would no longer provide suitable habitat for the vernal pool Covered Species (17%, of the existing 103,210 acres of Vernal Pool Ecosystem) (Table 6 below). This total includes approximately 16,927 acres of Vernal Pool Ecosystem located inside the UDAs (affecting 65% of the existing 26,048 acres of Vernal Pool Ecosystem inside the UDAs), and 322 acres of Vernal Pool Ecosystem outside the UDAs (affecting 0.4% of the existing 77,162 acres of Vernal Pool Ecosystem outside the UDAs) (Table 6 below).
In addition to the 142-acres of indirect effects to Vernal Pool Ecosystem from altered seasonal hydrology (Table 6 below), SSHCP Chapter 6.4.3 provided qualitative assessments of indirect effects to the Vernal Pool Ecosystem landcovers that could result from other Covered Activity indirect effect-mechanisms, such as contaminants and pesticides, windblown trash, colonization by invasive plant species, and the other environmental stressors discussed in Section 2.5.4 above.

Table 6. Permanent Loss of Vernal Pool Ecosystem Landcovers in the Action Area (acres)

SSHCP Landcover	Direct Effects (acres)	Indirect Effects to Hydrology (acres)	Total Permanent Effects (acres)	Total Existing in Action Area (acres)	Percent of Action-Area Total Acres Affected
Valley Grassland (in Vernal Pool Ecosystem)	16,472	Qualitative Estimate	16,472	97,349	17%
Vernal Pool	389	94	483	4,536	11%
Swale	234	44	278	1,252	22%
Stream/Creek (VPIH)	22	4	26	73	34%
Vernal Pool Ecosystem Total	17,116.39	142	17,259	103,210	17%

The SSHCP Conservation Strategy (including the SSHCP Preserve System), is intended to offset all unavoidable impacts of the SSHCP Covered Activities on each vernal pool Covered Species, including the indirect impacts to vernal pool Covered Species that are identified in SSHCP Chapter 7 as "qualitatively described and analyzed"(see discussions in Section 2.5.3 above). The SSHCP's Conservation Strategy for the Action Area's Vernal Pool Ecosystems is based on preservation of large assemblages of interconnected Vernal Pool, Swale, and Stream/Creek (VPIH) landcovers embedded in intact Valley Grassland landscapes, and the protection of the perched aquifers, existing hydrology, and water quality of vernal pool micro-watersheds. The SSHCP Conservation Strategy will offset the effects to Vernal Pool Ecosystem in several ways. The 36,282-acre SSHCP Preserve System will include the preservation of at least 23,284 acres of intact Vernal Pool Ecosystem (including 22,014 acres of Valley Grassland landcover, 966 acres of Vernal Pool landcover, 278 acres of the Swale landcover, and 26 acres of the Stream/Creek (VPIH) landcover or Swale landcover).

The size of the larger SSHCP Preserves (Core and Landscape) will facilitate appropriate upland vegetation-management activities that maintain habitat-functions provided by the Vernal Pool Ecosystem. Large preserves with less perimeter fencing allow more effective grazing operations and the implementation of the same habitat-management plan over a large area. Grazing operators would not be required to shuttle livestock between disjunct smaller preserve areas, or be required to use smaller grazing animals. Large preserves also allow use of prescribed-burning to remove thatch, above ground biomass, and any weed infestations in the uplands of the Vernal Pool Ecosystem. Grazing, fire, and other grassland management actions benefit vernal pool habitat-functions by increasing rainwater infiltration to the perched aquifer and by reducing the springtime growth and transpiration of non-native upland grasses, which can prematurely draw-down the perched aquifer and prematurely dry vernal pools in that Vernal Pool Ecosystem.

In an effort to preserve the full range of vernal pool heterogeneity present in the Action Area (i.e. vernal pool types, pool size and depth, soils and landforms, water chemistry, density of pools, and species), the SSHCP Conservation Strategy will assemble the SSHCP Preserves to include each of the different Action Area geologic landforms and soil types that support extant Vernal Pool Ecosystem (see Final SSHCP Tables 7-10, 7-11, 7-12). To maximize benefits of the SSHCP Preserve System to the vernal pool Covered Species, The SSHCP will assemble the SSHCP Preserve System following the preserve assembly requirements described in SSHCP Chapter 7.5 and SSHCP Table 7-1.

Because the SSHCP Preserve System will include a large areas of Valley Grassland uplands, we also expect the SSHCP to maintain populations of plants and wildlife species in the Action Area that are not Covered Species, but perform crucial ecosystem functions. These upland species include solitary bees and other pollinators of vernal pool plants, as well as the native wildlife species that passively disperse the seeds, cysts, and eggs of vernal pool species as they move in and through the Action Area.

The SSHCP Preserve System also will include the re-establishment or establishment of a minimum of 389 acres of functional vernal pools and 256 acres of functional swales. This also includes the re-establishment of at least 300 acres of intact, functional Vernal Pool Ecosystem on existing cropland landcovers that are located within or adjacent to (within one mile) the Mather Core Area (SSHCP Objective VP6). Valley Grassland uplands will be re-established/established at the same time as re-establishment/establishment of vernal pools and swales to form a complete Vernal Pool Ecosystem. When re-establishing Vernal Pool Ecosystem, the SSHCP will utilize past aerial photography to reestablish vernal pool and swales in their historical footprints and historical densities, to the extent possible. Soil inoculum will be harvested from vernal pools in Covered Activity project sites before the pools are lost. Inocula applied in the re-established or established vernal pools will be from impacted vernal pools that are within 1 mile of the re-established/established vernal pool, and from the same geologic formation/soil type as present at the re-establishment/establishment site. SSHCP Objective VP15, AMM RE-ESTABLISHMENT/ESTABLISHMENT-1, and AMM RE-ESTABLISHMENT/ESTABLISHMENT-2 provide conditions for SSHCP re-establishment or establishment of vernal pools. The success criteria for the re-established or established Vernal Pools and the long term monitoring and management plan provided by the SSHCP Preserve Monitoring and Maintenance Program will ensure that re-established/established vernal pools are adaptively managed over time, and that management can be corrected as necessary to be most beneficial to maintain the re-established vernal pools and associated uplands as functional habitat in perpetuity for the vernal pool Covered Species.

The size and shape of the SSHCP Preserves planned inside the UDA was constrained by existing development, other existing land use, and zoning designations. Consequently, most SSHCP Preserves inside the UDA will have a higher ratio of edge to interior acres than other SSHCP Preserves, and all SSHCP Preserves inside the UDA will eventually be bordered by urban development. However, the SSHCP includes requirements for all urban development Covered Activities to incorporate and implement required SSHCP AMMs, including the incorporation of low-impact development designs, placement of compatible adjacent uses, and minimum 50-foot wide Preserve Setbacks between new urban development in the UDA and vernal pool grassland protected in the UDA preserves (Final SSHCP Chapter 5.4). The application of the SSHCP's

EDGE AMMs will make each Preserve Setback as effective as possible to buffer vernal pool species and species habitat preserved inside in the UDA from the environmental stressors that will be produced by adjacent urban development. If the Preserve Setbacks or other EDGE AMMs are not effective, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width).

Therefore, the SSHCP effects analyses assumes that each of the SSHCP AMMs will be fully effective in avoiding indirect changes to the existing hydrology, physical characteristics, and habitat functions of the Vernal Pool Ecosystem aquatic landcovers located in UDA Preserve edge areas. Our analysis assumes that each edge-area aquatic landcover (Vernal Pools, Swales, and Stream/Creek VPIH) will continue to support the vernal pool Covered Species they supported at the time the Preserve was established, and will not diminish over time.

As summarized in Section 2.1.6 above, the SSHCP monitoring program will include oversight and monitoring of each AMM implemented by a SSHCP Covered Activity. The SSHCP AMMs include measures to reduce impacts to water quality (e.g., use of LID practices), requirement for Preserve Setbacks, use of BMPs during Covered Activity construction activities, and other measures designed to minimize or avoid indirect effects to vernal pool species habitat from urban run-off, nuisance flows, and disruption of existing hydrology of vernal pool Covered Species habitat near each SSHCP Preserve edge. If future monitoring indicates that the effectiveness of AMM in minimizing or avoiding effects to a Covered Species is not consistent with the predictions and assumptions made when the SSHCP was developed, the AMM will be adaptively modified to increase effectiveness to the level assumed in the SSHCP effects analysis, as described in Chapter 8.2.3 of the Final SSHCP. As discussed in Section 2.5.4 above, the SSHCP also will implement specific Special Studies to test the effectiveness of the SSHCP's EDGE AMMs. These include pre-project studies of existing hydrology and habitat conditions of the Vernal Pool Ecosystem aquatic landcovers located in the future edges of SSHCP Preserves within the UDA, and subsequent studies monitoring post-project conditions (see Final SSHCP Chapter 8.3.3.5).

Because proximity to urban development will expose SSHCP Preserves in the UDA to a wide variety of environmental stressors (see Section 2.5.4 above), SSHCP Preserves located inside the UDA will be more intensively monitored and managed. Consistent implementation of the SSHCP AMMs and the more intensive monitoring and management of Preserves within the UDA are expected to identify and quickly address any changes in physical or biological functions of the Vernal Pool Ecosystem landcovers that are located in the edge areas of the UDA Preserves.

Sections 2.5.6 below will assess the expected exposure and probable responses of each vernal pool Covered Species to the different SSHCP Covered Activity effect mechanisms discussed above, including direct habitat loss, indirect reduction in habitat function, and habitat improvements expected from implementation of the SSHCP Conservation Strategy Covered Activities.

2.5.5.1 Effects to the Mather Core Area

As discussed above (Section 2.1.1 and 2.5.2), the 24,335-acre Mather Core Area (USFWS 2005a) is almost entirely contained within the SSHCP's Urban Development Area (UDA) and the Sacramento County Urban Services Boundary (USB). New urban development in unincorporated Sacramento County will be largely shaped by the USB boundary, as described in the county's General Plan (County of Sacramento 2011). In addition, the City of Rancho Cordova's General Plan also directs new development in the portion of the Mather Core Area located in SSHCP PPU-2 (City of Rancho Cordova 2006). Consequently, there has been a high level of conflict between urban land use and the conservation of vernal pool grasslands within the Mather Core Area. The SSHCP's regional Conservation Strategy provides a mechanism to preserve larger blocks of intact Vernal Pool Ecosystem and maintain habitat connectivity between new and existing preserves in the Mather Core Area that would not be possible otherwise.

The SSHCP determined that urban development Covered Activities inside the UDA portion of the Action Area will remove 8,386 acres of vernal pool grasslands (Vernal Pool Ecosystem) from the Mather Core Area, and indirectly remove the existing seasonal hydrology and habitat functions on an additional 227 acres of Vernal Pool, Swale, and Stream/Creek landcovers in the Mather Core Area. In total, the SSHCP determined that Covered Activities will remove habitat functions from 8,386 acres (35%) of the 24,335-acre Mather Core Area (Table 7 below). Therefore, approximately 40% of the total 21,193 acres of Vernal Pool Ecosystem landcovers present in the Mather Core Area will be adversely affected by SSHCP Covered Activities over the Permit Term.

The SSHCP Conservation Strategy for the Mather Core Area includes the preservation of 5,493 acres of Vernal Pool Ecosystem landcovers within the Mather Core Area, including 213 acres of Vernal Pool, 90 acres of Swale, 26 acres of Stream/Creek (VPIH), and 5,155 acres of hydrologically connected Valley Grassland (see Table 7 below), which is approximately 26% of the 21,193 acres of Vernal Pool Ecosystem landcovers (suitable habitat) currently present in the Mather Core Area. Most of the suitable habitat preserved by the SSHCP in the Mather Core Area will be in large blocks, and all preserved habitat within the Mather Core Area will be contiguous or interconnected with existing vernal pool grassland preserves present in the Mather Core Area. In addition, as outlined in SSHCP Objective W-7, the SSHCP also will re-establish or establish a minimum of 50 acres of vernal pools, a minimum of 30 acres of swales, and a minimum of 300 acres of functional Vernal Pool Ecosystem (Valley Grassland, Vernal Pools, and Swales) within or adjacent to the Mather Core Area on farmland landcovers that historically supported Vernal Pool Ecosystem (see Table 7 below).

To assure that the landscape functions, the types of vernal pools present, and the genetic diversity of the vernal pool species that occupy the Mather Core Area will be conserved, SSHCP Objective VP1b requires Covered Activity direct effects to vernal pools within or near (within 1 mile of) the Mather Core Area be mitigated within or adjacent to the Mather Core Area. All SSHCP Preserves planned in the UDA portion of the Action Area will be established inside the Mather Core Area (except for a section of the Laguna Creek Wildlife Corridor that extends beyond the western boundary of the Mather Core Area). In total, three Core Preserves, three Minor Preserves, seven Satellite Preserves, and eleven Linkage Preserves will be assembled in the Mather Core Area. To maximize the effective size and habitat connectivity of the Vernal Pool Ecosystem acres preserved within the Mather Core Area, the SSHCP will follow the Preserve Assembly Criteria and meet all Preserve requirements discussed in SSHCP Chapter 7.5 and in SSHCP Table 7-1.

When considering the 4,608 acres of existing vernal pool grassland preserves present within the Mather Core Area, together with the total 5,793 acres of vernal pool grasslands that will be preserved or re-established by the SSHCP, a total of 10,401 acres of Vernal Pool Ecosystem inside the Mather Core Area will be protected and managed in perpetuity. The total 10,401 acres protected and managed by the SSHCP and other entities inside the Mather Core Area represents approximately 49% of the total 21,193 acres of the Vernal Pool Ecosystem landcovers currently present in the Mather Core Area, and represents approximately 43% of the total 24,335-acre Mather Core Area.

The SSHCP will maintain the existing habitat functions of all Vernal Pool Ecosystem acres protected by the SSHCP within the Mather Core Area in several ways. All urban development Covered Activities implemented in the Mather Core Area will incorporate the SSHCP AMMs described in SSHCP Chapter 5.4 and listed above in Section 2.1.5. The SSHCP also will monitor the effectiveness of the Covered Activity AMMs, including the EDGE AMMs, and then adaptively modify each AMM to be more effective, if needed. As discussed above in Section 2.5.4 and 2.5.5, the SSHCP Preserve System located in the Mather Core Area will be intensively monitored and managed, especially the edge-areas where a Preserve borders a road or urban development, edge-areas where a Preserve is divided by a roadway, and edge-areas where a Preserve is divided by a community trail. In addition, the smaller SSHCP preserves (i.e., the Satellite Preserves, Linkage Preserves, and Minor Preserves) will be more intensively monitored and managed. Management and monitoring of species habitat and Vernal Pool Ecosystem in each Mather Core Area SSHCP Preserve will be tailored to address the conditions in the Preserve and to the land uses adjacent to the Preserve, to assure that existing habitat functions are maintained or improved on all Preserves inside the Mather Core Area, including the smaller SSHCP Preserves. Preserve management actions will be prescribed to address thatch accumulation, weed infestations, and any edge area stressors identified in the intensive monitoring of the Preserve edge areas. The individual Preserve Management Plans (PMPs) prepared for each Preserve in the Mather Core Area will include monitoring of thatch and grass biomass and monitoring for invasive weeds, and will prescribe measures for control of thatch and invasive weeds. In addition, the SSHCP Monitoring and Management Program will develop a comprehensive weed detection and abatement plan for the UDA, which will include an early weed detection, mapping, and a weed abatement plan for roadsides within the Mather Core Area that are outside of the SSHCP Preserves.

In addition, the intensive monitoring and adaptive management of vernal pool Covered Species habitat in the SSHCP Preserves will be provided in perpetuity by the SSHCP Preserve Monitoring and Management Plan. This habitat management is expected to maintain and improve the existing habitat functions and suitability of each acre of the Mather Core Area that is protected in the SSHCP Preserve System, as discussed above in Section 2.5.4 and 2.5.5. The SSHCP effects analysis, and the analysis in this Opinion, expects the SSHCP Preserve System monitoring and management measures will be fully effective in protecting the vernal pool species and vernal pool habitat functions present on the 5,793 acres of the Mather Core Area that is within the SSHCP Preserve System.

As discussed below in Section 2.5.6, the SSHCP Conservation Strategy will protect a significant portion of vernal pool species suitable-habitat in the Mather Core Area and achieve several of the species-specific recovery criteria for the Mather Core Area identified in the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a). The SSHCP will preserve approximately 5,793 acres of Vernal Pool Ecosystem inside the Mather Core Area. When also considering the 4,608 acres of existing preserves in the Mather Core Area, approximately 10,401 acres of suitable habitat for vernal pool species in the Mather Core Area would be preserved and protected in perpetuity. This total is approximately 49% of the total 21,193 acres of Vernal Pool Ecosystem landcovers currently present in the Mather Core Area (based on SSHCP landcover mapping), and approximately 43% of the entire 24,335-acre Mather Core Area. Most of the suitable habitat preserved in the Mather Core Area will be in large blocks, and all Mather Core Area preserved habitat will be contiguous or interconnected. In addition, the intensive monitoring and adaptive management of the suitable habitat in the SSHCP

Preserves will be provided in perpetuity by the SSHCP Preserve Monitoring and Management Plan, and is expected to maintain or improve the existing habitat functions and suitability of each acre of vernal pool species suitable-habitat that will be protected in the Mather Core Area, as discussed above in Section 2.5.4 and 2.5.5.

Table 7. Mather Core Area Permanent Effects and Preservation (acres)

SSHCP Landcover	Direct Effects (acres)	Indirect Effects (acres)	Total Direct and Indirect Effects (acres)	Preservation (acres)	Re-established and/or Established (acres)
Vernal Pool Ecosystem	8,386	114	8,500	5,493[a]	300 [a]
Valley Grassland	8,118	Qualitative Estimate	8,118	5,155	270[b]
Vernal Pool	144	72	216	213	50[c]
Swale	112	38	150	90	30[d]
Stream/Creek (VPIH)	13	3	16	26	0

[a] SSHCP Page 7-98 and Table 7-8b.

[b] SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland, irrigated pasture, or disturbed areas within the UDA to functional Vernal Pool Ecosystem (see Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of the re-established Vernal Pool Ecosystem in the MCRA will be vernal pools and swales, so approximately 270 acres will be reestablished Valley Grassland uplands.

[c] SSHCP Objective VP2 requires a minimum of 50 acres of functional vernal pools be re-established or established within the Mather Core Area or within one mile of the Mather Core Area boundaries, however, additional vernal pool re-establishment or establishment may occur within the Mather Core Area.

[d] Final SSHCP Page 7-66 states that a minimum of 30 acres of swale will be re-established or established within or adjacent to the Mather Core Area.

As discussed below in Section 2.5.6, the SSHCP Conservation Strategy will protect a significant portion of vernal pool species suitable-habitat in the Mather Core Area and achieve several of the species-specific recovery criteria for the Mather Core Area identified in the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a). The SSHCP will preserve approximately 5,793 acres of Vernal Pool Ecosystem inside the Mather Core Area. When also considering the 4,608 acres of existing preserves in the Mather Core Area, approximately 10,401 acres of suitable habitat for vernal pool species in the Mather Core Area would be preserved and protected in perpetuity. This total is approximately 49% of the total 21,193 acres of Vernal Pool Ecosystem landcovers currently present in the Mather Core Area (based on SSHCP landcover mapping), and approximately 43% of the entire 24,335-acre Mather Core Area. Most of the suitable habitat preserved in the Mather Core Area will be in large blocks, and all Mather Core Area preserved habitat will be contiguous or interconnected. In addition, the intensive monitoring and adaptive management of the suitable habitat in the SSHCP Preserves will be provided in perpetuity by the SSHCP Preserve Monitoring and Management Plan, and is expected to maintain or improve the existing habitat functions and suitability of each acre of vernal pool species suitable-habitat that will be protected in the Mather Core Area, as discussed above in Section 2.5.4 and 2.5.5.

2.5.5.1 Effects to the Cosumnes/Rancho-Seco Core Area

As discussed above (Section 2.1.1 and 2.5.2), 44,388 acres (95%) of the total 46,599-acre Cosumnes/Rancho-Seco Core Area are within SSHCP PPU-7 and within the Action Area. The SSHCP determined that rural transportation Covered Activities implemented outside the UDA

portion of the Action Area will remove 53 acres of vernal pool grasslands (Vernal Pool Ecosystem), including 7 acres of Vernal Pool and Swale landcovers (Table 8 below). Therefore, less than 1% of the existing 38,510 acres of Vernal Pool Ecosystem landcovers present in the Cosumnes/Rancho-Seco Core Area portion of the Action Area would be affected by SSHCP Covered Activities.
The SSHCP Conservation Strategy for the Cosumnes/Rancho-Seco Core Area includes the preservation of 15,294 acres of Vernal Pool Ecosystem, including 703 acres of Vernal Pool, 189 acres of Swale, and 14,402 acres of hydrologically-connected Valley Grassland uplands (Table 8 below). Therefore, almost all of the 15,894 acres of SSHCP Preserves established within SSHCP PPU-7 (see Final SSHCP Table 7-6) will occur within the boundaries of the Cosumnes/Rancho-Seco Core Area. Consistent with the SSHCP Preserve System assembly criteria outlined in SSHCP Chapters 7.4 and 7.5, SSHCP Preserves established in the Cosumnes/Rancho-Seco Core Area will be adjacent to and contiguous with the existing preserves within the Cosumnes/Rancho-Seco Core Area, which will not be part of the SSHCP Preserve System (see Section 2.5.2). When considering the 15,294 acres of future SSHCP Preserves and the existing 19,237 acres of existing preserves in the Cosumnes/Rancho-Seco Core Area, approximately 34,531 acres (78%) of the Cosumnes/Rancho-Seco Core Area portion of the Action Area would be protected in perpetuity.

Table 8. Cosumnes/Rancho-Seco Core Area Effects and Preservation (acres)

SSHCP Landcover	Direct Effects (acres)	Indirect Effects (acres)	Total Direct and Indirect Effects (acres)	Preservation (acres)	Re-established and/or Established (acres)
Vernal Pool Ecosystem	53	0	53	15,293	0[a]
Valley Grassland	46	Qualitative Estimate	46	14,402	0[a]
Vernal Pool	6	0	6	703	6[b]
Swale	1	0	1	189	0[c]

a. SSHCP Objective VP6 requires a minimum of 300 acres of functional vernal pool ecosystem be re-established or established within or adjacent to the Mather Core Area. However, the SSHCP Conservation Strategy does not include a requirement an amount of re-established or established functional vernal pool ecosystem within or adjacent to the Cosumnes/Rancho-Seco Core Area.

b. SSHCP Objective VP1b requires Covered Activity impacts to vernal pools within or adjacent to a recovery Core Area be mitigated within or adjacent to that Core Area. Therefore, this Opinion assumes that a minimum of 6 acres of vernal pools will be re-established or established within the Cosumnes/Rancho-Seco Core Area. However, because SSHCP Objective VP2 requires the SSHCP to re-establish or establish 389 acres of functional vernal pools, with at least 50 acres of that vernal pool re-establishment or establishment inside or adjacent to the Mather Core Area—up to 339 acres of vernal pool establishment or re-establishment may occur within or adjacent to the Cosumnes/Rancho-Seco Core Area.

c. SSHCP Objective VP5 requires the SSHCP to re-establish or establish 256 acres of swale (or to instead re-establish or establish additional acres of vernal pool), but requires at least 30 acres of the swale/vernal pool re-establishment or establishment be inside or adjacent to the Mather Core Area—up to 226 acres of the Objective VP5 swale/vernal pool establishment or re-establishment requirement may occur within or adjacent to the Cosumnes/Rancho-Seco Core Area.

As discussed above in Section 2.5.4 and 2.5.5, the SSHCP Conservation Strategy will establish a contiguous 10,500-acre "landscape-size preserve" within the Cosumnes/Rancho-Seco Core Area. In total, the SSHCP Conservation Strategy will preserve and manage in perpetuity 15,294 acres of intact Vernal Pool Ecosystem within the Cosumnes/Rancho-Seco Core Area for the benefit of the vernal pool Covered Species (see Table 8). Individual Preserve Management Plans (PMPs) developed for Preserves within the Cosumnes/Rancho-Seco Core Area will prescribe monitoring of habitat quality and management of threats such as weed infestations, excessive growth of upland grasses and thatch accumulation.

As discussed below in Section 2.5.6, the SSHCP Conservation Strategy will protect a significant portion of the existing Vernal Pool Ecosystem landcovers (suitable-habitat) present within the

Cosumnes/Rancho-Seco Core Area, achieving several species-specific recovery criteria that are identified in the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a).

2.5.6 Effects of the Action on each Vernal Pool Covered Species.

The species-level effects described below build on Section 2.5.3, *General Effects of the Action on All Covered Species*, and on Section 2.5.5, *General Effects of the Action on Vernal Pool Ecosystem*. Effects previously described in these two sections of the Opinion are not repeated below.

The SSHCP assumes that each Vernal Pool Ecosystem aquatic-landcover included in modeled habitat for a vernal pool Covered Species could be occupied by individuals, cysts, eggs, or seeds of that vernal pool Covered Species. Therefore, the SSHCP did not quantify effects to occurrences of any vernal pool Covered Species. The effects analysis in this Opinion also assumes that the aquatic-landcovers included in the modeled habitat of each vernal pool Covered Species are occupied by the species.

Seven of the 11 vernal pool Covered Species discussed below are plants. The plant effects analysis also includes information on the locations of occurrences expected to be affected by Covered Activities, when that information is available. As discussed below, the SSHCP Conservation Strategy specifies the number of plant occurrences that must be preserved prior to Covered Activity effects to the species.

2.5.6.1 Effects on Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp/Critical Habitats

The modeled habitats developed by the SSHCP for the vernal pool fairy shrimp and for vernal pool tadpole shrimp in this Action Area are the same. This Opinion discusses effects to both species together to minimize repetition. Effects of SSHCP Covered Activities on vernal pool fairy shrimp and vernal pool tadpole shrimp include the conversion and loss of modeled habitat, the reduction or loss of existing habitat functions in avoided areas, and effects on vernal pool fairy shrimp and vernal pool tadpole shrimp individuals.

As discussed above in Section 2.5.2, modeled habitat for vernal pool fairy shrimp and the vernal pool tadpole shrimp encompasses all of the Action Area's 103,210 acres of Vernal Pool Ecosystem, including all of the Action Area's 5,861 acres of Vernal Pool, Swale, Stream/Creek (VPIH) aquatic landcovers, and all of the 97,349 acres of hydrologically connected Valley Grassland uplands. Therefore, SSHCP effects to the Action Area's Vernal Pool Ecosystem discussed above in Section 2.5.5 are also effects to modeled habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp (see Table 6 above).

Over the proposed 50-year Permit Term, Covered Activities will remove up to 17,117 acres of vernal pool fairy shrimp and vernal pool tadpole shrimp modeled habitat, including 645 acres of aquatic landcovers (i.e., Vernal Pools, Swales, and Streams/Creeks-VPIH) and 16,472 acres of hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem. This loss of vernal pool fairy shrimp and vernal pool tadpole shrimp modeled habitat will occur primarily inside the UDA, where up to 16,795 acres of Vernal Pool Ecosystem will be removed from the implementation of urban development Covered Activities. Outside the UDA, 332 acres of Vernal

Pool Ecosystem will be removed, primarily from implementation of the rural transportation Covered Activities (Table 9 below). The loss of 17,117 acres of vernal pool fairy shrimp and vernal pool tadpole shrimp modeled habitat within the Action Area includes the removal of species modeled habitat from 8,387 acres of the Mather Core Area (Table 7 above), and 53 acres of the Cosumnes/Rancho-Seco Core Area (Table 8 above).
Activities related to the implementation of SSHCP Covered Activities, such as the use of earth moving equipment, mass grading, placement of fill, paving, and the construction of facilities and structures that remove vernal pool fairy shrimp and vernal pool tadpole shrimp modeled habitat also will result in the death of all cysts on the 17,117 acres of suitable habitat that will be lost. Earthmoving equipment that moves soil and will fill Vernal Pool, Swale, and Swales and Stream/Creek-VPIH habitat during construction activities likely will crush, expose, or otherwise destroy cysts or will prevent the cysts from hatching and reproducing.

As discussed above in Section 2.5.5, the loss of Valley Grassland uplands in the Action Area can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic-landcovers that are located outside of a development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), the SSHCP determined that Covered Activities would indirectly and permanently affect the existing hydrology of an additional 142 acres of vernal pool fairy shrimp and vernal pool tadpole shrimp aquatic-habitats in the Action Area. Approximately 132 of the total indirect effects to the species aquatic habitat would be hydrologic changes to Vernal Pools, Swales, and Streams/Creek-VPIH habitat inside the UDA portion of the Action Area (Table 9 below). Inside the UDA, the indirect effects to the species aquatic-habitats would occur within existing preserves and future SSHCP Preserves that will be adjacent to future urban development Covered Activities. Approximately 10 acres of the total indirect effects to the species aquatic habitat would from hydrologic changes to Vernal Pools and Swales outside the UDA (Table 9 below). Outside the UDA, indirect effects to the species aquatic habitats would result from the rural transportation Covered Activities.

Impacts in the uplands of a Vernal Pool Ecosystem's micro-watershed can indirectly alter the existing seasonal hydrology of the avoided habitat, causing the avoided aquatic-habitat to dry too quickly for vernal pool tadpole shrimp and vernal pool fairy shrimp individuals to complete reproduction in some years, causing injury or death of individuals or cysts. The indirect changes to the existing hydrology of a vernal pool can also change the existing water chemistry or change the physical and biotic conditions in a vernal pool that support the community of periphyton and planktonic and plants and animals that co-exist with vernal pool tadpole shrimp or vernal pool fairy shrimp in a vernal pool. Changes to the existing vernal pool community could alter, decrease, or eliminate food sources for vernal pool tadpole shrimp or vernal pool fairy shrimp. Vernal pool hydrology and water chemistry changes can also reduce the abundance of vascular plant species that provide food material (detritus), physical structure, or shelter for the bacteria, unicellular algae, and the micrometazoa that vernal pool fairy shrimp consume, as well as the smaller crustaceans, insect larvae, and amphibian larvae that vernal pool tadpole shrimp also consume. Changes in food types or reduction in food availability may slow the maturation rate of nauplii (early larval stages), and reduce the number of vernal pool fairy shrimp and vernal pool tadpole shrimp that survive to maturity or reproduce in a given year.

As discussed in Sections 2.5.4 and 2.5.5 above, habitat for vernal pool fairy shrimp and vernal pool tadpole that is avoided but is within close proximity to urban landcovers and human activities can be exposed to other environmental stressors produced by urban landcovers, and these stressors also have the potential to indirectly affect additional habitat or individuals of vernal pool tadpole shrimp and vernal pool fairy shrimp in the edge areas of future SSHCP Preserves and other avoided habitat present inside the UDA (Final SSHCP Table 6- 39 and SSHCP Table 6-48). In addition, the SSHCP will allow certain uses and structures inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect vernal pool fairy shrimp and vernal pool tadpole shrimp habitat in the edge areas of the SSHCP Preserves. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP includes requirements for Covered Activity incorporation of SSHCP AMMs to avoid or minimize exposure of vernal pool fairy shrimp and vernal pool tadpole individuals and habitat to the environmental stressors produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program also will provide more intensive monitoring and management of SSHCP Preserve edge areas in perpetuity, assuring that existing quality of the vernal pool fairy shrimp and vernal pool tadpole shrimp habitats within each SSHCP Preserve edge areas will be maintained or improved. Therefore, although some vernal pool fairy shrimp and vernal pool tadpole shrimp individuals and suitable habitat will be exposed to other environmental stressors produced by urban development Covered Activities, the extent of that exposure is not expected to extend beyond the 142 acres of vernal pool fairy shrimp and vernal pool tadpole habitat already identified by the SSHCP as indirectly and permanently affected. In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP AMMs. The SSHCP also will conduct required Effectiveness Monitoring of each SSHCP Preserve and the SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy will achieve the SSHCP's biological goals for preserving the viability and distribution of vernal pool fairy shrimp and vernal pool tadpole shrimp throughout the Action Area (Final SSHCP Table 7-41 and SSHCP Table 7-49).

As discussed above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for vernal pool fairy shrimp and vernal pool tadpole in the Action Area, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on vernal pool fairy shrimp and vernal pool tadpole shrimp reproduction, and vernal pool fairy shrimp and vernal pool tadpole shrimp numbers and distribution in the Action Area analyzed here are the maximum effects that would occur over the SSHCP Permit Term.

Table 9. Effects to Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp Modeled Habitats (acres)

Landcovers in the Species Modeled Habitat	**Acres Inside UDA**				**Acres Outside UDA**			
	Existing Acres	**Permanent Direct Effects (acres)**	**Permanent Indirect Effects (acres)**	**Total Acres Affected in UDA**	**Existing Acres**	**Permanent Direct Effect (acres)**	**Permanent Indirect Effect (acres)**	**Total Acres Affected outside UDA**
Valley Grassland*	24,584	16,186	Qualitative Assessment	16,186	72,765	286	Qualitative Assessment	286
Vernal Pool	935	355	85	440	3,601	34	9	43
Swale	461	232	43	275	791	2	1	3
Streams/Creeks (VPIH)	68	22	4	26	5	0	0	0
Vernal Pool Ecosystem Total	**26,048**	**16,795**	**132**	**16,927**	**77,162**	**322**	**10**	**332**

* Total impacts to Valley Grassland in the species habitat model include an amount of indirect impact that was described and analyzed qualitatively by the SSHCP.

To offset SSHCP adverse effects to vernal pool fairy shrimp and vernal pool tadpole shrimp individuals and existing suitable habitat, the SSHCP will preserve least 23,284 acres of the high-quality habitat for the two species, including 22,014 acres of Valley Grassland landcover, 966 acres of Vernal Pool landcover, 278 acres of the Swale landcover, and 26 acres of the Stream/Creek (VPIH) landcover or Swale landcover. The species modeled habitat will be preserved following the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapters 7.4 and 7.5, and consistent with the SSHCP biological goals and objectives for vernal pool fairy shrimp and vernal pool tadpole shrimp (Final SSHCP Table 7-42 and SSHCP Table 7- 49).

The SSHCP Conservation Strategy will preserve occurrences and habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp in each type vernal pool present in the Action Area, including occurrences found in different size vernal pools, and the different soils, geological formations, and elevations that support vernal pools in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species compositions, and ecological conditions that support or could support vernal pool fairy shrimp and vernal pool tadpole shrimp in the Action Area.

The more intensive habitat management of vernal pool grassland above-ground biomass that will be provided by the SSHCP Preserve Monitoring and Management Program (Section 2.5.5 above) is expected to maintain or improve the existing habitat functions on preserved vernal pool fairy shrimp and vernal pool tadpole shrimp habitats. Many of the 966 acres of Vernal Pools preserved and managed by the SSHCP can be expected to pond water earlier each winter, and to maintain adequate water depth and water temperatures later in the spring (relative to filling and drying that would have occurred under the existing vernal pool grassland management). In water years with less rainfall, a greater number of vernal pools can be expected to achieve the water depths, period of ponding, and water temperature conditions required for cysts of vernal pool fairy shrimp and vernal pool tadpole shrimp to break dormancy and complete their lifecycle (relative to existing grassland management conditions). Therefore, improved habitat management of 23,284 acres of vernal pool grasslands in the SSHCP Preserve System is expected to increase reproduction of vernal pool fairy shrimp and vernal pool tadpole shrimp in most of the vernal pools protected in the SSHCP Preserve System.

In addition to the preservation of modeled habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp, the SSHCP Conservation Strategy also will establish or re-establish 645 acres of vernal pool fairy shrimp and vernal pool tadpole shrimp modeled aquatic habitat in the Action Area, with a priority on re-establishment before establishment. All vernal pool re-establishment and establishment sites will be inoculated with inoculum from the impact vernal pools, which will assist in maintaining the existing genetic diversity and existing distribution of vernal pool fairy shrimp and vernal pool tadpole shrimp in the Action Area. The effectiveness of inoculation and re-established and established vernal pools will be monitored through a special study, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve vernal pool fairy shrimp and vernal pool tadpole shrimp by ensuring no net loss of the total acreage of vernal pool aquatic habitat in the Action Area.

The Conservation Strategy for vernal pool fairy shrimp and vernal pool tadpole shrimp in provided by the SSHCP is consistent with the recovery criteria and generalized recovery strategy identified by the Vernal Pool Ecosystem Recovery Plan for vernal pool fairy shrimp and vernal pool tadpole shrimp present in the Mather Core Area and the Consumes/Rancho-Seco Core Area.

Effects on Critical Habitat for Vernal Pool Fairy Shrimp

As discussed in Section 2.5.2.1 above, vernal pool fairy shrimp Critical Habitat Unit-13 and Critical Habitat Unit-14 are within the Action Area.

SSHCP urban development Covered Activities in Critical Habitat Unit-13 will convert 692 acres of Vernal Pool Ecosystem to developed landcovers, removing all physical and biological features in those acres that provide for the life-history needs of vernal pool fairy shrimp, which are essential to the conservation of the species (described as primary constituent elements (PCEs) in Sections 2.5.1.1 and 2.5.2.1 above). The soil layers, topographic features, swales, and pools that provide the aquatic environment for vernal pool fairy shrimp incubation, maturation, and reproduction will be removed, eliminating features required for vernal pool fairy shrimp growth and reproduction. The surrounding uplands and watersheds, the topographic features, sources of detritus, the overland flow, and pools also will be removed, eliminating features that provide for dispersal, shelter, and food sources for vernal pool fairy shrimp.

The SSHCP also determined that Covered Activities implemented in Critical Habitat Unit-13 will affect the seasonal inundation of soil layers in grassland uplands, which will indirectly modify the function of the physical and biological features in an additional three acres of swales, depressions, and vernal pools present in Unit-13 (Final SSHCP Table 6-38). The number of days that the indirectly impacted vernal pools continuously hold water will be reduced, and the vernal pools may no longer continuously hold water for the minimum 18 days required for vernal pool fair shrimp to incubate, mature, and reproduce (PCE#2). Reduced filling and ponding of water also will reduce the frequency that each vernal pool fills to capacity and outflows into adjoining swales or ephemeral drainages, which will reduce or eliminate dispersal of vernal pool fairy shrimp by flowing surface water (PCEs #1, #2 and #3). The indirectly affected uplands, swales, pools, and depressions are located in the edge areas of the planned SSHCP Preserve System, and may also be exposed to urban contaminants and pesticides, which would further reduce or eliminate the ability of the affected vernal pools to support vernal pool fairy shrimp feeding and reproduction (PCEs #2 and #3).

The SSHCP Conservation Strategy will permanently preserve 464 acres in Critical Habitat Unit-13, which have all biological and physical features that provide for vernal pool fairy shrimp life-history needs, which are essential to the conservation of the species (the PCEs described in Sections 2.5.1.1 and 2.5.2.1 above), including vernal pool fairy shrimp feeding, growth, breeding, reproduction, shelter, and dispersal. SSHCP preservation in Critical Habitat Unit-13 will include the large SSHCP Core-2 Preserve and the narrower Linkage Preserve L-5 planned in PPU-2 (Final SSHCP Table 7-41). In addition, the north border of the large SSHCP Core-2 Preserve will be contiguous with the existing 1,342-acre Mather Wetland Preserve present in the north half of Critical Habitat Unit-13 (see Section 2.5.2.1 above), which will minimize edge effects and increase the functional size of the planned and existing preserves in Critical Habitat Unit-13, to provide a contiguous area that includes all of the PCEs essential to the conservation of the species.

The SSHCP Preserve Management and Monitoring Program and the specific Preserve Management Plans (PMPs) for the SSHCP Preserves within Unit-13 will provide the special management of vernal pool fairy shrimp Critical Habitat that borders urban development landcovers. Special management implemented in Unit-13 will include actions that prevent or reduce invasive plant and animal species; actions to maintain or improve the existing hydrology of the preserved Vernal Pool Ecosystem, actions to prevent edge contamination by urban pollutants, actions to prevent human degradation of vernal pools and uplands, and actions to restore any areas of degraded habitat within Critical Habitat Unit-13 preserved by the SSHCP. In addition, special management required in the portion of Unit-13 that is within the existing Mather Field Wetlands Preserve is being provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

When considering Covered Activity effects together with the environmental baseline of Critical Habitat Unit-13 (see Section 2.5.2.1 above), a total of 815 acres of the 2,450-acre Critical Habitat Unit-13 will no longer provide the physical and biological features that are essential for the conservation of vernal pool fairy shrimp. However, the SSHCP Conservation Strategy will preserve 464 acres of vernal pool fairy shrimp Critical Habitat Unit-13 that includes all of the PCEs essential to the conservation of vernal pool fairy shrimp, and the SSHCP will provide special management of those acres in perpetuity. The habitat protection and management provided by the SSHCP will maintain or improve the ability of the Critical Habitat Unit-13 to fulfill its conservation role for vernal pool fairy shrimp. When also considering the environmental baseline of Critical Habitat Unit-13 (see Section 2.5.2.1 above), a total of 1,474 acres of the 2,450-acre Critical Habitat Unit-13 will be preserved and managed in perpetuity to provide and maintain the topographic features, depressional features, water, hydroperiods, overland flows, sources of food, and sources of shelter that are described by the primary constituent elements for vernal pool fairy shrimp Critical Habitat, and would allow the Critical Habitat to fulfill its intended conservation role.

Within vernal pool fairy shrimp Critical Habitat Unit-14, the SSHCP rural transportation Covered Activities will convert 51 acres of Vernal Pool Ecosystem to developed landcovers, removing in those acres all physical and biological features essential to the conservation of vernal pool fairy shrimp (described as PCEs in Section 2.5.1.1 and 2.5.2.1 above).

The SSHCP Conservation Strategy will permanently preserve 11,456 acres in Critical Habitat Unit-14, which have all of the biological and physical features essential to vernal pool fairy shrimp feeding, growth, breeding, reproduction, shelter, and dispersal. SSHCP preservation in Critical Habitat Unit-14 will include the 10,500-acre SSHCP Landscape Preserve. In addition, the 11,456 acres of Preserves established by the SSHCP in Critical Habitat Unit-14 will be contiguous with the existing preserves already present in Critical Habitat Unit-14, which will increase the functional size of the planned and existing preserves to provide large, contiguous landscapes that include all of the PCEs essential to the conservation of vernal pool fairy shrimp.

The SSHCP Preserve Management and Monitoring Program and the specific Preserve Management Plans (PMPs) for the 11,456 acres of SSHCP Preserves within vernal pool fairy shrimp Critical Habitat Unit-14 will provide special management of the diversity of vernal pool types and geologic formations present in Critical Habitat Unit-14, the large areas of relatively undisturbed vernal pool complexes present in Critical Habitat Unit-14, and provide the special management needed to assure that created or restored vernal pools in Unit-14 continue to provide the necessary timing and length of inundation for vernal pool fairy shrimp growth and reproduction. The habitat protection and management provided by the SSHCP will maintain or improve the ability of the Critical Habitat Unit-14 to fulfill its conservation role for vernal pool fairy shrimp. When also considering the environmental baseline of Critical Habitat Unit-14 (see Section 2.5.2.1 above), a total of 27,258 acres of the 34,883 acres of Unit-14 located in the Action Area would be preserved and managed in perpetuity to maintain the PCEs essential to the conservation of vernal pool fairy shrimp.

In total, the SSHCP Conservation Strategy will preserve and manage 11,920 acres of vernal pool fairy shrimp Critical Habitat in the Action Area. The SSHCP Preserve Maintenance and Management Program and Preserve Management Plans for the 11,920 acres of vernal pool fairy shrimp Critical Habitat preserved in the SSHCP Preserve System will retain or improve the quality and function of the physical and biological features that are essential to the conservation of vernal pool fairy shrimp. We do not expect the direct and indirect alterations of 743 acres of vernal pool fairy shrimp Critical Habitat by SSHCP Covered Activities to appreciably diminish the value of the Critical Habitat designation for the conservation of vernal pool fairy shrimp, and we expect the Critical Habitat designation would remain functional to serve its intended conservation role for the species after implementation of the SSHCP.

Effects on Critical Habitat for Vernal Pool Tadpole Shrimp

As discussed above in Section 2.5.2.1, vernal pool tadpole shrimp Critical Habitat Unit-8 and Critical Habitat Unit-9 are within the Action Area.

SSHCP urban development Covered Activities in Critical Habitat Unit-8 will convert 692 acres of Vernal Pool Ecosystem to developed landcovers, which will remove all physical and biological features in those acres that provide for the life-history needs of vernal pool tadpole shrimp, which are essential to the conservation of the species (described as primary constituent elements (PCEs) in Sections 2.5.1.2 and 2.5.2.2 above). The soil layers, topographic features, swales, and pools that provide the aquatic environment for vernal pool tadpole shrimp incubation, maturation, and reproduction will be removed, eliminating features required for vernal pool tadpole shrimp growth and reproduction. The surrounding uplands and watersheds, the topographic features, sources of detritus, the overland flow, and pools also will be removed, eliminating features that provide for dispersal, shelter, and food sources for vernal pool tadpole shrimp.

The SSHCP also determined that Covered Activities implemented in Critical Habitat Unit-8 will affect the seasonal inundation of soil layers in grassland uplands, which will indirectly modify the functions of the physical and biological features in an additional three acres of swales, depressions, and vernal pools present in Unit-8 (Final SSHCP Table 6-47). The number of days that the indirectly impacted vernal pools continuously hold water will be reduced, and the vernal pools may no longer continuously hold water for the minimum 41 days required for vernal pool fair shrimp to incubate, mature, and reproduce (PCE#2). Reduced filling and ponding of water also will reduce the frequency that each vernal pool fills to capacity and outflows into adjoining swales or ephemeral drainages, which will reduce or eliminate dispersal of vernal pool tadpole shrimp by flowing surface water (PCEs #1, #2, and #3). The indirectly affected uplands, swales, pools, and depressions are located in the edge areas of the planned SSHCP Preserve System, and may also be exposed to urban contaminants and pesticides, which would further reduce or eliminate the ability of the vernal pools to support vernal pool tadpole shrimp feeding and reproduction (PCEs #2 and #3).

The SSHCP Conservation Strategy will permanently preserve 464 acres in Critical Habitat Unit-8 that have all biological and physical features that provide for vernal pool tadpole shrimp life-history needs, which are essential to the conservation of the species (the PCEs described in Sections 2.5.1.2 and 2.5.2.2 above), including vernal pool tadpole shrimp feeding, growth, breeding, reproduction, shelter, and dispersal. SSHCP preservation in Critical Habitat Unit-8 will include the large SSHCP Core-2 Preserve and the narrower Linkage Preserve L-5 planned in PPU-2 (Final SSHCP Table 7-48). In addition, the north border of the large SSHCP Core-2 Preserve will be contiguous with the

existing 1,342-acre Mather Wetland Preserve present in the north half of Critical Habitat Unit-8 (see Section 2.5.2.2 above), which will minimize edge effects and increase the functional size of the planned and existing preserves in Critical Habitat Unit-8, to provide a contiguous area that includes all of the PCEs essential to the conservation of the species.
The SSHCP Preserve Management and Monitoring Program and the specific Preserve Management Plans (PMPs) for the SSHCP Preserves within Unit-8 will provide the special management of vernal pool tadpole shrimp Critical Habitat that borders urban development landcovers. Special management implemented in Unit-8 will include actions that prevent or reduce invasive plant and animal species; actions to maintain or improve the existing hydrology of the preserved Vernal Pool Ecosystem, actions to prevent edge contamination by urban pollutants, actions to prevent human degradation of vernal pools and uplands, and actions to restore any areas of degraded habitat within Critical Habitat Unit-8 preserved by the SSHCP. In addition, special management required in the portion of Unit-8 that is within the existing Mather Field Wetlands Preserve is being provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

When considering Covered Activity effects together with the environmental baseline of Critical Habitat Unit-8 (see Section 2.5.2.1 above), a total of 815 acres of the 2,450-acre Critical Habitat Unit-8 will no longer provide the physical and biological features that are essential for the conservation of vernal pool tadpole shrimp. However, the SSHCP Conservation Strategy will preserve 464 acres of vernal pool tadpole shrimp Critical Habitat Unit-8 that includes all of the PCEs essential to the conservation of vernal pool tadpole shrimp, and the SSHCP will provide special management of those acres in perpetuity. The habitat protection and management provided by the SSHCP will maintain or improve the ability of the Critical Habitat Unit-8 to fulfill its conservation role for vernal pool tadpole shrimp. When also considering the environmental baseline of Critical Habitat Unit-8 (see Section 2.5.2.2 above), a total of 1,474 acres of the 2,450-acre Critical Habitat Unit-8 will be preserved and managed in perpetuity to provide and maintain the topographic features, depressional features, water, hydroperiods, overland flows, sources of food, and sources of shelter that are described by the primary constituent elements for vernal pool tadpole shrimp Critical Habitat, and would allow the Critical Habitat to fulfill its intended conservation role.

Within vernal pool tadpole shrimp Critical Habitat Unit-9, the SSHCP rural transportation Covered Activities will convert 51 acres of Vernal Pool Ecosystem to developed landcovers, removing in those acres all physical and biological features essential to the conservation of vernal pool tadpole shrimp (described as PCEs in Section 2.5.1.1 and 2.5.2.1 above).

The SSHCP Conservation Strategy will permanently preserve 11,456 acres in Critical Habitat Unit-9, which have all of the biological and physical features essential to vernal pool tadpole shrimp feeding, growth, breeding, reproduction, shelter, and dispersal. SSHCP preservation in Critical Habitat Unit-9 will include the 10,500-acre SSHCP Landscape Preserve. In addition, the 11,456 acres of Preserves established by the SSHCP in Critical Habitat Unit-9 will be contiguous with the existing preserves already present in Critical Habitat Unit-9, which will increase the functional size of the planned and existing preserves to provide large, contiguous landscapes that include all of the PCEs essential to the conservation of vernal pool tadpole shrimp.

The SSHCP Preserve Management and Monitoring Program and the specific Preserve Management Plans (PMPs) for the 11,456 acres of SSHCP Preserves within vernal pool tadpole shrimp Critical Habitat Unit-9 will provide special management of the diversity of vernal pool types and geologic formations present in Critical Habitat Unit-9, special management of the large areas of relatively undisturbed vernal pool complexes present in Critical Habitat Unit-9, and provide the special management needed to assure that created or restored vernal pools in Unit-9 continue to provide the necessary timing and length of inundation for vernal pool tadpole shrimp growth and reproduction. The habitat protection and management provided by the SSHCP will maintain or improve the ability of the Critical Habitat Unit-9 to fulfill its conservation role for vernal pool tadpole shrimp. When also considering the environmental baseline of Critical Habitat Unit-9 (see Section 2.5.2.2 above), a total of 27,258 acres of the 34,883 acres of Unit-9 located in the Action Area would be preserved and managed in perpetuity to maintain the PCEs essential to the conservation of vernal pool tadpole shrimp.

In total, the SSHCP Conservation Strategy will preserve and manage 11,920 acres of vernal pool tadpole shrimp Critical Habitat in the Action Area. The SSHCP Preserve Maintenance and Management Program and the Preserve Management Plans for the 11,920 acres of vernal pool tadpole shrimp Critical Habitat preserved in the SSHCP Preserve System will retain or improve the quality and function of the physical and biological features that are essential to the conservation of vernal pool tadpole shrimp. We do not expect the direct and indirect alterations of 743 acres of vernal pool tadpole shrimp Critical Habitat by SSHCP Covered Activities to appreciably diminish the value of the Critical Habitat designation for the conservation of vernal pool tadpole shrimp, and we expect the Critical Habitat designation would remain functional to serve its intended conservation role for the species after implementation of the SSHCP.

2.5.6.2 Effects on Mid-Valley Fairy Shrimp

Effects of SSHCP Covered Activities on mid-valley fairy shrimp include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on mid-valley fairy shrimp individuals.

Over the proposed Permit Term, SSHCP Covered Activities will remove 12,533 acres of mid-valley fairy shrimp modeled habitat, including 527 acres of mid-valley fairy shrimp aquatic habitats (i.e. Vernal Pools and Swales) and 12,006 acres of hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem. The removal of mid-valley fairy shrimp modeled habitat will primarily occur in the UDA portion of the Action Area, where up to 12,299 acres of Vernal Pool Ecosystem will be lost from the implementation of urban development Covered Activities. Outside the UDA, up to 234 acres of Vernal Pool Ecosystem will be lost, primarily from implementation of the rural transportation Covered Activities (Table 10 below). The loss of 12,533 acres of mid-valley fairy shrimp modeled habitat within the Action Area includes the loss of mid-valley fairy shrimp modeled habitat from 6,184 acres of the Mather Core Area, and 41 acres of the Cosumnes/Rancho-Seco Core Area (Table 8 above).

Activities related to the implementation of SSHCP Covered Activities, such as the use of earth moving equipment, mass grading, placement of paving, fill, and construction of facilities and structures that remove mid-valley fairy shrimp habitat and result in the death of all dormant cysts on the 12,533 acres of modeled habitat that will be lost. Earthmoving equipment that moves soil and will fill Vernal Pool and Swale aquatic habitats during construction activities likely will crush, expose, or otherwise destroy the cysts or will prevent the cysts from hatching and reproducing.

As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands in the Action Area can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers that are located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers

(Section 2.5.3 above), the SSHCP determined that Covered Activities would indirectly and permanently affect the existing hydrology of an additional 106 acres of mid-valley fairy shrimp aquatic habitats in the Action Area, with the majority of indirectly affected habitat (103 acres) occurring inside the UDA (Table 10 below). Inside the UDA, the indirect effects to the species aquatic-habitats would occur within existing preserves and future SSHCP Preserves that will be adjacent to future urban development Covered Activities. Indirect effects to the existing hydrology of a Vernal Pool Ecosystem can especially affect smaller vernal pools, which are preferred by the mid-valley fairy shrimp. Changes to the existing hydrology of a Vernal Pool Ecosystem may result in smaller vernal pool filling less frequently in average rainfall water-years, or not filling at all. In water-years when indirectly-affected small vernal pools do fill, they may not fill enough to trigger hatching of cysts, or they may dry too quickly for mid-valley shrimp individuals to complete reproduction causing injury or death of individuals. Indirect changes to the existing hydrology of a vernal pool can also change the existing water chemistry, or change the physical and biotic conditions in a vernal pool that support the community of periphyton and planktonic and plants and animals that co-exist with the mid-valley fairy shrimp in a vernal pool. Changes to the existing community in a vernal pool could alter, decrease, or eliminate food sources for the mid-valley fairy shrimp. In addition to feeding by indiscriminately filtering organisms and detritus from the water column, mid-valley fairy shrimp also rasp periphyton from sticks, plant stems, and leaves in the water column of a vernal pool (Final SSHCP Appendix B). Changes to vernal pool hydrology and water chemistry can reduce the abundance of planktonic food organisms, or reduce the number of vascular plants that provide the physical structure used by food organisms of the mid-valley fairy shrimp. Changes in food types or reduction in food availability may slow maturation rate of nauplii (early larval stages), and may reduce the number of mid-valley fairy shrimp that survive to maturity or reproduce in a given year.

Table 10. Effects to Mid-Valley Fairy Shrimp Modeled Habitat (acres)

SSHCP Landcovers in the Species Modeled Habitat	Effects Inside UDA				Effects Outside UDA			
	Existing Acres	Direct Effect	Indirect Effect	Total UDA Effects	Existing Acres	Direct Effect	Indirect Effect	Total outside UDA
Valley Grassland*	19,269	11,799	Qualitative Assessment	11,799		207	Qualitative Assessment	207
Vernal Pool	860	312	69	381	1,958	25	2	27
Swale	393	188	34	222	366	2	1	3
Vernal Pool Ecosystem Total	**20,522**	**12,299**	**103**	**12,402**	**33,116**	**234**	**3**	**237**

* Total impacts to Valley Grassland include an unknown but small amount of impact that was analyzed qualitatively.

As discussed in Sections 2.5.4 and 2.5.5 above, habitat for mid-valley fairy shrimp that is avoided, but is in close proximity to urban landcovers and human activities can also be exposed to several other environmental stressors produced by urban landcovers (Final SSHCP Table 6-43), and these stressors also have the potential to indirectly affect additional habitat for mid-valley fairy shrimp in future SSHCP Preserves and in other avoided habitat present inside the UDA In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect mid-valley fairy shrimp habitat in the edge areas of the SSHCP Preserves. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP includes requirements for Covered Activities to incorporate SSHCP AMMs that will avoid or minimize exposure of mid-valley fairy shrimp individuals and habitats to the environmental stressors produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the Permit Term. The SSHCP Preserve Management and

Monitoring Program also will provide more intensive monitoring and management of Preserve edge areas in perpetuity, assuring that existing quality of mid-valley fairy shrimp habitat within the edge areas of each SSHCP Preserve will be maintained. Therefore, although some mid-valley fairy shrimp individuals and suitable habitat will be exposed to additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 106 acres of existing mid-valley fairy shrimp habitat already identified by the SSHCP as indirectly and permanently affected. In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP indirect effect analysis, and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy will achieve the SSHCP's biological goals and objectives for preserving the viability and distribution of mid-valley fairy shrimp throughout the Action Area (Final SSHCP Table 7-44). SSHCP Conservation Action VPI1.1 will assure that appropriate vernal pool sizes, vernal pool densities, soil types, and geology included in mid-valley fairy shrimp modeled habitat are included in the SSHCP Preserve System.

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for mid-valley fairy shrimp in the Action Area, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on mid-valley fairy shrimp reproduction, numbers, and distribution in the Action Area that are discussed here are the maximum effects that would occur over the SSHCP Permit Term.

To offset the adverse effects to mid-valley fairy shrimp individuals and suitable-habitat in the Action Area, the SSHCP will preserve least 11,297 acres of high-quality suitable habitat for the mid-valley fairy shrimp in the Action Area, including 10,493 acres of Valley Grassland landcover, 603 acres of Vernal Pool landcover, and 201 acres of the Swale landcover following the SSHCP Preserve System assembly criteria outlined in SSHCP Chapter 7.4 and 7.5, and consistent with the SSHCP biological goals and objectives for mid-valley fairy shrimp (SSHCP Table 7-45). The SSHCP Preserve System will link together SSHCP Preserves and existing preserves that have modeled mid-valley fairy shrimp habitat to help maintain dispersal between vernal pool complexes (e.g., dispersal of cysts through surface flows, wind, and mud carried on the feet of animals). For example, seven documented occurrences for mid-valley fairy shrimp are located in existing preserves in PPU-3 (south of Jackson Highway), which would be linked together under the SSHCP by Core Preserves and Linkage Preserves to other existing preserves in PPU-3 and the SSHCP Preserve System in the UDA. By establishing large Preserves, the SSHCP also will ensure that connectivity between pools within Preserves is maintained. The SSHCP Conservation Strategy will preserve occurrences of mid-valley fairy shrimp within the different vernal pool types, soils, and geological formations that are found in the Action Area. In this manner, the SSHCP Conservation Strategy will help to conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions currently present in the Action Area.

The SSHCP Conservation Strategy will preserve occurrences and habitat for mid-valley fairy shrimp present in different types of vernal pools in the Action Area, including vernal pools found on the different soils, geological formations, and elevations in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support or could support mid-valley fairy shrimp in the Action Area.

The more intensive habitat management of vernal pool grassland above-ground biomass provided by the SSHCP Preserve Monitoring and Management Program (Section 2.5.5 above) is expected to maintain or improve the existing habitat functions provided on the 11,297 acres of preserved mid-valley fairy shrimp habitats. Many of the 603 acres of Vernal Pools in preserved modeled habitat for mid-valley fairy shrimp preserved and managed by the SSHCP can be expected to pond water earlier each winter, and to maintain adequate water depth and water temperatures later in the spring (relative to filling and drying that would have occurred under the existing vernal pool grassland management). In water years with less rainfall, a greater number of small vernal pools can be expected to achieve the water depth, period of ponding, and water temperature conditions required for cysts of mid-valley fairy shrimp to break dormancy and complete their lifecycle (relative to existing grassland management). Therefore, improved habitat management of 11,297 acres of vernal pool grasslands within the SSHCP Preserve System is expected to increase the reproduction of mid-valley fairy shrimp in most of the vernal pools protected in the SSHCP Preserve System.

In addition to the preservation of modeled habitat for mid-valley fairy shrimp, the SSHCP Conservation Strategy also will establish or re-establish 546 acres of mid-valley fairy shrimp modeled aquatic habitat in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining the existing genetic diversity and existing distribution of mid-valley fairy shrimp in the Action Area. The effectiveness of inoculation and re-established and established vernal pools will be monitored through a special study, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve mid-valley fairy shrimp by ensuring no net loss of the total acreage of mid-valley fairy shrimp aquatic habitat in the Action Area.

2.5.6.3 Effects on Ricksecker's Water Scavenger Beetle

Effects of SSHCP Covered Activities on Ricksecker's water scavenger beetle include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on individuals.

SSHCP Covered Activities will remove 17,095 acres of Ricksecker's water scavenger beetle modeled habitat, including the loss of 623 acres aquatic habitats (Vernal Pools and Swales) and 16,472 acres of hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem. The removal of Ricksecker's water scavenger beetle modeled habitat will occur primarily inside the UDA portion of the Action Area, where up to 16,773 acres of modeled habitat will be lost from the implementation of urban development Covered Activities. Outside the UDA, 322 acres of modeled habitat will be removed, primarily from implementation of the rural transportation Covered Activities (Table 11 below).

Activities related to the implementation of SSHCP Covered Activities, such as the use of earth moving equipment, mass grading, placement of fill, paving, and construction of facilities and structures, will remove Ricksecker's water scavenger beetle habitat and result in the death of all dormant adults, pupa, or eggs on the 17,095 acres of habitat that will be lost. Earthmoving equipment that moves soil and fills Vernal Pool and Swale aquatic habitats during construction activities likely will crush, expose, or otherwise destroy dormant adults, pupa, and eggs, or will otherwise prevent pupa from emerging and eggs from hatching and reproducing.

As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), implementation of SSHCP Covered Activities also will permanently and indirectly affect the existing hydrology of 138 acres of Ricksecker's water scavenger beetle aquatic habitats in the Action Area, with the majority of indirectly affected habitat (128 acres) occurring inside the UDA (Table 11 below). Inside the UDA, the indirect effects to the species aquatic-habitats would occur within existing preserves and future SSHCP Preserves that will be adjacent to future urban development Covered Activities.

Impacts in the uplands of a Vernal Pool Ecosystem's micro-watershed can indirectly alter the existing seasonal hydrology of the avoided Vernal Pools and Swales, causing the Vernal Pools and Swales to dry to quickly and water temperatures to increase before Ricksecker's water scavenger beetle individuals can complete reproduction, resulting in the injury or death of individuals. The indirect changes to the existing hydrology of a vernal pool can also change the existing water chemistry, physical conditions, or biotic conditions in a vernal pool that support the community of plants and benthic and planktonic plants and animals that co-exist with Ricksecker's water scavenger beetle larvae and adults, which can alter, decrease, or eliminate food sources for the Ricksecker's water scavenger beetle larvae and adults. Changes in food sources and reduction in food availability will slow maturation rate for each larval stage and reduce the number of larvae that pupate and survive to maturity, and reduce the number of adults that are able to successfully reproduce in a given year.

As discussed in Sections 2.5.4 and 2.5.5 above, avoided habitat for Ricksecker's water scavenger beetle within close proximity to urban landcovers and human activities can also be exposed to several other environmental stressors produced by urban landcovers, and these stressors also have the potential to indirectly reduce or eliminate additional habitat for Ricksecker's water scavenger beetle present in future SSHCP Preserves and other avoided habitat inside the UDA (Final SSHCP Table 6-51). In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect Ricksecker's water scavenger beetle habitat in the edge areas of the SSHCP Preserves. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP includes requirements for Covered Activities to incorporate SSHCP AMMs that will avoid or minimize exposure of Ricksecker's water scavenger beetle individuals and habitats to the environmental stressors produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program also will provide intensive monitoring and management of Preserve edge areas in perpetuity, assuring that existing quality of Ricksecker's water scavenger beetle habitat within all SSHCP Preserve edge areas will be maintained. Therefore, although some Ricksecker's water scavenger beetle individuals and suitable habitat will be exposed to additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 138 acres of existing Ricksecker's water scavenger beetle habitat already identified by the SSHCP as indirectly and permanently affected. In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP indirect effect analysis, and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the SSHCP Preserve System over the 50-year term of the proposed ITP, which will assure that the SSHCP Conservation Strategy will achieve the SSHCP's biological goals and objectives for preserving the viability and distribution of

Ricksecker's water scavenger beetle throughout the Action Area (Final SSHCP Table 7-52). SSHCP Conservation Action VPI4 will assure that appropriate vernal pool sizes, vernal pool densities, soil types, and geology included in Ricksecker's water scavenger beetle modeled habitat are included in the SSHCP Preserve System.

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for Ricksecker's water scavenger beetle in the Action Area, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on Ricksecker's water scavenger beetle reproduction, numbers, and distribution in the Action Area that are discussed here are the maximum effects that would occur over the SSHCP Permit Term.

Table 11. Effects to Ricksecker's Water Scavenger Beetle Habitat

SSHCP Landcovers in the Species Modeled Habitat	**Acres Inside UDA**				**Acres Outside UDA**			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	24,584	16,186	Qualitative Assessment	16,186	72,765	286	Qualitative Assessment	286
Vernal Pool	935	355	85	40	3,601	34	9	434 61
Swale	461	232	43	275	791	2	1	3
Vernal Pool Ecosystem Total	**25,980**	**16,773**	**128**	**16,901**	**77,157**	**322**	**10**	**332**

To offset the adverse effects to Ricksecker's water scavenger beetle individuals and suitable-habitat in the Action Area, the SSHCP will preserve least 23,258 acres of the high-quality suitable habitat for Ricksecker's water scavenger beetle in the Action Area, including 22,014 acres of Valley Grassland landcover, 966 acres of Vernal Pool landcover, and 278 acres of the Swale landcover, consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5 and consistent with the SSHCP biological goals and objectives for Ricksecker's water scavenger beetle (Final SSHCP Table 7-51). The SSHCP Preserve System will link together SSHCP Preserves and existing preserves that have modeled habitat for Ricksecker's water scavenger beetle, which will help maintain dispersal between vernal pool complexes (i.e. dispersal of mating adults, and the passive dispersal of eggs through surface flows and mud carried on the feet of animals). The four documented occurrences for Ricksecker's water scavenger beetle located in PPU-2 would adjoin the new SSHCP Core-2 Preserve, and would also be connected by Linkage Preserves to SSHCP Core-3 Preserves and large existing preserves in PPU-3.

The SSHCP Conservation Strategy will preserve occurrences and habitat for Ricksecker's water scavenger beetle present in different types of vernal pools in the Action Area, including vernal pools found on the different soils, geological formations, and elevations in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support or could support Ricksecker's water scavenger beetle in the Action Area.

The intensive habitat management of vernal pool grassland above-ground biomass that will be provided by the SSHCP Preserve Monitoring and Management Program (Section 2.5.5 above) is expected to maintain or improve the exiting habitat functions of the 23,258 acres of Ricksecker's water scavenger beetle modeled habitat that will be included in the SSHCP Preserve System. The more intensive and consistent management of vernal pool grasslands in the SSHCP Preserve System is expected to improve rainwater infiltration that forms the perched aquifer, and slow draw-down of perched aquifer and drying of Vernal Pools each spring. Therefore, the 603 acres of Vernal Pools in the preserved modeled habitat for Ricksecker's water scavenger beetle are expected, in most water years, to begin filling some number of days earlier each winter relative to current conditions. Similarly, many of the preserved Vernal Pools in modeled habitat for Ricksecker's water scavenger beetle are expected to maintain adequate water depth and water temperatures for additional days later each spring (relative to conditions under the existing management of those vernal pool grasslands). Consequently, a greater number of vernal pools in the SSHCP Preserve System can be expected to achieve the water depths, period of ponding, and water temperature conditions required for dormant eggs of Ricksecker's water scavenger beetle to hatch, larvae to grow and pupate, and adults to emerge and complete their lifecycle (relative to existing grassland management conditions). Therefore, improved habitat management of 23,258 acres of vernal pool grasslands in the SSHCP Preserve System is expected to increase reproduction of Ricksecker's water scavenger beetles in vernal pools where they occur in the SSHCP Preserve System, and improve suitable habitat for dispersing adults, eventually increasing the number of Ricksecker's water scavenger beetle occurrences and expanding the distribution of Ricksecker's water scavenger beetle within the Preserve System.

In addition to the preservation of modeled habitat for Ricksecker's water scavenger beetle, the SSHCP Conservation Strategy also will establish or re-establish 623 acres of Ricksecker's water scavenger beetle modeled aquatic habitat in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining the existing genetic diversity and existing distribution of Ricksecker's water scavenger beetle in the Action Area. The effectiveness of inoculation and re-established and established vernal pools will be monitored through a special study, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve Ricksecker's water scavenger beetle by ensuring no net loss of the total acreage of aquatic habitat in the Action Area.

2.5.6.4 Effects on Dwarf Downingia

Effects of SSHCP Covered Activities on dwarf downingia include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and potential effects on individuals.

SSHCP Covered Activities will remove 1,963 acres of dwarf downingia modeled habitat, including 140 acres of aquatic habitats (Vernal Pools and Swales) and 1,823 acres of hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem. Most loss of dwarf downingia modeled habitat will occur in the UDA portion of the Action Area, where up to 1,881 acres of modeled Vernal Pool Ecosystem habitat will be removed, primarily from the implementation of urban development Covered Activities. Outside the UDA, 82 acres of dwarf downingia modeled habitat will be lost, primarily from implementation of rural transportation Covered Activities (Table 12 below).

Activities related to the removal of natural landcovers and the implementation of SSHCP Covered Activities, such as the use of earth moving equipment, mass grading, placement of fill, paving, and

construction of facilities and structures that remove dwarf downingia modeled habitat will also result in the death of all individuals or dormant seeds on the 1,963 acres of modeled habitat that will be lost. Earthmoving equipment that moves soil and fills Vernal Pool and Swale aquatic habitats during construction activities likely will crush, expose, or otherwise destroy the seeds or will prevent the seeds from germinating and reproducing.
As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), implementation of SSHCP Covered Activities also will permanently and indirectly affect the existing hydrology of 19 acres of dwarf downingia aquatic habitats, all in the UDA portion of the Action Area (Table 12 below). Indirect changes to the existing hydrology of a Vernal Pool Ecosystem can especially affect smaller or "flashy" vernal pools, which are preferred by the dwarf downingia. Changes to the existing hydrology of the Vernal Pool Ecosystem in dwarf downingia modeled habitat may result in smaller vernal pool filling less frequently in average rainfall water-years, or not at all. In water-years when affected small vernal pools do fill, they may not fill enough to trigger germination of dormant seeds that may be present, or to support the growth, flowering, or seed production in the germinated dwarf downingia plants.

In addition to potential indirect effects from hydrology changes, avoided modeled habitat for dwarf downingia in close proximity to future urban landcovers and human activities could be exposed to other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above), and these stressors also have the potential to indirectly reduce or eliminate additional modeled habitat for dwarf downingia within the future SSHCP Preserves and other avoided habitat inside the UDA. In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect dwarf downingia modeled habitat along the edges of the SSHCP Preserves. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP includes requirements for Covered Activities to incorporate SSHCP AMMs that will avoid or minimize exposure of dwarf downingia suitable habitat to the environmental stressors produced by the urban development Covered Activities (Final SSHCP Table 6-15), and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program also will provide more intensive monitoring and management of the Preserve edge areas in perpetuity, assuring that the existing quality and function of dwarf downingia modeled habitat in the edge areas of each SSHCP Preserve will be maintained. Therefore, although some dwarf downingia suitable habitat will be exposed to additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 19 acres of dwarf downingia modeled habitat already identified by the SSHCP as indirectly and permanently affected.

In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs, and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the entire SSHCP Preserve System during the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy will achieve the SSHCP's biological goals and objectives for preserving the viability and distribution of dwarf downingia in the Action Area (Final SSHCP Table 7-24). The process and criteria for assembling the SSHCP Preserve System will assure that appropriate vernal pool sizes, vernal pool soil types, and geology included in the dwarf downingia modeled habitat are included in the SSHCP Preserve System.

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for dwarf downingia in the Action Area, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on dwarf downingia reproduction, numbers, and distribution in the Action Area that are discussed here are the maximum effects that would occur over the SSHCP Permit Term.

The 10 documented occurrences of dwarf downingia present in the Action Area are within existing preserves, and are not expected to be directed or indirectly affected by SSHCP Covered Activities. Because documented occurrences in the Action Area are already within existing preserves, no known occurrences would be enclosed by the SSHCP Preserve System. If additional occurrences of dwarf downingia are found within the Action Area over the term of the proposed Permit, SSHCP Objective VPP3 requires that, prior to Covered Activity loss or removal of any occurrence of dwarf downingia, one currently unpreserved and "biologically equivalent or superior" occurrence of dwarf downingia (as defined by the Service and the future SSHCP TAC) will be preserved within the Action Area. The minimum preserve size identified by the SSHCP for the protection of new dwarf downingia occurrences is a SSHCP "Satellite Preserve" (i.e. is 11 to 250 acres in size), that encloses the entire micro-watershed of the occupied vernal pool, and includes a minimum 50-foot Preserve Setback between the preserved habitat and SSHCP urban development Covered Activities. In addition, the preserved dwarf downingia occurrence will be surveyed in the growing season after the Preserve is established, and will be surveyed every 5 years thereafter in perpetuity, to monitor the abundance and persistence of the dwarf downingia occurrence in that Preserve. If monitoring indicates that the preserved population is not persisting, the SSHCP will conduct remediation efforts.

Table 12. Effects to Dwarf Downingia Modeled Habitats

SSHCP Landcovers in the Species Modeled Habitat	**Inside UDA (acres)**				**Outside UDA (acres)**			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	2,673	1,750	Qualitative Assessment	1,750	19,568	73	Qualitative Assessment	73
Vernal Pool	305	85	13	98	1.356	9	0	9
Swale	106	46	6	52	253	0	0	0
Vernal Pool Ecosystem Total	**3,084**	**1,881**	**19**	**1,900**	**21,117**	**82**	**0**	**82**

To offset the adverse effects to dwarf downingia modeled habitat, the SSHCP will preserve least 3,975 acres of high-quality modeled habitat for dwarf downingia in the Action Area including 3,733 acres of Valley Grassland landcover, 186 acres of Vernal Pool landcover, and 56 acres of the Swale landcover. Modeled habitat preserved for dwarf downingia will be assembled consistent with the Preserve System assembly criteria outlined in SSHCP Chapters 7.4 and 7.5, and consistent with the biological goals and objectives for dwarf downingia (Final SSHCP Table 7-23). By preserving large areas of modeled habitat for dwarf downingia, the SSHCP Preserve System may preserve previously unknown occurrences of dwarf downingia that are present in the Action Area. In addition, the SSHCP Preserve System will protect suitable habitat where dwarf downingia individuals may disperse and establish additional occurrences or additional populations of dwarf downingia in the Action Area. The SSHCP Preserve System also will preserve habitat linkages between the existing dwarf downingia occurrences and unoccupied dwarf downingia suitable habitat, which will maintain opportunities for dispersal to occur (e.g., dispersal of seeds through surface flows, waterfowl, and mud carried on the feet of animals).

The SSHCP Conservation Strategy will preserve habitat for dwarf downingia in a range of vernal pool types present in the Action Area, including smaller and shallower vernal pools found on the different soils, geological formations, and elevations in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support dwarf downingia in the Action Area.

The SSHCP Preserve Monitoring and Management Program discussed above (Section 2.5.5) is also expected to maintain or improve the existing habitat functions currently provided on the 3,975 acres of dwarf downingia modeled habitat that will be included in the SSHCP Preserve System. Since dwarf downingia occupies the smaller to medium size vernal pools and the margins of larger or deeper vernal pools, it may be more susceptible to the effects of excessive growth of non-native naturalized annual grass and thatch buildup in adjacent uplands. The more intensive vernal pool grassland monitoring and management provided by the individual Preserve Management Plans will reduce aboveground biomass and control annual grass use of water from the perched aquifer, improving dwarf downingia suitable habitat in the Preserve System. The improved management of dwarf downingia occurrences and habitat in the SSHCP Preserve System is expected to increase seed production and reproduction of individual dwarf downingia plants protected in the SSHCP Preserve System, eventually increasing the number of dwarf downingia occurrences and expanding distribution of dwarf downingia within the Preserve System.

In addition to the preservation of modeled habitat for dwarf downingia, the SSHCP Conservation Strategy also will establish or re-establish 141 acres of dwarf downingia modeled aquatic habitat in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining dwarf downingia in the Action Area. The effectiveness of inoculation and the success of re-established and established vernal pools will be monitored through Special Studies, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve dwarf downingia by ensuring no net loss of the total acreage of dwarf downingia aquatic habitat in the Action Area.

2.5.6.5 Effects on Boggs Lake Hedge-hyssop

Effects of SSHCP Covered Activities on Boggs Lake hedge-hyssop include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on individuals.

SSHCP Covered Activities will remove 8,672 acres of Boggs Lake hedge-hyssop modeled habitat, including 240 acres of vernal pools, 13 acres of seasonal wetlands, and 8,419 acres of Valley Grassland uplands in the Vernal Pool Ecosystem. Most removal of Boggs Lake hedge-hyssop modeled habitat will occur in the UDA portion of the Action Area, where up to 8,584 acres Boggs Lake hedge-hyssop modeled habitat will be removed. Outside the UDA, 139 acres of modeled Vernal Pool Ecosystem habitat will be removed, primarily from implementation of rural transportation Covered Activities (Table 13 below). Activities related to the removal of natural landcovers and the implementation of SSHCP Covered Activities (such as the use of earth moving equipment, mass grading, placement of fill, paving, and construction of facilities and structures) could result in the death of all individuals or dormant seeds present in the 8,672-acres of Boggs Lake hedge-hyssop modeled habitat that will be lost. Earthmoving equipment that moves soil and fills Vernal Pool and Seasonal Wetland aquatic habitats likely will crush, expose, or otherwise destroy dormant seeds of Boggs Lake hedge-hyssop, or will prevent the seeds from germinating and reproducing.

As discussed in Section 2.5.5 above, the conversion and loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), implementation of SSHCP Covered Activities would also permanently and indirectly affect the existing hydrology of an additional 52 acres of Vernal Pools located on Boggs Lake hedge-hyssop modeled habitat (Table 13 below). Indirect changes to existing seasonal hydrology of vernal pools could reduce the deeper water and the longer period of vernal pool inundation that is required by Boggs Lake Hedge-hyssop individuals to germinate, grow, flower, and set seed. Seedling mortality would be greater under a dryer hydrologic cycle, and plants that do flower would produce fewer seeds and fewer viable seeds (Griggs 1981). If the existing seasonal hydrology of an occupied vernal pool is permanently altered such that the pool is consistently smaller and more shallow, the combination environmental conditions that cue Boggs Lake Hedge-hyssop seeds to germinate may no longer occur, eventually resulting in the death of Boggs Lake Hedge-hyssop seeds present in the soil seed bank of that vernal pool.

In addition to potential indirect effects from hydrology changes, avoided modeled habitat for Boggs Lake hedge-hyssop in close proximity to future urban landcovers and human activities could be exposed to other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above), which also have the potential to indirectly affect the existing habitat functions of Boggs Lake hedge-hyssop suitable habitat present in the SSHCP Preserves and other avoided habitat inside the UDAs. In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect Boggs Lake hedge-hyssop modeled habitat present along the edges of the SSHCP Preserves established inside the UDAs. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP also includes requirements for Covered Activities to incorporate SSHCP AMMs that will avoid or minimize exposure of Boggs Lake hedge-hyssop individuals and suitable habitat to the environmental stressors that will be produced by the urban development Covered Activities (Final SSHCP Table 6-12), and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program also provides more intensive monitoring and management of Preserve edge areas in perpetuity, assuring that the existing quality and functions of Boggs Lake hedge-hyssop modeled habitat in the edge areas of each SSHCP Preserve will be maintained. Therefore, although some Boggs Lake hedge-hyssop modeled suitable habitat will be exposed to the additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 52 acres of Boggs Lake hedge-hyssop modeled habitat already identified by the SSHCP as indirectly and permanently affected.

In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs, and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy will achieve the SSHCP's biological goals and objectives for preserving the viability and distribution of Boggs Lake hedge-hyssop in the Action

Area (Final SSHCP Table 7-24). The process and criteria for assembling the SSHCP Preserve System will assure that appropriate vernal pool sizes, vernal pool soil types, and geology included in the modeled habitat for Boggs Lake hedge-hyssop are included in the SSHCP Preserve System.

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for Boggs Lake hedge-hyssop in the Action Area (Final SSHCP Table 7-21), the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on Boggs Lake hedge-hyssop reproduction, numbers, and distribution in the Action Area discussed here are the maximum effects that would occur over the SSHCP Permit Term.

Table 13. Effects to Boggs Lake Hedge-hyssop Modeled Habitats

SSHCP Landcovers in the Species Modeled Habitat	**Inside UDA (acres)**				**Outside UDA (acres)**			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	14,346	8,294	Qualitative Assessment	8,294	20,769	125	Qualitative Assessment	125
Vernal Pool	607	227	51	278	924	13	1	139
Seasonal Wetland	18	12	Qualitative Assessment	12	336	1	Qualitative Assessment	1
Total	**14,971**	**8,533**	**51**	**8,584**	**22029**	**139**	**1**	**140**

Seven documented occurrences of Boggs Lake hedge-hyssop will be directly impacted by urban development Covered Activities inside the UDA, and one will be preserved within in a planned SSHCP Preserve within PPU-1. To offset the adverse effects to Boggs Lake hedge-hyssop occurrences and modeled habitat, the SSHCP will preserve least 9,074 acres of high-quality suitable habitat for Boggs Lake hedge-hyssop in the Action Area, including 8,657 acres of Valley Grassland landcover, 382 acres of Vernal Pool landcover, and 35 acres of the Seasonal Wetland landcover, which will be assembled in the SSHCP Preserve System consistent with the preserve assembly criteria outlined in SSHCP Chapters 7.4 and 7.5, and consistent with the biological goals and objectives for Boggs Lake hedge-hyssop (Final SSHCP Table 7-21).

The SSHCP Conservation Strategy will preserve occurrences and habitat for Boggs Lake hedge-hyssop in the full range of vernal pool types present in the Action Area, including large or deep vernal pools found on the different soils, geological formations, and elevations in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support, or could support, Boggs Lake hedge-hyssop in the Action Area.

By preserving 9,074 acres of modeled habitat for Boggs Lake hedge-hyssop, the SSHCP Preserve System is expected to preserve vernal pools and seasonal wetlands where previously unknown occurrences of Boggs Lake hedge-hyssop are present in the Action Area. In addition, the Boggs Lake hedge-hyssop modeled habitat protected in the SSHCP Preserve System will protect 417acres of suitable vernal pools and seasonal wetlands where Boggs Lake hedge-hyssop individuals can disperse to establish additional occurrences or additional populations of Boggs Lake hedge-hyssop in the Action Area. The SSHCP Preserve System also will preserve habitat linkages between the existing Boggs Lake hedge-hyssop occurrences and unoccupied Boggs Lake hedge-hyssop aquatic habitats, which will maintain opportunities for dispersal to occur (e.g., dispersal of seeds through surface flows, waterfowl, and mud carried on the feet of animals).

The SSHCP Preserve Monitoring and Management Program discussed above (Section 2.5.5) is expected to maintain or improve the existing habitat functions provided on the 9,074 acres of Boggs Lake hedge-hyssop modeled habitat that will be protected in the SSHCP Preserve System. Because Bogg's Lake hedge-hyssop occupies medium to large and deeper vernal pools, the timing of livestock grazing to manage vernal pool grasslands is likely to be important in affecting persistence of Bogg's Lake hedge-hyssop (Stone et al. 1988). During the period when pools are inundated and upland annual-grass forage is still green and attractive, cattle tend not to congregate in vernal pools, so trampling and grazing pressures to most vernal pool plant species in their seedling or juvenile aquatic phase are minimized. As the upland annual grass forage cures and vernal pools are in their flowering and seed-producing "terrestrial phase", moist pools become more attractive to livestock and grazing and trampling pressures are increased. Because Bogg's Lake hedge-hyssop often grows in the relatively barren areas in the deeper portions of larger vernal pools, and often flowers and sets seeds when two to five inches of water remain in a pool basin, excessive trampling and grazing during this period may negatively affect reproduction of Bogg's Lake hedge-hyssop individuals. Instead, the individual Preserve Management Plan that will developed by the SSHCP for each Preserve will prescribe site-specific and species-specific measures to manage the vernal pool grasslands on that Preserve. Vernal pools occupied by Bogg's Lake hedge-hyssop will be managed to benefit Bogg's Lake hedge-hyssop and to address any site-specific threats to Bogg's Lake hedge-hyssop. The improved habitat management of Bogg's Lake hedge-hyssop occurrences and habitat in the SSHCP Preserve System is expected to increase seed production and reproduction of individual Bogg's Lake hedge-hyssop plants protected in the SSHCP Preserve System, eventually increasing the number of Bogg's Lake hedge-hyssop occurrences and expanding distribution of Bogg's Lake hedge-hyssop within the Preserve System.

In addition to the preservation of modeled habitat for Boggs Lake hedge-hyssop, the SSHCP Conservation Strategy also will establish or re-establish 140 acres of Boggs Lake hedge-hyssop modeled aquatic habitat in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining Boggs Lake hedge-hyssop in the Action Area. The effectiveness of inoculation and the effectiveness of re-established and established vernal pools will be monitored through a special study, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve Boggs Lake hedge-hyssop by ensuring no net loss of the total acreage of Boggs Lake hedge-hyssop aquatic habitat in the Action Area.

2.5.6.6 Effects on Ahart's Dwarf Rush

Effects of SSHCP Covered Activities on Ahart's dwarf rush include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on Ahart's dwarf rush individuals.

Over the proposed Permit Term, SSHCP Covered Activities will remove 7,332 acres of Ahart's dwarf rush modeled habitat, including 149 acres of vernal pools, 90 acres of seasonal wetlands, and 7,093 acres of hydrologically connected Valley Grassland uplands in the Vernal Pool Ecosystem. Most loss of Ahart's dwarf rush modeled habitat will occur in the UDA portion of the Action Area, where up to 7,340 acres Ahart's dwarf rush modeled habitat will be removed. Outside the UDA, 63 acres of modeled Vernal Pool Ecosystem habitat will be removed, primarily from implementation of the rural transportation Covered Activities (Table 14 below).

Activities related to the conversion of natural landcovers and the implementation of SSHCP Covered Activities (such as the use of earthmoving equipment, mass grading, placement of fill, paving, and construction of facilities and structures) could result in the death of all individuals or dormant seeds present in the total 7,403 acres of Ahart's dwarf rush modeled habitat that will be lost. Earthmoving equipment that moves soil and fills Vernal Pool and Swale modeled habitat likely will crush, expose, or otherwise destroy dormant seeds of Ahart's dwarf rush, or will prevent the seeds from germinating and reproducing.

As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), implementation of SSHCP Covered Activities would also permanently and indirectly affect the existing hydrology of an additional 71 acres of Vernal Pools and Swales within Ahart's dwarf rush modeled habitat. Indirect changes to the existing hydrology of a Vernal Pool Ecosystem can especially affect the smaller vernal pools and swales within the Vernal Pool Ecosystem that support the Ahart's dwarf rush. Changes to the existing hydrology of the Vernal Pool Ecosystem in Ahart's dwarf rush modeled habitat may result in smaller vernal pool filling less frequently in average rainfall water-years, or not at all. The larger pools may not fill completely, leaving soils in pool margins and in surface swales too dry for Ahart's dwarf rush germination, or may not support flowering or seed production of the Ahart's dwarf rush seeds that do germinate. Seedling mortality would be greater under a dryer hydrologic cycle, and plants that do flower would produce fewer seeds and fewer viable seeds (Griggs 1981). If the existing seasonal hydrology of occupied suitable habitat is altered such that the combination of environmental conditions that cue Ahart's dwarf rush seeds to germinate may no longer occur, eventually the dormant seeds of Ahart's dwarf rush in that Vernal Pool Ecosystem's soil seed-bank will die.

In addition to potential indirect effects from hydrology changes, avoided modeled habitat for Ahart's dwarf rush in close proximity to future urban landcovers and human activities could be exposed to other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above), and these also have the potential to indirectly affect the existing habitat functions of the Ahart's dwarf rush modeled habitat present in avoided habitat and SSHCP Preserves inside the UDAs. In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect Ahart's dwarf rush modeled habitat along the edges of SSHCP Preserves established inside the UDAs. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP includes requirements for Covered Activities to incorporate SSHCP AMMs (Final SSHCP Table 6-9) that will avoid or minimize exposure of Ahart's dwarf rush individuals and modeled habitat to the environmental stressors that will be produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program also provides more intensive monitoring and management of Preserve edge areas in perpetuity, assuring that the existing quality and functions of Ahart's dwarf rush modeled habitat within the edge areas of each SSHCP Preserve will be maintained. Therefore, although some Ahart's dwarf rush suitable habitat will be exposed to the additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 71 acres of Ahart's dwarf rush modeled habitat already identified by the SSHCP as indirectly and permanently affected.

In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs, and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the entire SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy achieves the SSHCP's biological goals and objectives for preserving the viability and the existing distribution of Ahart's dwarf rush throughout the Action Area (see Final SSHCP Table 7-18). The process and criteria for assembling the SSHCP Preserve System will assure that appropriate vernal pool sizes, soil types, and underlying geology included in the modeled habitat for Ahart's dwarf rush are included in the SSHCP Preserve System.

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for Ahart's dwarf rush in the Action Area (Final SSHCP Table 7-8), the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on Ahart's dwarf rush reproduction, numbers, and distribution in the Action Area discussed here are the maximum effects that would occur over the SSHCP Permit Term.

Table 14. Effects on Ahart's Dwarf Rush Modeled Habitats.

Habitat Model Landcovers	Inside UDA (acres)				Outside UDA (acres)			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	12,223	7,035	Qualitative Assessment	7,035	11,662	58	Qualitative Assessment	58
Vernal Pool	585	146	50	196	352	3	1	4
Swale	194	89	20	109	120	1	0	1
Vernal Pool Ecosystem Total	**13,002**	**7,270**	**70**	**7,340**	**12,134**		**1**	**63**

The documented occurrence of Ahart's dwarf rush in PPU-1 southeast of the intersection of Kiefer Boulevard and Sunrise Boulevard will be protected by the SSHCP in a 15-acre Satellite Preserve located adjacent to an existing preserve (Anatolia Preserve) to the north (Final SSHCP page 7-123).

With implementation of SSHCP Objective VPP1, the SSHCP will protect the documented occurrences of Ahart's dwarf rush the Action Area, and will protect most newly-discovered occurrences of Ahart's dwarf rush. Prior to allowing the loss or removal of an Ahart's dwarf rush occurrence, the SSHCP will preserve one currently unpreserved and "biologically equivalent or superior" occurrence of Ahart's dwarf rush (as defined by the Service and the Technical Advisory Committee (TAC). The minimum preserve size identified by the SSHCP for the protection of Ahart's dwarf rush occurrences is a SSHCP "Satellite Preserve" (i.e. is 11 to 250 acres in size), that encloses the entire micro-watershed of the occupied vernal pool, and includes a minimum 50-foot Preserve Setback between the preserved habitat and SSHCP urban development Covered Activities. In addition, surveys will be conducted after the first year of preservation and every 5 years thereafter to monitor persistence. If monitoring indicates that the preserved population is not persisting, the Implementing Entity will conduct remediation efforts.

To offset the adverse effects to Ahart's dwarf rush modeled habitat, the SSHCP will preserve least 12,592 acres of high-quality suitable habitat for Ahart's dwarf rush in the Action Area, including 11,949 acres of Valley Grassland landcover, 478 acres of Vernal Pool landcover, and 164 acres of the Swale landcover, which will be assembled in the SSHCP Preserve System consistent with the preserve assembly criteria outlined in SSHCP Chapters 7.4 and 7.5, and consistent with the biological goals and objectives for Ahart's dwarf rush (Final SSHCP Table 7-18). The SSHCP Conservation Strategy will preserve habitat for Ahart's dwarf rush in the full range of vernal pool types present in the Action Area, including smaller and shallower vernal pools found on the different soils, geological formations, and elevations in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that could support Ahart's dwarf rush in the Action Area.

By preserving 12,592 acres of modeled habitat for Ahart's dwarf rush, the SSHCP Preserve System may preserve previously unknown occurrences of Ahart's dwarf rush that are present in the Action Area. The large SSHCP Preserve System also will preserve habitat connectivity and habitat linkages that would maintain opportunities for dispersal of Ahart's dwarf rush to the 643 acres of Vernal Pools and Swale landcovers present in the preserved modeled habitat (e.g., dispersal of seeds through surface flows, waterfowl, and mud carried on the feet of animals).

The SSHCP Preserve Monitoring and Management Program discussed above (Section 2.5.5) is expected to maintain or improve the existing habitat functions present in the 12,592 acres of Ahart's dwarf rush modeled habitat that will be protected in the SSHCP Preserve System. Because Ahart's dwarf rush occupies smaller pools, swales, and the margins of larger vernal pools, it is assumed to be more susceptible to the effects of excessive growth of Italian wild rye and Mediterranean barley in and around pools and Medusa-head grass in surrounding uplands and thatch buildup, relative to the more "deep-pool adapted" vernal pool plant species (Ahart 2003 *in litt.*). The most vulnerable stage of Ahart's dwarf rush is after pool margins have dried and the plant is in flower, and before seeds mature. Ahart's dwarf rush will not attract grazers, but if trampled at this point in the life cycle, seed production may be reduced or eliminated (Ahart 2003 *in litt.*). The SSHCP Preserves managed to benefit Ahart's dwarf rush will develop individual Preserve Management Plans with site-specific and species-specific measures to improve habitat and minimize grazing effects on occurrences of Ahart's dwarf rush. The improved management of Ahart's dwarf rush habitat in the SSHCP Preserve System is expected to increase seed production and reproduction of individual Ahart's dwarf rush plants within the SSHCP Preserve System, eventually increasing the number of Ahart's dwarf rush occurrences and expanding Ahart's dwarf rush distribution within the Preserve System.

In addition to the preservation of 12,592 acres of modeled habitat for Ahart's dwarf rush, the SSHCP Conservation Strategy also will establish or re-establish 239 acres of Ahart's dwarf rush modeled aquatic habitat in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining Ahart's dwarf rush in the Action Area. The effectiveness of the inoculation and the effectiveness of the re-established and established vernal pools will be monitored through a special study, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve Ahart's dwarf rush by ensuring no net loss of the total acreage of Ahart's dwarf rush aquatic habitat in the Action Area.

2.5.6.7 Effects on Legenere

Effects of SSHCP Covered Activities on legenere include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on individuals.

SSHCP Covered Activities will remove up to 10,713 acres of legenere modeled habitat, including 312 acres of aquatic habitats (Vernal Pools and Seasonal Wetlands), and 10,401 acres of hydrologically connected Valley Grassland uplands in the Vernal Pool Ecosystem. Most removal of legenere modeled habitat will occur in the UDA portion of the Action Area, where up to 10,561 acres of legenere modeled habitat will be lost. Outside the UDA, 152 acres of legenere modeled habitat will be removed, primarily from implementation of the rural transportation Covered Activities (Table 15 below).

Activities related to the implementation of SSHCP Covered Activities, such as the use of earth moving equipment, mass grading, placement of fill, paving, and construction of facilities and structures, will remove suitable habitat for legenere and result in the death of all individuals or dormant seeds on the 10,713 acres of modeled habitat that will be lost. Earthmoving equipment that moves soil and fills Vernal Pool and Seasonal Wetland aquatic habitats during construction activities likely will crush, expose, or otherwise destroy dormant seeds or will prevent the seeds from germinating and reproducing.

As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of a development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to vernal pools (Section 2.5.3 above), implementation of SSHCP Covered Activities also will permanently and indirectly affect the existing hydrology of an additional 65 acres of legenere modeled habitat, primarily within the UDA portion of the Action Area (see Table 15 below). Indirect changes to existing seasonal hydrology of the Vernal Pool Ecosystem can reduce the water depths and the period of vernal pool inundation that is required by legenere individuals to germinate, grow, flower, and set seed. Seedling mortality would be greater under a dryer hydrologic cycle, and plants that do flower would produce fewer seeds and fewer viable seeds (Griggs 1981). If the existing seasonal hydrology of occupied vernal pool is permanently altered such that the pool is consistently smaller and more shallow, the combination environmental conditions that cue legenere seeds to germinate may no longer occur, eventually resulting in the death of legenere seeds present in the soil seed bank of that Vernal Pool Ecosystem.

In addition to potential indirect effects from hydrology changes, avoided modeled habitat for legenere that is close to future urban landcovers and human activities could be exposed to other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above), and these also have the potential to indirectly affect the existing habitat functions and quality of legenere modeled habitat present in the SSHCP Preserves and other avoided legenere habitat inside the UDAs. In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect legenere modeled habitat along the edges of the SSHCP Preserves established inside the UDAs. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP also includes requirements for Covered Activities to incorporate SSHCP AMMs (Final SSHCP Table 6-18) that will avoid or minimize exposure of legenere individuals and modeled habitat to the environmental stressors produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring

Program also will provide more intensive monitoring and management of Preserve edge areas in perpetuity, assuring that existing quality and functions of legenere modeled habitat within the edge areas of each SSHCP Preserve will be maintained in perpetuity. Therefore, although some legenere modeled suitable habitat will be exposed to additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 65 acres of legenere habitat already identified by the SSHCP as indirectly and permanently affected.

In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs (see Final SSHCP Chapter 7.6.2, Chapter 8.3.3.5, Table 8-3, Table 8-4, and Table 8-5), and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the overall SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy achieves the SSHCP's biological goals and objectives (Final SSHCP Table 7-26) for preserving the viability and distribution of legenere throughout the Action Area. The process and criteria for assembling the SSHCP Preserve System will assure that appropriate vernal pool sizes, vernal pool soil types, and geology included in the legenere modeled habitat are included in the SSHCP Preserve System.

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for legenere in the Action Area, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on legenere reproduction, numbers, and distribution in the Action Area that are discussed here are the maximum effects that would occur over the SSHCP Permit Term.

Of the 56 documented occurrences of legenere in the Action Area, 15 will be preserved in the SSHCP Preserve Systems, with 14 occurrences preserved inside the UDA (in PPU-1, PPU-2, PPU-3, and PPU-4) and 1 documented occurrence preserved outside the UDA (PPU-7).

Table 15. Effects to Legenere Modeled Habitats.

Landcovers in the Species' Modeled Habitat	Inside UDA (acres)				Outside UDA (acres)			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	17,040	10,264	Qualitative Assessment	10,264	30,487	137	Qualitative Assessment	137
Vernal Pool	825	263	64	327	1,735	13	1	14
Seasonal wetland	59	34	Qualitative Assessment	34	827	2	Qualitative Assessment	2
Total	**17,924**	**10,561**	**64**	**10,625**	**33,049**	**152**	**1**	**153**

Covered Activities are expected to remove 5 documented occurrences of legenere, all within the UDA. SSHCP Objective VPP3 requires that, prior to Covered Activity loss or removal of any occurrence of legenere (documented or newly discovered), the SSHCP will preserve one currently unpreserved and "biologically equivalent or superior" occurrence of legenere (as defined by the Service and the future SSHCP TAC) in the Action Area.

The minimum preserve size identified by the SSHCP for the protection of legenere occurrences is a SSHCP "Satellite Preserve" (i.e. is 15 to 250 acres in size), that encloses the entire micro-watershed of the occupied vernal pool, and includes a minimum 50-foot Preserve Setback between the preserved habitat and SSHCP urban development Covered Activities. In addition, the preserved legenere occurrence will be surveyed in the growing season after the Preserve is established, and will be surveyed every 5 years thereafter in perpetuity, to monitor the abundance and persistence of legenere occurrence in that Preserve. If monitoring indicates that the preserved population is not persisting, the SSHCP will conduct remediation efforts.

To offset the adverse effects to legenere modeled habitat, the SSHCP will preserve least 11,615 acres of the high-quality suitable habitat for legenere present in the Action Area, including 11,061 acres of Valley Grassland landcover, 512 acres of Vernal Pools, and 42 acres of the Seasonal Wetlands, which will be assembled consistent with the Preserve System assembly criteria outlined in SSHCP Chapters 7.4 and 7.5, and consistent with the biological goals and objectives for legenere (Final SSHCP Table 7-26). By preserving large areas of modeled habitat for legenere, the SSHCP Preserve System may preserve previously unknown occurrences of legenere that are present in the Action Area. In addition, the SSHCP Preserve System will protect suitable habitat where legenere individuals might disperse and establish additional occurrences of legenere in the Action Area. The SSHCP Preserve System also will preserve habitat linkages between the existing legenere occurrences and unoccupied legenere suitable habitat, which will maintain opportunities for dispersal to occur (e.g., dispersal of seeds through surface flows, waterfowl feeding and waste, and mud carried on the feet of animals).

The SSHCP Conservation Strategy will preserve occurrences and habitat for legenere in the full range of vernal pool types present in the Action Area, including large or deep vernal pools and seasonal wetlands found on the different soils, geological formations, and elevations in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support, or could support, legenere in the Action Area.

The SSHCP Preserve Monitoring and Management Program discussed above (Section 2.5.5) is also expected to maintain or improve the existing habitat functions currently provided on the total 10,713 acres of legenere modeled habitat that will be included in the SSHCP Preserve System. Legenere is the only rare vernal pool plant with a decumbent or sprawling habit, and it tends to grow intermingled and intertwined with a mass of comparatively succulent stems of other vernal pool plants. This growth habit, combined with typically low population numbers may make legenere somewhat more susceptible to inappropriately timed livestock grazing. Instead, the more intensive vernal pool grassland monitoring and management and the individual Preserve Management Plans that will developed by the SSHCP for each SSHCP Preserve will prescribe site-specific and species-specific measures to manage the vernal pool grasslands, vernal pools, and seasonal wetlands on each Preserve. Preserves occupied by legenere will be managed to benefit legenere and to address any site-specific threats to legenere. The improved management of legenere occurrences and habitat in the SSHCP Preserve System is expected to increase seed production and reproduction of individual legenere plants protected in the SSHCP Preserve System, eventually increasing the number of legenere occurrences and expanding distribution of legenere within the Preserve System.

In addition to the preservation of 11,615 acres of legenere modeled habitat, the SSHCP Conservation Strategy also will establish or re-establish 130 acres of aquatic modeled habitat for legenere in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining legenere in the Action Area. The effectiveness of inoculation and the success of re-established and established vernal pools will be monitored through Special Studies, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve legenere by ensuring no net loss of the total acreage of legenere aquatic habitat in the Action Area.

2.5.6.8 Effects on Pincushion Navarretia

Effects of SSHCP Covered Activities on pincushion navarretia include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and potential effects on individuals.

SSHCP Covered Activities will remove 8,201 acres of pincushion navarretia modeled habitat, including 214 acres of aquatic habitat (Vernal Pools and Swales), and 7,987 acres of hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem. Most removal of pincushion navarretia modeled habitat will occur in the UDA portion of the Action Area, where up to 8,119 acres of pincushion navarretia modeled habitat will be lost from implementation of urban development Covered Activities. Outside the UDA, 82 acres of modeled habitat will be removed, primarily from implementation of rural transportation Covered Activities (Table 12 below).

Activities related to the loss of natural landcovers and the implementation of SSHCP Covered Activities, such as the use of earth moving equipment, mass grading, placement of fill, paving, and construction of facilities and structures that remove suitable habitat for pincushion navarretia will also result in the death of all individuals or dormant seeds on the 8,201 acres of modeled habitat that will be lost. Earthmoving equipment that moves soil and fills Vernal Pool and Swale aquatic habitats during construction activities likely will crush, expose, or otherwise destroy the seeds, or will prevent the seeds from germinating and reproducing.

As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), implementation of SSHCP Covered Activities also will permanently and indirectly affect the existing hydrology of an additional 57 acres of Vernal Pools and Swales in pincushion navarretia modeled habitat, primarily in the UDA portion of the Action Area (Table 16). Indirect changes to the existing hydrology of a Vernal Pool Ecosystem can especially affect smaller and shallower vernal pools, which provide habitat for pincushion navarretia. Changes to the existing seasonal hydrology of the Vernal Pool Ecosystem can result in smaller vernal pool filling less frequently in average rainfall water-years, or not at all. In water-years when affected small vernal pools do fill, they may not fill enough to trigger germination of dormant seeds that may be present. Seeds that do germinate under a dryer hydrologic cycle would have greater seedling mortality, and plants that do flower would produce fewer seeds and fewer viable seeds (Griggs 1981). If the combination environmental conditions that cue pincushion navarretia seeds to germinate may no longer occur, eventually all pincushion navarretia seeds present in the soil seed bank of that Vernal Pool Ecosystem will die.

In addition to potential indirect effects from hydrology changes, avoided modeled habitat for pincushion navarretia that is in close proximity to future urban landcovers and human activities could be exposed to other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above), and these stressors also have the potential to indirectly affect the existing habitat functions and quality of the pincushion navarretia modeled habitat present in SSHCP Preserves and other avoided pincushion habitat inside the UDAs. In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect pincushion navarretia modeled habitat along the edges of the SSHCP Preserves established inside the UDAs. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP includes requirements for Covered Activities to incorporate SSHCP AMMs (Final SSHCP Table 6-21) that will avoid or minimize exposure of pincushion navarretia modeled habitat to the environmental stressors produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program also will provide more intensive monitoring and management of Preserve edge areas in perpetuity, assuring that existing quality and functions of pincushion navarretia modeled habitat in the edge areas of each SSHCP Preserve will be maintained in perpetuity. Therefore, although some pincushion navarretia modeled suitable habitat will be exposed to environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 57 acres of pincushion navarretia modeled habitat already identified by the SSHCP as indirectly and permanently affected.

In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs (see Final SSHCP Chapter 7.6.2, Chapter 8.3.3.5, Table 8-3, Table 8-4, and Table 8-5), and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the SSHCP Preserve System throughout the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy will achieve the SSHCP's biological goals and objectives (Final SSHCP Table 7-29) for preserving the viability and distribution of pincushion navarretia throughout the Action Area. The process and criteria for assembling the SSHCP Preserve System will assure that appropriate vernal pool sizes, vernal pool soil types, and underlying geology included in the modeled habitat for pincushion navarretia are included in the SSHCP Preserve System.

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for pincushion navarretia in the Action Area, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on pincushion navarretia reproduction, numbers, and distribution in the Action Area that are discussed here are the maximum effects that would occur over the SSHCP Permit Term.

Table16. Effects to Pincushion Navarretia suitable habitat.

Habitat Model Landcovers	**Inside UDA (acres)**				**Outside UDA (acres)**			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	11,440	7,910	Qualitative Assessment	7,910	77		Qualitative Assessment	77
Vernal Pool	475	114	35	149	1,369	4	1	5
Swale	186	95	21	116	441	1	0	1
Vernal Pool Ecosystem Total	**12,101**	**8,119**	**56**	**8,175**	**45,337**	**82**	**1**	**83**

The 48 occupied vernal pools and swales present in the Action Area will not be directly or indirectly affected by SSHCP Covered Activities. Because most documented occurrences in the Action Area are already within existing preserves, no known occurrences of pincushion navarretia would be enclosed by the SSHCP Preserve System.

If additional occurrences of pincushion navarretia are found within the Action Area over the term of the proposed Permit, SSHCP Objective VPP5 requires that, prior to Covered Activity loss or removal of any occurrence of pincushion navarretia, one currently unpreserved and "biologically equivalent or superior" occurrence of pincushion navarretia (as defined by the Service and the future SSHCP TAC) will be preserved by the SSHCP within the Action Area. The minimum preserve size identified by the SSHCP for the protection of new pincushion navarretia occurrences is a SSHCP "Satellite Preserve" (i.e. is 11 to 250 acres in size), that encloses the entire micro-watershed of the occupied vernal pool, and includes a minimum 50-foot Preserve Setback between the preserved habitat and SSHCP urban development Covered Activities. In addition, the preserved pincushion navarretia occurrence will be surveyed in the growing season after the Preserve is established, and will be surveyed every 5 years thereafter in perpetuity, to monitor the abundance and persistence of the pincushion navarretia occurrence in that Preserve. If monitoring indicates that the preserved population is not persisting, the SSHCP will conduct remediation efforts.

To offset the adverse effects to pincushion navarretia modeled habitat, the SSHCP will preserve least 14,642 acres of the high-quality suitable habitat for pincushion navarretia present in the Action Area, including 13,945 acres of Valley Grassland landcover, 514 acres of Vernal Pool landcover, and 514 acres of the Swale landcover, which will be assembled consistent with the SSHCP Preserve System assembly criteria outlined in SSHCP Chapters 7.4 and 7.5, and consistent with the biological goals and objectives for pincushion navarretia (Final SSHCP Table 7-28). By preserving large areas of modeled habitat for pincushion navarretia, the SSHCP Preserve System may preserve previously unknown occurrences of pincushion navarretia that are present in the Action Area. In addition, the SSHCP Preserve System will protect suitable habitat where pincushion navarretia individuals may disperse and establish additional occurrences or additional populations of pincushion navarretia in the Action Area. The SSHCP Preserve System also will preserve habitat linkages between preserves with occurrences of pincushion navarretia and unoccupied pincushion navarretia suitable habitat, which will provide opportunities for dispersal to occur (e.g., dispersal of seeds through surface flows, waterfowl, and mud carried on the feet of animals).

The SSHCP Conservation Strategy will preserve occurrences and habitat for pincushion navarretia in the full range of vernal pool types present in the Action Area, including smaller and shallower vernal pools found on the high-terrace geological formations and soils in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support, or could support, pincushion navarretia in the Action Area.

The SSHCP Preserve Monitoring and Management Program discussed above (Section 2.5.5) is also expected to maintain or improve the existing habitat functions present in the 14,642 acres of pincushion navarretia modeled habitat that will be included in the SSHCP Preserve System. Since pincushion navarretia occupies swales and smaller vernal pools, it may be more susceptible to the effects of excessive growth of non-native naturalized annual grasses and thatch buildup in adjacent uplands. The more intensive vernal pool grassland monitoring and management that will be provided by the individual Preserve Management Plans will reduce aboveground biomass and control annual grass use of water from the perched aquifer, improving habitat conditions of pincushion navarretia modeled habitat within the Preserve System. The improved habitat management of pincushion navarretia habitat in the SSHCP Preserve System is expected to increase seed production and reproduction of individual pincushion navarretia plants within the SSHCP Preserve System, eventually increasing the number of pincushion navarretia occurrences and expanding distribution of pincushion navarretia within the Preserve System.

In addition to the preservation of 14,642 acres of modeled habitat for pincushion navarretia, the SSHCP Conservation Strategy also will establish or re-establish 141 acres of pincushion navarretia modeled aquatic-habitat in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining pincushion navarretia in the Action Area. The effectiveness of inoculation and the success of re-established and established vernal pools will be monitored through Special Studies, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will further mitigate losses of pincushion navarretia by ensuring no net loss of the total acreage of pincushion navarretia aquatic habitat in the Action Area.

2.5.6.9 Effects on Slender Orcutt Grass/Critical Habitat

Effects of SSHCP Covered Activities on slender Orcutt grass include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on individuals.

SSHCP Covered Activities will remove 7,139 acres of slender Orcutt grass modeled habitat, including 148 acres of Vernal Pool and 6,991 acres of hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem. Most loss of slender Orcutt grass modeled habitat will occur in the UDA portion of the Action Area, where up to 7,069 acres of slender Orcutt grass modeled habitat will be removed. Outside the UDA, 70 acres of modeled Vernal Pool Ecosystem habitat will be removed, primarily from implementation of rural transportation Covered Activities (Table 17 below).

Activities related to the conversion of natural landcovers and the implementation of SSHCP Covered Activities (such as the use of earth moving equipment, mass grading, placement of fill, paving, and construction of facilities and structures) could result in the death of all individuals or dormant seeds present in the 7,139 acres of slender Orcutt grass modeled habitat that will be lost. Earthmoving equipment that moves soil and fills Vernal Pool likely will crush, expose, or otherwise destroy dormant seeds of slender Orcutt grass, or will prevent the seeds from germinating and reproducing. However, the four documented occurrences of slender Orcutt grass in the Action Area will not be removed by SSHCP Covered Activities. All urban development Covered Activity project sites that contain modeled habitat for slender Orcutt grass will be surveyed for unknown occurrences of slender Orcutt grass during the appropriate time of year when slender Orcutt grass is observable (AMM ORCUTT-1). Any newly-discovered occurrences slender Orcutt grass within a Covered Activity project-site will be avoided and will be preserved in the SSHCP Preserve System (SSHCP Objective VPP7, and AMM ORCUTT-2).

As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), implementation of SSHCP Covered Activities would also permanently and indirectly affect the existing hydrology of an additional 48 acres of Vernal Pools within slender Orcutt grass modeled habitat (Table 17 below). Indirect changes to the existing seasonal hydrology of a Vernal Pool Ecosystem can reduce the vernal pool water depth and reduce the longer period of vernal pool inundation that is required by slender Orcutt grass individuals to germinate, grow, flower, and set seed. Seedling mortality would be greater under the dryer hydrology, and plants that do flower would likely produce fewer seeds (Griggs 1981). If the existing seasonal hydrology of an occupied vernal pool is altered such that the pool is consistently smaller and more shallow each year, the combination of environmental conditions that cue slender Orcutt grass seeds to germinate may no longer occur in that pool, eventually resulting in the death of dormant seeds present in the pool's soil seed-bank.

In addition to potential indirect effects from hydrology changes, avoided modeled habitat for slender Orcutt grass in close proximity to future urban landcovers and human activities could be exposed to other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above), and these stressors also have the potential to indirectly affect the existing habitat function and habitat quality of slender Orcutt grass modeled habitat present in SSHCP Preserves and other avoided habitat inside the UDAs. In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect slender Orcutt grass modeled habitat along the edges of the SSHCP Preserves established inside the UDAs. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP also includes requirements for Covered Activities to incorporate SSHCP AMMs (Final SSHCP Table 6-31) that will avoid or minimize exposure of slender Orcutt grass individuals and modeled habitat to the environmental stressors that will be produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program will provide intensive monitoring and management of Preserve edge areas, assuring that the existing quality and functions of slender Orcutt grass modeled habitat in the edge areas of each Preserve will be maintained in perpetuity. Therefore, although some slender Orcutt grass suitable habitat will be exposed to the environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 48 acres of slender Orcutt grass modeled habitat already identified by the SSHCP as indirectly and permanently affected.

In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs(see Final SSHCP Chapter 7.6.2, Chapter 8.3.3.5, Table 8-3, Table 8-4, and Table 8-5), and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure the SSHCP Conservation Strategy achieves the SSHCP's biological goals and objectives (Final SSHCP Table 7-36) for preserving the viability and existing distribution of slender Orcutt grass in the Action Area. The process and criteria for assembling the SSHCP Preserve System will assure that appropriate vernal pool sizes, vernal pool soil types, and geology included in the modeled habitat for slender Orcutt grass is included in the SSHCP Preserve System. As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for slender Orcutt grass in the Action Area (Final SSHCP Table 7-36), the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on slender Orcutt grass reproduction, numbers, and species distribution discussed here are the maximum effects that would occur over the SSHCP Permit Term.

Table 17. Slender Orcutt Grass Effects.

Habitat Model Landcovers	Inside UDA (acres)				Outside UDA (acres)			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	11,971	6,925	Qualitative Assessment	6,925	21,294	66	Qualitative Assessment	66
Vernal Pool	456	144	47	191	771	4	1	5
Total	**12,427**	**7,069**	**47**	**7,116**	**22,065**	**70**	**1**	**71**

To offset the adverse effects to slender Orcutt grass modeled habitat, the SSHCP will preserve at least 9,710 acres of high-quality suitable habitat for slender Orcutt grass in the Action Area, including 9,332 acres of Valley Grassland landcover and 378 acres of Vernal Pool landcover, which will be assembled in the SSHCP Preserve System following the preserve assembly criteria and outlined in SSHCP Chapters 7.4 and 7.5, and will be consistent with the SSHCP biological goals and objectives for slender Orcutt grass (Final SSHCP Table 7-36). The requirements for assembling the SSHCP Preserve System will assure that large vernal pools with the soil types and underlying geology described in the species model for slender Orcutt grass will be included in the SSHCP Preserve System.

The SSHCP the Conservation Strategy for slender Orcutt grass is focused on preserving slender Orcutt grass suitable-habitat and preserving habitat connectivity inside PPU-1 and PPU-3, where the known occurrences of slender Orcutt grass are located in the Action Area. The SSHCP will establish three Core Preserves in PPU-1 and PPU-3, each preserving more than 300 acres of slender Orcutt grass modeled habitat (with a combined total of 1,733 acres, and the SSHCP will establish three Minor Preserves and seven Satellite Preserves in PPUs 1, 2, and 3 to maintain connectivity of slender Orcutt grass suitable-habitat. The SSHCP Conservation Strategy will preserve habitat for slender Orcutt grass in a range of vernal pool types present in the Action Area, including large or deep vernal pools found on the different soils, geological formations, and elevations in the Action Area, including large and deep vernal pools on Redding soils. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support slender Orcutt grass in the Action Area.

The Action Area's three unprotected vernal pool features occupied by slender Orcutt grass will be permanently protected by the SSHCP Conservation Strategy, in the planned Core Preserve C-1 in PPU-3. The SSHCP will require urban development Covered Activities to survey vernal pools inside the UDA for unknown occurrences of slender Orcutt grass (AMM ORCUTT-1). If additional occurrences of slender Orcutt grass are found within the Action Area over the term of the proposed Permit, the new occurrence will be protected in a SSHCP Preserve that is at least 50 acres in size, and with Preserve boundaries located a minimum of 300 feet from the new occurrence of slender Orcutt grass (AMM ORCUTT-2). New occurrences of sender Orcutt grass will be surveyed after the first year of preservation, and surveyed every 5 years thereafter to monitor persistence. If monitoring indicates that a preserved population is not thriving, the Implementing Entity will conduct remediation efforts.

The SSHCP Preserve System will protect and manage 378 acres of suitable vernal pool habitat in which slender Orcutt grass has the potential to disperse and establish additional occurrences of slender Orcutt grass in the Action Area. By preserving contiguous areas of Vernal Pool Ecosystem and preserving habitat linkages between occupied slender Orcutt grass habitat and unoccupied slender Orcutt grass habitats, the SSHCP Preserve System will maintain opportunities for dispersal to occur (e.g., dispersal of seeds through surface flows, waterfowl, and mud carried on the feet of animals).

The SSHCP Preserve Monitoring and Management Program discussed above (Section 2.5.5) will provide appropriate vegetation management to maintain and improve the current habitat functions of the vernal pool grasslands present in the 9,710 acres of slender Orcutt grass modeled habitat that will be protected in the SSHCP Preserve System. Because slender Orcutt grass occupies larger and deeper vernal pools, the timing of livestock grazing to manage vernal pool grasslands is likely to be important in affecting persistence of slender Orcutt grass (Stone et al. 1988). During the period when pools are inundated and upland annual-grass forage is still green and attractive, cattle tend not to congregate in vernal pools, so trampling and grazing pressures to most vernal pool plant species in their seedling or juvenile aquatic phase are minimized. As the upland annual grass forage cures and vernal pools are in their flowering and seed-producing "terrestrial phase", moist pools become more attractive to livestock and grazing and trampling pressures are increased. Because slender Orcutt grass often grows in the relatively barren areas in the deeper portions of larger vernal pools, and often flowers and sets seeds when two to five inches of water remain in a pool basin, excessive trampling and grazing during this period may negatively affect reproduction of slender Orcutt grass individuals. Instead, the individual Preserve Management Plans (PMPs) that will developed by the SSHCP for each Preserve will prescribe site-specific and species-specific measures to manage the vernal pool grasslands on that Preserve for the benefit of slender Orcutt grass, and to address any site-specific threats to slender Orcutt grass. The improved habitat management of occupied vernal pools in the SSHCP Preserve System is expected to increase seed production and reproduction in slender Orcutt grass occurrences protected in the SSHCP Preserve System.

In addition to the preservation of modeled habitat for slender Orcutt grass, the SSHCP Conservation Strategy also will establish or re-establish 148 acres of slender Orcutt grass aquatic-habitat in the Action Area, with a priority on re-establishment before establishment. All re-establishment and establishment sites will be inoculated with inoculum from the impact sites, which will assist in maintaining slender Orcutt grass in the Action Area. The effectiveness of the inoculation and the effectiveness of the re-established and established vernal pools will be monitored through a special study, as described in SSHCP Chapter 8.3.3.5. Re-establishing and establishing vernal pools will help to conserve slender Orcutt grass by ensuring no net loss of the total acreage of slender Orcutt grass aquatic habitat in the Action Area.

The SSHCP Conservation Strategy includes the development of a vernal pool "inocula bank" program in the first year after the Permit is issued, in collaboration with the Service and the SSHCP Technical Advisory Committee (Final SSHCP Chapter 8.3.3.5). The SSHCP will study different methods for storing vernal pool "inocula" soils to preserve the viability of the seeds, cysts, eggs of vernal pool species present in "inocula" soils harvested from Covered Activity project sites. These SSHCP studies and the SSHCP's future "inocula bank" may be consistent with the Vernal Pool Recovery Plan's species-specific recovery criteria to collect and bank seeds of slender Orcutt grass from the populations located in the Mather Core Area, and to reintroduce slender Orcutt grass to extirpated sites (Final SSHCP Table 3-3; Service 2005a).

Effects on Critical Habitat for Slender Orcutt Grass

As discussed above in Section 2.5.2.10, the 1,161-acre slender Orcutt grass Critical Habitat Unit-6 is within the boundaries of SSHCP PPU-2, inside the SSHCP UDA. SSHCP urban development

Covered Activities in Critical Habitat Unit-6 will convert 235 acres of Vernal Pool Ecosystem to developed landcovers, which will remove all physical and biological features in those acres that provide for the life-history needs of slender Orcutt grass and are essential to the conservation of the species (described as PCEs in Section 2.5.2.10 above). The soil layers, topographic features, swales, and pools that provide the aquatic environment for slender Orcutt grass germination, flowering, and seed production will be removed, eliminating the physical and biological features required for slender Orcutt grass reproduction. The surrounding uplands and watersheds, topographic features, overland flows, and vernal pools also will be removed, eliminating physical and biological features that provide for slender Orcutt grass dispersal.

The SSHCP also determined that Covered Activities implemented in Critical Habitat Unit-6 will affect the seasonal inundation of upland soil layers, which will indirectly modify the function of the physical and biological features of an addition one acre of vernal pools present in Unit-6 (Final SSHCP Table 6-30). The water depth and the number of days that the indirectly impacted vernal pools continuously hold water will be reduced, and the affected vernal pools may not continuously hold water for the period required for slender Orcutt grass seeds to break dormancy, grow, flower, and produce seeds (PCE#2). Reduced water depth also will reduce the frequency that each affected vernal pool fills to capacity and outflows into adjoining swales or ephemeral drainages, which will reduce or eliminate seed dispersal by flowing surface water (PCE #1).

Within slender Orcutt Grass Critical Habitat Unit-6, the SSHCP Conservation Strategy will permanently preserve 287 acres of Vernal Pool Ecosystem (Final SSHCP Table 7-35). The acres of Vernal Pool Ecosystem preserved by the SSHCP have all biological and physical features that provide for the species' life-history needs (the PCEs), which are essential to the conservation of the species, including germination, growth, flowering, seed production, and dispersal. SSHCP Preserves in Critical Habitat Unit-6 will include the large SSHCP Core-2 Preserve and the narrower Linkage Preserve L-5 planned in PPU-2 (Final SSHCP Table 7-35; SSHCP Chapter 7.5.1.2). In addition, the north border of the large SSHCP Core-2 Preserve will be contiguous with the existing Mather Wetland Preserve present in the northern portion of Critical Habitat Unit-6 (see Section 2.5.2.10 above), which will minimize edge effects and increase the functional size of the planned and existing preserves in Critical Habitat Unit-6, to provide a contiguous area that includes all of the PCEs essential to the conservation of the species.

The SSHCP Preserve Management and Monitoring Program and the specific Preserve Management Plans (PMPs) for the SSHCP Preserves within Critical Habitat Unit-6 will provide special management of Critical Habitat that borders urban development landcovers. Special management implemented in Unit-6 will include actions that prevent or reduce invasive plants (including manna grass), actions to maintain or improve the existing hydrology of the preserved Vernal Pool Ecosystem, actions to prevent edge contamination by urban pollutants, actions to prevent human degradation of vernal pools and uplands, and actions to restore any areas of degraded habitat within Unit-6. In addition, special management of the 99-acre portion of Critical Habitat Unit-6 that is within the existing Mather Field Wetlands Preserve is being provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

When considering the adverse effects of the SSHCP Covered Activities together with the environmental baseline of Critical Habitat Unit-6 (see Section 2.5.2.10 above), a total of 276 acres of the 1,161-acre Critical Habitat Unit-6 will no longer provide the physical and biological features that are essential for the conservation of slender Orcutt grass. However, the SSHCP Conservation Strategy will preserve 287 acres of slender Orcutt grass Critical Habitat Unit-6 that have all PCEs essential to the conservation of the species, and will provide special management to retain or improve the quality and function of the physical and biological features that are essential to the conservation of the species. When also considering the environmental baseline of Critical Habitat Unit-6 (see Section 2.5.2.10 above), a total of 386 acres of the 1,161-acre Critical Habitat Unit-6 will be preserved and managed in perpetuity to provide and maintain the physical and biological features (constituent elements) essential for the conservation of slender Orcutt grass.

We do not expect the direct and indirect alterations of 236 acres of slender Orcutt grass Critical Habitat by SSHCP Covered Activities to appreciably diminish the value of the Critical Habitat designation for the conservation of slender Orcutt grass, and we expect the Critical Habitat designation will remain functional to serve its intended conservation role for the species after the SSHCP is fully implemented.

2.5.6.10 Effects on Sacramento Orcutt Grass/Critical Habitat

Effects of SSHCP Covered Activities on Sacramento Orcutt grass include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on individuals.

SSHCP Covered Activities will remove 7,139 acres of Sacramento Orcutt grass modeled habitat, including 148 acres of Vernal Pool and 6,991 acres of hydrologically connected Valley Grassland uplands within the Vernal Pool Ecosystem. Most removal of Sacramento Orcutt grass modeled habitat will occur in the UDA portion of the Action Area, where up to 7,069 acres of Sacramento Orcutt grass modeled habitat will be lost. Outside the UDA, 70 acres of modeled Vernal Pool Ecosystem habitat will be removed, primarily from implementation of rural transportation Covered Activities (Table 18 below).

Activities related to the conversion of natural landcovers and the implementation of SSHCP Covered Activities (such as the use of earth moving equipment, mass grading, placement of fill, paving, and construction of facilities and structures) could result in the death of all individuals or dormant seeds present in the 7,139 acres of Sacramento Orcutt grass modeled habitat that will be removed. Earthmoving equipment that moves soil and fills Vernal Pools likely will crush, expose, or otherwise destroy dormant seeds of Sacramento Orcutt grass, or will prevent the seeds from germinating and reproducing. However, no occurrences of Sacramento Orcutt grass will be removed by SSHCP Covered Activities. In addition, all urban development Covered Activity sites that contain modeled habitat for Sacramento Orcutt grass will be surveyed for unknown occurrences of Sacramento Orcutt grass during the appropriate time of year when Sacramento Orcutt grass is observable (AMM ORCUTT-1). Any newly-discovered occurrences Sacramento Orcutt within a Covered Activity project-site will be avoided and will be preserved in the SSHCP Preserve System (AMM ORCUTT-2, Objective VPP6, and Conservation Action VPP6.1).

As discussed in Section 2.5.5 above, the loss of Valley Grassland uplands can indirectly affect the seasonal hydrology and habitat functions of Vernal Pool Ecosystem aquatic landcovers located outside of the development or disturbance footprint. Using the SSHCP methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), implementation of SSHCP Covered Activities is expected to permanently and indirectly affect the existing hydrology of an additional 48 acres of Vernal Pools located in modeled habitat for Sacramento Orcutt grass (Table 18 below). Indirect changes to the existing seasonal hydrology of the Vernal Pool Ecosystem can reduce the vernal pool water depth and reduce the longer period of vernal pool inundation that is required by Sacramento Orcutt grass individuals to germinate, grow, flower, and set seed. Seedling mortality would be greater under the dryer hydrology, and plants that do flower would likely produce fewer seeds (Griggs 1981). If the existing seasonal hydrology of an occupied vernal pool is altered such that the vernal pool is consistently smaller and more shallow each year, the combination of environmental conditions that cue Sacramento Orcutt grass seeds to germinate may no longer occur in that pool, eventually resulting in the death of dormant seeds in that vernal pool's soil seed-bank. Although 48 acres of Sacramento Orcutt grass will be indirectly impacted, the SSHCP Conservation Strategy includes measures to avoid indirect effects to the existing hydrology of occupied vernal pools, as discussed below.

In addition to potential indirect effects from hydrology changes, avoided Sacramento Orcutt grass modeled habitat in close proximity to future urban development and human activities could be exposed to other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above), and these stressors also have the potential to indirectly affect the existing habitat functions and quality of Sacramento Orcutt grass modeled habitat present in SSHCP Preserves and other avoided Sacramento Orcutt grass habitat inside the UDAs. In addition, the SSHCP will allow certain structures and uses inside the planned 50-foot wide Preserve Setbacks, which also have potential to indirectly affect Sacramento Orcutt grass modeled habitat in the edge areas of the SSHCP Preserves established inside the UDAs. However, as discussed in Section 2.5.4 and 2.5.5 above, the SSHCP includes requirements for Covered Activities to incorporate SSHCP AMMs (Final SSHCP Table 6-21) that will avoid or minimize exposure of Sacramento Orcutt grass habitat to the environmental stressors that will be produced by the urban development Covered Activities, and the SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. The SSHCP Preserve Management and Monitoring Program also will provide intensive monitoring and management of Preserve edge areas in perpetuity, assuring that the existing functions and quality of Sacramento Orcutt grass modeled habitat in the edge areas of each SSHCP Preserve will be maintained in perpetuity. Therefore, although some Sacramento Orcutt grass suitable habitat will be exposed to the additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 48 acres of Sacramento Orcutt grass modeled habitat already identified by the SSHCP as indirectly and permanently affected.

In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs(see Final SSHCP Chapter 7.6.2, Chapter 8.3.3.5, Table 8-3, Table 8-4, and Table 8-5), and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the entire SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy (Final SSHCP Table 7-32) will achieve the SSHCP's biological goals and objectives for preserving the existing distribution of Sacramento Orcutt grass in the Action Area. As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for Sacramento Orcutt grass in the Action Area (Final SSHCP Table 7- 32), the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on Sacramento Orcutt grass reproduction, numbers, and distribution in the Action Area that are discussed here are the maximum effects that would occur over the SSHCP Permit Term.

To offset the adverse effects to Sacramento Orcutt grass modeled habitat, the SSHCP will preserve at least 14,459 acres of high-quality suitable habitat for Sacramento Orcutt grass in the Action Area, including 13,945 acres of Valley Grassland landcover and 514 acres of Vernal Pool landcover, which will be assembled in the SSHCP Preserve System following the preserve assembly criteria and outlined in SSHCP Chapters 7.4 and 7.5, and consistent with the SSHCP biological goals and objectives for Sacramento Orcutt grass (Final SSHCP Table 7-32). The SSHCP Conservation Strategy will preserve habitat for Sacramento Orcutt grass in the range of vernal pool types present in the Action Area, including the larger and deeper vernal pools found on the different soils, geological formations, and elevations in the Action Area. In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological conditions that support, or could support, Sacramento Orcutt grass in the Action Area.

By preserving 14,459 acres of modeled habitat for Sacramento Orcutt grass, the SSHCP Preserve System may benefit Sacramento Orcutt grass by preserving previously unknown occurrences in the Action Area. Especially, the planned 271-acre Major Preserve M-1, and the planned 247-acre Major Preserve M-2 in PPU-1 may contain unknown occurrences of Sacramento Orcutt grass, based on the number of occupied vernal pools currently present in the adjacent Kiefer Landfill Wetland Preserve. In addition, by preserving large contiguous areas of Vernal Pool Ecosystem and by preserving habitat linkages between areas of occupied and unoccupied suitable-habitat, the SSHCP Preserve System will maintain opportunities for dispersal to occur (e.g., dispersal of Sacramento Orcutt grass seeds through surface flows, waterfowl, and mud carried on the feet of animals).

Table 18. Effects to Sacramento Orcutt Grass Habitat

Habitat Model Landcovers	Inside UDA (acres)				Outside UDA (acres)			
	Existing Acres	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Existing Acres*	*Direct Effect*	*Indirect Effect*	*Total Effect*
Valley Grassland*	11,971	6,925	Qualitative Assessment	6,925	21,294	66	Qualitative Assessment	66
Vernal Pool	456	144	47	191	771	4	1	5
Total	**12,427**	**7,069**	**47**	**7,116**	**22,065**	**70**	**1**	**71**

By preserving 14,459 acres of modeled habitat for Sacramento Orcutt grass, the SSHCP Preserve System may benefit Sacramento Orcutt grass by preserving previously unknown occurrences in the Action Area. Especially, the planned 271-acre Major Preserve M-1, and the planned 247-acre Major Preserve M-2 in PPU-1 may contain unknown occurrences of Sacramento Orcutt grass, based on the number of occupied vernal pools currently present in the adjacent Kiefer Landfill Wetland Preserve. In addition, by preserving large contiguous areas of Vernal Pool Ecosystem and by preserving habitat linkages between areas of occupied and unoccupied suitable-habitat, the SSHCP Preserve System will maintain opportunities for dispersal to occur (e.g., dispersal of Sacramento Orcutt grass seeds through surface flows, waterfowl, and mud carried on the feet of animals).

As discussed above in Section 2.5.2.11, there are 9 CNDDB occurrences of Sacramento Orcutt grass known in the Action Area, and 3 occurrences are currently unprotected (i.e. CNDDB #19, #21, and #22). Each of the currently unprotected occurrences of Sacramento Orcutt grass would be protected by the SSHCP Preserve System established in PPU-1. The currently unprotected Sacramento Orcutt grass Occurrence #19 is located east of Grant Line Road and south of Glory Lane, and is comprised of three occupied vernal pools (Witham 2013; USFWS 2016). This occurrence is within the boundary of the Cordova Hills Specific Plan urban development Covered Activity (see Final SSHCP Appendix K).[15.] The three vernal pools in Occurrence #19 would be protected within the south half of the 839-acre SSHCP Core Preserve C-1, which is also known as the "Plateau Preserve". The Cordova Hills Specific Plan would not remove the three occupied vernal pools. However, as discussed above in Section 2.5.5, the Cordova Hills Specific Plan will construct an arterial-size roadway (the North Loop Road) that would bisect the occupied vernal pools in Occurrence #19, isolating one pool from the other two, and fragmenting an intact Vernal Pool Ecosystem landscape that includes both occupied and unoccupied suitable habitat for Sacramento Orcutt grass. Bisection by the arterial-sized roadway will introduce the potential for nitrogen enrichment of the three occupied vernal pools and other vernal pools in the immediate area, and increase potential for invasive weeds, increase trash, and increase road-related contaminants, as discussed above in Sections 2.5.4 and 2.5.5. However, the Cordova Hills Specific Plan will incorporate the SSHCP'S avoidance and minimization measures (i.e. the EDGE-AMMs, the BMPs, the ROAD-AMMSs, the PLANT-AMMs), which will avoid or minimize exposure of Sacramento Orcutt grass individuals and suitable habitat to the direct and the indirect environmental stressors that will be produced by the construction and future operation of the North Loop Road.

As required by the SSHCP's Orcutt grass AMMs (ORCUTT-1 and ORCUTT-2), the construction of the North Loop Road will be a minimum of 300 feet from all of the Sacramento Orcutt grass occurrences, and the construction-footprint of the North Loop Road and would impact less than ten percent of the micro-watershed of each occupied vernal pool. The SSHCP Preserve Management and Monitoring Program and the individual Preserve Management Plan that will be prepared by the SSHCP for the "Plateau Preserve" section of the SSHCP Core Preserve C-1 will require more intensive monitoring and habitat management of the preserve's edge areas along the North Loop Road, assuring that the existing habitat conditions and functions in each of the three occupied vernal pools will be maintained in perpetuity, and will not be vulnerable to gradual long-term habitat degradation from the potential edge effects along this new roadway. The Cordova Hills Specific Plan's construction of the North Loop Road also includes the placement of two underground water-transmission pipelines (16" and 24") inside the North Loop Road's right-of-way. Trenching to construct and place the two water pipelines will break and remove the exiting soil restrictive layer, which could alter the hydrology of the three occupied vernal pools, and the hydrology of other nearby vernal pools. The Cordova Hills Specific Plan's construction of the two water pipelines will not implement the SSHCP AMMs for trenching (i.e. UTILITY-3, UTILITY-4), but the Cordova Hills Specific Plan instead will reduce impacts to the soil restrictive-layer by backfilling a clay-bentonite soil mix into the trench up to the level of the top of the existing duripan (once the pipeline is in place), to ensure that the existing hydrology of the perched aquifer will be maintained. Therefore, the three occupied vernal pools that currently comprise Sacramento Orcutt grass Occurrence #19 are expected to remain hydrologically connected (USFWS 2016).

The currently unprotected Sacramento Orcutt grass CNDDB Occurrence #21 is composed of a single vernal pool, which is located along a drainage east of Grant Line Road that is known as the "Central Drainage," but is in a section of the Central Drainage that is north of the Cordova Hills Specific Plan boundary. Sacramento Orcutt grass Occurrence #21 will be protected within the 231-acre SSHCP Linkage Preserve L-1, which is also known as the "Carson Creek Linkage". Linkage

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[15] As noted in section 1.0 of this Opinion, the Service issued a "SSHCP on-ramp" biological opinion for the Cordova Hills Specific Plan in December 2016, and the USACE issued CWA 404 authorization to the Cordova Hills Specific Plan in February 2017.

Preserve L-1 will maintain habitat connectivity and hydrologic connectivity between SSHCP Core Preserve C-1 and the intact natural landscapes in PPU-1 that are east of the UDA. Linkage Preserve L-1 will be designed to place the Sacramento Orcutt grass occupied vernal pool in the interior of the Preserve, at a distance not less than 300 feet from the edge of the Preserve (AMM ORCUTT-2). This vernal pool also will be protected from adjacent future development Covered Activities by adequately sized Stream Setbacks and Preserve Setbacks, and by the other SSHCP AMMs listed in Section 2.1.5 of this Opinion. Because Linkage Preserve L-1 also will be crossed by future roads, additional design features in the SSHCP ROAD AMMs and the EDGE AMMs will be employed to ensure that habitat functions of the Preserve and the occupied vernal pool are maintained.

The currently unprotected Sacramento Orcutt grass CNDDB Occurrence #22 is located on the northern border of PPU-1 near White Rock Road, and is composed of one vernal pool. This occurrence is within the area of the planned Heritage Falls development. The occupied vernal pool would be protected by the SSHCP in the 118-acre SSHCP Satellite Preserve S-1. It is anticipated that Satellite Preserve S-1 will eventually be surrounded by residential or commercial development at full buildout of the UDA, but will be connected by Linkage Preserve L-8 to the existing Rio Del Oro Preserve to the west, and will be connected by Linkage Preserve L-3 to Core Preserve C-1 to the east. Satellite Preserve S-1 will be designed to place the occupied vernal pool in the interior of the Preserve, at a distance not less than 300 feet from the edge of the Preserve (AMM ORCUTT-2). In addition, the adjacent lands slope and drain away from Satellite Preserve S-1, further ensuring that the micro-watershed for this vernal pool will remain intact when the adjacent areas are developed.

The SSHCP will require urban development Covered Activities to survey the Sacramento Orcutt grass modeled habitat within a project site for unknown occurrences of Sacramento Orcutt grass (ORCUTT-1). If additional occurrences of Sacramento Orcutt grass are found over the term of the proposed Permit, the new occurrence will be protected in a SSHCP Preserve that is at least 50 acres in size, and the occupied vernal pool will be a minimum of 300 feet from the Preserve boundary (ORCUTT-2). The new occurrence will be surveyed after the first year of preservation, and every 5 years thereafter to monitor persistence. If monitoring indicates that the preserved population is not persisting, the Implementing Entity will conduct remediation efforts.

In total, the large SSHCP Preserve System will protect and manage 9,437 acres of Sacramento Orcutt grass modeled habitat in the Action Area. By preserving contiguous areas of Vernal Pool Ecosystem and by preserving habitat linkages between occupied Sacramento Orcutt grass habitat and unoccupied Sacramento Orcutt grass suitable-habitat, the SSHCP Preserve System will maintain opportunities for dispersal of Sacramento Orcutt grass seeds (e.g., dispersal through surface flows, waterfowl wastes, wind, and mud carried on the feet of animals) and the establishment of additional occurrences of Sacramento Orcutt grass in the Action Area.

The SSHCP Conservation Strategy will preserve habitat for Sacramento Orcutt grass in a range of vernal pool types present in the Action Area, including large and deep vernal pools found on soils associated the three Sacramento Orcutt grass population centers (Witham 2013). In this manner, the SSHCP Conservation Strategy will conserve the full extent of the physical and environmental conditions, species composition, and ecological processes that support Sacramento Orcutt grass over much of the species limited range.

The SSHCP Preserve Monitoring and Management Program discussed above (Section 2.5.5) will provide appropriate vegetation management, monitoring, and adaptive management techniques that are expected to retain or improve the current habitat functions of the Sacramento Orcutt grass modeled habitat that will be protected in the SSHCP Preserve System. Competition from invasive vernal pool plants, such as pale spikerush (*Eleocharis* sp.) and mannagrass (*Glyceria* sp.), have the potential to displace Sacramento Orcutt grass in ungrazed vernal pool grasslands (Stone et al. 1988, Cochrane *in litt.* 1995a, Cochrane *in litt.* 1995b, Clark et al. 1998). Because Sacramento Orcutt grass occupies larger and deeper vernal pools, the timing of livestock grazing to manage vernal pool grasslands is likely to be important in affecting persistence of Sacramento Orcutt grass at each known occurrence (Stone et al. 1988). During the period when pools are inundated and upland annual-grass forage is still green and attractive, cattle tend not to congregate in vernal pools, so trampling and grazing pressures to most vernal pool plant species in their seedling or juvenile aquatic phase are minimized. As the upland annual-grass forage cures and vernal pools are in their flowering and seed-producing "terrestrial phase", moist pools become more attractive to livestock and grazing and trampling pressures are increased. Because Sacramento Orcutt grass often grows in the relatively barren areas in the deeper portions of larger vernal pools, and often flower and sets seeds when two to five inches of water remain in a pool basin, excessive trampling and grazing during this period may negatively affect reproduction of Sacramento Orcutt grass individuals. Instead, the SSHCP's individual Preserve Management Plans (PMPs) will prescribe site-specific and species-specific measures to manage the vernal pool grasslands on each Preserve with an occurrence of Sacramento Orcutt Grass. Preserves occupied by Sacramento Orcutt grass will be managed to benefit Sacramento Orcutt grass and to address any site-specific threats to Sacramento Orcutt grass. The improved habitat management of vernal pool grasslands in the SSHCP Preserve System is expected to increase reproduction of Sacramento Orcutt grass populations protected in the SSHCP Preserve System.

The SSHCP will maintain the existing distribution of Sacramento Orcutt grass in the Action Area by preserving all known occurrences of Sacramento Orcutt grass, and by preserving 14,459-acres of modeled habitat for Sacramento Orcutt grass. In addition to the preservation of 14,459-acres of modeled habitat, the re-establishment or establishment of 148 acres of vernal pools by the SSHCP Conservation Strategy may assist in maintaining or re-establishing the historical distribution of the species in the Action Area.

The manner in which the SSHCP achieves consistency with Sacramento Orcutt grass recovery-criteria is discussed in detail in SSHCP Chapter 7.6.3. The SSHCP Conservation Strategy includes the development of a vernal pool "inocula bank" program in the first year after the Permit is issued, in collaboration with the Service and the SSHCP Technical Advisory Committee (Final SSHCP Chapter 8.3.3.5). The SSHCP will study different methods for storing vernal pool "inocula" soils to preserve the viability of the seeds, cysts, eggs of vernal pool species present in "inocula" soils harvested from Covered Activity project sites. These SSHCP studies and the SSHCP's future "inocula bank" may be consistent with the Vernal Pool Recovery Plan's species-specific recovery criteria to collect and bank seeds of Sacramento Orcutt grass from the populations in the Mather Core Area and to reintroduce Sacramento Orcutt grass to extirpated sites (Final SSHCP Table 3-3; Service 2005a). In addition, the SSHCP Conservation Strategy is consistent with the Vernal Pool Recovery Plan's Sacramento Orcutt grass recovery-criteria of preserving 100% of documented occurrences of Sacramento Orcutt grass throughout its range.

<u>Effects on Sacramento Orcutt Grass Critical Habitat</u>

As discussed above in Section 2.5.2.11, two Critical Habitat Units for Sacramento Orcutt grass are in within the Action Area. Sacramento Orcutt grass Critical Habitat Unit-2 is located in the UDA

portion of the Action Area (in PPU-2), and Sacramento Orcutt grass Critical Habitat Unit-3 is located outside the UDA (in PPU-7).
SSHCP urban development Covered Activities in Sacramento Orcutt grass Critical Habitat Unit-2 will convert 235 acres of existing Vernal Pool Ecosystem to developed landcovers, which will remove all physical and biological features in those acres that provide for the life-history needs of Sacramento Orcutt grass, which are essential to the conservation of the species (described as PCEs in Section 2.5.2.11 above). The soil layers, topographic features, swales, and pools that provide the aquatic environment for Sacramento Orcutt grass germination, flowering, and seed production will be removed, eliminating the physical and biological features required for Sacramento Orcutt grass reproduction (PCE #2). The surrounding uplands and watersheds, topographic features, overland flows, and vernal pools also will be removed, eliminating physical and biological features that provide for Sacramento Orcutt grass dispersal (PCE#1).

The SSHCP also determined that Covered Activities implemented in Critical Habitat Unit-2 will affect the seasonal inundation of upland soil layers, which will indirectly modify the function of the physical and biological features of an addition one acre of vernal pools present in Unit-2 (Final SSHCP Table 6-25). The water depth and the number of days that the indirectly impacted vernal pools continuously hold water will be reduced, and the affected vernal pools may not continuously hold water for the period required for Sacramento Orcutt grass seeds to break dormancy, grow, flower, and produce seeds (PCE#2). Reduced water depth also will reduce the frequency that each affected vernal pool fills to capacity and outflows into adjoining swales or ephemeral drainages, which will reduce or eliminate seed dispersal by flowing surface water (PCE #1).

Within Sacramento Orcutt Grass Critical Habitat Unit-2, the SSHCP Conservation Strategy will permanently preserve 287 acres of Vernal Pool Ecosystem (Final SSHCP Table 7-31). The acres of Vernal Pool Ecosystem preserved by the SSHCP have all biological and physical features that provide for the species life-history needs (the PCEs), which are essential to the conservation of the species, including germination, growth, flowering, seed production, and dispersal. SSHCP Preserves in Critical Habitat Unit-2 will include the large SSHCP Core-2 Preserve and the narrower Linkage Preserve L-5 planned in PPU-2 (see Final SSHCP Chapter 7.5.1.2). In addition, the north border of the large SSHCP Core-2 Preserve will be contiguous with the existing Mather Wetland Preserve present in the northern portion of Critical Habitat Unit-2 (see Section 2.5.2.11 above), which will minimize edge effects and increase the functional size of the preserves in Critical Habitat Unit-2, to provide a contiguous area that includes all of the PCEs essential to the conservation of the species.

The SSHCP Preserve Management and Monitoring Program and the specific Preserve Management Plans (PMPs) for the SSHCP Preserves within Critical Habitat Unit-2 will provide special management of Sacramento Orcutt grass Critical Habitat that borders urban development landcovers. Special management implemented in Unit-2 will include actions that reduce invasive plants (including manna grass), actions to maintain or improve the existing hydrology of the preserved Vernal Pool Ecosystem, actions to prevent edge contamination by urban pollutants, actions to prevent human degradation of vernal pools and uplands, and actions to restore any areas of degraded habitat within the preserved areas of Critical Habitat Unit-2. In addition, special management of the 99-acre portion of Critical Habitat Unit-2 that is within the existing Mather Field Wetlands Preserve is being provided by the South Mather Wetlands Management Plan (County of Sacramento 2014).

Within Sacramento Orcutt grass Critical Habitat Unit-3, SSHCP rural transportation Covered Activities will convert 13 acres of existing Vernal Pool Ecosystem to developed landcovers, removing in those acres all physical and biological features essential to the conservation of Sacramento Orcutt grass (described as PCEs in Section 2.5.2.11 above). When considering the adverse effects of the SSHCP Covered Activities together with the environmental baseline of Critical Habitat Unit-3 (see Section 2.5.2.11 above), approximately 1,793 acres of the 29,876 acres of Critical Habitat Unit-3 located within the Action Area will no longer provide the physical and biological features that are essential for the conservation of Sacramento Orcutt grass.

Within Sacramento Orcutt grass Critical Habitat Unit-3[16], the SSHCP Conservation Strategy will permanently preserve 10,443 acres of Vernal Pool Ecosystem, which have all biological and physical features (all PCEs) that provide for the species' life-history needs, including germination, growth, flowering, seed production, and dispersal. The 10,443 acres of Preserves established by the SSHCP in Critical Habitat Unit-3 will be contiguous with the existing preserves already present in Critical Habitat Unit-3, which will increase the functional size of the planned and existing preserves to provide contiguous landscapes that include all of the PCEs essential to the conservation of Sacramento Orcutt grass. When also considering the environmental baseline of Critical Habitat Unit-3 (see Section 2.5.2.11 above), approximately 24,595 acres of the 29,876 acres of Critical Habitat Unit-3 in the Action Area would be preserved and managed in perpetuity to maintain the physical and biological features essential to the conservation of Sacramento Orcutt grass.

The SSHCP Preserve Management and Monitoring Program and the specific Preserve Management Plans (PMPs) will provide special management of the 10,443 acres of SSHCP Preserves within Sacramento Orcutt grass Critical Habitat Unit-3. Special management implemented in Critical Habitat Unit-3 will include actions that maintain high-terrace landscapes with large vernal pools on Corning soils, to maintain physical and biological features essential to the conservation of Sacramento Orcutt grass at the southern extent of the species range. The habitat protection and habitat management provided by the SSHCP will maintain or improve the ability of the Critical Habitat Unit-3 to fulfill its conservation role for Sacramento Orcutt grass.

In total, the SSHCP Conservation Strategy will preserve and manage a minimum of 10,730 acres of Sacramento Orcutt grass Critical Habitat in the Action Area. The SSHCP Preserve Maintenance and Management Program and the Preserve Management Plans for the 10,730 acres of Sacramento Orcutt grass Critical Habitat preserved in the SSHCP Preserve System will retain or improve the quality and function of physical and biological features that are essential to the conservation of Sacramento Orcutt grass.

We do not expect the direct and indirect alterations of 249 acres of Sacramento Orcutt grass Critical Habitat by SSHCP Covered Activities to appreciably diminish the value of the Critical Habitat designation for the conservation of Sacramento Orcutt grass, and we expect the Critical Habitat designation will remain functional to serve its intended conservation role for the species after the SSHCP is fully implemented.

2.5.7 Cumulative Effects on the Vernal Pool Covered Species

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[16] Our aalysis of Sacramento Orcutt grass includes corrections to SSHCP Table 7-31 and Chapter 7.6.2.6 provided in the Erratum to the Final SSHCP.

As described in Section 1.0 of this Opinion, the SSHCP was developed in part to respond to biological opinions issued by the Service in 1999 and 2004, and to address the indirect and cumulative effects of those large-scale water infrastructure projects in south Sacramento County.

Cumulative effects in a section 7 analysis are the effects of future state, tribal, county, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Several reasonably certain projects in the Action Area, such as the California High-Speed Train System and the California Waterfix, will require will require future federal actions and separate consultations under the ESA, and are not considered in this Opinion's cumulative effects analysis.

Reasonably certain activities in the Action Area, unrelated to the SSHCP and with no federal nexus, include the continued expansion of low-density rural development (see Section 2.3.4 above) within the approximately 19,600 acres of PPU-7 and PPU-6 that are designated as Agriculture Residential areas in the Sacramento County General Plan (County of Sacramento 2011). Construction of new residential structures or barns may occur, along with associated grading, landscaping, and accessory structures such as corrals and fences. In many cases, these activities will occur on large lots with extant vernal pools and other natural landcovers that provide suitable habitat for the SSHCP Covered Species. Land use changes and construction of structures within the Agricultural Residential areas may not obtain authorizations under ESA, CESA, and the CWA, particularly at project sites that are not subject to CEQA. Projects that are not subject to CEQA would not prepare a CEQA document to identify potential environmental impacts, and the project proponent may not have the expertise to identify biological resources or understand the regulations, and the project impacts to species or habitat is beyond the purview of the County regulators reviewing building plans. Effects vernal pool Covered Species individuals and suitable habitat from projects within the Agricultural Residential areas would result in the types of effects similar to those discussed in Sections 2.5.4, 2.5.5, and 2.5.6 of this Opinion.

Additional conversion of natural landcovers to vineyards, cropland, orchards, irrigated pasture, and other farmland uses is also expected to occur in the future outside the UDA, in the portions of the Action Area zoned for agricultural uses by the County's General Plan (County of Sacramento 2011). It is not possible, however, to predict how crop types or agricultural uses may change over the 50-year Permit Term. Nonetheless, some conversion of vernal pool grassland (Vernal Pool Ecosystem) to a more intensively managed agricultural use (such as cropland, vineyards, or orchards) would be expected over the 50-year Permit Term. The conversions of vernal pool grasslands to orchards or vineyards would include "deep-ripping" of soils, which would remove the existing soil structure that forms the perched aquifer and supports the ecology of the Vernal Pool Ecosystem. Changes to more intensively managed agricultural uses would result in the types of effects similar to those discussed in Section 2.5.4, 2.5.5 and 2.5.6.

Other non-Federal actions that may occur in the Action Area are considered too speculative to evaluate at this point in time.

2.5.8 Conclusion for the Vernal Pool Covered Species.

After reviewing the current status of the vernal pool fairy shrimp, vernal pool tadpole shrimp, mid-valley fairy shrimp, Ricksecker's water scavenger beetle, and dwarf downingia, Boggs Lake hedge-hyssop, Ahart's dwarf rush, legenere, pincushion navarretia, slender Orcutt grass, and Sacramento

Orcutt grass (the vernal pool Covered Species); the environmental baselines for the Action Area; and the effects of the proposed actions, including all measures to avoid, minimize, and mitigate adverse effects; and the cumulative effects; it is the Service's biological opinion and conference opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to jeopardize the continued existence of the vernal pool Covered Species. The Service reached this conclusion because the project-related effects to the vernal pool Covered Species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of any vernal pool Covered Species. We reached this conclusion because:

- Although Covered Activities will remove 17,259 acres of Vernal Pool Ecosystem and vernal pool Covered Species modeled habitats in the Action Area (i.e. 16,795 acres in the UDAs and 332 acres outside the UDAs), the SSHCP Conservation Strategy will permanently protect and manage at least 23,284 acres of Vernal Pool Ecosystem in the Action Area, which will provide benefits to each vernal pool Covered Species in perpetuity, and will reduce the amount of Vernal Pool Ecosystem habitat that can be lost in the future.
- The SSHCP will preserve Vernal Pool Ecosystem in large blocks of connected habitat, which will minimize habitat fragmentation in the Action Area, protect existing populations of each vernal pool species in perpetuity, and result in a SSHCP Preserve System that provides more interior area and less edge area. The large habitat preserves and the protection of known species occurrences in the Action Area will help ensure each vernal pool Covered Species persists.
- The SSHCP will assemble the SSHCP Preserve System to include the range of existing physical and biological heterogeneity of the Action Area's Vernal Pool Ecosystems, including the heterogeneity of vernal pool types, sizes, spatial patterns, locations, geologic formations, soils, water chemistry, species community composition, and ecological conditions that are present in the Action Area. This will conserve the existing genetic diversity and existing distribution of each vernal pool Covered Species in the Action Area.
- The SSHCP Preserve System will be established adjacent to and contiguous with existing vernal pool grassland preserves within the Action Area, increasing the effective functional size of the SSHCP Preserve System. When considering the planned SSHCP Preserves together with the 37,619 acres of existing preserves, approximately 69,900 acres (59%) of the Action Area's remaining 103,320 acres of Vernal Pool Ecosystem will be preserved and managed in perpetuity. The large and interconnected SSHCP Preserve System will help to maintain functioning metapopulations of each vernal pool Covered Species, by preserving habitat and surface hydrologic connectivity, and by maintaining populations of upland wildlife species in the Action Area that are not Covered Species, but perform crucial ecosystem functions. These upland species include solitary bees and other pollinators of vernal pool plant Covered Species, as well as native wildlife species that passively disperse the seeds, cysts, and eggs of vernal pool species as they move in and through the Action Area.
- The SSHCP Conservation Strategy will also protect and manage a significant portion of two vernal pool ecosystem recovery Core Areas (USFWS 2005a). Much of the total 36,282-acre SSHCP Preserve System will be established within the boundaries of the Mather Core Area and the Cosumnes/Rancho-Seco Core Area, which have the highest quality vernal pool grassland habitat remaining in the Action Area, have been identified by the Service as the highest priority for protection, and have been identified as important for the recovery of 8 of the 11 SSHCP vernal pool Covered Species. When considering the planned SSHCP Preserve System together

with existing preserves, approximately 49% of the Mather Core Area, and approximately 78% of the Cosumnes/Rancho-Seco Core Area will be preserved and managed in perpetuity. Thus, the SSHCP would contribute to the survival and recovery of each vernal pool Covered Species.

- Individual Covered Activity projects will implement avoidance and minimization measures to reduce the extent and severity of effects of construction dust, encroachment of humans and equipment, light, noise on Covered Species. The design of each Covered Activity project will include design features and edge treatments to reduce the extent and severity of indirect effects that could reduce or impair functionality of preserved vernal pool habitat where SSHCP Preserve edges abut intensive urban development.
- All vernal pool Covered Species modeled habitat protected in the 36,282-acre SSHCP Preserve System will be monitored and managed in perpetuity under a single cohesive adaptive management program to maintain and improve habitat functions for each vernal Pool Covered Species, and ameliorate the effects of edge stressors, such as invasive species, wildfire risk, urban runoff, non-point source pollution, and human activity. The more intensive and more consistent management of Vernal Pool Ecosystem grasslands by the SSHCP Preserve Monitoring and Management Program is expected to improve the habitat functions of all Vernal Pool Ecosystem acres within the SSHCP Preserve System, leading to increased reproduction of each vernal pool Covered Species, and eventually expanding the distribution of many vernal pool Covered Species in the Action Area.
- Where a Covered Activity project location overlaps with modeled habitat for dwarf downingia, Boggs Lake hedge-hyssop, Ahart's dwarf rush, legenere, pincushion navarretia, slender Orcutt grass, or Sacramento Orcutt grass, the SSHCP will require pre-activity surveys using rare plant survey protocols.
- The SSHCP Conservation Strategy will conserve all documented occurrences of dwarf downingia, Ahart's dwarf rush, pincushion navarretia, slender Orcutt grass, and Sacramento Orcutt grass present in the Action Area. If new occurrences of the narrowly distributed Ahart's dwarf rush, slender Orcutt grass or Sacramento Orcutt grass are found in the Action Area, the SSHCP will protect all new occurrences inside the SSHCP Preserve System.
- If a new occurrence of dwarf downingia, legenere, or pincushion navarretia are found in the Action Area, the SSHCP Conservation Strategy requires that, prior to Covered Activity loss or removal of the occurrence, at least one currently unpreserved and "biologically equivalent or superior" occurrence of that species be preserved within the SSHCP Preserve System.

After reviewing the current status of designated critical habitat for the vernal pool fairy shrimp, vernal pool tadpole shrimp, slender Orcutt grass, and Sacramento Orcutt grass; the environmental baseline for the action area; the effects of the proposed SSHCP; and the cumulative effects; it is the Service's biological opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to destroy or adversely modify designated critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of designated critical habitat for vernal pool fairy shrimp, vernal pool tadpole shrimp, slender Orcutt grass, or Sacramento Orcutt grass to serve its intended conservation role for the species. We reached this conclusion because:

- SSHCP effects to critical habitat designations for the vernal pool fairy shrimp, vernal pool tadpole shrimp, slender Orcutt grass, and Sacramento Orcutt grass are small and discrete, relative to the entire area designated as critical habitat for vernal pool fairy shrimp, vernal pool tadpole shrimp, slender Orcutt grass, and Sacramento Orcutt grass.

- We do not expect the direct and indirect alterations of 743 acres of vernal pool fairy shrimp Critical Habitat, the direct and indirect alterations of 743 acres of vernal pool tadpole shrimp Critical Habitat, the direct and indirect alterations of 236 acres of slender Orcutt grass Critical Habitat, or the direct and indirect alterations of 249 acres of Sacramento Orcutt grass Critical Habitat by SSHCP Covered Activities to appreciably diminish the value of the Critical Habitat designation for the conservation of vernal pool fairy shrimp, vernal pool tadpole shrimp, slender Orcutt grass, and Sacramento Orcutt grass, and we expect each Critical Habitat designation would remain functional to serve its intended conservation role for vernal pool fairy shrimp, vernal pool tadpole shrimp, slender Orcutt grass, and Sacramento Orcutt grass, after implementation of the SSHCP.

2.6 Other-Aquatic Species

For the purposes of this Opinion, the central California tiger salamander, western spadefoot, western pond turtle, giant garter snake, and Sanford's arrowhead are grouped together and identified as "aquatic species." These Covered Species are grouped together because each spends a portion of its life history in seasonal or perennial aquatic-ecosystems, and many anticipated effects of the SSHCP on these species will be similar. This Opinion analyzes the effects on each of these species individually. They are grouped together here, for the purposes of streamlining the Opinion and minimizing repetition in Section 2.6.4, *Effects of the Action on Aquatic Species.*

2.6.1 Overview of the Other Aquatic Covered-Species Status and Critical Habitat

The status of each aquatic Covered Species is discussed below in Sections 2.6.1.1 to 2.5.1.5. To minimize redundancy, this section of the Opinion (Section 2.6.1) summarizes factors that have affected the range-wide status of the five aquatic Covered Species (central California tiger salamander, western spadefoot, western pond turtle, giant garter snake, and Sanford's arrowhead). The individual species status discussions for the federally-listed aquatic Covered Species will refer to Recovery Plans and the most recent 5-year review for each species (USFWS 2012, 2014, 2017a, 2017b), as well as other information summarized here in Section 2.6.1. In addition, this section summarizes some of the species life history and reproductive needs that are common to the aquatic Covered Species, and are relevant to the aquatic-species effects-analyses presented in Section 2.6.4 below.

After the settlement of California by Europeans, emergent marsh and other aquatic ecosystems have undergone a dramatic rate of loss, similar to the loss of vernal pool grasslands discussed above in Section 2.5.1. In California, over 90 percent of the historical wetlands have been diked, drained, and filled primarily for agricultural development and urban development (Frayer et al. 1989).

In the 1800s, the Central Valley contained more than 4 million acres of wetland habitats. Many wetlands were seasonal in nature and resulted from over-bank flooding of rivers and streams that inundated large areas of the Central Valley during winter and spring. Most of these wetlands were bordered by grassland and riparian habitats. At one time virtually all alluvial soils in the Central Valley supported riparian woodlands, marshlands, or perennial grasslands, but these lands were converted to agricultural and urbanization uses (Frayer et al. 1989). More than 95% of historical wetlands and 98% of historical riparian habitats in the Central Valley have been destroyed or modified, with just over 205,000 acres of wetlands remaining in the Central Valley (Central Valley

Joint Venture 2006). The over-bank flooding that once formed and characterized the California Central Valley seasonal-wetlands is essentially gone. Dams, levees, and flood bypasses now confine the flows to controlled pathways. Therefore, most of the Central Valley's emergent and seasonal wetlands now rely on water from managed systems. The long term reliability of water supplies for these wetlands is uncertain, as other water users in California compete for this limited resource. Shortages of water for the remaining Central Valley wetlands are expected to grow as urban demand for water increases in California (Central Valley Joint Venture 2006).

No comprehensive range-wide surveys of numbers or distribution have been conducted for any of the five "other aquatic" Covered Species. Where species surveys have been conducted, most surveys were designed to determine just presence or absence of federally-listed species, and most surveys did not collect information on numbers or abundance (CNDDB 2018). Occurrence records for the aquatic Covered Species are typically a reflection of where species surveys have been conducted or where the species has been anecdotally observed, rather than a delineation of species distribution and abundance. As discussed above in Section 2.5.1 above, species occurrence data compiled in the California Natural Diversity Data Bank (CNDDB) has limitations. However, our Opinion discusses CNDDB occurrences records and other available species survey records because they provide the best available information on the aquatic Covered Species distribution in California, and they provide information that informed our diagnoses of the current range-wide condition of each species, threats to each species, and trends in numbers.

Most adult frogs, salamanders, and turtles are ectothermic, and rely on environmental heat sources to control body temperatures. Generally philopatric to individual wetlands, adults move between both aquatic and terrestrial habitats to reproduce, forage, thermoregulate, escape, shelter, or aestivate/hibernate (Burk and Gibbons 1995; Semlitsch 1998). Consequently, the terrestrial habitats surrounding aquatic-habitat sites are critical to the survival of the semiaquatic species that depend on both aquatic and upland habitats to complete their life cycles (Semlitsch and Bodie 2003). Several studies have shown the close dependence of semiaquatic species, such as reptiles and amphibians, on terrestrial habitats for critical life history functions. During periods of drought, aquatic habitats may not be available to semiaquatic species for periods of their lives. In such cases, terrestrial habitats may act as population reservoirs or sources for adults until breeding and reproduction can again occur (Semlitsch and Bodie 2003).

The individual frog, salamander, and turtle Covered-Species each have a metapopulation reproductive-strategy. A metapopulation is a set of local populations or breeding sites within an area, where dispersal from one local population or breeding site to other areas containing suitable habitat is possible, but not routine (Pulliam 1988; Marsh and Trenham 2001). It is generally thought that dispersal among populations is achieved primarily by juveniles for amphibians (Gill 1978; Breden 1987; Berven and Grudzien 1990) or by males for turtles (Morreale et al. 1984). Dispersal by juvenile amphibians tends to be unidirectional and longer in distance than the annual movements of breeding adults (Breden 1987; Seburn et al. 1997). Thus, upland habitats adjacent to wetlands can serve as stopping points and travel corridors for dispersal to other nearby wetlands (Semlitsch and Bodie 2003).The status of the individual "other aquatic" Covered Species is discussed below in Sections 2.6.1.1 to 2.6.1.5.

2.6.1.1 Status of California Tiger Salamander/Critical Habitat (Central California DPS)

The CNDDB currently reports a total of 1,177 documented extant occurrences of California tiger salamander in California (CNDDB 2018). All California tiger salamanders are federally listed, but are listed as three unique entities, or Distinct Population Segments (DPSs): the Sonoma County DPS of California tiger salamander, the Santa Barbara County DPS of California tiger salamander, and the central California DPS of California tiger salamander (the central California tiger salamander).

For the most recent comprehensive assessment of the central California tiger salamander range-wide status, please refer to the *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (Ambystoma californiense)* (Central California DPS Recovery Plan)(USFWS 2017b). The Central California DPS Recovery Plan actions and implementation schedule are based on factors that continue to contribute to the species current listing status. Threats evaluated during the recovery plan review have continued to act on the species since the recovery plan was published. While there have been continued losses of central California tiger salamander habitat throughout its range, including habitat loss in the various recovery units identified for central California tiger salamander (USFWS 2017b), to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the species.

The California tiger salamander has an obligate biphasic life cycle during which it utilizes both aquatic and terrestrial habitat (Shaffer et al. 2004; Trenham et al. 2001). California tiger salamanders spend the majority of their lives underground in small mammal burrows. Adult California tiger salamanders are rarely seen except during their nocturnal breeding migrations which begin with the first seasonal rains, usually in November or December (Barry and Shaffer 1994; Trenham and Shaffer 2005). Historically, California tiger salamanders utilized vernal pools as breeding sites, but the species now also breeds in fish-free seasonal wetlands and livestock ponds that fill during winter and dry in the summer (Petranka 1998). The California tiger salamander requires upland habitat that is occupied by small burrowing mammals such as California ground squirrel (*Otospermophilus beecheyi*) and Botta's pocket gopher (*Thommomys bottae*), which create underground burrow systems utilized by the salamanders throughout the year (Shaffer et al. 1993; Pittman 2005). Upland habitats surrounding known central California tiger salamander breeding pools are typically dominated by valley grassland, but oak savanna, oak woodland, and other uplands area also used (USFWS 2017b). Large tracts of upland habitat, preferably with multiple breeding ponds, are necessary for the central California tiger salamander to persist. Therefore, the aquatic and upland habitat for California tiger salamander is generally consistent with the description of the Vernal Pool Ecosystem, discussed above in Section 2.3.5.

As discussed in Sections 2.5.1 and 2.6.1 above, urbanization and intensive agriculture have eliminated virtually all vernal pool grassland and oak savanna habitat from the Central Valley floor, leaving most remaining suitable habitat for the central California tiger salamanders distributed in a ring around the Central Valley (R. Holland 1978; Shaffer et al. 1993). The current distribution of the central California tiger salamander is now restricted to disjunct populations in 23 California counties that form a ring along the foothills of the Central Valley, from Sacramento and Yolo Counties in the north to San Luis Obispo, Kern, and Tulare Counties in the south. The remaining populations of central California tiger salamander occur near scattered and increasingly isolated breeding sites, reducing opportunities for inter-pond dispersal. The loss, degradation, and fragmentation of aquatic habitat and upland habitat as the result of human activities are the primary threats to the central California tiger salamander (Davidson et al. 2002; Service 2014, 2017). A summary of the range-wide loss of natural seasonal-wetlands is provided above in Section 2.6.1, and a summary of the range-wide loss and fragmentation of the Central Valley vernal pool grasslands used by the central California tiger salamander is provided above in Section 2.5.1, and are not repeated here.

The loss of central California tiger salamander suitable-habitat has been slowed somewhat by the preservation of vernal pool grasslands, rangelands, and other suitable-habitat. The Service has determined that over 34,000 acres of suitable central California tiger salamander habitat is currently protected by conservation easement or owned in fee title by government agencies or other conservation organizations (USFWS 2017b).

The current range of the central California tiger salamander has been classified into four Recovery Units by the central California DPS Recovery Plan (USFWS 2017b). These four Recovery Units are: (1) the Central Valley Recovery Unit, (2) the Southern San Joaquin Valley Recovery Unit, (3) the Bay Area Recovery Unit, and (4) the Central Coast Range Recovery Unit (USFWS 2017b). The four central California tiger salamander Recovery Units represent biologically (genetically) distinct areas where recovery actions should take place to eliminate or ameliorate threats to the central California tiger salamander. Because of the genetic distinctiveness of each of the four Recovery Units, recovery in each of these units is essential to recovery of the DPS as a whole. Therefore, recovery criteria must be achieved within each designated recovery unit to achieve recovery of the central California tiger salamander. Each of the four Recovery Unit also contains smaller Management Units, which face different levels of threats that may require different management actions. Together, the separate Management Units include the full genetic, geographic, and ecological range of each distinct Recovery Unit identified for the central California tiger salamander (USFWS 2017b). The Action Area is located within the Central Valley Recovery Unit, which has 12 Management Units (including one Management Unit within the Action Area). The actions and implementation schedule of the central California DPS Recovery Plan are based on factors that continue to contribute to the species current listing status. In addition to the loss and fragmentation of suitable habitat, other threats affecting the current status of central California tiger salamander include mortality from road crossings; contaminants, competition with invasive species, predation from invasive species, small mammal burrow control efforts in upland habitat, and hybridization with nonnative barred tiger salamanders *(Ambystoma tigrinum)* (USFWS 2004b, 2014, 2017b).

Central California tiger salamanders have been killed by vehicular traffic while crossing roads (USFWS 2017b). The CNDDB (2018) reports 27 occurrences of central California tiger salamanders that are threatened by vehicular traffic and road mortality. Of these, 18 occurrence sites have documented central California tiger salamanders that were struck by vehicles. The majority of these vehicle-strikes are reported in Alameda County (13), and other vehicle-strikes are reported in Contra Costa, Mariposa, Merced, Santa Cruz, Santa Clara, San Benito, San Joaquin, and Stanislaus Counties. Roads and highways can also create permanent physical obstacles to central California tiger salamanders movement, which increases habitat fragmentation.

Bullfrogs are a threat to the central California tiger salamanders (USFWS 2004b, 2017). Bullfrogs have been documented to prey upon central California tiger salamanders (Anderson, P. 1968) and have eliminated some central California tiger salamander populations (Shaffer et al. 1993). Although bullfrogs are unable to establish permanent breeding populations in unaltered vernal pools and seasonal ponds that do not hold water year-round, dispersing bullfrogs take up residence in vernal pools and other ephemeral wetlands during the winter and spring (Seymour and Westphal 1994) and prey on central California tiger salamander larvae and migrating adults. In addition, most breeding sites that are currently available over the range of the species are now perennial features (Riley et al. 2003; J. Johnson et al. 2013), which favors bullfrogs, non-native salamanders, and non-native fish, which may prey on California tiger salamander larvae.

Contaminants are considered a threat to central California tiger salamanders at the time of listing (USFWS 2004b) and are still considered a threat at this time. Sources of chemical pollution that may adversely affect central California tiger salamanders include hydrocarbon and other contaminants from oil production and road runoff, the application of chemicals for agricultural production and urban/suburban landscape maintenance, increased nitrogen levels in aquatic habitats, and rodent and vector control programs (USFWS 2004b, 2014).

At the time of listing, the Service determined that hybridization between central California tiger salamanders and non-native barred tiger salamanders posed a significant threat to the central California tiger salamander (USFWS 2004b, 2017b). There was a large-scale introduction of barred tiger salamanders approximately 60 years ago in the Salinas Valley in support of the bass-bait industry. These introduced salamanders began breeding with central California tiger salamanders (Riley et al. 2003). The invasion has spread from the original source populations out across the Salinas Valley and the coast range portion of the range of the DPS (Fitzpatrick and Shaffer 2007). Central California tiger salamanders in the Salinas Valley (Central Coast Recovery Unit), in particular, are threatened by hybridization with non-native tiger salamanders. Non-native tiger salamanders were likely also introduced to ponds in Merced County (in the Central Valley Recovery Unit) (Fitzpatrick and Shaffer 2007).

Because California experiences highly variable annual rainfall events and droughts, California tiger salamanders have adapted a life history strategy to deal with these inconsistent environmental conditions, including a metapopulation reproductive-strategy. Central California tiger salamanders appear to have high site fidelity, returning to their natal vernal pools or pond as adults; and after breeding, they commonly return to the same terrestrial habitat areas (Orloff 2007 and 2011). However, some salamanders will disperse to new breeding ponds (Trenham 2001; Wang et al. 2009). Adult central California tiger salamanders engage in mass migrations during a few rainy nights per year, typically from November through April, although migrating adults have been observed as early as October and as late as May. During these rain events, adults leave their underground burrows and return to breeding ponds to mate and will then return to their underground burrows (R. Hansen and Tremper 1993; Loredo and Van Vuren 1996; Petranka 1998; Trenham et al. 2000). The aquatic larval-stage of the central California tiger salamander usually lasts 3 to 6 months, with metamorphosis to juvenile form beginning in late spring or early summer (Petranka 1998). Larvae fed on vernal pool zooplankton, snails, and aquatic insects until they grow large enough to consume larger aquatic prey. Central California tiger salamander larvae are known to consume rotifer eggs, algae, water fleas, mosquito larvae, branchiopod crustaceans, Pacific chorus frog tadpoles, western spadefoot toad tadpoles, and smaller central California tiger salamander larvae (Anderson 1968b, Feaver 1971). Once metamorphosis occurs, juveniles typically depart their natal ponds at night and enter terrestrial upland habitat in search of suitable underground burrows (Petranka 1998). Central California tiger salamanders have been reported to migrate up to 1.3 miles (2.2 kilometers) between breeding ponds and upland habitat (Orloff 2007). Searcy and Shaffer (2011) estimated average migration distance to be 1,844 feet and they estimated that central California tiger salamanders are physiologically capable of migrating up to 1.5 miles each breeding season. While individuals may survive for more than 10 years, most individuals do not reach sexual maturity until they are two to five years old, and mortality of individuals exceeds 50 percent during their first summer (Trenham et al. 2000; Shaffer et al. 1993).

Status of Critical Habitat for the Central California Tiger Salamander

Under the ESA, a Critical Habitat designation establishes a geographic area that includes the physical and biological features (primary constituent elements) that are essential for the conservation of the threatened or endangered species, and may require special management considerations or protections. Primary constituent elements (PCEs) include, but are not limited to (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, and, (5) habitats that are protected from disturbance or are representative of the historical geographical and ecological distributions of a species (USFWS and NMFS 1998).

On September 22, 2005, the Service designated approximately 199,109 acres of critical habitat for the central California tiger salamander (USFWS 2005b). The designated critical habitat is comprised of 31 Critical Habitat Units located within 19 California counties. The 31 Critical Habitat Units for the central California tiger salamander are within four geographic regions (Central Valley, Southern San Joaquin, East Bay, and Central Coast). The Central Valley geographic region includes an area of the Central Valley from northern Yolo County south to northern Madera County, and includes portions of Solano, Contra Costa, Sacramento, San Joaquin, Amador, Calaveras, Stanislaus, and Merced Counties. …

Within the Central Valley geographic region, the Service has designated 12 critical habitat units that total approximately 97,045 acres. The 12 critical habitat units within the Central Valley geographic region occur in four of 17 vernal pool regions. The areas designated as critical habitat for the central California tiger salamander provide needed aquatic and upland refugia habitats for adult salamanders to maintain extant occurrences of the species throughout their geographic and genetic ranges and provide those habitat components essential for the conservation of the species (USFWS 2005b).

The three primary constituent elements for the California tiger salamander Critical Habitat are:

1. Standing bodies of fresh water [including natural and manmade (i.e., stock) ponds], vernal pools, and other ephemeral or permanent water bodies which typically support inundation during winter rains and hold water for a minimum of 12 weeks in a year of average rainfall;
2. Upland habitats adjacent to and accessible from breeding ponds that contain small mammal burrows or other underground habitat that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation; and
3. Accessible upland dispersal habitat between occupied locations that allow for movement between such sites.

Each central California tiger salamander Critical Habitat Unit contains these essential aquatic habitat features, upland habitat features, and dispersal habitat features. The following factors are responsible for the current condition of California tiger salamander critical habitat (USFWS 2005b):

- Non-native predators. Introduction of non-native predators such as bullfrogs and fish are significant threats to California tiger salamander breeding success;
- Breeding habitat disturbance. Activities that involve heavy equipment operation, ground disturbance, maintenance activities, off-road travel, or recreation disturb aquatic breeding habitats during the breeding season;
- Water quality impairment. Activities that impair the water quality of aquatic breeding habitat threatens the breeding success of the species;

- Rodent control. Rodent control activities that reduce small mammal populations results in insufficient underground refugia used for foraging, protection from predators, and shelter from the elements;
- Barriers. The creation of impassable barriers for the California tiger salamander increases mortality in upland habitat, reduce breeding success, and fragment populations;
- Disruption of vernal pool complexes. Activities that fragment or disrupt the hydrology of vernal pool complexes reduce breeding success of California tiger salamanders.

2.6.1.2 Status of Western Spadefoot

The western spadefoot is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The western spadefoot is nearly endemic to California, and historically ranged from Redding in Shasta County southward to northwestern Baja California, Mexico. The western spadefoot occurred throughout the Central Valley, adjacent foothills below 3,000 feet, and costal lowlands. Western spadefoots have two distinct habitat requirements including quiet streams, or seasonal wetlands, or vernal pools for breeding, and uplands for foraging and dry-season aestivation (Stebbins 2003). However, in recent decades the western spadefoot has been extirpated from many historical locations within the Central Valley and in the costal lowlands of southern California. The CNDDB currently reports a total of 463 occurrences of western spadefoot in 27 California counties, including 11 extant occurrences in Sacramento County (CNDDB 2018).

As discussed in Section 2.5.1 and 2.6.1 above, much of the historical suitable-habitat for western spadefoot has been lost. The western spadefoot suffered dramatic reductions after 1900 when agricultural and urban development began to rapidly remove vernal pool grasslands and other natural habitats in the Central Valley and southern California (Jennings and Hayes 1994). Over 80% of the landcover habitats once known to be occupied by western spadefoot in southern California has been developed or converted to uses that are incompatible with successful reproduction of the species, and approximately 30% of suitable habitat landcovers in north and central California have been converted or developed (Jennings and Hayes 1994). The average elevation of sites where western spadefoot still occurs is significantly higher than the average elevation for the historical records of western spadefoot in California (Stebbins 1985; Morey 1988, Fisher and Shaffer 1996). Similar to the other vernal pool Covered Species and the central California tiger salamander, much of the remaining suitable aquatic and upland habitats for the western spadefoot are now concentrated on valley terraces along the edges of the Central Valley floor (Jennings and Hayes 1994). A summary of the range-wide loss and fragmentation of the Central Valley vernal pool grassland habitats used by the western spadefoot was provided above in Sections 2.5.1 and 2.6.1, so is not repeated here.

In addition to the removal of suitable breeding and upland habitats, physical barriers, such as roads and canals have dammed or blocked hydrologically linked systems, altering the hydrology of western spadefoot aquatic habitat and inhibiting movement of individuals. Habitat fragmentation generally is a result of activities associated with habitat loss, but roads and other infrastructure projects have contributes to the isolation and fragmentation of western spadefoot suitable habitats. Habitat loss and fragmentation are currently the most significant threats to the survival and recovery of western spadefoot (USFWS 2005a).

The western spadefoot has an obligate biphasic life cycle during which it utilizes both aquatic and terrestrial habitat. However, western spadefoots are almost completely terrestrial, and enter water only to breed (Dimmitt and Ruibal 1980; Baldwin 1988). Western spadefoot eggs and larvae have been observed in a variety of aquatic features, including temporary rain pools, vernal pools, seasonal wetlands, stock ponds, ditches, pools within intermittent streams, and quite backwaters of creeks and streams (Fisher and Shaffer 1996; CNDDB 2018). However, it appears that vernal pools and other ephemeral wetlands may be optimal for breeding due to the absence or reduced abundance of both native and nonnative predators, many of which require more permanent waters. The western spadefoot also depends on the surrounding terrestrial landcovers that provide foraging habitat and dry-season aestivation habitat (Stebbins 2003).

Western spadefoots breed from January to May, primarily in temporary wetlands, pools, and drainages that form following winter or spring rains. Water temperatures in these pools must be between 48 and 86 degrees Fahrenheit for western spadefoots to reproduce (Brown 1966). Egg-laying does not occur until water temperatures reach the required minimum of 48 degrees Fahrenheit (Jennings and Hayes 1994). Depending on the water temperature and annual rainfall, egg laying oviposition may occur between late February and late May (Storer 1925; Burgess 1950; Feaver 1971; Stebbins 1985). The eggs of western spadefoots are deposited on plant stems, pieces of detritus, and other submerged objects in their aquatic habitats (Stebbins 1985). Larval development can be completed in 3 to 11 weeks depending on food resources and water temperature, but must be completed before pools dry (Burgess 1950; Feaver 1971). The specific food habits of western spadefoot larvae are unknown; but larvae of other spadefoot species consume planktonic organisms and algae, and also will scavenge dead organisms, including other spadefoot larvae (Bragg 1964). In addition, larvae of Plains spadefoots reportedly will prey on fairy shrimp (e.g., *Branchinecta* spp.) (Bragg 1962).

Ephemeral pools and wetlands that persisted for longer periods were found to provide longer larval development that resulting in larger juveniles with greater fat reserves at metamorphosis (Morey 1998, Balfour and Morey 1999). A longer period of larval development is associated with larger body size at metamorphosis, which is correlated to greater survivorship and reproductive fitness and (Pfennig 1992). Annual reproductive success probably varies with precipitation levels with success being lower in drier years (Fisher and Shaffer 1996).

Metamorphosing larvae may leave the water while their tails are still relatively long (greater than 1 centimeter (Storer 1925). Recently metamorphosed juveniles emerge from water and seek refuge in the immediate vicinity of natal ponds where they spend several hours to several days near ponds before dispersing. Toadlets of other spadefoot species initially seek refuge in drying mud cracks, under boards, and under other surface objects including decomposing cow manure. Little information is available regarding western spadefoot dispersal distances and overland movement patterns from aquatic breeding sites to upland aestivation sites. Research on other amphibian species suggests that average upland habitat utilization falls within 1,210 feet of aquatic habitats, but some amphibian species disperse up to 5,250 feet (Semlitsch and Brodie 2003). Spadefoot toads prefer to construct burrows in soils that are relatively sandy and friable as these soil attributes facilitate both digging and absorption of water from the soil (Ruibal et al. 1969). Spadefoots construct and occupy aestivation burrows that may be up to 3 feet in depth (Ruibal et al. 1969), where they remain for 8 to 10 months. Age of sexual maturity in western spadefoot is unknown, but considering the relatively long period of subterranean dormancy (8 to 10 months), individuals may require at least two years to mature (Jennings and Hayes 1994).

Spadefoot toads emerge from burrows to forage and breed following rains in the winter and spring. The factors that stimulate emergence are not well understood. Sound or vibration from rain striking the ground appears to be the primary emergence cue used by spadefoot toads, and even the vibrations of a motor can cause toads to emerge (Dimmitt and Ruibal 1980). Western spadefoot responses to vibration and noise likely will vary depending on multiple factors, including, but not limited to season, ambient noise, and habituation.

Nocturnal surface activity has been observed in months between Octobers to May (Morey 1988; Morey and Guinn 1992). During the day, spadefoots dig and occupy relatively shallow burrows two to five centimeters (0.5 to 2 inches) in depth (Ruibal et al. 1969), and may even use small mammal burrows. In addition to breeding during periods of above-ground activity, spadefoots must acquire sufficient energy resources prior to reentering dormancy (Seymour 1973). Adult western spadefoots forage on a variety of insects, worms, and other invertebrates (Morey and Guinn 1992). Adult spadefoots can consume 11 percent of their body mass during a single outing, and Dimmit and Ruibal (1980) speculated that adult southern spadefoots may be able to acquire sufficient energy for their long dormancy period (eight to nine months) in only a few weeks.

Extant occurrences of western spadefoot have been recorded in 11 of the 17 vernal pool regions described in the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a). Species-specific recovery criteria for the western spadefoot were identified for the 11 vernal pool regions where western spadefoot species exists (i.e. Carrizo, Central Coast, NE Sacramento Valley, NW Sacramento Valley, San Diego, San Joaquin, Santa Barbara, SE Sacramento Valley, Solano-Colusa, Southern Sierra Foothills, and Western Riverside County). Within the Southeastern Sacramento vernal pool region, four recovery Core Areas were identified for western spadefoot (i.e. Cosumnes/Rancho-Seco, Mather, Phoenix Field and Phoenix Park, and Western Placer County) (USFWS 2005a). Because western spadefoot toads occur in a broader range of habitat types than the other vernal pool species addressed in the Vernal Pool Recovery Plan, the amount of habitat protection and the other recovery-actions recommendations for western spadefoot by the Vernal Pool Ecosystem Recovery Plan applies to those areas where western spadefoot co-occurs with other vernal pool species within Vernal Pool Ecosystem habitats (USFWS 2005a page III-112).

2.6.1.3 Status of Western Pond Turtle

The western pond turtle is not currently listed under the ESA nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The western pond turtle is widely distributed in the western United States, including Washington State, Oregon, California, and Baja California, Mexico from sea level to elevations of 6,500 feet. Historically, the western pond turtle inhabited the vast areas of permanent and seasonal wetlands in the Central Valley, with the historical Tulare Lake area being a stronghold for the species. Today, the western pond turtle still remains in 90 percent of its historical range, but at greatly reduced numbers (D. Holland 1991a; Jennings and Hayes 1994). Habitat loss and alteration are most responsible for the decline of western pond turtles throughout its range. In California, over 90 percent of the historical wetlands have been diked, drained, and filled primarily for agricultural development and urban development (Frayer et al. 1989; and Section 2.5.2 above). Urbanization also significantly altered or eliminated western pond turtle habitat through the channelization or cementing of numerous wetlands and waterways. Channelized waterways are also periodically cleaned of aquatic vegetation, further reducing habitat for western pond turtles (Brattstrom and Messer 1988; D. Holland 1991a).

The western pond turtle uses both aquatic and terrestrial habitat. Western pond turtles inhabit a variety of aquatic habitats, including marshes, rivers, ponds, and streams, and may occur in man-made habitats, such as irrigation ditches, reservoirs, and sewage ponds. Preferred aquatic habitat is characterized by slow moving or quiet water, emergent aquatic vegetation, deep pools with undercut banks for refugia, and partially submerged rocks and logs for thermoregulatory basking. Western pond turtles use aquatic habitats primarily for foraging, thermoregulation, and avoidance of predators (Boyer 1965; D. Holland 1994; Reese and Welsh 1998). Because turtles are ectothermic animals, they rely on external sources of heat to warm their bodies. Basking in the sun is done intermittently throughout the day and is primarily conducted to maintain a body temperature of 75 to 90 degrees Fahrenheit (Boyer 1965; Bury 1986). The removal of basking sites (e.g., logs, snags, and rocks) is known to change thermoregulatory behavior of turtles and reduces available foraging and refuge sites. According to D. Holland (1992), the reduction in number of basking sites was a primary factor in the observed decline of western pond turtles in several lakes in Oregon. Western pond turtles tend to be wary, and quickly abandon basking sites if they see human or animal movement in adjacent uplands.

Western pond turtles are generally inactive during the winter months (December to February) within most of their range. During this time, turtles either bury into the bottom mud of ponds, creeks, or other watercourses, or they move upland, well away from water, to find suitable habitat to wait out periods of flooding or unsuitable weather. Aquatic refugia consist of rocks, logs, mud, and undercut areas along banks, and upland winter refugia/hibernacula consist of burrows in leaf litter, heavy brush, or soil (D. Holland 1994; Reese and Welsh 1997). In central California coastal-streams, most western pond turtles leave drying creeks in late summer and return after winter floods. These turtles spend an average of 111 days in upland refugia that are an average of 164 feet from the creeks (Rathbun et al. 1992, 2002).

After their winter inactive period, western pond turtles have been reported to congregate in vernal pools before returning to riverine systems. This may allow them to utilize a warm water habitat while high seasonal water flows in rivers still exist (Ashton et al. 1998). In the majority of its range, western pond turtles are active from approximately March through October with the peak of activity in May and June. During their active season, western pond turtles engage in movements along the watercourses in which they live, seeking suitable foraging and basking habitat. Active season home-ranges are typically represented by several hundred yards of the same creek bank, as they rarely move between drainages (D. Holland 1991b; D. Holland 1994). Western pond turtles are dietary generalists, but prefer live prey, which they capture opportunistically. The majority of their diet consists of small crustaceans, aquatic insect larvae, and crayfish, but western pond turtles also eat plant matter, carrion, and small vertebrates (Bury 1986; D. Holland 1994).

Western pond turtles first breed at 10 to 14 years of age (Stebbins 2003). From May through August of the active-season, gravid females make extended movements into upland habitat where they dig shallow nests (Rathburn et al. 1992; Reese and Welsh 1997). Nest locations range from 39 to 1,319 feet from aquatic habitat, and are typically located in open areas dominated by grasses and forbs (Storer 1930; D. Holland 1991b; Rathbun et al. 1992, 2002). Eggs of the western pond turtle must normally be laid in soils that are relatively dry. Typically, western pond turtles dig nests in open sunny areas that are on slopes no steeper than 25 degrees (Feldman 1982). Incubation requires from

96 to 104 days in the wild (D. Holland 1991b). Most hatchlings overwinter in the nest and move to water in during March to April (D. Holland 1994; Reese and Welsh 1997). Western pond turtles exhibit a high degree of site fidelity in both aquatic and terrestrial environments, and have nest-site philopatry. This suggests a great need for the protection of upland habitats that may be used by nesting turtles (Ashton et al. 1998; D. Holland 1994). Hatchling and young turtles (one year) require shallow water areas (less than 12 inches deep) dominated primarily by emergent aquatic reeds (Juncus spp.) and sedges (Carex spp.) (D. Holland 1991b) and have been observed to avoid areas of open water lacking these plant species (Boyer 1965; D. Holland 1994; Hays et al. 1999; Reese and Welsh 1998).

Where croplands are established adjacent to western pond turtle aquatic habitat, upland nesting opportunities may become limited or nonexistent if farming occurs up to the edge of aquatic habitats. Such farming practices typically result in the elimination of western pond turtles from affected waters (D. Holland 1991a). However, because western pond turtles are long-lived (40 to 50 years), populations may persist in isolated wetlands long after recruitment of young has ceased, resulting in very small and heavily adult-biased populations (D. Holland 1991a; Jennings and Hayes 1994; Ashton et al. 1998).

The western pond turtle is preyed upon by a wide variety of native and introduced predators. The native raccoon is a ubiquitous and effective predator, taking animals of all sizes, including eggs and hatchlings, and skunks are nest predators. In Oregon, over 90 percent of 100 nests examined in one year were destroyed by predators, most likely raccoons, or skunks (D. Holland 1992). Raccoon populations, in particular, respond favorably to urban environments, where human refuse may support larger populations than normal, as discussed above in Section 2.5.3. Larger populations of raccoons and other predators combined with reduced nesting habitat for western pond turtles adjacent to aquatic habitat results in concentrations of nests, which are more easily detected by predators (D. Holland 1992). Two introduced aquatic predators of particular concern are the bullfrog and introduced bass species (*Micropterus spp.* and *Morone saxatilis*), which have been observed feeding on juvenile western pond turtles. Bullfrogs especially forage in shallow warm water, the microhabitat of hatchling and juvenile western pond turtles (Moyle 1973; D. Holland 1991a).

The construction and operation of roadways adjacent to western pond turtle habitat may adversely affect western pond turtles in several ways. First, roads often present a partial or complete barrier to turtles traveling overland to nesting or winter refugia sites. Western pond turtles have been observed crushed on roadways in California, Oregon, and Washington, with the majority of these being gravid females (with developing eggs) or postpartum females. In addition to hampering access to nesting areas, roadbeds reduce the area of potential nesting (D. Holland 1985; D. Holland 1992). D. Holland (1994) also reported overland movements of 3.1 miles in turtles seeking more appropriate aquatic habitat, exposing turtles to roadways and other threats. In addition, roadways are also a source of contaminants and run-off that can enter aquatic habitats (see Section 2.5.4 above). The long life span and food habits of the western pond turtle could render this species prone to bioaccumulation of contaminants (D. Holland 1991a).

Another significant source of habitat alteration throughout the range of the western pond turtle is excessive livestock grazing and habitat disturbance in riparian areas (Behnke and Raleigh 1978; Kauffman and Krueger 1984). Cattle have a disproportionately greater adverse effect on riparian and other wetland habitats because they tend to concentrate in these areas during the summer dry season (Marlow and Pogacnik 1985). Cattle trample and eat emergent vegetation that serves as foraging and escape habitat for turtles of all sizes, and is critical microhabitat for hatchlings and first-year animals.

Stream banks also are trampled by cattle often resulting in the collapse of undercut banks that provide refugia for turtles, and cattle may crush turtles (D. Holland 1991a). Cattle-grazing also results in increased erosion in streams, which in turn fills in deep pools, increases stream velocity, and adversely affects aquatic invertebrates and other prey species consumed by western pond turtles (Behnke and Raleigh 1978; Platts 1981).

2.6.1.4 Status of Giant Garter snake

For the most recent comprehensive assessment of the species' range-wide status, please refer to the final *Recovery Plan for the Giant Garter Snake (Thamnophis gigas)* (GGS Recovery Plan) (USFWS 2017c). The recovery plan actions and implementation schedule are based on factors that continue to contribute to the species current listing status. While there have been continued losses of giant garter snake habitat throughout its range, including habitat loss in the Recovery Units identified for the giant garter snake (USFWS 2017c), to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the species.

The giant garter snake is endemic to the California Central Valley, inhabiting natural marshes as well as the seasonal wetlands that were created by overbank flooding of the rivers and streams (Fitch 1940, 1941). As discussed in Section 2.6.1, less than 5 percent of the Central Valley's historical wetlands remain (Central Valley Joint Venture 2006). The giant garter snake continues to inhabit the fragmented wetlands that remain in the Central Valley, including marshes, ponds, small lakes, low-gradient streams, and other waterways. However, giant garter snakes are now most numerous in rice growing regions of the Central Valley. Over much of its range, rice fields and associated agricultural water conveyance systems has replaced natural wetlands as an important habitat for giant garter snake, and giant garter snakes now use highly modified and degraded aquatic habitats, including agricultural rice fields, irrigation ditches, and drainage canals. Giant garter snakes remain absent from larger rivers and lakes, which support populations of large, predatory fish (R. Hansen 1980; Brode 1988; Brode1990).

Extant occurrences of giant garter snake in the Central Valley extend from Chico in Butte County in the north to the Mendota Wildlife Area in Fresno County in the south (E. Hansen 2008), with extant occurrences ranging in elevation from 0 to 180 feet above sea level (Hansen and Brode 1980). The wide geographic range of the giant garter snake has been classified into nine Recovery Units by the GGS Recovery Plan (USFWS 2017c). The nine GGS Recovery Units correspond directly to nine geographically and genetically-distinct giant garter snake populations (i.e. the Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin, Cosumnes-Mokelumne Basin, Delta Basin, San Joaquin Basin, and the Tulare Basin).The nine GGS Recovery Units are currently isolated from each other, without suitable corridors for dispersal between the populations (USFWS 2017c). The CNDDB currently reports a total of 365 extant occurrences of giant garter snake in California (CNDDB 2018).

The giant garter snake is primarily an aquatic species, but it also occupies upland terrestrial habitat. Although usually found in or adjacent to aquatic habitats, giant garter snakes have been observed in uplands hundreds of yards distant from any water body (Wylie et al. 1997). Suitable habitat for giant garter snake consists of (1) adequate water during the snake's active season (early spring through mid-fall) to provide food and cover, (2) emergent, herbaceous wetland vegetation, such as *Scirpus* and *Typha spp.* for escape cover and foraging habitat during the active season, (3) grassy banks and openings in waterside vegetation for basking, and (4) uplands for winter hibernacula sites and refuge from flood waters during the snake's dormant season in the winter (G. Hansen 1988). Riparian woodlands do not typically provide suitable upland habitat because of excessive shade, lack of basking sites, and reduced prey populations (R. Hansen 1980).

Snakes are ectothermic animals, relying on external sources to warm or cool their bodies. A snake's ability to thermoregulate its body within narrow limits using external sources of heating and cooling are believed to play an important role in feeding and digestion, growth, reproduction, and in their vulnerability to predation (Pough et al. 2001). Giant garter snakes warm themselves in cool weather by basking on canal banks, and remain cool during hot days by moving to underground burrows (small mammal burrows, crayfish burrows, and soil crevices) (G. Hansen and Brode 1993; Wylie et al. 2009). Giant garter snakes at Badger Creek Marsh in Sacramento County used daytime burrows as much as 164 feet away from the marsh edge to escape extreme heat (Wylie et al. 1997).

Wylie et al. (2008) found that giant garter snakes at the Colusa Drain site in Yolo County traveled on average 148 feet to 328 feet per day during the active season, but decreased activity significantly during the fall and winter when daily travel was about 23 feet. Giant garter snakes usually remain in close proximity to wetland habitats, but can be found in uplands as far away as 820 feet from their edge (G. Hansen 1988; Wylie et al. 1997). G. Hansen and Brode (1993) also documented giant garter snakes moving at least 1,312 feet (0.25 miles) between small lateral ditches and larger canals within the Natomas Basin in Sacramento County, and some marked and recaptured giant garter snakes moved distances greater than 0.5 miles in as little as a day.
During the winter dormant season (i.e., November to mid-March), giant garter snakes use small mammal burrows and other soil crevices above prevailing flood elevations as hibernacula, typically with sunny exposures along south- and west-facing slopes (USFWS 1999b). The average distance between upland over-wintering sites and aquatic breeding-sites is approximately 490 feet, ranging from 164 feet to 1,312 feet (Wylie, pers. comm. 2005). Giant garter snakes begin emerging from winter retreats (hibernacula) as early as March 1 in some years and in some locations (R. Hansen 1980; G. Hansen and Brode 1993; Wylie et al. 1997). By April 15th, most giant garter snakes are active and are searching for food (G. Hansen and Brode 1993). The giant garter snake breeding season begins soon after emergence from over-wintering sites and extends from March into May (USFWS 1999b). Females brood young internally, and typically give birth to live young from late July through early September (Hansen and Hansen 1990). Giant garter snake activity peaks during April and May, and then activity is reduced during the mid- to late summer months (G. Hansen and Brode 1993). Around October 1st, giant garter snakes begin seeking upland winter retreats.

Adult bullfrogs are known to eat young (neonate) giant garter snakes. Predation by bullfrogs accounted for the mortality of 21.5 percent of all neonate giant garter snakes in the study conducted by Wylie et al. (2003). Direct mortality of adult snakes from vehicle strikes on roads has been well documented and is a threat to giant garter snakes throughout the Central Valley (USFWS 2012). Snakes are particularly vulnerable to vehicle strikes because of their long bodies that provide a large target area, their relatively slow speed, and their habit of lying on warm roadways during the evening to raise their body temperatures (Rosen and Lowe 1994). In addition to direct mortality from vehicle strikes, roads also function as barriers that reduce ecosystem connectivity and disrupt aquatic systems (Forman et al. 2003). Because much of the remaining giant garter snake habitat in the Central Valley is now subject to farming, flood control, and canal maintenance activities, individual are exposed to on-going risks of mortality and injury, and the effects of habitat degradation (USFWS 2012). Farming and canal-maintenance activities can kill or injure snakes, remove critical escape cover, eliminate prey populations, and destroy small mammal burrows and other soil fissures used as winter hibernacula (G. Hansen 1988; Brode and Hansen 1992; G. Hansen and Brode 1993).

2.6.1.5 Status of Sanford's Arrowhead

Stanford's arrowhead is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

Occurrences of Sanford's Arrowhead have been documented in the Central Valley, the Cascade Range Foothills, the Outer North Coast Range, the Western Transverse Range, and the South Coast regions of California, from Butte and Tehama Counties at the northern edge of the Central Valley south to Orange and Ventura Counties in southern California. The CNDDB (2018) has records for 126 occurrences of Stanford's arrowhead in California, with 59 (47%) of those occurrences in Sacramento County. Observations indicate that the number of individuals at an occurrence can vary greatly between years (Mason 1957).

Sanford's Arrowhead is an emergent, perennial, aquatic-plant that is strictly associated with freshwater marshes, including natural and man-made marshes at the margins of rivers, streams, ponds, reservoirs, irrigation and drainage canals and ditches, and stock-ponds. Sanford's Arrowhead is also reported to occur in several seasonal wetlands that have sufficient hydrology to support emergent marsh species. At one occurrence, Sanford's Arrowhead co-occurs with plant species associated with deeper vernal pools, including legenere and dwarf downingia (CNDDB 2018). As with most perennial marsh plant-species, Sanford's arrowhead typically inhabits a specific zone of water depth, typically between four inches to two feet in depth. Observations usually describe Sanford's arrowhead as found in relatively shallow margins of deeper marsh systems (CNDDB 2018). As discussed in Section 2.6.1 above, most of the historical suitable-habitat for Stanford's arrowhead has been lost. Mason reported a 100-acre population of Sanford's Arrowhead in 1912 located near Tracy that by 1954 was gone, and the area entirely under cultivation (Mason 1957). Loss of Sanford's arrowhead populations and habitat since pre-settlement times has been substantial.

Like many perennial marsh species, Sanford's Arrowhead reproduces asexually by dispersal of fragmented rhizomes and tubers, as well as sexually, via flowering and seed production. Sanford's Arrowhead has the perennial clonal-growth found in most other emergent marsh plants. Thin elongate rhizomes produce tubers (corms) at their tips that allow the plant to persist within the submersed substrate through the dormant winter season. New plants (clones) are produced from these tubers at the onset of favorable growing conditions (Mason 1957). Observations have also been made of a Sanford's Arrowhead colony reappearing with vigor following a year during which the habitat failed to flood and above ground leaves and stems were completely absent (Gause pers. comm.). The ability of this colony to withstand at least one year of unfavorable hydrologic conditions and then reappear with vigor is likely attributable to the dormant rhizome and associated tubers/corms.

Sanford's Arrowhead flowers from May through October. This species has separate male and female flowers within a single inflorescence. Although pollination and breeding experiments have not been carried out for Sanford's Arrowhead specifically, the separate male and female flowers and well-developed petals suggest an out-crossing breeding system. Pollination ecology of Sanford's arrowhead has not been investigated. Seed longevity, dormancy characteristics, and germination requirements for Sanford's Arrowhead also have not been investigated. Many marsh species exhibit soil-seed banking as a dynamic of their population ecology, but this trait is unknown for Sanford's Arrowhead.

Potential direct threats to Sanford's Arrowhead include the continued loss of emergent marsh habitat by agricultural and urban land use conversion, modification of natural waterways for flood control, flood control channel management activities, maintenance of irrigation and drainage ditches, road widening and maintenance, inappropriate livestock grazing regimes, and recreational vehicles (CNDDB 2018).

2.6.2 Environmental Baseline of the Other Aquatic Covered Species

The *environmental baseline* describes the current condition of a species and their habitat within an action area. The environmental baseline includes the past and ongoing effects of all State, tribal, local, and private actions and other human activities in the action area, as well as the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early ESA section 7 consultation, and the impact of State and private actions in the action area that are contemporaneous with this consultation (50 CFR §402.02).

The locations and existing conditions of the aquatic and upland landcovers that provide habitat for the "other aquatic" Covered Species was described above in Section 2.3.5. Most creeks, streams and other waterways that run through existing communities in the UDA portion of the Action Area are now surrounded by urban activities. Typically, only minor setbacks from waterways were required by local jurisdictions during the land use planning processes, so most natural waterways in the UDA and in other locations of the Action Area have been physically modified to remain a relatively narrow corridor, and natural waterway-meandering and associated ecosystem processes no longer occur in those stream reaches. The urbanized sections of some UDA streams have been armored with concrete or rock slope to prevent downcutting and bank erosion. Where stream corridors exist, many have incorporated recreational land uses such as trails, parks, and golf courses; or stream corridors are designated as narrow strips of open space with no required setbacks from buildings or streets (USFWS and Sacramento County 2018).

Within the UDA portion of the Action Area, many of the creeks and drainages primarily converge into Morrison Creek, including Florin Creek, Elder Creek, Laguna Creek (north), and Unionhouse Creek. During winter storm events, these waterways are operated for flood management under the South County Streams program of the Sacramento Area Flood Control Agency. Morrison Creek conveys flow to the low-lying Stone Lakes/Beach Lake basin adjacent to the Sacramento River levee, where during wet weather events most excess flow is pumped into the Sacramento River near Clarksburg, but some flows drain south into Snodgrass Slough and to the Mokelumne River in the southwestern portion of the Action Area (Final SSHCP Figure 2-4).

A USACE study of projects in the Action Area that obtained CWA permits between 1979 and January 2013 found that during this 34-year time period, 991 acres of wetlands and other waters of the United States (including vernal pools, marshes, other wetlands, streams, creeks, and other aquatic resources) were filled (lost) (USACE 2014; see Final SSHCP EIS/EIR Appendix A). Consistent with the findings of Witham et al. (2013, 2014), most losses of the Action Area aquatic resources authorized by CWA permits between 1979 and 2013 occurred inside the UDA (829 acres), and 162 acres of loss occurred outside the UDA. Therefore, aquatic resources within the UDA have experienced great losses, and many of the aquatic resources that remain in the UDA are now exposed to adverse effects from close proximity to development, such as decreased water quality resulting from urban runoff, changes in hydrologic regime, and reductions in habitat quality (USACE 2014).

As stated in the Final SSHCP (pages 5-3, 6-32, 6-55), several properties within the UDA portion of the Action Area have already obtained local entitlements and have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations from the CDFW, the Service, and the USACE. These UDA properties total 21,413 acres, and include several small lots in PPU-8, several small lots located west of Excelsior Road (PPU-3 and PPU-4), properties in the Rio Del Oro Specific Plan area (PPU-1), properties in the Sunridge Specific Plan area (PPU-1), and properties within the Mather Field Specific Plan area (PPU-2). These properties are part of the 317,656-acre Action Area. However, because planned urban development on these properties have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations, these properties were not included in the SSHCP Chapter 6 effects analyses. Where planned urban development has already obtained (or is close to obtaining) ESA authorizations, this Opinion addresses the authorized loss of habitat and loss of species individuals as part of the Environmental Baseline of each aquatic Covered Species.

Outside the UDA portion of the Action Area, existing creeks, and waterways include Deer Creek, Cosumnes River, Badger Creek, the Laguna Creek (south), Skunk Creek, and Dry Creek, which is on the south border of Sacramento County and the Action Area. Most stormwater runoff from the Galt UDA (PPU-8) is conveyed into Laguna Creek (south) (Final SSHCP Figure 2-4). Agricultural operators in the Sacramento Valley Water Quality Coalition fund a water-quality monitoring program at 35 rural stream sites to study potential water quality effects of agricultural activities, including sites in the lower Cosumnes River, Laguna Creek (south) and Dry Creek in the south part of the Action Area. Approximately 30 % of samples had exceedances for three pesticides (Chlorpyrifos, Diazinon, and Malathion) and DDT (or a DDT breakdown product) (Larry Walker Associates 2015). The Sacramento Valley Water Quality Coalition evaluation of trends also indicated long-term water quality degradation is occurring in approximately 5% of the sample sites, including sites with significant adverse trends in conductivity, dissolved oxygen, pH, temperature, total organic carbon, and total suspended solids (Larry Walker Associates 2015). The City of Galt wastewater treatment plant currently produces about 2.3 mgd of tertiary treated effluent per day, and it discharges that treated effluent to Laguna Creek (south), a tributary to the lower Cosumnes River (Final SSHCP 2-4). Galt's wastewater treatment plant complies with the Central Valley RWQCB's regulations concerning the operation of the City's wastewater treatment plant (Larry Walker Associates 2015).

Invasive plant species commonly found in wetlands, streams, and riparian systems in the Action Area include broadleaved pepperweed, common water hyacinth (*Eichhornia crassipes*), and Brazilian waterweed (*Egeria densa*) (Kleinschmidt Associates 2008).

2.6.2.1 California Tiger Salamander/Critical Habitat Environmental Baselines (Central California DPS)

The California Natural Diversity Database includes 22 occurrence records of the central California tiger salamander in Sacramento County (CNDDB 2018), all of which are located south of the Cosumnes River in the Action Area. The central California tiger salamander is thought to have historically occurred throughout Sacramento County and the Action Area (USFWS 2014a, 2017b). However, there are no records of the central California tiger salamanders north of the Cosumnes River, despite extensive surveys in very large areas of vernal pool grassland with suitable habitat, including the existing 1,342-acre Mather Field Preserve in PPU-2; Sacramento Valley Conservancy's Vernal Pool Prairie Preserve in PPU-3; the area of the Sunrise Douglas Specific Plan, the Kiefer

Landfill Wetland Preserve, and in the vernal pool grasslands east of Grant Line Road in PPU-1 (Final SSHCP Chapter 3.4.3).

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 31 features (vernal pools, stock ponds, other seasonal wetlands, and uplands) with documented occurrences of the central California tiger salamanders in the Action Area (Final SSHCP Table 3-6). These occurrences include two extirpated occurrences within PPU-8 (i.e. the City of Galt's Urban Development Area) and 29 extant occurrences within PPU-7 (the southeast portion of the Action Area, outside of the SSHCP UDAs). SSHCP Figure 3-16 shows the documented locations of the central California tiger salamander in the Action Area. However, adults and juveniles occupying underground upland habitat are difficult to detect, and most of the vernal pools and seasonal wetlands located south of the Cosumnes River have not been surveyed for central California tiger salamanders larvae. Therefore, the total number of central California tiger salamander occurrences in the Action Area is unknown.

Due to the programmatic nature of the proposed action, the environmental baseline for central California tiger salamander in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.3. Based on the life history of the central California tiger salamander, the SSHCP landcovers that provide suitable habitat are Vernal Pool and Seasonal Wetland (breeding habitat) and Valley Grassland, Blue Oak Woodland, and Blue Oak Savanna landcovers (upland refugia habitat). Therefore, SSHCP modeled habitat for the California tiger salamander is all Vernal Pool and Seasonal Wetland landcovers located south of the Cosumnes River, and all Valley Grassland, Blue Oak Savanna, and Blue Oak Woodland located within 1.5 miles of the modeled aquatic habitats (i.e., within 1.5 miles of any Vernal Pool or Seasonal Wetland that is south of the Cosumnes River). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

The SSHCP mapped a total of 89,794 acres of modeled habitat for the central California tiger salamander within the Action Area (4,424 acres of aquatic breeding habitat, and 85,370 acres of upland refugia habitat), within four of the eight SSHCP PPUs (PPUs 5, 6, 7 and 8)(Final SSHCP Figure 3-16). In PPU-5 south of the Cosumnes River, relatively large areas of vernal pool grassland modeled habitat are found on both sides of Dillard Road, but are interspersed by many small, rural residential developments (low-density development) and other non-habitat landcovers. In the eastern half of PPU-6, relatively large patches of suitable habitat remain in the vernal pool grasslands along the Cosumnes River, Badger Creek, and Laguna Creek.

As discussed in Section 2.3 above, much the vernal pool grassland in southwestern PPU-7 has become fragmented by farmland and rural-residential development. However, the eastern portion of PPU-7 contains large, contiguous landscapes of vernal pool grassland, as well as areas of Blue Oak Savanna and Blue Oak Woodland, which provide high-quality aquatic and upland habitat for the central California tiger salamander.

Within the 7,133-acre PPU-8 (the Galt UDA) 1,421-acres of modeled habitat remain in relatively small fragments of vernal pool grassland that are widely scattered in large blocks of farmland landcovers (Final SSHCP Figure 3-16). However, central California tiger salamander have been documented to travel up to 1.5 miles each breeding season, and the habitat fragments in the Galt UDA may be providing islands of suitable habitat for individuals moving between eastern PPU-6 and western PPU-7. SSHCP Figure 3-16 illustrates the locations of central California tiger salamander modeled habitat in the Action Area.

The central California DPS Recovery Plan (USFWS 2017b) designated the 207,093-acre Rancho-Seco Management Unit (of the Central Valley Recovery Unit) in southeastern Sacramento and northeastern San Joaquin Counties (USFWS 2017b), which encompasses much of the SSHCP modeled habitat for central California tiger salamander present in SSHCP PPU-7. The boundary of the central California DPS Rancho-Seco Management Unit in the Action Area is similar to the boundary of the Cosumnes/Rancho-Seco Core Area designated by the Vernal Pool Ecosystem Recovery Plan (USFWS 2005a). Therefore, the existing landcovers and the environmental baseline of the central California tiger salamander's Rancho-Seco Management Unit were described above in Section 2.3 and Section 2.5.2, and is not repeated here.

The existing Twin Cities Road (State Highway 104) is an east-west rural collector roadway that bisects SSHCP PPU-7, and also bisects the portion of the Rancho-Seco Management Unit that is within PPU-7. Large areas of modeled habitat and documented occurrences of central California tiger salamander are present on both sides of Twin Cities Road, and the species is believed to cross Twin Cities Road when they migrate between breeding areas and non-breeding areas. Modeled habitat for central California tiger salamander occurs on both sides of other Action Area roadways, including the north-south Clay Station Road in PPU-7, the north-south Alta Mesa Road in PPU-7, the east-west Borden Road in PPU-7, the east-west Valensin Road in PPU-7 and PPU-6, and the east-west Dillard Road, which parallels the Cosumnes River in southern PPU-5. Central California tiger salamanders have been killed by vehicular traffic while crossing roads in nine other Central Valley counties (USFWS 2017b), but there are no reports of dead or injured central California tiger salamander individuals collected from roadways in the Action Area or in Sacramento County (CNDDB 2018). However, salamanders that are crushed by vehicles are not easily identifiable, and dead or wounded California tiger salamanders are likely removed from roads quickly by scavengers, making detection less likely for this species (Shaffer et al. 1993). Nonetheless, there are anecdotal reports of vehicle strikes within PPU-7 on the small road and driveways between Twin Cities Road and the parking lot of the Sacramento Municipal Utility District's energy generating facility near Rancho-Seco Lake (Bacchini *in lit.* 2014, 2016; Martine *in lit.* 2014), suggesting that central California tiger salamander mortality from vehicle-strikes is also occurring on other roadways in the southeastern portion of the Action Area.

Hybridization between non-native tiger salamanders and the central California tiger salamander has been detected in the south part of the Central Valley Recovery Unit, at the Merced Management Unit and the Le Grand/Raymond Management Unit, both in Merced County (USFWS 2017b). However, no central California tiger salamanders with non-native alleles have been detected in the north part of the Central Valley Recovery Unit, including in the Rancho-Seco Management Unit and the Action Area.

Bullfrogs are a common non-native species in the Action Area (see Section 2.3 and Section2.5.4), and have been observed in perennial wetlands, seasonal wetlands, and vernal pools that are located in PPU-7. Of the 22 CNDDB occurrences of central California tiger salamander reported in the Action Area, 4 of the occurrences are threatened by the presence of bullfrogs. One of the CNDDB occurrences noted that the larva occurrence of central California tiger salamander was collected from the stomachs of bullfrogs in the vernal pool (CNDDB 2018).

California Tiger Salamander Critical Habitat Environmental Baseline

As discussed in Section 2.6.1.1, Sacramento County and the Action Area are located within the Central Valley geographic region for the species (USFWS 2005b). One critical habitat unit for the central California tiger salamander is present in the Action Area. The 9,966-acre California tiger salamander Critical Habitat Unit-3 located within SSHCP PPU-7 in the southeastern portion of the Action Area, and is the only central California tiger salamander critical habitat unit in Sacramento County (USFWS 2005b).

Critical Habitat Unit-3 is essential to the conservation of the central California tiger salamander because it is needed to maintain the current geographic and ecological distribution of the species within the Central Valley. Critical Habitat Unit-3 represents the northern-central portion of the range of the species, and is only one of a few occupied areas in the Sacramento Valley portion of the Central Valley (USFWS 2005b). A cluster of eight CNDDB occurrences of central California tiger salamander have been documented within Critical Habitat Unit-3 (USFWS 2005b; CNDDB 2018). The SSHCP's compilation of records and species-surveys within the Action Area identified 15 individual features (vernal pools, stock ponds, other seasonal wetlands, and uplands) with documented occurrences of the central California tiger salamanders in Critical Habitat Unit-3 (Final SSHCP Figure 3-16).

Critical Habitat Unit-3 includes the physical and biological features (primary constituent elements) that are essential for the conservation of the California tiger salamander, and may require special management considerations or protections (see Section 2.6.1.1 above). Approximately 7,533 acres of the 9,966-acre Critical Habitat Unit-3 (76%) remain as native or naturalized SSHCP landcovers (vernal pool grasslands, mixed riparian woodland, and other upland landcovers), which provide all three of the primary constituent element (PCEs) for central California tiger salamander Critical Habitat, including standing bodies of water for reproduction (PCE#1), accessible dispersal habitat that allows for movement between occupied locations (PCE#3), and adjacent uplands with small mammal burrows or other underground habitat that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation (PCE#2).

Since the designation of central California tiger salamander Critical Habitat (USFWS 2005b), approximately 1,704 acres of several areas of Critical Habitat Unit-3 have been converted to vineyards, irrigated pasture, cropland, and other landcovers that do not provide standing bodies of freshwater that hold water for a minimum of 12 weeks (PCE #1). However, these agricultural landcovers provide upland dispersal habitat (PCE#3), and may provide upland habitat with small mammal burrows or other underground habitat that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation (PCE#2).

Approximately 685 acres (7%) of Critical Habitat Unit-3 (7%) have been converted to developed landcovers that do not provide standing bodies of water for reproduction (PCE#1), and do not provide adjacent uplands with small mammal burrows or other underground habitat that California tiger salamanders depend upon for food, shelter, and protection (PCE#2). The developed landcovers present in Critical Habitat Unit-3 may allow some movement and dispersal of central California tiger salamander to continue through the developed area (PCE#3). However, some developed areas in Critical Habitat Unit-3 are known to inhibit movement or even trap individuals, resulting in injury or death. The existing Twin Cities Road (State Highway 104) bisects Critical Habitat Unit-3, and the operation of this highway injures and crushes central California tiger salamander individuals as they migrate between the breeding areas and non-breeding areas present on both sides of Twin Cities Road (Final SSHCP Figure 6-5). In past breeding seasons, migrating individuals have been found injured or killed in the roads, parking lots, and buildings of Sacramento Municipal Utility District's energy generating facility near Rancho-Seco Lake in Critical Habitat Unit-3 (Bacchini *in lit.* 2014, 2016, 2017; Martine *in lit.* 2014, CNDDB 2018).

Identified threats to central California tiger salamander that require special management considerations in Critical Habitat Unit-3 include road construction and operation, rangeland conversion, urban development, and predators such as bullfrogs. Aquatic predators such as bullfrogs require special management because they can impair breeding success (USFWS 2005b). Additional conversions of vernal pool grassland/rangeland in Critical Habitat Unit-3 could destroy or degrade aquatic habitat essential for breeding and rearing; and destroy, degrade, or fragment upland habitat essential for growth, feeding, resting, aestivation, and dispersal.

Of the total 9,966 acres within central California tiger salamander Critical Habitat Unit-3, the SSHCP has identified 3,487 acres (40%) that are currently protected within existing preserves. The existing preserves are presumed to administer land management actions that are maintaining the physical and biological features that are essential to the conservation of the species.

2.6.2.2 Western Spadefoot Environmental Baseline

Western spadefoot is uncommon, with documented occurrences widely distributed throughout the Action Area. The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 41 individual aquatic features where western spadefoot has been documented in the Action Area (Final SSHCP Table 3-6). Twenty of the documented occurrences are inside the UDA (i.e. 7in PPU-1, 12 in PPU-2, and 1 in PPU-3), and 21 of the documented occurrences are outside of the UDA (i.e. 2 in PPU-5 and 19 in PPU-7). However, much of the Action Area has not been surveyed for the species, and the total number of occupied aquatic features is unknown. SSHCP Figure 3-6 shows the locations of the documented occurrences in the Action Area.

Due to the programmatic nature of the SSHCP, the environmental baseline for the species relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.3. Based on life history needs of western spadefoot (Section 2.6.1.2), suitable aquatic breeding habitat is provided by the Vernal Pool, Seasonal Wetland, Swale, Open Water, and the Stream/Creek landcovers. Suitable upland habitat for foraging and underground aestivation includes Valley Grassland, Blue Oak Savanna, and Blue Oak Woodland. Therefore, SSHCP modeled aquatic habitat for western spadefoot is all Vernal Pool, Seasonal Wetland, Swale, Open Water, and Stream/Creek landcovers in the Action Area, and modeled upland habitat is all Blue Oak Woodland, Blue Oak Savanna, and Valley Grassland landcovers that are within 1,600 meters (5,249 feet or approximately 1 mile) from modeled aquatic habitat.

In total, the SSHCP mapped 23,065 acres of western spadefoot modeled habitat within the Action Area, including 4,536 acres of Vernal Pools, 1,252 acres of Swale, 2,600 acres of Seasonal Wetland, 2,344 acres of Open Water, 2,674 acres of Stream/Creek, and 73 acres of Stream/Creek-VPIH (Final SSHCP Table 6-61). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

Western spadefoot recovery was addressed in the Vernal Pool Recovery Plan (see discussion in 2.5.1 above)(USFWS 2005a). The 23,065 acres of western spadefoot modeled habitat available in the Action Area includes 18,568 acres that are within the Mather Core Area in (PPUs 1, 2, and 3), and

41,475 acres in the Cosumnes/Rancho-Seco Core Area (PPU-7). Identified recovery criteria for western spadefoot within the Mather Core Area and the Cosumnes/Rancho-Seco Core area are to protect suitable habitat, where western spadefoot co-occurs with other vernal pool species. The baseline condition of the vernal pool grassland landcovers in the Core Areas was discussed above in Section 2.5.2 and is not repeated here.

2.6.2.3 Western Pond Turtle Environmental Baseline

The CNDDB currently reports 1,342 extant occurrences of western pond turtle in California, with 29 widely-distributed occurrences within Sacramento County. Within Sacramento County, 19 occurrences are located within the Action Area (CNDDB 2018). Three of the 19 Action Area occurrences are within the UDA (two occurrences in in PPU-2 and one occurrence in PPU-4 near the Waste Water Treatment Plant). Sixteen of the 19 Action Area occurrences are outside of the UDA, including one in PPU-5, seven in PPU-6, and eight in PPU-7. However, comprehensive surveys for western pond turtle in the Action Area have not been conducted, and the occurrences are based on incidental observations. Therefore, the number of western pond turtle occurrences and occupied habitat is not known.

Due to the programmatic nature of the proposed action, the environmental baseline for western pond turtle in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.3. Habitats used by western pond turtles, such as suitable riverine and lacustrine habitats and adjacent uplands, occur throughout much of the Central Valley and are well represented in Sacramento County and the Action Area (Final SSHCP Chapter 2.5 and 3.2). Based on the species life history description, SSHCP aquatic landcovers that provide suitable habitat for western pond turtles include Stream/Creek, Freshwater Marsh, and Open Water. Upland landcovers that provide suitable nesting and aestivation refugia habitat include Valley Grassland, Mixed Riparian Woodland, Mixed Riparian Scrub, Mine Tailing Riparian Woodland, Blue Oak Savanna, and Blue Oak Woodland located near suitable aquatic habitat (Final SSHCP Table 3-2). Therefore, western pond turtle modeled aquatic habitats are all Stream/Creek landcovers in the Action Area, and all Freshwater Marsh and Open Water landcovers that are within 440 yards (0.25 mile) of the Stream/Creek landcovers. Western pond turtle modeled upland habitats are Valley Grassland, Mixed Riparian Woodland, Mixed Riparian Scrub, Mine Tailing Riparian Woodland, Blue Oak Savanna, and Blue Oak Woodland that is within 0.25 mile of modeled aquatic habitat. SSHCP Figure 3-19 illustrates the location of modeled habitat as well as the documented occurrences of western pond turtle within the Action Area. The SSHCP mapped 6,355 acres of western pond turtle aquatic-habitats in the Action Area (including 2,674 acres of Stream/Creek, 2,240 acres of Freshwater Marsh, and 1,441 acres of Open Water), and 110,846 acres of associated uplands (including 91,580 acres Valley Grassland, 6,831 acres of riparian landcovers, and 12,435 acres of Blue Oak Savanna and Blue Oak Woodland). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

Most of the modeled habitat for western pond turtle is found outside the UDA (103,060 acres), with only 10% (10,346 acres) found within the UDA. Many of the streams, creeks and other waterways that run through existing communities within the western half of the UDA (PPU-4, western PPU-2, and western PPU-3) are now bordered by urban development, with little or no “setback area” between the stream channel and the development. Where setbacks do occur, they may be for recreational uses such as trails or parks. The western sections of many UDA creeks and streams also include sections of concrete or rock slope to prevent down-cutting and bank erosion, which may allow movement of western pond turtle, but provide little aquatic foraging, aestivation, or basking-habitat. Currently, most of the County's land-use zones within the Action Area do not require setbacks between new urban development and the banks of an existing stream or creek, and there is no management of stream corridors that would minimize impacts from encroaching human activity (USFWS and Sacramento County 2018). The sections of Elder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, and Sun Creek in the eastern portion of the UDA are less disturbed, and currently provide suitable aquatic habitat and suitable upland habitat for western pond turtle nesting and estivation.

In the Action Area south of the UDA (in PPUs 5, 6 and 7), most creeks and streams (including Deer Creek, the Cosumnes River, Badger Creek, Laguna Creek, and Skunk Creek), remain in a natural condition and provide suitable aquatic-habitat for the western pond turtle. Most sections of these waterways are bordered by landcovers that provide suitable upland habitat for western pond turtle, but sections of upper Deer Creek, upper Cosumnes River, upper Badger Creek, lower Laguna Creek, and lower Skunk Creek are also bordered by farmland landcovers or the low-density development landcover (Final SSHCP Figures 2-4 and 3-19).

2.6.2.4 Giant Garter Snake Environmental Baseline

The CNNDB includes 52 extant occurrences of giant garter snake in Sacramento County (CNDDB 2018), primarily outside the Action Area in northwestern Sacramento County. Of the 18 occurrences in Sacramento County that are south of Interstate 80, four occurrences of giant garter snake are from waterways within the city of Elk Grove, and are also outside the Action Area (CNDDB 2018). Within the Action Area, there are currently 14 extant occurrences of giant garter snake documented (CNDDB 2018). SSHCP Figure 3-18 illustrates the location of the documented occurrences of giant garter snake within the Action Area.

Four of the Action Area's documented occurrences are from waterways located west of Interstate-5 (i.e. in western PPU-6), and include occurrences near Beach Lake, Stone Lake, and Snodgrass Slough. This portion of the Action Area (west of Interstate-5) is within the giant garter snake Delta Basin Recovery Unit (USFWS 2017c). The remaining 10 Action Area documented occurrences of giant garter snake are located east of Interstate-5, and are within the Cosumnes-Mokelumne Basin Recovery Unit (USFWS 2017c). Three of the Cosumnes-Mokelumne Basin Recovery Unit occurrences are in or near the water treatment plant Bufferlands, which borders Interstate-5 in SSHCP PPU-4. There also is a single occurrence of giant garter snake in SSHCP PPU-7, from a roadway near the intersection of Twin Cities Road and Clay Station Road (Final SSHCP Figure 3-18).

Six of the Action Area's documented occurrences of giant garter snake are in the northeastern portion of PPU-6, from the Badger Creek/Willow Creek area (Final SSHCP Figure 3-18). Wylie et al. (2010) determined that over the current range of the species, the 593-acre Badger Creek/Willow Creek area best represents the historical habitat conditions of the giant garter snake over its range. Wylie et al. (2010) also found that the Badger Creek/Willow Creek area has the highest density of giant garter snakes of the sites they studied. Densities of giant garter snakes at Badger Creek (8 snakes per hectare) was an order of magnitude greater than giant garter snake densities Wylie et al. (2010) found in wetlands managed for waterfowl or wetlands managed for agriculture. Wylie et al. (2010) also determined that the snakes at Badger Creek had the highest measured Body Condition Index of the sites they studied, indicating the giant garter snakes at Badger Creek also have the best health of the remaining giant garter snake occurrences (Wylie et al. 2010). Two of the six Badger

Creek/Willow Creek documented occurrences are already protected in the Badger Creek Unit of the existing 46,000-acre Cosumnes River Preserve located in PPU-6.

However, most of the Action Area has not been surveyed for giant garter snake, and the total number of occurrences and the existing distribution of giant garter snake in the Action Area are not known. Due to the programmatic nature of the SSHCP, the environmental baseline for the giant garter snake relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.4. Based on the likely extent of the historical tule marshes in the Sacramento Valley and the historical occurrences of giant garter snake (Section 2.6.1.4 above), the SSHCP determined that the species modeled habitat would not occur above 230 feet in elevation. Based on the giant garter snake life history description, suitable aquatic-habitat for giant garter snake in the Action Area occurs within the SSHCP's Freshwater Marsh, Open Water, Stream/Creek, and Seasonal-Wetland landcovers. Suitable upland habitat occurs within SSHCP Valley Grassland and Mixed Riparian Scrub landcovers (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here. Although rice fields are now a key habitat for giant garter snakes throughout most of its current range, there is no active rice cultivation within the Action Area.

The SSHCP also determined that the following Action Area streams, creeks, or drainages are locations that are known to, or are believed to, support giant garter snakes:

- The perennial segments of Laguna Creek (north) and perennial tributaries to Laguna Creek (north) in PPU-3 west of Sunrise Boulevard, which are suitable habitat due to presence of Freshwater Marsh habitat and hydrological connectivity to downstream documented occurrences in PPU-4 (at the Bufferlands Preserve) and documented occurrences outside the Action Area in the City of Elk Grove.
- A prominent unnamed drainageway (in the Elliot mitigation site along Interstate-5) that is wet year-round, and links to Stone Lakes National Wildlife Refuge west of Interstate-5;
- Drainage canals south of Elk Grove, which have old occurrence records, and link to Stone Lakes NWR west of Interstate-5; the perennial segments of these canals are suitable habitat;
- Badger Creek, Willow Creek, and all other creeks that drain into the marsh at the Cosumnes River Preserve, which are likely high-quality habitat due to proximity and connectivity to a significant population of giant garter snakes; the perennial segments of these creeks are suitable habitat;
- The perennial segments of Laguna Creek (south) and perennial tributaries to Laguna Creek (south) in PPU-6 and PPU-7, which are suitable habitat due to presence of Freshwater Marsh habitat and proximity to documented occurrences.
- The perennial segments of natural drainages and canals leading from the Cosumnes River Preserve in PPU-6 (including Deadman's Gulch), which supports suitable habitat.

Based on scientific studies of giant garter snake movements between aquatic and upland habitat (Section 2.6.1.4 above), the SSHCP determined that giant garter snakes present in the Action Area are unlikely to travel more than 0.25 miles (1,320 feet) between areas of suitable habitat. Therefore, the waterways listed above, plus all Freshwater Marsh Stream/Creek, Freshwater Marsh, Open Water, and Seasonal Wetland landcovers that are entirely or partially within 0.25 mile of these waterways are defined by the SSHCP as "high-value" aquatic habitat for the giant garter snake. In addition to the areas of "high-value" aquatic habitat, the SSHCP also defined "non-high-value" modeled aquatic-habitat for giant garter snake as any Stream/Creek, Freshwater Marsh, Open

Water, and Seasonal Wetland landcover that is entirely or partially within 0.25 mile of the giant garter snake high-value modeled aquatic habitat, and is also below 230 feet in elevation.

The "high-value" modeled upland habitat for giant garter snake was defined as any modeled upland habitat (Valley Grassland or Mixed Riparian Scrub landcovers) that is within 200 feet of the "high-value" aquatic habitat. The "non-high value" upland habitat for giant garter snake is defined by the SSHCP as any modeled upland habitat (Valley Grassland or Mixed Riparian Scrub landcovers) that is within 0.25 mile from modeled aquatic habitat ("high value" and "non-high value" in Freshwater Marsh Stream/Creek, Freshwater Marsh, Open Water, and Seasonal Wetland landcovers), and is also below 230 feet in elevation.

The SSHCP mapped a total of 7,290 acres of giant garter snake modeled aquatic-habitat in the Action Area (with 3,628 of those acres also mapped as "high value" aquatic habitat), and the SSHCP mapped a total of 27,869 acres of modeled upland habitat in the Action Area (with 6,853 of those acres also mapped as "high value" upland habitat). The existing conditions of these landcovers in the Action Area, and the primary factors responsible for those conditions, were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here. SSHCP Figure 3-18 illustrates the locations of modeled habitat for giant garter snake within the Action Area.

The Action Area includes two groundwater basins. The "central basin" occurs under the Action Area watersheds that are north of the Cosumnes River, and the "south basin" occurs under the Action Area watersheds that are south of the Cosumnes River (Final SSHCP Figure 2-4; SSHCP EIS/EIR Chapter 7). The extensive pumping and use of groundwater in and near the Action Area have resulted in two large cones of groundwater depression (i.e., an area of lower groundwater levels relative to groundwater level in the surrounding areas of the aquifer, resulting from groundwater pumping). One is located west of Elk Grove in the Action Area, under the "central basin". A similar cone of ground water depression is located east of Galt in the Action Area, under the "south basin" (Final SSHCP EIS/EIR Chapter 7). The lowering of the water table may affect surface flows in the Cosumnes River and its tributaries, such as Badger Creek (E. Hansen 2001), and can also deplete nearby wetland habitats (Dunne and Leopold 1978). The existing amount of groundwater pumped and the depleted groundwater levels have resulted in reduced surface flows in the Cosumnes River during the fall season, which is hydrologically connected to Badger Creek and the Badger Creek giant garter snake population (USFWS 2012). Fall flows in the Cosumnes River have been so low in some years that the entire lower river has frequently been completely dry between October and December (Fleckenstein et al. 2004). Historically, Badger Creek provided persistent year-round surface water in channels; however, the water level of Badger Creek in now more dependent on seasonal precipitation and agricultural runoff, which provide no guarantee of sustainable suitable habitat for the giant garter snake (E. Hansen 2001). In 2001, Badger Creek experienced a comprehensive drying of aquatic habitat, which disrupted the connectivity between the western portion of the Badger Creek giant garter snake population and the formerly occupied snake habitat upstream (E. Hansen 2001). The drying of aquatic habitat persisted throughout the active season of the snake, and may have resulted in part from water diversion for agricultural use (E. Hansen 2001). Additionally, the drying of aquatic habitat, such as that which occurred in 2001, may eliminates populations of prey species of the snake (E. Hansen 2001).

2.6.2.5 Sanford's Arrowhead Environmental Baseline

The SSHCP's extensive compilation of records and species-surveys conducted within the Action Area was able to document 64 locations of Sanford's arrowhead in the Action Area (Final SSHCP

Table 3-6). Of the 64 occurrences documented in the Action Area, at least 40 are in modified channels, including maintained irrigation, drainage, or flood control conveyances. Approximately 15 documented occurrences in the Action Area appear to be associated with relatively natural wetland systems or channels (Final SSHCP Appendix B). Fifteen of the Action Area documented occurrences are located in the UDA (three in PPU-2, two in PPU-3, and 10 in PPU-4), and 49 of the occurrences are located outside of the UDA. Most of the occurrences located outside the UDA (49) are within in PPU-6, primarily in channeled drainages that lead to Snodgrass Slough west of Interstate-5, and more natural drainages leading to the Cosumnes River. The three occurrences in PPU-5 are also in drainages leading to the Cosumnes River, but the three occurrences in PPU-7 are in drainages leading to Laguna Creek (south). SSHCP Figure 3-10 shows the locations of the known occurrences in the Action Area.

However, much of the Action Area has not been surveyed for Sanford's arrowhead, and the total number of occurrences is unknown. Sanford's Arrowhead is a relatively cryptic emergent marsh species, the habitats are not easily surveyed, and much un-surveyed habitat is associated with agricultural and urbanized channels, neither of which is frequented by botanists. For these reasons, additional as-yet undiscovered Sanford's Arrowhead occurrences should be expected within the Action Area (Final SSHCP Appendix B).

Due to the programmatic nature of the SSHCP, the environmental baseline for Stanford's arrowhead relies heavily on the species' modeled habitat described in SSHCP Chapter 3.4.1. SSHCP landcovers that provide suitable habitat based on the species life history descriptions are Seasonal Wetland, Freshwater Marsh, Open Water, and Stream/Creek (Final SSHCP Chapter 3.4.1). Because Seasonal Wetland, Freshwater Marsh, Open Water, and Stream/Creek landcovers are dependent on surrounding uplands, the Valley Grassland landcover is also considered suitable habitat for this species. The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

Occurrences of Sanford's Arrowhead in Sacramento County have been documented in the following Landform Formations: Basin deposits, lower and middle units in the Riverbank Formation, stream channel deposits, Turlock Lake Formation, and upper Modesto Formation/Alluvial deposits (CNDDB 2018). Therefore, SSHCP modeled habitat for Sanford's arrowhead is all Seasonal Wetland, Freshwater Marsh, Open Water, and Stream/Creek landcovers that are associated with Argonaut-Auburn complex, 3% to 8% slopes; Clear Lake clay, partially drained, 0 to 2% slopes frequently flooded; Columbia sandy loam, partially drained, 0 to 2% slopes; Columbia sandy loam, drained, 0 to 2% slopes, occasionally flooded; Cosumnes silt loam, drained, 0 to 2% slopes, occasionally flooded; Creviscreek sandy loam, 0 to 3% slopes; Dierssen sandy clay loam, drained, 0 to 2% slopes; Dierssen clay loam, deep, drained, 0 to 2% slopes; Durixeralfs, 0 to 1% slopes; Egbert clay, partially drained, 0 to 2% slopes; Egbert clay, partially drained, 0 to 2% slopes, frequently flooded; Fiddyment fine sandy loam, 1% to 8% slopes; Fluvaquents, 0 to 2% slopes, frequently flooded; Hedge loam, 0 to 2% slopes; Hicksville loam, 0 to 2% slopes, occasionally flooded; Hicksville gravelly loam, 0 to 2% slopes, occasionally flooded; Kimball-Urban land complex, 0 to 2% slopes; Liveoak sandy clay loam, 0 to 2% slopes, occasionally flooded; Madera loam, 2% to 8% slopes; Mokelumne-Pits mine complex, 15% to 50% slopes; Red Bluff-Redding complex, 0 to 5% slopes; Redding loam, 2% to 8% slopes; Redding gravelly loam, 0 to 8% slopes; San Joaquin silt loam, leveled, 0 to 1% slopes; San Joaquin silt loam, 0 to 3% slopes; San Joaquin silt loam, 3% to 8% slopes; San Joaquin-Galt complex, leveled, 0 to 1% slopes; San Joaquin-Urban land complex, 0 to 2% slopes; San Joaquin-Xerarents complex, leveled, 0 to 1% slopes; Reiff fine sandy loam, 0 to 2%

slopes, occasionally flooded; Scribner clay loam, partially drained, 0 to 2% slopes; and Tinnin loamy sand, 0 to 2% slopes. SSHCP Figure 3-10 illustrates the location of modeled habitat of Sanford's arrowhead within the Action Area.

2.6.3 General Effects of the Action on the other Aquatic Species

To minimize repetition, mechanisms by which SSHCP Covered Activities could affect each of the five aquatic Covered Species (central California tiger salamander, western spadefoot, western pond turtle, giant garter snake, Sanford's arrowhead) are discussed here in Section 2.6.3. General effects of the Action on all Covered Species, previously described in Section 2.5.4 above, are not repeated here. The effects to each of the five aquatic Covered Species that are in addition to those described previously are discussed below, in Section 2.6.4. Also, information on vernal pool ecosystems previously discussed above in Sections 2.5.3 and Section 2.5.5 above is not repeated here for California Tiger Salamander or western spadefoot.

Most effects on the other aquatic Covered Species modeled habitats will occur inside the UDA from the construction and future operation of the urban development Covered Activities. A relatively small amount of modeled habitat will be affected outside the UDA by the rural-transportation Covered Activities and the recycled water project Covered Activity.

The SSHCP quantified direct-effects to modeled habitat present in wetland, stream, and riparian landcovers using GIS methodologies, as discussed above in Section 2.5.3. However, the SSHCP provided a qualitative analysis of indirect effects to modeled habitat present in wetland, aquatic, and riparian landcovers (Table 19 below). Examples of SSHCP Covered Activity elements that will result in direct and indirect adverse effects to modeled habitat include installation of hardscape in the channel, stream bank stabilization projects, installation of culvert through a channel, construction and operation of outfall structures that allow the discharge of stormwater into a stream channel from adjacent urban development areas, reducing channel complexity (e.g., removing riffle, runs, or pools), replacing existing stream crossings (bridges), and construction of new stream crossings (bridges or pedestrian crossings) over a stream channel (Final SSHCP Chapter 5.2).

Table 19. Permanent Loss of Aquatic and Riparian Landcovers in the Action Area

SSHCP Landcover	Permanent Direct Effects (acres)	Permanent Indirect Effects (acres)	Total Permanent Effects (acres)	Total Available in Action Area (acres)	Percent of Plan-Area Total Acres Affected
Other Aquatic Landcovers					
Seasonal Wetlands	105	Qualitative Assessment	105	2,600	4%
Freshwater Marsh	127	Qualitative Assessment	127	2,954	4%
Streams/Creeks	117	Qualitative Assessment	117	2,778	4%
Open Water	155	Qualitative Assessment	155	2,344	7%
Total Aquatic	504		504	10,676	5%
Riparian Landcovers					

Mixed Riparian Woodland	184	Qualitative Assessment	184	5,856	3%
Mixed Riparian Scrub	189	Qualitative Assessment	189	1,454	13%
Mine Tailing Riparian Woodland	218	Qualitative Assessment	218	641	34%
Total Riparian	591	Qualitative Assessment	591	7,951	7%

As discussed above in Section 2.5.4, indirect alterations to existing hydrology from new impervious-surfaces may adversely affect the ecology and natural communities in downstream aquatic resources that provide habitat for the aquatic Covered Species. Potential indirect impacts of Covered Activities can result from increased upland erosion and sediment runoff into aquatic areas resulting in decreased transmittance of light through the water column; nutrient loading into streams or water bodies resulting in increased nutrient concentrations and eutrophication (depletion of oxygen in water); introduction of fecal coliform into aquatic areas that contributes to nutrient loading and can introduce pathogenic organisms; the introduction of chemicals, pesticides, and heavy metals into aquatic areas that may result in mortality of aquatic species; modification of stream water temperature and stream microclimate that may damage the aquatic ecosystem; and the modification of stream channel complexity (e.g. runs, riffles, pools) that may reduce bank stabilization and increase erosion (Final SSHCP Chapter 5.2.6). As discussed in Section 2.6.4 these habitat alterations can injure individuals, decrease reproduction in individual, or decrease habitat functions that provide food or shelter to aquatic species (Hall and Henry 1992).

Temporary hydrologic alterations from construction related stream-diversions and dewatering activities have the potential to change flow rates and patterns in streams and rivers, which can could affect downstream aquatic, wetland, and riparian communities. The rural transportation Covered Activities outside the UDA could result in hydrologic and water quality-related effects to creeks and streams from the construction, realignment, or widening of roadways, culverts, bridges, or other stream-crossing facilities (Final SSHCP Chapter 5.2.3). In addition, riparian and wetland aquatic-ecosystems are extremely vulnerable to invasive plants because of the highly effective transport of invasive plant-species propagules along rivers and streams. Invasive species can eventually dominate the biomass of riparian and wetland communities, eventually choking out the native vegetation. Increased human activity, especially inside the UDA, also will increase the amount of trash and debris that enters streams, marshes, and waterways. Trash and debris can degrade vegetation communities and wildlife habitat, and can attract nuisance and pest predator species. Individually and collectively, these indirect effects could result in the affected aquatic landcovers becoming unsuitable for the SSHCP aquatic Covered Species (Final SSHCP Chapter 6.5).

Proper implementation of the SSHCP Conditions on Covered Activities and the SSHCP AMMs (Final SSHCP Chapter 5.4.1) will minimize potential indirect effects on the aquatic landcovers. SSHCP Condition 1 is designed to conserve and/or rehabilitate project-site natural creeks and streams. This condition will require Covered Activities to incorporate low-impact development (AMM LID) drainage measures and utilize AMM BMPs, which will assure that runoff from developed lands will closely mimic the pre-development conditions, and that receiving waters will retain most pre-development hydrologic functions. AMM LID-3 (*Natural Site Features):* will incorporate preservation of a site's natural aquatic features (such as creeks and streams) into project design to retain existing hydrologic patterns and to retain aquatic habitat of the Covered Species. SSHCP Condition 7 is designed to avoid and minimized impacts to Action Area streams and creeks.

Condition 7 will be applied to all UDA Covered Activities to avoid or minimize potential indirect and direct impacts to streams and creeks by establishing minimum 100-foot-wide Stream Setbacks measured from the top of the bank on both sides of the following streams within the UDA: Elder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, Sun Creek, and the Laguna Creek Wildlife Corridor. The primary purpose of each Stream Setback is to minimize future indirect effects of adjacent urban development Covered Activities on the hydrologic functions of Action Area streams, creeks, and waterways (including water quality), and to avoid or reduce other undesired disturbances to sensitive aquatic resources. For each Stream Setback, an easement will be granted that gives the SSHCP the ability to enforce the requirements of the SSHCP Stream Setback easement in perpetuity. Condition 7 includes the application of the STREAM AMMs.

2.6.4 Effects of the Action on each Aquatic Species

The species-level effects described below build on Section 2.5.4, *General Effects of the Action on All Covered Species* and on Section 2.6.3 *General Effects of the Action on the Other-Aquatic Covered Species*. In addition, the species-level effects described below for the central California tiger salamander and western spadefoot build on discussions of vernal pools, seasonal wetlands, and the Vernal Pool Ecosystem presented above in Section 2.3.5 *Native and Naturalized Landcovers* and presented in Section 2.5.5 *General Effects of the Action on the Vernal Pool Ecosystem.* Effects previously described in those sections of the Opinion are not repeated below.

The SSHCP assumes that the landcovers included in modeled habitat for each of the five other-aquatic species could be occupied by adults, juveniles, larvae, or eggs of central California Tiger Salamander, western spadefoot, western pond turtle, and giant garter snake, or dormant seeds and tubers of Sanford's arrowhead. Therefore, the SSHCP did not quantify effects to individual occurrences of the other-aquatic Covered Species. The effects analysis in this Opinion also assumes that the landcovers included in the modeled habitat of each Covered Species could be occupied by the species.

2.6.4.1 Effects on the Central California Tiger Salamander/Critical Habitat (Central California DPS)

Effects of SSHCP Covered Activities on the central California tiger salamander include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on individuals.

Within the existing 89,794 acres of central California tiger salamander modeled habitat in the Action Area, SSHCP Covered Activities will remove a total of 1,757 acres (2%) of the modeled habitat. The landcover conversions will include 80 acres of breeding and rearing habitat (Vernal Pool and Seasonal Wetland landcovers) and 1,677 acres of upland refugia and dispersal habitat (Valley Grassland, Blue Oak Savanna, and Blue Oak Woodland). No known occurrences of central California tiger salamander will be removed by SSHCP Covered Activities.

Most of effects to central California tiger salamander modeled habitat (1,421 acres of the total 1,757 acres) will result from urban development Covered Activities within the City of Galt's UDA (i.e. PPU-8). Future urban development Covered Activities within the City of Galt's UDA will eventually remove all of the existing 34 acres of Vernal Pools and 21 acres of Seasonal Wetlands (which provide suitable aquatic habitat for breeding and rearing of central California tiger salamander), and also will remove all of the existing 1,366 acres of Valley Grassland uplands present in the City of

Galt's UDA (which provide habitat for shelter, feeding, and growth and habitat for movement and dispersal of central California tiger salamander).

Many of the individual road improvement projects described in SSHCP Chapter 5.2.3 will occur in central California tiger salamander modeled habitat (Final SSHCP Chapter 5.2.3; SSHCP Figures 5-5 and 3-16). The implementation of rural transportation Covered Activities south of the Cosumnes River will remove 334 acres of central California tiger salamander modeled habitat, including 23 acres of Vernal Pools and 311 acres of Valley Grassland upland.

Equipment and activities used to implement the urban development Covered Activities and the rural transportation Covered Activities (including use of earth moving equipment, grading, placement of fill, and the construction of facilities and structures) will crush, bury, or expose all adult and juvenile individuals present in underground refugia. The equipment and activities may also disturb aquatic habitats during the breeding season, resulting in the injury or death of eggs, larvae, juveniles, or adult individuals. Direct effects to central California tiger salamander will be minimized or avoided by the SSHCP AMMs (Final SSHCP Table 6-59). SSHCP AMMs for central California tiger salamander include CTS-1, which will require all ground disturbing Covered Activities within modeled habitat to occur outside the central California tiger salamander breeding and dispersal season. However, if ground disturbing Covered Activities must occur after October 15 and before July 31, work is limited to daylight hours. AMM CTS-2 requires the use of exclusion-fencing around project sites in modeled habitat; AMM CTS-3 requires the presence of a biological monitor on site; AMMs CTS-4, CTS-6, and BMP-2 require project-site measures to avoid the entrapment of individuals, and AMM CTS-5 establishes protocols if central California tiger salamander individuals are encountered during implementation of a SSHCP Covered Activity. Each individual Covered Activity project will monitor the effectiveness of the SSHCP AMMs implemented at the project site, and the project will provide monthly monitoring reports to the SSHCP (see Final SSHCP Tables 8-2 and 8-3). In addition to removing 1,421 acres of central California tiger salamander, the full build out of the Galt UDA (i.e. PPU-8) also will isolate existing areas of modeled habitat located west of the Galt UDA (in PPU-6) from areas of modeled located east of the Galt UDA (in PPU-7) (Final SSHCP Figure 3-16).

Using the methodology described in Section 2.5.2, the SSHCP also determined that the rural transportation Covered Activities will indirectly affect the existing hydrology of 2 acres of Vernal Pools that are within modeled habitat for central California tiger salamander. Altered hydrology in the 2 acres of indirectly-affected vernal pools could alter existing water-depths and alter the length of the inundation period, which would adversely affect the ability of central California tiger salamander larvae to complete metamorphosis prior to the pool drying, and would increase the potential for larvae predation due to shallower water depths.

In addition, the SSHCP identified unquantified indirect effects to central California tiger salamanders that will result from implementation of the SSHCP rural transportation Covered Activities. Five of the rural transportation Covered Activities planned within central California tiger salamander modeled habitat will change existing 2-lane rural roadways to 4-lane arterial roadways, which include a raised center median or a center two-way turn lane. The existing two-lane rural roads within central California tiger salamander modeled habitat that will become arterial roadways are: Twin Cities Road between SR 99 in the east and Interstate 5 in the west (8 miles in PPU-6); Dillard Road, between SR-99 in the east and Jackson Highway in the west (14.5 miles in PPU-6and PPU-5); Green Road, between Dillard Road and Wilton Road (2.5 miles in PPU-5); Alta Mesa Road, between Dillard Road in the north and Twin Cities Road in the south (8.5 miles in PPU-5 and PPU-

7); and Valensin Road, between Arno Road and Colony Road (3.5 miles in PPU-6 and PPU-7) (see Table 1b above). In addition, Valensin Road will be extended one mile east of Colony Road to Alta Mesa Road (in PPU-7). This one mile extension of Valensin Road will occur on natural landcovers that did not previously include a roadway or other developed landcover.

The improvement and widening of rural roadways within central California tiger salamander modeled habitat and associated increases in traffic volume and vehicle speed have the potential to increase vehicle strikes in the Action Area, causing death or injury of individuals. The central California tiger salamander is especially vulnerable to being killed on roadways due to their slow movements and their metapopulation life history, which includes seasonal migrations between breeding habitats and upland habitats (Trombulak and Frissell 2000, Service 2014). Studies in Sonoma and Contra Costa Counties have also shown that California tiger salamander are able to enter roadways, but are not able to crawl over curbs or other obstacles to exit the roadway, resulting in death from desiccation or predation (USFWS 2014a).

The rural transportation Covered Activities will increase the fragmentation of central California tiger salamander modeled habitat present in the Action Area (Final SSHCP Figures 3-16 and 5-5). Rural transportation Covered Activities that widen existing roadways (especially the new arterial roadways) have the potential to inhibit or obstruct migration of adults between breeding habitat and upland refugia, and inhibit or obstruct dispersal of metamorphs and juveniles leaving natal ponds, resulting in the injury or death of individuals. Some areas of central California tiger salamander modeled habitat in the Action Area (Final SSHCP Figure 3-16) may become isolated by the rural transportation Covered Activities, which could isolate individuals or populations of central California tiger salamanders, resulting in the types of effects discussed above in Section 2.5.4. Especially, the 14-mile long east-west Dillard Road project could create a movement and dispersal barrier that isolates modeled habitat located north of Dillard Road in PPU-5 and PPU-6 from the California tiger salamander habitat and populations that are located south of Dillard Road (Final SSHCP Figure 3-16). In a similar manner, the 8.5-mile long north-south Alta Mesa Road project could create a barrier that isolates modeled habitat west of Alta Mesa Road from the California tiger salamander habitat and populations located east of Alta Mesa Road (Final SSHCP Figures 5-5 and 3-16).

To avoid or minimize these potential effects, Objective CTS3 requires the SSHCP to implement California tiger salamander mobility studies to determine if salamander mobility could be affected by the conversion of 2-rural roadways to 4-lane arterial roadways. The locations and methodology of the California tiger salamander mobility studies will be determined in consultation with USFWS and CDFW (Final SSHCP Table 7-1, Table 7-7 Table 8-1). Data collected from the Objective CTS3 mobility studies will be used to identify locations where under-road culvert crossings may be needed to maintain and facilitate California tiger salamander movement across each roadway (Final SSHCP Chapter 7.6.2.14, Table 7-1, and Table 7-7). After arterial roadway improvements are completed, Objective CTS3 also requires monitoring of California tiger salamander movement across and along the improved roadway to assess how California tiger salamander movement changed in response to the road improvement project (Final SSHCP Table 7-1, Table 7-7). The post-construction monitoring results will be used to determine if additional design considerations will be used when future rural transportation Covered Activity projects are implemented (Final SSHCP Table 7-1, Table 7-7).

In addition to the arterial-roadway improvement projects, some 2-lane rural collector roadways within central California tiger salamander modeled habitat will remain 2-lane roads, but will be improved to widen the road's paved or gravel shoulder, add drainage improvements, and improve road surfaces. As shown in Table 1b above, rural-collector roadway improvement projects within California tiger salamander modeled habitat include Borden Road between Twin Cities Road and Clay Station Road (4.5 miles in south-central PPU-7); Clay Station Road between Dillard Road in the north and the San Joaquin County Line in the south (12.9 miles in PPU-5 and PPU-7); Ione Road between Jackson Highway and the Amador County line (6 miles in northeast PPU-7). Road shoulder and road drainage improvement projects have the potential to trap salamanders if improvements include design features such as road curbs, open culverts, steep ditches, or the improved shoulder includes an abrupt or steep transition to the adjacent habitat. To prevent injury or mortality of California tiger salamanders from a completed roadway improvement project, the SSHCP will develop an additional CTS AMM that addresses project design requirements. As described in the *Erratum to the Final SSHCP* (Sacrament County et al. 2019), the additional CTS AMM will be developed by the SSHCP in collaboration with the Service and CDFW.

Other indirect effects may result from the operation and maintenance of the SSHCP rural transportation Covered Activities. Increased traffic on widened or improved roadways within central California tiger salamander modeled habitat may increase exposure of individuals and suitable habitat to sources of chemical pollution. These pollutants include hydrocarbon and other contaminants that wash off roadways and enter aquatic habitats, and nitrogen deposition from increased vehicle traffic and exhaust (see Section 2.5.4 above). These roadway pollutants can alter rates of metamorphosis, cause growth abnormalities, and negatively affect aquatic and upland prey species of the central California tiger salamander (USFWS 2014a). Furthermore, all County activities related to routine maintenance of rural roadways in the Action Area are SSHCP Covered Activities (Final SSHCP Chapter 5.2.1 and 5.2.3). Road maintenance Covered Activities include debris removal form roads and road shoulders; weed control by manual, mechanical, and chemical methods; mowing of medians and shoulders; and the grading of road shoulders and other areas within the road right-of-way. The SSHCP will avoid or minimize effects to central California tiger salamander during maintenance of rural roadways by implementing AMM ROAD-3, which limits use of pesticides along roadsides. In addition, AMM ROAD-3 requires the SSHCP to post signs along road shoulders adjacent to central California tiger salamander breeding ponds that identify pesticide and road maintenance restrictions in those sensitive areas. AMM CTS-7 also restricts rodent control and use of rodenticides along roadways.

AMMs WBO-7 and CTS-7 will minimize the effects of rodenticide use on central California tiger salamanders in the Action Area. Use of pesticides (including rodenticides and herbicides) is not an SSHCP Covered Activity. However, pesticide uses specified in Final SSHCP Chapter 5.3 are allowed as land management tools, provided the applications are otherwise legal and conforms to all conditions in SSHCP Chapter Section 5.4. Rodent control will be allowed only within the developed portions of an urban development Covered Activity project site. Under some circumstances, Agricultural Preserves outside the UDA may allow rodent control measures. Where rodenticides are allowed, the individual conservation easement and the individual Preserve Management Plan for the Agricultural Preserve will assure that the rodent control measures comply with the methods of rodent control that are discussed in the 4(d) Rule published in the U.S. Fish and Wildlife Service's (2004c) final listing rule for tiger salamander, and include limitations on timing and area of application, amounts to be used, and acceptable rodenticides (Final SSHCP Page 6-340).

Table 20. California Tiger Salamander Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Upland Habitat					
Blue Oak Savanna	0	Qualitative Assessment	0	33	0
Valley Grassland	1,677	Qualitative Assessment	1,677	16,144	0
Total Upland Habitat	**1,677**	Qualitative Assessment	**1,677**	**16,177**	**0**
Aquatic Habitat					
Vernal Pool	57	2	59	762	58
Seasonal Wetland	21	Qualitative Assessment	21	123	21
Total Aquatic Habitat	**78**	**2**	**80**	**885**	**79**
Totals	**1,755**	**2**	**1,757**	**17,062**	**79**

To offset unavoidable Covered Activity direct and indirect effects to California tiger salamander habitat and individuals, the SSHCP will preserve at least 17,062 acres of high quality California tiger salamander modeled habitat within the SSHCP Preserve System, including 885 acres of aquatic habitat (Vernal Pool and Seasonal Wetland) and 16,177 acres of upland habitats (Valley Grassland and Blue Oak Savanna). Within the 885 acres of Vernal Pools and Seasonal Wetland modeled habitat preserved by the SSHCP, a minimum of 5 pools or wetlands will be occupied by breeding central California tiger salamanders (SSHCP Objective CTS1). Breeding pools preserved by the SSHCP will be surveyed for occupancy every two years (Final SSHCP Table 8-1 and Table 8-5). The SSHCP will develop appropriate methodology to survey for central California tiger salamanders, including statistical sampling of pools for occupancy, and the use of reference sites (Final SSHCP Table 8-1 and Table 8-5). Every 5 years the SSHCP also will survey a subset of preserved upland habitat for use by migrating or dispersing individuals (Final SSHCP Table 8-4).

Approximately 15,314 acres of the total 17,062 acres of central California tiger salamander modeled habitat preserved by the SSHCP will occur within PPU-7 in the southeastern portion of the Action Area (Final SSHCP Table 7-6). All SSHCP preserves in PPU-7 will abut existing preserves in PPU-7 (e.g. the existing 12,500-acre Howard (Chance) Ranch), which will preserve continuity of modeled habitat and allow dispersal of individuals between currently-protected occurrences and currently-unprotected occurrences. For example, of the 21 CNDDB occurrences of central California tiger salamander present in the Action Area, 14 of the CNDDB occurrences are within the existing preserves located in PPU-7 (CNDDB 2018). The SSHCP preserves established in PPU-7 will protect an additional 6 CNDDB occurrences, and will preserve habitat connectivity between those occurrences and the occurrences present in existing preserves (Final SSHCP page 7-216).

In addition to the preservation and management of high quality California tiger salamander modeled habitat, the SSHCP Conservation Strategy also will establish or re-establish 79 acres of central California tiger salamander aquatic habitat in the Action Area, with a priority on re-establishment before establishment. Re-establishing or establishing vernal pools will further mitigate Covered Activity effects and will help to conserve central California tiger salamander by ensuring no net loss of the total acreage of vernal pool aquatic habitat in the Action Area.

The *SSHCP Preserve Monitoring and Management Program* (Final SSHCP Chapter 8.3) is expected to improve the habitat functions of the 17,029 acres of central California tiger salamander modeled habitat protected in the SSHCP Preserve System (see Section 2.5.5 above), including the ecosystem functions that support aquatic and upland prey species. As discussed in Section 2.6.1.1, central California tiger salamanders breed in large vernal pools and seasonal wetlands (e.g. stock ponds) that are hydrologically connected to the surrounding Valley Grassland uplands. The more intensive and consistent management of vernal pool grasslands in the SSHCP Preserve System is expected to improve rainwater infiltration that forms the perched aquifer each winter, and also slow the draw-down of perched aquifer and the drying of Vernal Pools, Seasonal Wetlands, and other central California tiger salamander aquatic habitats each spring. Therefore, the 885 acres of aquatic modeled habitat protected in the SSHCP Preserve System are expected, in most water years, to hold water for additional days each year (relative to conditions under the existing management of those vernal pool grasslands). Consequently, a greater number of vernal pools and other wetlands in the SSHCP Preserve System can be expected to provide water depth, period of ponding, and water temperature conditions required for central California tiger salamander to grow, undergo metamorphosis, and successfully disperse (relative to conditions under the existing grassland management). The Individual Preserve Management Plan (PMPs) that will developed by the SSHCP for each Preserve will prescribe preserve-specific measures to manage the vernal pool grasslands on that SSHCP Preserve to help maintain or improve the existing vernal pool water depths and a period of inundation that allows central California tiger salamanders larvae to become juveniles that are capable of dispersing from the breeding site to suitable upland refugia. In addition, the individual Preserve Management Plan (PMPs) will monitor for dispersing bullfrogs that can take up residence in vernal pools and other ephemeral wetlands during the winter and spring to prey on central California tiger salamander larvae and breeding adults.

As discussed in Section 2.6.2.1 above, the 207,093-acre Rancho-Seco Management Unit (of the Central Valley Recovery Unit) was designated in southeastern Sacramento County and northeastern San Joaquin Counties by the central California DPS Recovery Plan (USFWS 2017b). Species Recovery Action A/1 specifies that at least 16,990 acres of the Rancho-Seco Management Unit should be preserved within 5 preserves, and each preserve in the Rancho-Seco Management Unit should be a least 3,398 acres in size (USFWS 2017b). The SSHCP Conservation Strategy will protect and manage, approximately 15,308 acres of central California tiger salamander modeled habitat within the portion of the Rancho-Seco Management Unit that is within Sacramento County. Habitat management actions in the Rancho-Seco Management Unit provided by the SSHCP Preserve Monitoring and Maintenance Program will eliminate or ameliorate threats to central California tiger salamander, as discussed below.

Consistent with Species Recovery Action E/4 from the central California DPS Recovery Plan (USFWS 2017b), the SSHCP Preserve Monitoring and Management Program (Final SSHCP Chapter 8.3) will develop and implement an adaptive management and monitoring plan for central California tiger salamander habitat protected in the by the SSHCP Preserve System. In SSHCP Preserves with central California tiger salamander modeled habitat, the Preserve Management Plan (PMP) will include a management and monitoring plan that specifically targets central California tiger salamander breeding and upland habitat, and will maintain habitat suitability on the Preserve in perpetuity. The individual PMPs may include, but are not limited to, actions to identify and reduce: harmful contaminants, non-native predator species, road mortality, and any non-native tiger salamanders hybrids that may move into the Action Area. The preserve PMPs also will describe grazing management, and California tiger salamander disease-prevention strategies. The PMPs will be updated based on monitoring feedback, and also will be adaptive to climate change and other variables. In addition, many of the SSHCP Preserves will be located where fossorial mammals create adequate burrow habitat (SSHCP Objective CTS2), the SSHCP will manage or remove non-native invasive vegetation and invasive wildlife species from Preserves (SSHCP Objective HAB4), and the SSHCP Preserve system will maintain linkages between SSHCP Preserves (SSHCP Objective L2).

The California tiger salamander movement-studies that will be implemented by SSHCP Objective CTS3 (Final SSHCP Table 7-1, Table 7-7, Table 8-1) may partially implement Recovery Action E/3 from the central California DPS Recovery Plan (USFWS 2017b). Recovery Action E/3 specifies that roads within protected-areas be assessed for road-mortality issues, and that measures be implemented to reduce mortality where high levels of crossing mortality are occurring. Measures identified by the Recovery Plan to reduce roadway-mortality include retro-fitting existing roads with wildlife tunnels or constructing elevated roads that allow for salamanders to travel under the road to suitable habitat on the other side of the road (USFWS 2017b). Pursuant to SSHCP Objective CTS3, the SSHCP may install under-road culvert crossings that are designed to maintain and facilitate California tiger salamander movement across improved rural roadways (Final SSHCP Chapter 7.6.2.14, Table 7-1, and Table 7-7).

As discussed in Section 2.5.4 above, if non-native or hybrid California tiger salamanders are found in or near the SSHCP Preserves, the SSHCP will contract with species experts to help identify potential remediation measures for the hybrid California tiger salamander. The SSHCP will meet with the Service, CDFW, the SSCA Technical Advisory Committee, and species experts to develop a plan for selecting and implementing remediation measures in the SSHCP Preserve System to address non-native or hybrid California tiger salamanders. The SSHCP will work with the Service and CDFW to develop a plan to eradicate non-native or hybrid California tiger salamander, or take other appropriate actions (Final SSHCP Chapter 11.4.3.5).

Therefore, the habitat preservation and management provided by the SSHCP Conservation Strategy will aid in the recovery of the central California tiger salamander by achieving most Recovery Actions identified by the Service for the Rancho-Seco Management Unit (USFWS 2017b).

Effects on Critical Habitat for the Central California Tiger Salamander

As discussed in Section 2.6.1.1 above, the 9,966-acre central California tiger salamander Critical Habitat Unit-3 is located within PPU-7 (in the area west of Clay Station Road and south of Laguna Creek). No rural transportation Covered Activities are proposed on the portion of Twin Cities Road that bisects Critical Habitat Unit-3, or on the portion of Clay Station Road adjacent to Critical Habitat Unit-3. Therefore, SSHCP Covered Activities will not remove or indirectly affect any landcovers that are within Critical Habitat Unit-3, and will not remove or indirectly affect the documented occurrences of California tiger salamander that are within Critical Habitat Unit-3 (Final SSHCP Table 6-58, SSHCP Figures 3-16 and 5-5).

The SSHCP Conservation Strategy will permanently preserve 1,872 acres (19%) of central California tiger salamander Critical Habitat Unit-3, including 61 acres of aquatic landcovers that provide standing bodies of fresh water (including stock ponds, seasonal wetlands, vernal pools, and other ephemeral and permanent water bodies) that hold water for a minimum of 12 weeks each rainy season (PCE #1), and preserve 1,811 acres of upland landcovers that are accessible from breeding ponds and contain small mammal burrows or other underground habitat that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation; and allow movement between occupied sites (PCEs #2 and #3).

Implementation of the SSHCP Preserve Maintenance and Management Program on the 1,872 acres of Critical Habitat Unit-3 protected in the SSHCP Preserve System is expected to improve the function of the physical and biological features present in those 1,872 acres that provide for central California tiger salamander life-history needs, which are essential to the conservation of the species (i.e. the PCEs described in Section 2.6.1.1 above). The more intensive habitat management of vernal pool grassland above-ground biomass that will be provided by the SSHCP Preserve Monitoring and Management Program (Section 2.5.5 above) will minimize thatch accumulation and excessive growth of non-native naturalized annual grasses from the vernal pool grassland uplands. As discussed in Section 2.3.5 and 2.5.4 above, the 61 acres of aquatic landcovers preserved by the SSHCP in Critical Habitat Unit-3 can be expected to pond water earlier each winter, and to maintain adequate water depth and water temperatures later in the spring (relative to filling and drying that would have occurred under the existing vernal pool grassland management). In water years with less rainfall, a greater number of vernal pools can be expected to achieve the water depths and period of ponding described by PCE#1. Removal of thatch and excessive growth of annual grasses in 1,811-acres of Valley Grassland uplands preserved in Critical Habitat Unit-3 will also enhance the dispersal and seasonal migration of central California tiger salamander individuals described by PCE#3. SSHCP actions to maintain and expand colonies of fossorial animals and establish new underground burrows (see discussion in Section 2.7.4.3 below), will increase the number of and improve the condition of the underground physical and biological features that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation. Therefore, improved management of 1,872 acres of Critical Habitat Unit-3 in perpetuity is expected to maintain or improve the ability of Critical Habitat Unit-3 to fulfill its conservation role for central California tiger salamanders.

When also considering the environmental baseline of Critical Habitat Unit-3 (see Section 2.6.2.1 above), a total of 5,298 acres (53%) of Critical Habitat Unit-3 would be preserved and managed in perpetuity to maintain the PCEs essential to the conservation of central California tiger salamander.

2.6.4.2 Effects on Western Spadefoot

The effects of SSHCP Covered Activities on western spadefoot include the loss of modeled habitat, the reduction or loss of existing habitat functions in some avoided areas, and effects on western spadefoot individuals that are within the affected habitat.

Within the total 163,342 acres of western spadefoot modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 23,065 acres of western spadefoot modeled habitat, including 1,022 acres aquatic breeding and rearing habitats, and 22,043 acres of upland foraging and estivation habitats (Table 21 below). Most removal of western spadefoot modeled habitat will occur in the UDA portions of the Action Area, where a total of 22,286 acres of modeled habitat will be lost. Outside the UDA, a total of 779 acres of modeled habitat will be removed, primarily from implementation of the rural transportation Covered Activities (Final SSHCP Table 6-61).

Activities related to the removal of natural landcovers, such as the use of earth moving equipment, mass grading, placement of fill, paving, and construction of facilities and structures that remove western spadefoot upland habitat will result in the death of all aestivating individuals within the 22,043 acres of upland habitat that is removed. Earthmoving equipment and other activities will crush, burry, or expose the adult and juvenile individuals present in underground refugia within the removed upland landcovers. Construction activities and operation of equipment may affect aquatic habitats during the species breeding season, resulting in the injury or death of eggs, larvae, juveniles, and adult individuals present in the aquatic habitat.

Direct effects to western spadefoot modeled habitat will be minimized or avoided by the general SSHCP AMMs, and by the species-specific SSHCP AMMs for western spadefoot (Section 2.5.4 above and SSHCP Table 6-63). SSHCP species-specific AMMs for western spadefoot include AMM WS-1, which will require all ground disturbing Covered Activities within modeled habitat to occur outside the western spadefoot breeding and dispersal season to the maximum extent practicable. However, if ground disturbing Covered Activities must occur after October 15 and before May 15, AMM WS-2 requires the use of exclusion-fencing around project sites in modeled habitat; AMM WS-3 requires the presence of a biological monitor on site; AMMs WS-4, WS-5, and BMP-2 require project-site measures to avoid the entrapment of individuals, and AMM WS-6 establishes protocols if Western spadefoot individuals are encountered during implementation of a SSHCP Covered Activity. Each individual Covered Activity project will monitor the compliance and effectiveness of the SSHCP AMMs implemented at the project site, and the project will provide monthly monitoring reports to the SSHCP (see Final SSHCP Tables 8-2 and 8-3).

Indirect effects to western spadefoot modeled habitat also will occur. As discussed in Section 2.5.5, the loss and conversion of uplands within western spadefoot modeled habitat can indirectly affect the existing seasonal hydrology and habitat functions of western spadefoot aquatic-habitat that is located outside of the development or disturbance footprint (see Section 2.5.5 above). Using the methodology for determining indirect effects to the Vernal Pool Ecosystem aquatic landcovers (Section 2.5.3 above), the SSHCP determined that Covered Activities would indirectly affect the existing hydrology of an additional 142 acres of Vernal Pool, Swale, Stream/Creek-VPIH landcovers located within western spadefoot modeled habitat. Most of these indirectly-affected Vernal Pool Ecosystem aquatic landcovers (132 acres) would be within in the UDA. In addition, the other aquatic landcovers included in western spadefoot modeled habitat (i.e. Seasonal Wetlands, Stream/Creek, and Open Water) are also hydrologically connected to the surrounding uplands, and co-occur with Vernal Pool and Swales within the areas of indirectly-affected Vernal Pool Ecosystem. Therefore, an unquantified amount of Seasonal Wetlands, Stream/Creek, and Open Water landcovers within wester spadefoot modeled habitat also will be indirectly affected by SSHCP Covered Activities (Final SSHCP Table 6-61). Inside the UDA, the indirect effects to western spadefoot aquatic-habitats would occur within future SSHCP Preserves and where existing preserves are adjacent to future urban development Covered Activities. Outside the UDA, indirect effects to aquatic habitats would result from the rural transportation Covered Activities.

Indirect effects to the existing hydrology of avoided aquatic-habitat can cause the habitat to dry too quickly to allow western spadefoot larvae to achieve adequate weight, undergo metamorphosis, and successfully disperse from natal ponds to upland habitat, resulting in injury or death of individuals. The indirect changes to the existing hydrology of an aquatic feature can also change the existing water chemistry or change the physical and biotic conditions that support the community of planktonic and benthic plants and animals that co-exist with western spadefoot larvae in aquatic habitats. Changes to the existing vernal pool community could alter, decrease, or eliminate food sources for western spadefoot. Vernal pool hydrology and water chemistry changes can also reduce the abundance of vascular plant species that provide food material (detritus), physical structure for egg laying, or shelter for western spadefoot larvae, and the small crustaceans, insect larvae, and amphibian larvae prey that western spadefoot larvae consume. Changes in food types or reduction in food availability can slow the maturation rate of western spadefoot larvae, and reduce the number of western spadefoot larvae that survive and disperse in a given year. Therefore, alterations to the existing hydrology of western spadefoot breeding habitat can lead to a reduction or failure of successful breeding.

In addition to indirect hydrology changes, avoided habitat for western spadefoot that is within close proximity to urban landcovers and human activities can also be exposed to several other environmental stressors produced by urban landcovers (see Sections 2.5.4 and 2.5.5 above). These other stressors also have the potential to indirectly reduce or eliminate suitable habitat for western spadefoot present in future SSHCP Preserves and other avoided habitats inside the UDA (Final SSHCP Table 6-63). For example, the construction and operation of new urban roadways inside the UDAs, including the Capital Southeast Connector, and increased traffic on existing roadways are likely to increase ground vibration and noise in western spadefoot modeled habitat inside the UDAs. Because sound or vibration from rain striking the ground appears to be the primary emergence cue used by aestivating spadefoots, and even the vibrations of a motor can cause them to emerge (Dimmitt and Ruibal 1980), the SSHCP includes AMMs that require setbacks between aquatic habitats and Covered Activities. The larger preservers established by the SSHCP Conservation Strategy will have less edge area and greater interior-area, which also will reduce western spadefoot exposure to ground vibration and noise.

The roadway improvement, operation, and maintenance Covered Activities inside and outside the UDA may indirectly expose individuals and suitable habitat to sources of chemical pollution. These pollutants include hydrocarbon and other contaminants that wash off roadways and enter aquatic habitats, and nitrogen deposition from increased vehicle traffic and exhaust (see Section 2.5.4 above). These roadway pollutants can alter rates of metamorphosis, cause growth abnormalities, and negatively affect aquatic and upland prey species of the western spadefoot.

In addition, Covered Activities related to routine maintenance of roadways in the Action Area are SSHCP Covered Activities (Final SSHCP Chapter 5.2.1 and 5.2.3), and may include manual, mechanical, and chemical weed control, mowing of medians and shoulders; grading shoulders and other areas within the roadway's right-of-way. The SSHCP will avoid or minimize effects to western spadefoot during road maintenance by implementing AMM ROAD-3, which limits use of pesticides along roadsides. In addition AMM ROAD-3 requires the SSHCP to post signs along road shoulders adjacent to western spadefoot breeding ponds that identify pesticide and road maintenance restrictions in those sensitive areas. The EDGE AMMs will prevent urban run-off from entering SSHCP Preserves and other natural landcovers.

The SSHCP will adaptively monitor each SSHCP AMM to assure its effectiveness over the term of the Permit. As discussed in Section 2.5.4 and 2.5.5 above, the SSHCP Preserve Management and Monitoring Program also will provide intensive monitoring and management of SSHCP Preserve edge areas in perpetuity, assuring that existing quality of western spadefoot habitat within each SSHCP Preserve edge area will be maintained. Therefore, although some western spadefoot individuals and suitable habitat will be exposed to additional environmental stressors produced by the urban development Covered Activities, the extent of that exposure is not expected to extend beyond the total 142 acres of existing western spadefoot habitat already identified by the SSHCP as indirectly and permanently affected. In addition, the SSHCP will conduct several Special Studies to test the assumptions of the SSHCP EDGE-AMMs, and the SSHCP will conduct required Effectiveness Monitoring of each SSHCP Preserve and the SSHCP Preserve System over the 50-year term of the proposed Permit, which will assure that the SSHCP Conservation Strategy will achieve the SSHCP's biological goals and objectives for preserving the viability and distribution of western spadefoot throughout the Action Area (Final SSHCP Table 7-60).

As discussed in Section 2.5.6 above, if the Preserve Setbacks or other EDGE AMMs are not effective, if a western spadefoot AMM is not effective, if an individual SSHCP Preserve is not meeting habitat success-standards, or the SSHCP Conservation Strategy is not achieving the identified goals and objectives for western spadefoot in the Action Area, the SSHCP will implement modifications such as remedial actions (e.g., adaptive management) or other additional preservation actions (e.g., adding preserve acreage or increasing setback width). Therefore, the direct and indirect effects of the SSHCP on western spadefoot reproduction, numbers, and distribution in the Action Area that are discussed here are the maximum effects that would occur over the SSHCP Permit Term.

Table 21. Western Spadefoot Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Upland Habitat					
Blue Oak Savanna	38	Qualitative Assessment	38	38	38
Blue Oak Woodland	9	Qualitative Assessment	9	9	9
Valley Grassland	21,996	Qualitative Assessment	21,996	22,016	270[a]
Total Upland Habitat	**22,043**	Qualitative Assessment	**22,043**	**22061**	**47**
Aquatic Habitat					
Vernal Pool	389	94	483	966	389
Swale	234	44	278	278	256
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Open Water	155	Qualitative Assessment	155	155	155
Stream/Creek	117	Qualitative Assessment	117	117	117
Stream/Creek VPIH	22	4	26	26	0
Total Aquatic Habitat	**1,022**	**142**	**1,164**	**1,647**	**1,022**
Totals	**23,065**	**142**	**23,207**	**23,708**	**1,069**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales. Therefore, approximately 270 acres of the re-established Vernal Pool Ecosystem will be Valley Grassland uplands.

To offset the adverse effects to western spadefoot individuals and suitable-habitat in the Action Area, the SSHCP will preserve at least 23,708 acres of high-quality suitable habitat for western spadefoot in the Action Area, including a minimum of 22,061 acres of modeled upland habitat and a minimum of 1,647 acres of modeled aquatic landcover, with 1,534 acres of the modeled aquatic habitat preserved within the Mather and the Cosumnes/Rancho-Seco Core Areas (Final SSHCP Tables 6-62 and 6-61). The acres of suitable aquatic and upland habitat preserved for western spadefoot will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5 and consistent with the SSHCP biological goals and objectives for western spadefoot (Final SSHCP Table 7-1 and 7-60). A primary conservation focus of the SSHCP Conservation Strategy for western spadefoot is the formation of a large landscape-scale Preserve (at least 10,500 acres) in the Cosumnes/Rancho-Seco Core Recovery Area, which will connects to and augment existing preserves that are not part of the SSHCP Preserve System. The SSHCP Landscape Preserve will encompass a heterogeneous range of the aquatic and upland landcovers and soil types associated with western spadefoot modeled habitat and the Vernal Pool Ecosystem within the Action Area. The SSHCP Preserve System will link together SSHCP Preserves and existing preserves that have modeled habitat and documented occurrences of western spadefoot, which will help maintain dispersal of western spadefoot inside the UDA and outside the UDA.

The improved management of vernal pool grasslands and reduction in above-ground biomass that will be provided by the SSHCP Preserve Monitoring and Management Program (Section 2.5.5

above) is expected to improve the exiting habitat functions of the 23,708 acres of western spadefoot upland and aquatic habitats that would be included in the SSHCP Preserve System. The more intensive and consistent management of vernal pool grasslands in the SSHCP Preserve System is expected to improve rainwater infiltration that forms the perched aquifer each winter, and also slow the draw-down of the seasonal perched aquifer and the drying of Vernal Pools, Seasonal Wetlands, and other aquatic habitats each spring. Therefore, the 1,647 acres of western spadefoot aquatic habitat in the SSHCP Preserve System are expected, in most water years, to hold water for additional days each year (relative to conditions under the existing management of those vernal pool grasslands). Consequently, a greater number of vernal pools and other wetlands in the SSHCP Preserve System can be expected to provide water depth, period of ponding, and water temperature conditions required for western spadefoot larvae to grow, undergo metamorphosis, and successfully disperse (relative to conditions under the existing grassland management). In addition, improved management of vernal pool grasslands uplands also will help to maintain upland soil moisture, which must be absorbed by aestivating individuals. SSHCP Objectives HAB1, HAB2, and HAB4 will require the preparation and implementation of individual Preserve Management Plans designed to maintain and enhance western spadefoot aquatic habitats, including early detection and eradication of invasive species such as American bullfrogs and crayfish, in SSHCP Preserves (Final SSHCP Table 7-57). Additionally, Objective HAB7 will include monitoring of upland thatch buildup and vegetation height, which will benefit western spadefoot because the species has difficulty moving through tall or dense vegetation, and are known to prefer areas of open vegetation and short grasses (Stebbins 1985). Therefore, improved habitat management of 23,708 acres of western spadefoot habitat in the SSHCP Preserve System is expected to increase reproduction and survival of western spadefoot and survival of in the SSHCP Preserve System, and the Action Area.

In addition to the preservation of 23,708 acres of modeled habitat for western spadefoot, the SSHCP Conservation Strategy also will establish or re-establish 1,069 acres of western spadefoot aquatic habitat in the Action Area (i.e. Vernal Pools, Swales, Seasonal Wetlands, and Stream/Creek), with a priority on re-establishment before establishment. All re-establishment and establishment sites will be consistent with the SSHCP biological goals and measureable objectives for western spadefoot (Final SSHCP Tables 7-1, 7-60). Re-establishing and establishing aquatic landcovers will help to conserve western spadefoot by ensuring no net loss of the total acreage of aquatic habitat in the Action Area.

2.6.4.3 Effects on Western Pond Turtle

Effects of SSHCP Covered Activities on the western pond turtle include the conversion and loss of habitat, the indirect reduction or loss of habitat functions in avoided habitat, and effects on individuals.

Within the total 117,201 acres of western pond turtle modeled habitat available in the Action Area, the SSHCP Covered Activities will remove 10,972 acres (9%) of the species modeled habitat (Table 22 below). Most loss of western pond turtle modeled habitat will result from implementation of urban development Covered Activities inside the UDA portion of the Action Area, where a total of 10,346 acres of modeled habitat will be removed (282 acres of aquatic habitat and 10,064 acres of upland habitat). Outside the UDA, the implementation of rural transportation Covered Activities and recycled water pipeline Covered Activities will remove 626 acres of western pond turtle modeled habitat (34 acres of aquatic habitat and 592 acres of upland habitats) (Final SSHCP Table 6-69).

Activities related to the removal of upland landcovers and implementation of urban development Covered Activities, such as the use of earth moving equipment, mass grading, placement of fill, grading, paving, and the construction of facilities and structures that remove western pond turtle upland habitat will result in the injury or death of all the individuals that may be present in the 10,064 acres of upland habitat that will be removed, including aestivating adults and juveniles, nesting females, eggs, and over-wintering hatchlings. Equipment that moves soil or removes vegetation likely will crush, burry, or expose western pond turtle individuals present in the removed or disturbed uplands, resulting in the death or injury of all individuals.

The STREAM AMMs will reduce direct effects to western pond turtle upland habitat. The SSHCP will require all UDA Covered Activities to establishing minimum 100-foot-wide Stream Setbacks on both banks of Eder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, and Sun Creek (AMM STREAM-2), and also will require UDA Covered Activities to establish 150-foot-wide Stream Setback along both banks of Laguna Creek as part of the Laguna Creek Wildlife Corridor (AMM STREAM-1). In addition, minimum 25-foot wide Stream Setbacks will be established on both banks of first-order and second-order tributaries that flow into those seven UDA streams (see AMM STREAM-3 and Objective W6). The UDA Stream Setbacks will preserve the upland natural-landcovers that are present along these seven UDA streams, including areas of suitable upland nesting-habitat and suitable upland aestivation-habitat for the western pond turtle. However, certain SSHCP Covered Activities also will be allowed within the Stream Setbacks, including the construction of bioswales, fencing, riparian plantings, and new stream crossings (new roads, bike or pedestrian trails, railroads, sewer lines, water lines, recycled water lines, or utility lines)(Final SSHCP Chapter 5.2.6). In addition, 16-foot wide paved trails, interpretive signs, benches, shade structures, and planted shade-trees will be allowed within the 100-foot-wide Stream Setbacks along Eder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, and Sun Creek are SSHCP Covered Activities. These activities will reduce the amount of suitable upland habitat available to western pond turtle in each of the UDA Stream Setbacks. In addition, the entity that will own the property within a Stream Setbacks will be responsible for managing and maintaining the species habitat within the Stream Setback, and will be responsible for maintaining any constructed features in the Stream Setback (e.g., trails, bioswales) (Final SSHCP page 5-44). The SSHCP Conservation Strategy does not require owners of the Stream Setbacks to maintain or to enhance the existing western pond turtle upland habitat within in the Stream Setback areas.

SSHCP urban development Covered Activities also will remove aquatic-habitats of western pond turtle. Approximately 282 acres of western pond turtle aquatic-habitat in the UDA will be removed or permanently altered by urban development Covered Activity projects, including projects what will permanently deepen, widen, re-align, or re-locate existing stream channels and tributaries that are within urban-developments sites (Table 1 above). Urban development Covered Activities also will remove western pond turtle aquatic habitat by installing hardscape in stream channels, by installing in-stream structures to stabilize bank erosion; by installing culverts or other facilities in stream channels, by installing new bridges over stream channels; by reducing channel complexity (e.g., removing riffle, runs, or pools) and by constructing outfall structures that allow the discharge of stormwater into stream channels from adjacent urban development areas (Final SSHCP Chapter 5.2.1). During construction of some Covered Activities (e.g. water supply pipelines, utilities, wastewater pipelines, urban-transportation facilities, rural-transportation projects, or the Capital Southeast Connector project), it may also be necessary to temporally divert and dewater a stream channel.

The direct effects to western pond turtle modeled habitat by urban development Covered Activities will be reduced by the general SSHCP AMMs (Table 2 above), and by the species-specific SSHCP AMMs for the western pond turtle (Chapter 5.4.2 in the 2019Erratum to the Final SSHCP). Urban development Covered Activities that re-locate or re-align a stream, creek, or drainage will incorporate the design requirements of AMM STREAM-5, which will restore channel complexity and minimize hardscaping. Covered Activities that must divert a stream channel will implement AMM STREAM-4 to avoid western pond turtle individuals, prevent removal of aquatic habitat, or change downstream water quality and ecology. AMM WPT-1 requires all Covered Activities to delineate western pond turtle upland and aquatic modeled habitat within a project footprint and within 300 feet of a project footprint, and then avoid the delineated habitat. AMM WPT-2 also requires stormwater-maintenance and improvement Covered Activities to avoid delineated habitat and confine equipment use to existing roadways. AMM WPT-3 requires an on-site biologist at Covered Activity project sites with western pond turtle modeled habitat. AMM WPT-4 requires the dewatering of modeled aquatic habitat and the installation of exclusion fencing prior to any Covered Activity work within western pond turtle aquatic habitat. AMMs WPT-5, WPT-6, and BMP-2 require measures at project sites that will avoid the entrapment of individuals, and AMM WPT-8 establishes protocols if western pond turtle individuals are encountered during implementation of a SSHCP Covered Activity. In addition, WPT-9 requires post-construction restoration of western pond turtle aquatic and upland habitat that is disturbed in a project site, including re-vegetation of upland habitat, replanting of aquatic vegetation, and the placing natural or artificial basking sites in stream channels or wetlands. Each individual Covered Activity project will monitor the effectiveness of each implemented AMMs in avoiding direct effects to western pond turtle individuals and habitats, and the project will provide monthly monitoring reports to the SSHCP (see Final SSHCP Tables 8-2 and 8-3).

The maintenance and improvement of existing and new stormwater-abatement facilities in the UDA are a category of the SSHCP urban development Covered Activities (see Final SSHCP Chapter 5.2.1), which will remove or modify western pond turtle aquatic and upland habitats. Stormwater abatement facilities include stormwater channels, re-aligned stream channels, natural stream-channels, weirs, stormwater pumping stations, and detention basins (Table 1 above). Maintenance activities will include (1) control of aquatic plants or woody growth that obstructs flow in improved or in unimproved channels; (2) removal of fallen trees and trees that could fall across the channel, (3) beaver dam removal, and (4) removal of debris, trash, rubbish, flood-deposited woody and herbaceous vegetation, and (5) vegetation control on stream banks (forbs, grasses, and woody growth less than 4 inches in diameter) (Final SSHCP Chapter 5.2.1). Therefore, the stormwater management Covered Activities will periodically reduce the amount of suitable western pond turtle aquatic habitat in many stream channels in the UDA by removing logs and other materials used as basking sites, by removing aquatic plants that provide food and shelter, by removing aquatic habitat required by prey-species, and by mowing or removing upland vegetation that provide nesting habitat and hides nesting females from predators. As described in the Erratum to the Final SSHCP (County of Sacramento County et al. 2019), AMM WPT-1 requires an approved biologist to first delineate western pond turtle aquatic and upland habitat within the footprint of a Covered Activity and within 300 feet of the project footprint, and AMM WPT-3 requires an approved biologist on site during implementation of vegetation maintenance activities. Therefore, the Service expects the WPT AMMs will minimize the injury and death of aestivating adults and juveniles, and minimize injury and death of overwintering-hatchlings during the mechanical removal of debris and aquatic plants from UDA stream channels and other UDA stormwater abatement facilities.

The indirect effects of SSHCP Covered Activities on western pond turtle modeled habitat were assessed and analyzed qualitatively by the SSHCP (Final SSHCP Tables 6-69, and 6-70). Potential indirect effects include habitat fragmentation and isolation; altered hydrology; water quality degradation (including introduction of pollutants, toxins, pesticides, and fertilizers); increased human activity (including trash, pets, debris, and vegetation trampling); altered fire regime; aquatic-community alterations (including increased predation); and ground vibration issues (Final SSHCP page 6-266 and Table 6-70). Indirect changes to existing hydrology could reduce aquatic habitat available for foraging or movement during the active season, and reduce habitat available for prey species of the western pond turtle. In addition, sediments carried in runoff and flooding could adversely affect vegetation and habitat for prey species, and carry pollutants into western pond turtle aquatic habitat. The LID-, EDGE-, BMP- and ROAD-AMMs discussed in Section 2.5.4 above would avoid or minimize these indirect effect to western pond turtle modeled aquatic habitat (Final SSHCP Table 6-70).

As discussed in Section 2.5.4 above, the numbers of invasive animals, feral pets, and "mesopredators" are expected to increase within the UDA over the Permit Term, including an increased number of raccoons and skunks. As the natural landcovers in the UDA are developed over the Permit Term, the Stream Setbacks will be used by many wildlife species as movement corridors through the UDA's developed landscapes. The greater number of predators combined with the reduced area of upland nesting-habitat in the UDA will concentrate western pond turtle nest locations as well as wildlife movement into the UDA Stream Setbacks, making western pond turtle nests and aestivating individuals more easily detected by their predators, including raccoons and skunks. Over-wintering hatchlings also will be vulnerable to the greater number of predators expected in the Stream Setbacks. Once hatchlings move into their shallow aquatic habitats, they will be vulnerable to the increased greater numbers of non-native bullfrogs and other aquatic predators that are expected within the UDA's waterways and emergent marshes. Consequently, the Service expects western pond turtle nesting and reproductive success within the UDA to decrease over the Permit Term.

In addition to the increased predation along streams and waterways in the UDA, other indirect effects to western pond turtle are expected, including the potential degradation of water quality in modeled aquatic habitats. The close proximity of urban development Covered Activities and some rural transportation Covered Activity projects to modeled aquatic habitat increases the likelihood that water quality changes will result from urban-runoff and from roadway-runoff, which could introduce pollutants and toxins (including fertilizers, herbicides, pesticides, paints, fuel, oil, and lubricants) to western pond turtle aquatic habitat. However, the SSHCP requirements for all urban development Covered Activities to incorporate and implement required SSHCP AMMs (including the LID, EDGE, and STREAM AMMs that minimize urban stormwater runoff), and the ROAD-AMMs (which limit road project location, maintenance, and pesticide use in sensitive areas), will avoid or minimize SSHCP Covered Activities indirect effects on the existing water quality of western pond turtle aquatic habitat in the Action Area.

As discussed in Section 2.6.1.1 above, western pond turtles are very wary, and quickly abandon basking sites, foraging sites, and nest sites when they are startled. The increased presence of humans near or within upland and aquatic habitats (especially human activity in the UDA Stream Setbacks), is expected to adversely affect western pond turtles by causing more frequent interruptions of thermal-regulation basking-behaviors. To escape disturbance, western pond turtles will submerge under water, and shorter basking periods can interfere with thermoregulation (Nyhof 2013). Longer periods of lower body temperature can adversely affect many western pond turtle behaviors, including foraging success, ability to flee actual predators, and reproductive behaviors. There are no SSHCP AMMs to reduce effects of human activities or recreation trails constructed in the UDA Stream Setbacks. However, disturbance from human activities will be avoided or minimized within the SSHCP Preserve System by the SSHCP AMMs, including the NATRUE TRAIL AMMs and by the individual Preserve Management Plans for Preserves that include western pond turtle modeled habitat (Final SSHCP Table 6-70).

Indirect effects to western pond turtle may result from increased number of roads that will be constructed inside the UDA (including the Capitol Southeast Connector project) and from increased traffic expected in the rural transportation Covered Activities located outside the UDA. These roadway projects are expected to inhibit western pond turtle movements between upland habitats and aquatic habitat, and are expected to increase injuries or deaths from vehicle-strikes. As discussed in Section 2.6.1.3 above, vehicles can adversely affect this species, primarily by striking females moving into or leaving upland nesting sites, and individuals dispersing through uplands to seek more appropriate aquatic habitat. SSHCP AMMs will avoid vehicle and equipment strikes in Covered Activity project-sites by requiring species surveys, requiring a biological monitor at the project site, and by enforcing a maximum 20-mile-per-hour speed limit for all construction and maintenance vehicles operating within western pond turtle modeled habitat (AMMs WPT-1, WPT-2, and WPT-7). In addition, the ROAD-2 AMM will require the design of the Capitol Southeast Connector, UDA urban-roadway projects, and the rural transportation Covered Activities to incorporate an adequate number of wildlife crossing structures in the road design to allow for dispersal and movement of western pond turtles via their aquatic habitats. In addition, the general SSHCP AMMs that require urban development Covered Activities to have compatible land uses, single-loaded streets, preserve setbacks, and stream setbacks also will reduce the potential for western pond turtle individuals to enter new roadways where vehicle collisions could occur.

Table 22. Western Pond Turtle Habitat Effects and Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Upland Habitat					
Blue Oak Woodland	9	Qualitative Assessment	9	0	9
Blue Oak Savanna	35	Qualitative Assessment	35	34	35
Valley Grassland	10,256	Qualitative Assessment	10,256	12,319	0
Mine Tailing Riparian	41	Qualitative Assessment	41	37	41
Mixed Riparian Woodland	170	Qualitative Assessment	170	368	170
Mixed Riparian Scrub	145	Qualitative Assessment	145	14	145
Total Upland Habitat	**10,656**	Qualitative Assessment	**10,656**	**12,772**	**400**
Aquatic Habitat					
Freshwater Marsh	95	Qualitative Assessment	95	127	95
Open Water	104	Qualitative Assessment	104	86	104
Stream/Creek	117	Qualitative Assessment	117	117	117
Total Aquatic Habitat	**316**	Qualitative Assessment	**316**	**330**	**316**
Totals	**10,972**	Qualitative Assessment	**10,972**	**13,102**	**716**

To offset the direct and indirect adverse effects to western pond turtle individuals and suitable-habitat, the SSHCP will preserve least 13,102 acres of suitable habitat for western pond turtle in the Action Area, including 12,772 acres of modeled upland habitat and 330 acres of modeled aquatic landcover (Table 22 above). The characteristics and locations of the of aquatic and upland habitat preserved for western pond turtle will be consistent with the SSHCP Preserve System assembly criteria, the requirements outlined in SSHCP Chapter 7.4 and 7.5, and will be consistent with the SSHCP biological goals and objectives for western pond turtle (Final SSHCP Table 7-1 and 7-67).

SSHCP Biological Objective WPT1 will benefit western pond turtle during assembly of the SSHCP Preserve System, by ensuring that suitable aquatic habitat in the Action Area is preserved in perpetuity, including Freshwater Marsh, Open Water, and Stream/Creek using the following criteria:

- Contains slow-moving or quiet water with emergent aquatic vegetation and deep pools with undercut banks for refugia.
- Contains basking sites such as rocks, logs, matted floating vegetation, terrestrial islands within the aquatic habitat, and human-made basking sites.
- Provides suitable aquatic and upland habitat along a minimum stream reach of 600 feet in length.
- Will allow a minimum 300-foot setback on at least one side of stream reaches that are preserved for western pond turtle.
- Will preserve stream reaches that are at least 600 feet in length.

- Outside the UDA, will provide a minimum of 400-foot setback of suitable upland habitat (Valley Grassland, Mixed Riparian Scrub, and Mixed Riparian Woodland) along both sides of stream reaches identified for western pond turtle mitigation.
- Inside the UDA, will provide a minimum 300-foot setback of suitable upland habitat (Valley Grassland, Mixed Riparian Scrub, and Mixed Riparian Woodland) along each side of North Laguna Creek to the maximum extent feasible, with a minimum stream corridor width of 600 feet plus the width of the creek, with additional setbacks as defined by local government ordinances.

The primary component of the SSHCP's Conservation Strategy for western pond turtle in the Action Area is the establishment of the large landscape-scale Preserve (at least 10,500 acres) outside the UDA (in PPU-7), which will include approximately 101 acres of modeled aquatic habitats and approximately 8,879 acres of modeled upland habitats for the western pond turtle. The Landscape Preserve in PPU-7 will connect to and augment the existing preserves in PPU-7 that are not part of the SSHCP Preserve System, including the existing 12,500-acre Howard (Chance) Ranch. The preserves in PPU-7 will protect headwater drainages, tributaries, and long sections of several streams in PPU-7, including Laguna Creek (south), Browns Creek, and Hadselville Creek (including stream sections that have documented occurrences of western pond turtle), as well as headwater drainages and tributaries of Skunk Creek and Dry Creek in south PPU-7. The upland landcovers in the SSHCP Preserves in the PPU-7 will encompass the range of upland landcovers and soil types, which will provide adequate amounts of upland nesting habitat and upland aestivation habitat.

In addition to the Landscape Preserve in PPU-7, the SSHCP Conservation Strategy for western pond turtle includes the establishment of the east-west Cosumnes River/Deer Creek Wildlife Corridor outside the UDA, and the east-west North Laguna Creek Wildlife Movement Corridor inside the UDA (see Section 2.1.6 above and SSHCP Chapter 5.2.8). The Cosumnes River/Deer Creek Wildlife Corridor outside the UDA will provide an aquatic-dispersal corridor between documented occurrences of western pond turtle present in PPU-6 (i.e. in lower Snodgrass Slough, Cosumnes River Preserve, and Badger Creek) and suitable aquatic and upland habitat present in PPU-5 and in northern PPU-7. Likewise, the North Laguna Creek Wildlife Movement Corridor in the UDA will provide an aquatic dispersal corridor between the documented occurrences of western pond turtle present in PPU-6 and PPU-4 (i.e. in Stone Lakes, Beach Lake, and the Bufferlands) to aquatic and upland habitat in SSHCP Preserves in PPU-3 and in PPU-1 (Final SSHCP Figure 3-19).

The improved management of upland habitat and aquatic habitat that will be provided by the SSHCP Preserve Monitoring and Management Program (Section 2.5.5 above) is expected to improve the habitat-functions of the 13,102 acres of western pond turtle habitat that will be protected within the SSHCP Preserve System (Final SSHCP Tables 8-1, 8-3, 8-4). The individual Preserve Management Plans will include the monitoring and adaptive management of western pond turtle habitat present in individual SSHCP Preserves, assuring that the habitat functions provided by the aquatic resources, upland vegetation, aquatic vegetation, basking habitat, and other components of western pond turtle modeled habitat are not degraded, or will improve under SSHCP management, relative to the existing habitat conditions. The preparation of individual Preserve Management Plans (Objectives HAB1, HAB2, and HAB4) will be designed to maintain or enhance aquatic habitat in the Preserves, including early detection and eradication of non-native aquatic species such as American bullfrogs and introduced bass species. The large size of the Landscape Preserve in PPU-7 will provide large areas of intact uplands, allowing uninhibited movement, upland nesting, and upland aestivation behaviors to occur over a large area, and minimizing exposure of individuals to upland predators. The preservation of high quality habitat within large Preserves, coupled with careful habitat management and monitoring, is expected to maintain or increase the existing reproductive success of the western pond turtle in the portion of the Action Area that is outside of the UDA.

The SSHCP also will re-establish and/or establish 316 acres of western pond turtle aquatic habitats and 400 acres of western pond turtle upland habitat (Table 21 above). SSHCP Objective WPT2 identifies the minimum size of re-established or established aquatic habitat, criteria of re-established or established habitat, and assures that only stream sections with non-modeled habitat is converted to modeled habitat. Additionally, this SSHCP Objective will ensure that any re-established and/or established aquatic habitat is located no more than 500 feet from preserved aquatic habitat (Final SSHCP Page 7-242). This requirement will increase the likelihood that the re-established or established aquatic habitat will be occupied by western pond turtle in the future, which will assist in maintaining the existing distribution of the species in the Action Area. Re-establishing and/or establishing aquatic habitat also will ensure no net loss of western pond turtle aquatic habitat in the Action Area.

2.6.4.4 Effects on Giant Garter Snake

Effects of SSHCP Covered Activities on the giant garter snake include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on individuals.

Of the total 35,159 acres of giant garter snake modeled habitat present in the Action Area, SSHCP Covered Activities will remove a total of 2,358 acres (7%) of the modeled habitat, including 169 acres of aquatic habitat (Freshwater Marsh, Open Water, Stream/Creek, and Seasonal Wetland landcovers), and 2,189 acres of upland habitat (Valley Grassland, Mixed Riparian Scrub). Covered Activity removal of giant garter snake modeled aquatic habitat will occur primarily within the UDA, where approximately 144 acres of aquatic habitat and 1,965 acres of upland habitat will be removed (Final SSHCP Table 6-65). The rural transportation Covered Activities and the recycled-water pipeline Covered activities implemented outside the UDA will remove 25 acres of giant garter snake aquatic habitat and 224 acres of giant garter snake upland modeled habitat (Final SSHCP Table 6-65).

Of the total 10,481 acres of giant garter snake modeled habitat also categorized as "high value" habitat, SSHCP Covered Activities will remove 104 acres of "high value aquatic habitat", and 502 acres of "high-quality upland habitat." The portions of the Action Area delineated "high-value" habitat include the Badger Creek area and the Stone Lakes area, which support important populations of giant garter snake. However, most loss of "high value" modeled habitat will occur within the UDA portions of the Action Area (i.e. 88 acres of "high value" aquatic habitat, and 461 acres of "high value" upland habitat) (Final SSHCP Table 6-66). No sites with documented occurrences of giant garter snake will be removed by SSHCP Covered Activities (see Final SSHCP Figure 3-18).

In addition to direct effects of urban development Covered Activities inside the UDAs, the maintenance of flood-control channels inside the UDA (by the SCWA, the City of Rancho Cordova, and the City of Galt) will remove affect giant garter snake modeled habitat within the UDA (Final SSHCP Chapter 5.2.1, Chapter 6.4.2). Also, the construction and maintenance of flood control and drainage facilities in the UDA Stream Setbacks and in the UDA portions of the Laguna Creek Wildlife Corridor will directly affect giant garter snake modeled habitat (Final SSHCP Chapter 5.2.6

and Chapter 5.2.8). These UDA channel-maintenance and flood-control facility construction and maintenance activities could crush, injure, or kill giant garter snake individuals. In addition, the channel maintenance activities also will periodically remove (in perpetuity) some of all of the aquatic-vegetation that provides habitat for giant garter snakes and their prey species, and also will periodically remove upland vegetation from giant garter snake basking habitat on the slopes of the channels. However, no documented occurrences of giant garter snake are presently known inside the UDAs, and only 4,536 acres (13%) of the Action Area's total 35,159 acres of giant garter snake modeled habitat are within the UDAs (i.e. in PPU-3 along Laguna Creek (north) and its tributaries, and in the Galt UDA (PPU-8) along Deadman's Gulch and other Cosumnes River tributaries) (Final SSHCP Figure 3-18). Therefore, the UDA flood control Covered Activities are not expected to kill or injure giant garter snake individuals.

The SSHCP AMMs will avoid or minimize direct effects to giant garter snake individuals and giant garter snake modeled habitat. For example, AMM GGS-1 requires a qualified biologist to survey and delineate giant garter snake aquatic habitat that is inside or within 300 feet of any Covered Activity project footprint, and to avoid that giant garter snake habitat. If giant garter snake modeled habitat cannot be avoided, AMM GGS-2 limits work to the snake's active season (after May 1 and before September 15). AMM GGS-3 requires an on-site biological monitor if Covered Activities are conducted within modeled aquatic habitat or within 300 feet of modeled aquatic habitat. If a Covered Activity must dewater modeled aquatic habitat, GGS-4 provides protocols for on-site dewatering and the installation of exclusion fences. Three SSHCP AMMs (GGS-5, GGS-6, and BMP-2) requires Covered Activity project sites to implement measures that will avoid entrapment of giant garter snake individuals. AMM CTS-7 establishes protocols to follow if giant garter snake individuals are encountered during the implementation of any SSHCP Covered Activity. AMM GGS-8 requires the restoration of disturbed giant garter snake habitat to pre-project conditions. AMM BMP-11 will reduce speeds of Covered Activity construction or maintenance vehicles to 10 mile-per-hour on unpaved roads (including levees) and vehicles will observe posted speed limits on paved road, which will minimize effects of flood control Covered Activities giant garter snakes that use roadways and levees for basking.

The indirect effects of SSHCP Covered Activities on giant garter snake modeled habitat were assessed and analyzed qualitatively by the SSHCP (Final SSHCP Tables 6-65, 6-66 and 6-67). Potential indirect effects include habitat fragmentation and isolation; altered hydrology; water quality degradation (including introduction of pollutants, toxins, pesticides, and fertilizers); increased human activity (including trash, pets, debris, and vegetation trampling); altered fire regime; aquatic-community alterations (including increased predation); and ground vibration issues (Final SSHCP page 6-255 and Table 6-67). Indirect changes to existing hydrology could reduce aquatic habitat available for foraging or movement during the active season, and reduce habitat available for prey species of the giant garter snake. Conversely, if Covered Activities result in increased surface run-off and discharges to local waterways after winter rains, water levels in downstream giant garter snake habitat could flood upland hibernacula, injuring or killing giant garter snake individuals. In addition, sediments carried in runoff and flooding could adversely affect vegetation and habitat for prey species, and carry pollutants into giant garter snake aquatic habitat. The SSHCP's LID-, EDGE-, BMP- and ROAD-AMMs discussed in Section 2.5.4 above would avoid or minimize these indirect effect to the existing hydrology of giant garter snake modeled aquatic habitat (Final SSHCP Table 6-67). In addition, the indirect effects of urban development Covered Activities on giant garter snake modeled aquatic-habitat present in the SSHCP UDAs will be reduced by Stream Setbacks, as required by AMMs STREAM-1 and STREAM-2 (Final SSHCP Chapter 5.4.1).

Giant garter snakes usually remain in close proximity to wetland habitats, but can be found in uplands as far away as 820 feet from any water body (G. Hansen 1988; Wylie et al. 1997). Hansen and Brode (1993) also documented giant garter snakes moving at least 1,312 feet (0.25 miles) between small lateral ditches and larger canals within the Natomas Basin in Sacramento County, and some marked and recaptured giant garter snakes moved distances greater than 0.5 mile in as little as a day. Increased traffic on the improved rural roadways that cross or are adjacent to giant garter snake modeled habitat (Final SSHCP Figures 5-5 and 3-18) could increase vehicle strikes of individual giant garter snakes if they bask on those roadways, or strike individuals that cross the roadways during upland migrations or longer-distance dispersals

Where the rural transportation Covered Activities or the recycled-water pipeline Covered Activity cross streams, creeks, and drainages that have giant garter snake aquatic-habitat, using an incorrect type or an incorrectly-sized road culvert can alter or disrupt the existing upstream and downstream water flow, or result in excessive current velocity that inhibits or prevents movement of giant garter snake within that waterway (USFWS 2012). As described in AMM ROAD-2 and the *Erratum to the Final SSHCP* (Sacrament County et al. 2019), where a rural transportation Covered Activity project includes the replacement or the modification of an existing drainage feature, and/or the project crosses a stream, creek, ditch, or other drainage; the rural transportation Covered Activity will incorporate appropriate project design features to improve opportunities for giant gartersnake passage and dispersal. In addition, the future SSHCP Wildlife Crossing Maintenance Manual shall identify techniques for the maintenance and the management of structures and aquatic habitat that provide passage opportunities for the giant garter snake in the Action Area. The Service's most recent 5-year review of the giant garter snake (USFWS 2012) recommends that as individual roads and bridges are constructed or repaired within the range of the giant garter snake, larger and more frequent box-culverts should be installed to facilitate giant garter snake movement, and especially efforts should be made to improve connectivity across Interstate Highway 5 and State Highway 99 (USFWS 2012). For this reason, the requirements of AMM ROAD-2 will apply to all rural transportation Covered Activity projects implementing in giant garter snake modeled aquatic habitat, and will apply to rural transportation Covered Activity projects in PPU-6 that are not within giant garter snake modeled aquatic habitat, but are located between areas of mapped giant garter snake modeled habitat (e.g. some Bruceville Road improvements) (Figure 3-18 and Figure 5-5 in the Erratum to the Final SSHCP).

Future water-supply demands of the urban-development Covered Activities planned inside the Galt UDA (inside PPU-8) are expected to be met by additional groundwater pumping (City of Galt 2008, pp. 6-5 to 6-47). This additional groundwater pumping within PPU-8 may increase the existing cone of groundwater-depression that is located east of the City of Galt, resulting in decreased summer water flows in Badger Creek and the other tributaries of the Cosumnes River located in PPU-6 and PPU-8, especially in years of low rainfall or drought. Lower water level or drying of streams and tributaries in the Badger Creek Basin can be reasonably anticipated to result in the following effects to giant garter snakes and their habitat: increased stress on snakes that must disperse further to find suitable habitat (including summer water) and prey items, increased predation on snakes due to the loss of aquatic refugia, increased competition for food and shelter resources between displaced and resident snakes, and ultimately, reduced reproduction and recruitment as females are displaced from familiar retreats and basking sites and neonates and juveniles are deprived of essential nutrients to facilitate growth and sexual maturation. These detrimental impacts to individuals have the potential to affect the population of giant garter snake in the Badger Creek area if the quality of habitat and food resources is reduced persistently, over time, or undergoes annual fluctuations of high magnitude.

To reduce the effect of urban development Covered Activity groundwater-pumping on giant garter snake aquatic habitat, AMM-2 requires the SSHCP to prioritize placement of SSHCP Preserves in areas that are suitable for groundwater recharge, especially the SSHCP Preserves that will contain Freshwater Marsh, Riparian, and Open Water landcovers. AMM LID-3 requires Covered Activity project proponents and the responsible Land-Use Authority Permittee (i.e. the County of Sacramento, City of Rancho Cordova, City of Galt) to identify areas within each Covered Activity project site that could be appropriate for groundwater recharge, and incorporate groundwater recharge into the project's drainage design, to the maximum extent feasible (Final SSHCP Table 8-2). Compliance with AMM LID-3 will be monitored by the SSHCP, and reported in the SSHCP annual reports (Final SSHCP Chapter 8.2.2). In addition, the Preserve Management Plans developed for individual SSHCP Preserves that include giant garter snake modeled habitat must take into account the existing land use and the future land use surrounding the Preserve, including effects of land uses that could draw from groundwater supplies that sustain aquatic habitat on the Preserve (Final SSHCP page 8-109). Changes in off-site land use near a SSHCP preserve will be document in annual reports and will be considered when updating individual PMPs (Final SSHCP page 8-109). Furthermore, construction and completion of the Recycled-Water Pipeline Covered Activity (see Section 2.1.4 above) will provide recycled water for use on agriculture lands and habitat preserves located the southwest portion of the Action Area, including uses to improve aquatic and terrestrial habitat on existing and future conservation-lands near the Cosumnes River Preserve(Final SSHCP page 5-31). Recycled water may also be used to irrigate re-established/ established wetlands and manmade groundwater-recharge basins in PPU-6 (Final SSHCP page 5-31).

Under SSHCP Objective GGS3 the SSHCP also will conduct a study to determine hydrologic baseline conditions along Badger Creek, and identify what level of hydrology is necessary to support giant garter snake in Badger Creek. This SSHCP study will measure hydrologic parameters (flow rate, temperature, and timing of flows) within Badger Creek at locations known to be occupied by giant garter snake. Three monthly hydrologic measurements will be made during the dry season of an average or better rainfall year. Each recording will occur over a full week to identify any regular interruptions in flow or changes in conditions due to diversions or inflows (Final SSHCP Table 7-7). After determining the baseline hydrologic parameters for occupied giant garter-snake habitat along Badger Creek, the SSHCP will identify water sources and acquire water-rights that will be used to supplement natural and agricultural flows and maintain that minimum level of hydrology throughout Badger Creek during the summer months when agricultural runoff may wane (Final SSHCP Table 7-1, Table 7-7, and Table 7-64.). The SSHCP hydrological study along Badger Creek will be initiated within two years of Permit issuance (Final SSHCP Table 7-7).

Table 23. Giant Garter Snake Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Upland Habitat					
Mixed Riparian Scrub	135	Qualitative Assessment	135	105	134
Valley Grassland	2,054	Qualitative Assessment	2,054	5,013	0
Total Upland Habitat	**2,189**	Qualitative Assessment	**2,189**	**5,118**	**134**
Aquatic Habitat					
Seasonal Wetland	39	Qualitative Assessment	39	100	39
Freshwater Marsh	71	Qualitative Assessment	71	127	71
Open Water	25	Qualitative Assessment	25	62	25
Streams/Creeks	34	Qualitative Assessment	34	117	34
Total Aquatic Habitat	**169**	Qualitative Assessment	**169**	**406**	**169**
Totals	**2,358**	Qualitative Assessment	**2,358**	**5,524**	**303**

To offset the direct and indirect adverse effects to giant garter snake individuals and suitable habitat, the SSHCP will preserve at least 5,524 acres of giant garter snake modeled habitat, including 406 acres of aquatic habitat (Seasonal Wetland, Freshwater Marsh, Open Water, and Streams/ Creeks) and 2,189 acres of modeled upland habitats (Valley Grassland and Mixed Riparian Scrub). Preservation of giant garter snake habitat will include at least 325 acres of "high-value" aquatic habitats and 671 acres of "high-value" upland habitat for giant garter snake, primarily in the Badger Creek watershed (Final SSHCP Table 7-63). Under SSHCP Objective GGS1, the SSHCP will preserve giant garter snake modeled habitat along these waterways in the Action Area:

- Skunk Creek, which flows into the Cosumnes River northwest of the City of Galt (in PPU-6);
- Willow Creek and tributaries of Badger Creek, which are located west of the Folsom South Canal and to the north of the Laguna Creek in PPU-6;
- The Badger Marsh area (in PPU-6)
- Laguna Creek (south), mainly between Miess Road and Twin Cities Road (State Route 104) in PPU-7;
- or other creeks that are determined by the SSHCP Technical Advisory Committee to provide similar habitat value for giant garter snake.

Sties selected for SSHCP Preserves along these waterways will have adequate water during the giant garter snake's active season (early spring through mid-fall), emergent or herbaceous wetland vegetation that provides foraging or escape cover, and have grassy banks and openings in waterside vegetation for basking. The section of waterway within the SSHCP Preserves will be at least 600 feet in length, with suitable winter-refugia upland habitat located within 200 feet of the aquatic habitat. In addition, at least one side of the preserved stream-reach will include a minimum 300-foot-wide setback (Final SSHCP Table 7-1).

Most of the documented occurrences of giant garter snake within the Action Area are within PPU-6 in the Badger Creek area and the Stone Lakes NWR area, and the SSHCP has designated "high-value" habitat for giant garter snake in those portions of the Action Area. The SSHCP Preserve System will preserve 325 acres of high-value aquatic-habitat located in in the Badger Creek area and the Stone Lakes NWR area (west of Interstate-5), along with 671 acres of high-value upland habitat within the Badger Creek and Stone Lakes NWR areas (Final SSHCP Chatper7.6.2.16). The SSHCP Preserves established in the Badger Creek area and the Stone Lakes NWR area will be contiguous with the existing preserves in those areas, which will increase the functional size of the SSHCP Preserves with modeled giant garter snake habitat. This will help maintain giant garter snake dispersal between documented occurrences, and maintain movement habitat between breeding sites and upland habitat. In addition, any direct effects of SSHCP Covered Activities on giant garter snake modeled habitat within the Badger Creek area or within the Stone Lakes area will be mitigated in those drainages, to help maintain giant garter snake occurrences in those areas (Final SSHCP Table 7-1). Based on its elevation and position within the watershed, the SSHCP assumes that SSHCP Preserves within the Badger Creek watershed would not be vulnerable to future flooding from sea level rise. Therefore, the SSHCP assumes that suitable upland habitat will remain available to support overwintering giant garter snakes in the Badger Creek SSHCP Preserves in perpetuity, even during future flood events (Final SSHCP Page 11-24).

As discussed in Section 2.6.2.4 above, the GGS Recovery Plan identified two giant garter snake Recovery Units within the Action Area (USFWS 2017c). Within the Cosumnes-Mokelumne Watershed Recovery Unit [the Action Area east of Interstate-5 west to the foothills in eastern Sacramento County (i.e. 230-foot elevation], SSHCP Covered Activities would remove 131 acres of modeled aquatic habitat and 1,887 acres of modeled upland habitat for the giant garter snake. To offset the loss of giant garter snake habitat in this Recovery Unit, the SSHCP Preserve System will include 344 acres of modeled aquatic habitat and 1,858 acres of modeled upland habitat for giant garter snake that is within the Cosumnes-Mokelumne Watershed Recovery Unit (Final SSHCP Table 7-65). The SSHCP Preserves within the Cosumnes-Mokelumne Watershed Recovery Unit will contribute to giant garter snake Recovery Criteria A6, which requires a minimum of two 539-acre blocks of contiguous and buffered perennial wetland habitat be preserved no further that 5 miles apart within the 234,960-acre Cosumnes-Mokelumne Watershed Recovery Unit.

Within the giant garter snake Delta Basin Recovery Unit (Action Area west of Interstate-5), SSHCP Covered Activities would remove 13 acres of modeled aquatic habitat and 73 acres of modeled upland habitat for the giant garter snake. To offset the loss of giant garter snake habitat in this Recovery Unit, the SSHCP will preserve 78 acres of modeled aquatic habitat and 127 acres of modeled upland habitat for giant garter snake within the Delta Basin Recovery Unit (Final SSHCP Table 7-65). To offset the loss of giant garter snake habitat in the Delta Basin Recovery Unit, the SSHCP Preserve System will include 78 acres of modeled aquatic habitat and 127 acres of modeled upland habitat for giant garter snake within the Stone Lakes Basin Management Unit of the Delta Basin Recovery Unit (Final SSHCP Table 7-65). SSHCP Preserves within the Stone Lakes Basin Management Unit will contribute to giant garter snake Recovery Criteria A7, which requires a minimum of ten 539-acre blocks of contiguous and buffered perennial wetland habitat be preserved no further that 5 miles apart in the 234,960-acre Delta Basin Recovery Unit.

In addition to the preservation of modeled habitat for the giant garter snake, the SSHCP Conservation Strategy also will establish or re-establish 303 acres of giant garter snake modeled aquatic-habitat in the Action Area, with a priority on re-establishment before establishment (Final SSHCP Table 6-63). The 303 acres of established or re-established modeled habitat will include 169 acres of modeled aquatic habitat and 134 acres of modeled upland habitat. Approximately 232 acres of the 303 acres to be re-established and/or established will be in giant garter snake high-value habitat. The locations and criteria for giant garter snake re-established and/or established habitat will be consistent with SSHCP Objective GGS2 and SSHCP Conservation Actions GGS2.1 and GGS2.2 (Final SSHCP Table 7-1, Table 7-64). These SSHCP Objectives and Conservation Actions will benefit giant garter snake in the Action Area by ensuring that modeled habitats for giant garter snake are re-established and/or established along specified creeks that provide important giant garter snake habitat, and will assist in maintaining or increasing the distribution of giant garter snake in the Action Area.

2.6.4.5 Effects on Sanford's Arrowhead

The effects of SSHCP Covered Activities on Sanford's arrowhead include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in some avoided areas, and effects on individuals that are within the affected habitat.

Of the 52,823 acres of Sanford's arrowhead modeled habitat available in the Action Area, SSHCP Covered Activities will remove 10,620 acres of modeled habitat, including 326 acres of aquatic habitat (103 acres of freshwater marsh, 72 acres of seasonal wetlands, 68 acres of open water, and 83 acres of streams/creeks), and 10,294 acres of hydrologically-connected Valley Grassland uplands (Table 24 below). Covered Activity removal of Sanford's arrowhead modeled habitat will occur primarily inside the UDA.

Most of the Sanford Arrowhead modeled habitat removed will be inside the UDAs (10,397 acres or 98%), with approximately 223 acres (2%) will be removed outside the UDA (2%) (Final SSHCP Table 6-33). The SSHCP determined that 12 known occurrences of Sanford's arrowhead will be removed by Covered Activities implemented inside the UDA. No occurrences of Sanford arrowhead outside the UDA will be removed by Covered Activities (see Final SSHCP Figure 3-10).

In addition to the removal of modeled habitat by urban development Covered Activities, Covered Activities within the UDAs include the maintenance and improvement of existing and new stormwater-abatement facilities (Final SSHCP Chapter 5.2.1 and Chapter 6.4.2), and these activities will alter or remove Sanford's arrowhead aquatic habitat from the UDAs. Stormwater abatement facilities include stormwater channels, re-aligned stream channels, natural stream-channels, weirs, stormwater pumping stations, and detention basins (Table 1 above). Flood Maintenance Covered Activities include the removal of aquatic plants or woody growth that obstructs flow in improved or in unimproved channels, and the removal of debris, rubbish, and flood-deposited vegetation (Final SSHCP Chapter 5.2.1). Therefore, the stormwater management Covered Activities could periodically remove Sanford's arrowhead individuals from stream channels within the UDAs.

The direct effects to Sanford's arrowhead modeled habitat by urban development Covered Activities will be reduced by the general SSHCP AMMs (Table 2 above), and by the SSHCP AMMs for the rare plant Covered Species Chapter 5.4.2). Direct effects to Sanford's arrowhead will be avoided or minimized by PLANT-1 (rare plant surveys) and PLANT-2 (rare plant protection) (Final SSHCP Table 6-34). If a Covered Activity project site includes modeled habitat for Sanford's arrowhead, the project site will be surveyed for the rare plant by an approved biologist and following the California Department of Fish and Wildlife rare plant survey protocols (CDFG 2009) or the most recent CDFW rare plant survey protocols. An approved biologist will conduct the field surveys and will identify and map plant species occurrences according to the protocols (AMM PLANT-1). Under

SSHCP Conservation Action SA1.1, the approved biologist will conduct surveys in the project footprint during the appropriate time of year when Sanford's arrowhead is observable.

If individuals of Sanford's arrowhead are detected within the proposed footprint of the Covered Activity, or are detected within 250 feet of the project footprint, no disturbance will occur at the project site before the SSHCP protects one unprotected occurrence of Sanford's arrowhead within a SSHCP Preserve (AMM PLANT-2). The minimum SSHCP Preserve size to protect an occurrence of Sanford's arrowhead is a Satellite Preserve (i.e. is 11 to 250 acres in size), that also encloses the watershed of the occupied site, and includes a minimum 50-foot Preserve Setback between the preserved habitat and any urban development Covered Activities.

The indirect effects of SSHCP Covered Activities on Sanford arrowhead modeled habitat were assessed and analyzed qualitatively by the SSHCP (Final SSHCP Table 6-33). Potential indirect effects include permanent alterations to watershed hydrographs and downstream water quality, habitat fragmentation and isolation; water quality degradation (including introduction of pollutants, toxins, pesticides, and fertilizers); increased human activity (including trash, debris, and trampling); aquatic-community alterations (including increased competition from invasive aquatic weeds). Implementation of SSHCP AMMs, including the LID-, EDGE-, BMP- and ROAD-AMMs discussed in Section 2.5.4 above will require control of stormwater runoff, control of pollutants and toxins, protection of sensitive habitats, avoidance and project design outside of sensitive habitats, measures to minimize effects from channel re-routing, educational awareness for workers, and monitoring of biological resources will assure that pollutants will not enter Sanford's arrowhead modeled habitat and that water quality of modeled aquatic habitat will not be affected (Table 6-34). In addition, the indirect effects of urban development Covered Activities on Sanford's arrowhead modeled aquatic-habitat within the SSHCP UDAs will be further reduced by Stream Setbacks, as required by AMMs STREAM-1 and STREAM-2 (Final SSHCP Chapter 5.4.1).

Table 24. Sanford Arrowhead Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Upland Habitat					
Valley Grassland	10,294	Qualitative Assessment	10,294	11,735	0
Total Upland Habitat	**10,294**	Qualitative Assessment	**10,294**	**11,735**	**0**
Aquatic Habitat					
Freshwater Marsh	103	Qualitative Assessment	103	127	103
Open Water	68	Qualitative Assessment	68	23	68
Seasonal Wetlands	72	Qualitative Assessment	72	87	72
Stream/Creeks	83	Qualitative Assessment	83	117	83
Total Aquatic Habitat	**326**	Qualitative Assessment	**326**	**354**	**326**
Totals	**10,620**	Qualitative Assessment		**12,089**	**326**

To offset the direct and indirect adverse effects to Sanford's arrowhead individuals and modeled habitat, the SSHCP will preserve least 12,089 acres of modeled habitat for Sanford's arrowhead in the Action Area, including 11,735 acres of upland modeled habitat and 354 acres of aquatic modeled habitat (27 acres of Freshwater Marsh, 23 acres of Open Water, 87 acres of Seasonal Wetland, and 117 acres of Stream/Creek). The characteristics and locations of the of aquatic and upland habitat preserved for Sanford's arrowhead will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5 and consistent with the SSHCP biological goals and objectives for Sanford's arrowhead (Final SSHCP Table 7-1 and 7-39).

In addition to the preservation of modeled habitat for Sanford's arrowhead, the SSHCP Conservation Strategy also will establish or re-establish 326 acres of Sanford's arrowhead modeled aquatic-habitat in the Action Area, with a priority on re-establishment before establishment (Final SSHCP Table 7-38). During re-establishment and/or establishment of Seasonal Wetland, Freshwater Marsh, Open Water, and Stream/Creek, the SSHCP will translocate impacted Sanford's arrowhead salvaged from Covered Activity project sites. Under SSHCP Conservation Action SA1.2, The SSHCP will select translocation sites for Sanford's arrowhead that are within emergent Freshwater Marsh vegetation (possibly the margins of rivers, streams, ponds, reservoirs, irrigation and drainage canals, ditches, and stock-ponds), and the SSHCP will consider these criteria: (1) sites that are known to support Sanford's arrowhead, (2) sites that are proposed for re-establishment/establishment, and (3) are areas that can be re-established to support Sanford's arrowhead populations and natural ecosystem processes (Final SSHCP Table 7-1). The preservation of high quality habitat for Sanford's arrowhead and the translocation of salvaged Sanford's arrowhead plants, coupled with careful habitat management and monitoring, is expected to maintain or increase the numbers and distribution of Sanford's arrowhead within the Action Area.

2.6.5 Cumulative Effects on the Other Aquatic Species

As described in Section 1.0 of this Opinion, the SSHCP was developed in part to respond to biological opinions issued by the Service in 1999 and 2004, and to address the indirect and cumulative effects of those large-scale water infrastructure projects in south Sacramento County.

Cumulative effects in a section 7 analysis are the effects of future state, tribal, county, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Several reasonably certain projects in the Action Area, such as the California High-Speed Train System and the California Waterfix, will require will require future federal actions and separate consultations under the ESA, and are not considered in this Opinion's cumulative effects analysis.

Reasonably certain activities in the Action Area, unrelated to the SSHCP and with no federal nexus, include the continued expansion of low-density rural development (see Section 2.3.4 above) within the approximately 19,600 acres of PPU-7 and PPU-6 that are designated as Agriculture Residential areas in the Sacramento County General Plan (County of Sacramento 2011). Construction of new residential structures or barns may occur, along with associated grading, landscaping, and accessory structures such as corrals and fences. In many cases, these activities will occur on large lots with streams, creeks, seasonal wetlands, vernal pools and other natural landcovers that provide suitable habitat for the SSHCP aquatic Covered Species. Land use changes and construction of structures within the Agricultural Residential areas may not obtain authorizations under ESA, CESA, and the CWA, particularly at project sites that are not subject to CEQA. Projects that are not subject to

CEQA would not prepare a CEQA document to identify potential environmental impacts, and the project proponent may not have the expertise to identify biological resources or understand the regulations, and the project impacts to species or habitat is beyond the purview of the County regulators reviewing building plans. Effects to the other aquatic Covered Species individuals and suitable habitat from projects within the Agricultural Residential areas would result in the types of effects similar to those discussed in Sections 2.5.4, 2.5.5, and 2.6.4 of this Opinion.

Additional conversion of natural landcovers to vineyards, cropland, orchards, irrigated pasture, and other farmland uses is also expected to occur in the future outside the UDAs, in the portions of the Action Area zoned for agricultural uses by the County's General Plan (County of Sacramento 2011). It is not possible, however, to predict how crop types or agricultural uses may change over the 50-year Permit Term. Nonetheless, some conversion of aquatic landcovers to an intensively managed agricultural use would be expected over the 50-year study period. Changes to more intensively managed agricultural uses would result in the types of effects to the other aquatic Covered Species that are similar to those discussed in Section 2.5.4, 2.5.5 and 2.6.4.

Other non-Federal actions that may occur in the Action Area are considered too speculative to evaluate at this point in time.

2.6.6 Conclusion for the Aquatic Covered Species

After reviewing the current status of the central California tiger salamander, the western spadefoot, the western pond turtle, the giant garter snake, and Sanford's arrowhead (the aquatic Covered Species); the environmental baselines for the Action Area; the effects of the proposed actions, including all measures to avoid, minimize, and mitigate adverse effects; and the cumulative effects; it is the Service's biological opinion and conference opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to jeopardize the continued existence of the aquatic Covered Species. The Service reached this conclusion because the project-related effects to the aquatic Covered Species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of any aquatic Covered Species. We reached this conclusion because:

- SSHCP Covered Activities would remove a relatively small amount of each aquatic Covered Species modeled habitat relative to the amount of modeled habitat available in the Action Area (i.e. 2% of central California tiger salamander modeled habitat, 7% of giant garter snake modeled habitat, 9% of western pond turtle modeled habitat; 14% of western spadefoot modeled habitat, and 20% of the Sanford' arrowhead modeled habitat), and the Covered Activities would not change the overall distribution of any aquatic Covered Species in the Action Area. Therefore, the effects of the Covered Activities would not reduce the reproduction, numbers, or distribution of any aquatic Covered Species rangewide.
- The SSHCP Preserve System will be established adjacent to and contiguous with existing vernal pool grassland preserves within the Action Area, increasing the effective functional size of the SSHCP Preserve System. The SSHCP Preserve System will preserve and manage a relatively large amount of each aquatic Covered Species modeled habitat present in the Action Area (i.e. 20% of central California tiger salamander modeled habitat, 17% of giant garter snake modeled habitat, 12% of western pond turtle modeled habitat; 15% of western spadefoot modeled habitat, and 24% of the Sanford' arrowhead modeled habitat). The large and interconnected

SSHCP Preserve System will help to maintain functioning metapopulations of California tiger salamander, giant garter snake, western pond turtle, and western spadefoot by preserving habitat connectivity in the Action Area and with areas outside of the Action Area. The large habitat preserves and the protection of known occurrences in the Action Area will help ensure each aquatic Covered Species persists.

- All aquatic Covered Species modeled habitat protected in the 36,282-acre SSHCP Preserve System will be monitored and managed in perpetuity under a single cohesive adaptive management program to maintain and improve habitat functions for each aquatic Covered Species, and to ameliorate the effects of edge stressors, such as invasive species, wildfire risk, urban runoff, non-point source pollution, and human activity.
- The more intensive and more consistent management of Vernal Pool Ecosystem grasslands by the SSHCP Preserve Monitoring and Management Program will benefit the aquatic Covered Species in perpetuity by improving the movement, seasonal migration, and dispersal of central California tiger salamander and western spadefoot within their upland habitats; and will maintain or improve ecosystem functions of aquatic breeding habitats for central California tiger salamander and western spadefoot. As discussed above, we expect the benefits of the SSHCP Preserve Monitoring and Management Program may lead to increased reproduction of the central California tiger salamander and western spadefoot within the Action Area.
- Each SSHCP Covered Activity will implement measures to avoid or minimize effects to each aquatic Covered Species, including measures that establish setbacks between streams and new urban development, and measures that will ameliorate the effects of edge stressors, such as invasive species, urban mesopredators, urban runoff, non-point source pollution, and human activity.
- All rural transportation Covered Activities implemented in central California tiger salamander modeled habitat will be designed to ensure the improved roadway would not become a movement barrier to central California tiger salamander. Therefore, the SSHCP would not reduce the current distribution of the central California tiger salamander, and would not inhibit the migration or dispersal of central California tiger salamander in the Action Area.
- Where a rural transportation Covered Activity project includes the replacement or the modification of an existing drainage feature; or the project crosses a stream, creek, ditch, or other drainage; the rural transportation Covered Activity will incorporate appropriate project design features that improve aquatic passage opportunities for the giant garter snake and western pond turtle. Therefore, the SSHCP would not inhibit the dispersal of giant garter snake and western pond turtle in the Action Area.
- Where a Covered Activity project location overlaps with modeled habitat for Sanford's arrowhead, the SSHCP will require pre-activity surveys using rare plant survey protocols. If Sanford's arrowhead is detected, no disturbance will occur at the project site before the SSHCP protects one unprotected occurrence of Sanford's arrowhead within a SSHCP Preserve.
- The SSHCP Conservation Strategy will contribute to the recovery of the giant garter snake by preserving and managing 344 acres of modeled aquatic habitat and 1,858 acres of modeled upland habitat for giant garter snake within the Cosumnes-Mokelumne Watershed Recovery Unit; and by preserving and managing 78 acres of modeled aquatic habitat and 127 acres of modeled upland habitat for giant garter snake within the Delta Basin Recovery Unit.
- The SSHCP Conservation Strategy will contribute to the recovery of the California tiger salamander protect and manage, approximately 15,308 acres of central California tiger salamander modeled habitat within the portion of the Rancho-Seco Management Unit that is within Sacramento County. Habitat management actions in the Rancho-Seco Management Unit provided by the SSHCP Preserve Monitoring and Maintenance Program will eliminate or

ameliorate threats to central California tiger salamander, including harmful contaminants, non-native predator species, road mortality, and non-native tiger salamanders hybrids that may move into the Action Area.

After reviewing the current status of designated critical habitat for the central California tiger salamander; the environmental baseline for the action area; the effects of the proposed SSHCP; and the cumulative effects; it is the Service's biological opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to destroy or adversely modify designated critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of critical habitat for the central California tiger salamander to serve its intended conservation role for the species. We have reached this conclusion because:

- The effect to the central California tiger salamander Critical Habitat Unit-3 is small and discrete, relative to the entire area designated.
- The SSHCP Conservation Strategy will permanently preserve and manage 1,872 acres (19%) of central California tiger salamander Critical Habitat Unit-3 to maintain or improve the physical and biological features which are essential to the conservation of the species (the PCEs), and maintain the ability of Critical Habitat Unit-3 to fulfill its conservation role for central California tiger salamanders. When also considering the environmental baseline of Critical Habitat Unit-3, a total of 5,298 acres (53%) of Critical Habitat Unit-3 would be preserved and managed in perpetuity to maintain the PCEs essential to the conservation of central California tiger salamander.

2.7 Avian Species

For the purposes of this Opinion, Cooper's hawk, tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, and loggerhead shrike are grouped together and identified as the "avian species." These species are grouped together because all are highly mobile and wide-ranging in the Action Area, they share similar reproductive strategies, most forage in or utilize the Action Area's vernal pool grasslands and other Valley Grassland landcovers, and have the same or similar prey species. Therefore, many anticipated effects of the SSHCP on these species will be similar. This Opinion analyzes the effects on each of these species individually. They are grouped together here, for the purposes of streamlining the Opinion and minimizing repetition in Section 2.7.4, *Effects of the Action on Avian Species*.

2.7.1 Overview of the Avian Covered Species

The status of each avian Covered Species is discussed below in Sections 2.7.1.1 to 2.7.1.9. To minimize redundancy, this section of the Opinion (Section 2.7.1) summarizes factors that have affected the range-wide status of the nine avian Covered Species. In addition, this section summarizes life history needs that are common to the avian Covered Species, and are relevant to the avian species effects-analyses presented in Section 2.7.4 below.

Each of the avian Covered Species occupies a large geographic range outside of the Action Area. Similar to the loss of vernal pool ecosystems, emergent marshes, and other ecosystems discussed in

Sections 2.5.1 and 2.6.1 above, the trees, upland forests, riparian forests, and grasslands that provide nesting, roosting, and foraging habitats over the range of each avian Covered Species have undergone a dramatic rate of loss in last century. As discussed above, approximately 85 percent of the California grasslands, more than 98% of all riparian habitat, and more than 90 percent of California forests have been lost over the last century and a half, initially from conversion to agricultural uses, and additional losses from urbanization (Heady 1977; Barr 1991; Barbour et al. 1991; Smith F. 1980; Reiner and Griggs 1989; Naiman et al. 1993; Naiman and Décamps 1997, Katibah 1981; Katibah et al. 1984; R. Holland 2009).

Most of the avian Covered Species historically foraged over grasslands. As discussed above, the conversion of grasslands to urban and agricultural uses proportionately exceeds the conversion of any other habitat type in California (Ewing et al. 1988; Hunting 2001). Much of the grassland in California and over the range of each avian Covered Species has been converted to other uses. Some of these uses, including agricultural crops such as rice, corn, winter wheat, and irrigated pasture, attract prey species and provide high quality habitat for many of the avian Covered Species. More recently, some beneficial crops have been replaced by a variety of crops that are not used by prey species of the avian Covered Species, or are lower habitat quality and rarely used by the avian Covered Species (e.g. fruit and nuts, vineyards, cotton, tomatoes, and potatoes) (DeHaven 2000; Ivey and Herziger 2003).

Habitat fragmentation and decreasing patch size of nesting and foraging habitats has been found to reduce habitat suitability for many bird species. Habitat fragmentation increases foraging distances, makes hunting less efficient, and reduces reproductive success (Remsen 1978). Another cause of population declines in many avian species may be pesticide use. Pesticide drift from agriculture use, or direct fogging of riparian areas by mosquito abatement districts or state health departments can adversely affects insect prey species and insect prey abundance. Rodent control measures, including the use of rodenticides, have been shown to contaminate the prey of many avian species, and reduce or eliminate the prey base.

2.7.1.1 Status of Cooper's hawk

The Cooper's hawk is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

Cooper's hawk is widely distributed in North American and populations of Cooper's hawk occur throughout most of the United States as well as southern Canada and northern Mexico (AOU 1957; Asay 1987). Most Cooper's hawks breeding in California are permanent, non-migratory residents; however, Cooper's hawks breeding in California may exhibit seasonal movements, moving to snow-free lower elevations during winter (Zeiner et al. 1990).

Remsen (1978) reported that breeding populations of Cooper's hawk had declined throughout California over the two or three decades prior to 1978. Also, analysis of Breeding Bird Survey (BBS) data for a 20-year period (1983 to 2003) also suggests that Cooper's hawk populations in California have declined during that period (Sauer et al. 2004). The primary threat to Cooper's hawk, particularly in California, is habitat loss and degradation as a result of urbanization and development. Direct or indirect human disturbance of nesting activities, particularly in suburban areas, may also threaten populations (Bosakowski et al. 1993; Boal and Mannan 1998). The maximum reported age of a Cooper's hawk is 12 years, while nine years is the maximum age known for a breeding bird.

In a study of 77 Cooper's hawk nests in California, Asay (1987) found that nearly all nests (i.e., 75) were in live oak trees (*Quercus wislizenii or Q. agrifolia*). The other two nests were in a blue oak (Q. douglasii) and California sycamore (*Platanus racemosa*). In much of California's Central Valley and foothill landscapes, (including those within the Action Area), Cooper's hawk appears strongly associated with live oak woodlands in a matrix of rolling grasslands (Asay 1987). Other key findings of Asay's (1987) study of Cooper's hawk nesting habitat in the Central Valley were: 1) most nests occurred in groves of six or more trees; 2) stand structure was characterized by the canopies of multiple trees growing together; 3) the understory of these stands was relatively sparse, comprised of larger branches, few small branches and leaves, and sparse ground cover that included short grass and/or poison oak; 4) most nest trees (79%) were in flat or bottomland areas, although 21 percent occurred on steep hillsides; and 5) nests were typically constructed in one of the tallest or most mature trees in the stand, in or just below the canopy. However, Cooper's hawks are also known to breed in suburban and urban areas. Several urban populations of Cooper's hawks have been well documented (Rosenfield et al. 1991; Mannan et al. 2004). Cooper's hawks appear relatively tolerant of habitat fragmentation and human disturbance near the nest (Beebe 1974; Murphy et al. 1988; Palmer 1988; Rosenfield et al. 1992).

The breeding season for Cooper's hawk is generally March to July, however breeding is sometimes initiated earlier. Cooper's hawks typically begin breeding after two years of age (Moore and Henny 1984; Asay 1987). Cooper's hawks are monogamous and generally breed once per year (Rosenfield and Bielefeldt 1993). Pairs generally return to the same territory each year, but typically build a new (alternate) nest in the vicinity of the existing nest (Reynolds and Wight 1978). In California, Cooper's hawks typically lay eggs in April and May. Incubation lasts approximately 34 to 36 days, and young remain in the nest an additional 30 to 34 days.

Cooper's hawk home ranges have been estimated at 988 to 4,446 acres. Home range size varies through the nesting cycle, and small portions of the home range may be used disproportionately (Rosenfield and Bielefeldt 1993). In a study of nesting Cooper's hawks in the Sacramento area, the average distance between adjacent nests was 0.99 mile (Asay 1987).

Cooper's hawks are considered ambush predators, using concealment at perch sites to catch prey. They often use a series of brief perch and scan episodes to locate and capture prey. Surprise attacks are often initiated at close range from behind an obstruction (Roth and Lima 2003). Cooper's hawks primarily eat medium-sized birds and mammals, with birds comprising most of their diet (Peterson and Murphy 1992; Rosenfield and Bielefeldt 1993). Important avian prey includes mourning dove (*Zenaida macroura*), American robin (*Turdus migratorius*), northern flicker (*Colaptes auratus*), jays (*Cyanocitta* spp., *Aphelocoma* spp.), and European starling (*Sturnus vulgari*s). Mammalian prey may include includes chipmunks (*Tamius* spp., Eutamius spp.), deer mouse (*Peromyscu*s), tree squirrels (*Sciurus* spp., *Tamiasciurus*), ground squirrels (*Ammospermophilus* spp., *Spermophil*us spp.). Cooper's hawks also eat reptiles, mammals, insects, and fish.

2.7.1.2 Status of Tricolored Blackbird

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

Historically, tricolored blackbirds ranged throughout most of lower-elevation California, with smaller nesting colonies in Baja California, Nevada, and Oregon. The range of the Tricolored Blackbird has changed little since at least the mid-1930s, however the range has retracted from Baja California and southern California, where the species is no longer found among its former coastal range. Also, scattered tricolored blackbird breeding has been known to occur in Washington (Beedy and Hamilton 1999). However, tricolored blackbirds are largely endemic to California, and more than 99 percent of the global population occurs in the state. In any given year, more than 75 percent of the total breeding population occurs in the California Central Valley, and breeding colonies have been observed in all Central Valley counties (Beedy and Hamilton 1997; Meese 2014).

During the breeding season, tricolored blackbirds typically nest in dense colonies, with males defending small territories and mating with one to four females (Beedy and Hamilton 1999). As many as 20,000 or 30,000 tricolored blackbird nests have been recorded in emergent wetlands of 9 acres or less, and individual nests may be built less than 1.5 feet (0.50 meters) from each other (Neff 1937; DeHaven et al. 1975). The tricolored blackbird's highly synchronized colonial breeding system adapted to exploit an environment where the locations of secure nesting habitat and rich insect food supplies were ephemeral and likely to change each year (Orians 1961; Payne 1969).

Studies by Neff (1937) reported that nesting colonies were typically located in seasonal wetlands with tules (*Scirpus* spp.) and cattails (*Typha* spp.). More recently, nesting colonies are regularly found in Himalayan blackberry (*Rubus discolor*), and in grain fields (Cook 1996, 1999; DeHaven 2000). In the 2014 tricolored blackbird statewide surveys, the most common substrates for nesting colonies were Himalayan blackberry (41%) and triticale (38%), with approximately 7% in cattails and tules (Meese 2014).

Nest building takes about four days, and egg laying ordinarily starts about four days after the arrival of birds at breeding sites. Clutch size is typically three to four eggs, and the eggs in a nest hatch asynchronously (Payne 1969). Emlen (1941) and Orians (1961) estimated tricolored blackbird incubation period at 11 or 12 days, while Payne (1969) estimated this interval at 11 to 14 days. Tricolored blackbird clutches take about nine days from hatching until the oldest nestling is able to jump from the nest when disturbed. Fledglings generally are able to obtain food on their own after about 25 days, but follow adults to locate food sources (Payne 1969; Beedy et al. 2017). Thus, a successful nesting effort for a reproductive pair takes about 45 days (Hamilton et al. 1995).

The tricolored blackbird is an itinerant colonial-breeder, moving from an initial breeding colony site to another location to breed again (Hamilton 1998; Beedy and Hamilton 1999; Beedy et al. 2017). In the Central Valley, initial nesting colonies are typically found in the San Joaquin Valley and Sacramento County, and then shift northward in the Sacramento Valley for a second nesting attempt later in the breeding season (Beedy and Hamilton 1999; Beedy et al. 2017). Initial nesting colonies are established from March until April in the San Joaquin Valley and in Sacramento County. A successful tricolored blackbird colony, including asynchronous nests, takes about 50 days from nest initiation to fledging (Beedy and Hamilton 1997). After nestlings have fledged and are fully independent, breeding colonies begin to move northward, although in some locations a second wave of nesting can occur at the initial colony site after the first young have fledged (Beedy and Hamilton 1999). Most tricolored blackbirds probably move from the San Joaquin Valley and Sacramento County to the northern Sacramento Valley for second or third nesting attempts. However, breeding colonies may form throughout the breeding range at any time during the breeding season (March through July). The movement from one breeding location to another is likely in response to changing habitat conditions (i.e., reduction in insect abundance or change in nesting habitat) (Hamilton et al. 1995; Hamilton 2000).

DeHaven et al. (1975) found that tricolored blackbirds were unlikely to nest at sites where they hatched or where they had nested the year before. However, other studies have demonstrated that breeding colonies often exhibit site fidelity and traditionally use many of the same areas year after year if the site continues to provide essential resources, including secure nesting substrates, water, and suitable foraging habitats (Beedy et al. 1991; Hamilton et al. 1995; Beedy and Hamilton 1997; Hamilton 2000). Therefore, there may be regional differences in the degree of site fidelity. Tricolored blackbirds are extremely sensitive to human disturbance at active nesting colonies. Entry into colonies may be required for management purposes or for scientific study; however, to avoid unnecessary disturbance of the nesting birds, colonies should not be entered by casual observers (Beedy and Hamilton 1999).

Tricolored blackbirds have three basic requirements for selecting their breeding colony sites: a protected nesting substrate that is either flooded, thorny, spiny, or "visually" but not actually spiny; a suitable foraging space providing adequate insect prey within a few miles of the nesting colony; and open accessible water (Hamilton et al. 1995; Beedy and Hamilton 1997, 1999). DeHaven (2000), however, questioned whether the lack of open water constitutes a significant limitation on breeding substrate utilization. To obtain food efficiently, nesting adults require suitable foraging habitat generally within three miles of their colony sites, but commute distances of up to eight miles have been reported (Orians 1961). Short-distance foraging (i.e., in sight of the colony) to feed nestling also is common. Both sexes are known to feed nestlings (Crase and DeHaven 1977; Beedy and Hamilton 1999).

Habitat loss appears to be a major threat to existing tricolored blackbird populations. During a 6-year study of tricolored blackbird nesting in the Central Valley, Neff (1937) found 93% of tricolored breeding colonies contained cattails or bulrushes. By the mid-1980s, the amount of freshwater emergent marsh habitat within the Central Valley had declined to almost half of 1939 levels (Frayer et al. 1989, Section 2.6.1 above). Likewise, during the 1970s and 1980s, the reported number of nesting tricolored blackbirds declined by about 50% (Beedy and Hayworth 1992). One of the main causes for their dramatic decline has been the near elimination of native cattail (*Typha latifolia*) wetland complexes throughout the Central Valley following agricultural expansion and conversion of wetlands into arable land (Kyle and Kelsey 2011; Section 2.6.1 above). Additionally, acres of foraging habitat provided by native perennial grasslands and naturalized annual grasslands in the Central Valley and Sierra Nevada foothills have declined by about 99% from historical levels due to agriculture or urban development (Kreissman 1991; Beedy and Hamilton 1997; Section 2.5.5 above). In turn, the insect assemblages associated with native perennial grasslands that historically provided a food base for itinerant tricolored blackbirds undoubtedly shifted in abundance accordingly. Tricolored blackbird narrow geographic range and formation of immense breeding colonies has made them highly vulnerable to disturbance and habitat loss resulting in an 80% decline in 90 years (DeHaven et al. 1975; Beedy et al 1991; Beedy and Hamilton 1997, 1999; Kelsey 2008; Keiller and Kelsey 2011). However, tricolored blackbirds have been able to adapt to using habitat provided by nonnative species, such as Himalayan blackberry, and by supplementing native forage habitats with food found on disturbed habitats (Beedy 2008).

Proximity to suitable foraging habitat appears to be extremely important for the establishment of colony sites, because tricolored blackbirds always forage, at least initially, in the field containing the colony site (Cook 1999). Usually only a minor fraction of the area within the commuting ranges of a colony, however, provides suitable foraging habitat (Beedy and Hamilton 1999; Cook 1999). For example, within a three-mile radius there may be low-quality foraging habitats such as cultivated row crops, orchards, and vineyards, along with high-quality foraging areas like irrigated pastures, lightly grazed rangelands, vernal pools, and recently hayed alfalfa fields (Cook 1999).

Historically, foraging habitats with abundant insect populations and vegetative diet items were grasslands, shrublands, wetlands, riparian scrub, and other forested habitats (Beedy 2008; Beedy and Hamilton 1997).

Year-round tricolored blackbird foraging habitats now include annual grasslands, wet and dry vernal pools and other seasonal wetlands, agricultural fields that support abundant insect populations (such as alfalfa, irrigated pastures with continuous haying schedules, rice, sunflower, and recently-tilled fields), cattle feedlots, and dairies (Meese 2013; Crase and DeHaven 1978). The importance of grasshoppers as a dietary item has been highlighted during the breeding season (DeHaven 2000). Tricolored blackbirds also forage occasionally in mixed riparian scrub habitats along marsh borders. However, weed-free row crops, vineyards, and orchards do not serve as regular foraging sites (Beedy and Hamilton 1997, 1999; DeHaven 2000). Studies conducted since the 1980's have documented tricolored blackbirds feeding on dairy-cow silage commonly stored in large open piles on the ground (Beedy and Hamilton 1997, 1999; DeHaven 2000). Triticale in particular, a hybrid of wheat and rye grown as silage on dairies for its high nutritional value, provides robust structure to construct their nests and these are commonly associated with abundant food and water in nearby pasture and feed lots. As a result, the expanding dairy industry in the San Joaquin Valley has resulted in a population shift and a consolidation of the species into mega-colonies of tens of thousands of birds, all concentrated around dairy farms. Approximately half of the breeding tricolored blackbirds in California may now be nesting in silage fields (Kelsey 2008; Meese 2014).

Local, regional, and statewide tricolored blackbird populations began experiencing declines beginning around 1994. These declines are especially alarming because approximately 99 percent of the global population of the species occurs in California (Beedy and Hamilton 1999). Research has shown chronically low reproductive success since 2007, and that reproductive success is correlated with local insect abundance (Meese 2013). In statewide surveys conducted from 2008 to 2011, the number of tricolor blackbirds in California dropped by 34%, from 395,000 to 258,000 birds (Kyle and Kelsey 2011). From 2011 to 2014 the number of tricolors dropped 44%, from 258,000 to 145,000 birds (Meese 2014). There are likely several reasons for the decline, but clearly the rate of mortality of adults now far exceeds that of the recruitment of new breeding birds into the population, and the chronically low reproductive success since 2007 appear to be the major factor causing the disparity between mortality and recruitment (Meese 2013).

Although the statewide numbers of tricolor blackbirds is trending downward, the decline is not uniform across different regions in California. The decline is most pronounced in the San Joaquin Valley and along the Central Coast. Along the Central Coast, the number of birds is down 91% in 6 years, from 7,014 to 627 birds (Meese 2014). The number of birds in the San Joaquin Valley plummeted 78% in 6 years, from 340,700 to about 73,500 birds, and the decline is especially alarming in Kern and Merced counties (Meese 2014). In the immediate past, the San Joaquin Valley held the vast majority of birds during the statewide survey (Kelsey 2008; Kyle and Kelsey 2011); if the San Joaquin Valley is no longer able to support those numbers of birds, a northward shift in the distribution of initial-breeding colonies may be occurring (Meese 2014). During the same 6 year interval, the numbers of tricolor blackbirds in the Sierra foothills region and Sacramento County have increased by about 145%, from about 22,500 birds to about 54,000 birds. These numbers suggest either that tricolor blackbirds are (1) moving into the foothills from other regions or (2) are breeding relatively more successfully in the Sierra foothill counties than they are in the San Joaquin Valley or the Central Coast region (Meese 2014).

Survey results since 1994 have identified several important distribution and population trends for tricolored blackbirds: (1) local, regional, and statewide populations and distributions vary from year to year; (2) 60 percent of all tricolored blackbirds located in all years were found in the ten largest colonies; (3) 70 percent of all tricolored blackbird nests and 86 percent of all foraging by nesting birds were on private agricultural lands; (4) in some portions of their range, tricolored blackbirds have declined or been eliminated (Hamilton et al. 1995; Beedy and Hamilton 1997; Hamilton 2000; Meese 2014).

Many sources of tricolor blackbird mortality are of essentially unknown severity (e.g., disease, predation, starvation) but some sources of mortality are well known. The destruction of colonies through the harvest of nesting substrates persists as an annual event in colonies established in grain fields surrounding dairies, especially in the San Joaquin Valley. Harvesting cereal crops, silage, and plowing weedy fields are currently the most common reasons tricolored blackbird colonies are destroyed on agricultural lands (Hamilton et al. 1995; Meese 2014). Changes in agricultural cropping patterns have also affected tricolored blackbird habitat. Tricolored blackbird "friendly" landcovers such as rangelands, grassland, and pastures have decreased. These habitats are often replaced by other crops that do not provide habitat (e.g., fruit and nuts, vegetables and melons, cotton, tomatoes, beans, potatoes, sugar beets, and vineyards) (DeHaven 2000).

Tricolored blackbirds have been demonstrated to be sensitive to pesticides and herbicides, and the application of herbicides and pesticides is known to affect the nesting success of colonies in agricultural areas (Beedy and Hamilton 1999). Pesticides also reduce the abundance of insect prey that tricolored blackbird depend on. More intensive pest control management practices in hay pastures are hypothesized to have substantially reduce insect-foraging opportunities (DeHaven 2000). Hamilton (2000) observed a colony sprayed by mosquito abatement operators in Kern County. All sprayed eggs failed to hatch. Hosea (1986) attributed the loss of at least two tricolored blackbird colonies to aerial herbicide applications. Application of poisons has also caused mass mortality, including poisoning by strychnine and selenium and spraying with mosquito abatement oil McCabe 1932; Beedy and Hayworth 1992; Beedy and Hamilton 1999; Beedy 2008).

Predation is a major cause of complete nesting failure at some tricolored blackbird colonies (Hamilton et al. 1995; Beedy and Hayworth 1992). Historical accounts have documented the destruction of nesting colonies by many types of native predators (Neff 1937). Payne (1969) reported predation of tricolored blackbird nests by feral domestic cats, American crows (*Corvus brachyrhynchos*), raccoons, mink (*Mustela vison*) northern harriers, barn owls (*Tyto alba*), short-eared owls (*Asio flammeus*), and yellow-billed magpies (*Pica nuttallii*). In the southern San Joaquin Valley, common ravens (*Corvus corax*) may assemble and destroy all or almost all nests within colonies. Throughout the Central Valley, coyotes are a major predator of tricolored blackbird colonies, especially in silage field colonies, and in cattail colonies when water is withdrawn (Final SSHCP Appendix B).

Following the breeding season, most tricolors are found in the Sacramento Valley where they aggregate with red-winged and other blackbird species and feed, often in large flocks, on ripening rice. An unknown number of adult tricolors are shot each fall due to their similarity in appearance to red-wings, as red-wings are exempted from protection under the Migratory Bird Treaty Act and are legally shot each fall as they feed on ripening rice (Meese 2014).

2.7.1.3 Status of Western Burrowing Owl

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The western burrowing owl is a small, ground-dwelling owl that inhabits open habitats such as grasslands, deserts, steppes, and agricultural lands. Western burrowing owl occurs throughout western Canada and western United States, south through Mexico to Panama in Central America, as well as in Florida and the Bahamas (Haug et al. 1993). The burrowing owl is experiencing precipitous population declines throughout North America. In Canada, its numbers are rapidly declining, and in 1995 the Committee on the Status of Endangered Wildlife in Canada listed it as an endangered species. In Mexico, it is officially considered a threatened species. The burrowing owl is also declining throughout most of the western United States (DeSante and Ruhlen 1995).

In California, western burrowing owl is a year-round resident. Historically, burrowing owl was widespread and occurred in suitable habitats throughout the state (Grinnell and Miller 1944), but its range has contracted significantly, particularly in coastal grasslands. Most of the burrowing owl's original prairie habitat in California has been removed and other open habitats in lowland landscapes are experiencing the most intensive urban development pressures in the state (CBD et al. 2003). Nearly 60 percent of California burrowing owl colonies that existed in the 1980's had disappeared by the early 1990s. Burrowing owls are now absent from coastal areas north of Sonoma County. They are also absent from montane regions in California, such as the Sierra Nevada and the ranges between Santa Barbara and San Bernardino Counties. In the San Francisco Bay Area and the middle portion of the Central Valley (from Yolo and Sacramento Counties to Merced County), the burrowing owl population has declined by at least 65 percent since 1986 (DeSante and Ruhlen 1995; DeSante et al. 1997).

The present range of western burrowing owl is north-central California (west of the Sierra Nevada), south to Mexico, as well as the desert regions of southwestern California, and scattered locations in the Great Basin (DeSante et al. 1996). There are historical records of burrowing owl occurrence from nearly every county in the Central Valley, and burrowing owls remain throughout nearly all of their historical Central Valley range (DeSante et al. 1996). However, approximately half of all breeding groups known to occur in the Central Valley during the 1980s had disappeared by the early 1990s (DeSante and Ruhlen 1995). DeSante et al. (1996) estimated that the Central Valley supports 14 percent of the total California burrowing owl population, and some of the highest population densities.

The rapid conversion of their natural grassland habitat to urban and agricultural uses, and the loss of suitable agricultural lands to urban development over much of the species range are thought to be largely responsible for declining numbers of burrowing owls (Bates 2006). Equally important is the loss of fossorial rodent populations, especially prairie dogs and ground squirrels, across much of the owl's historical habitat. Eradication programs have decimated populations of these rodents, which have in turn disrupted the commensal ecological relationship western burrowing owls have with these fossorial species. Another cause of population declines is thought to be pesticide use, especially organophosphates in southern Canada (Gervais et al. 1997). Fragmentation of their habitats probably increases foraging distances, making hunting less efficient, and potentially reducing reproductive success. Furthermore, fragmentation may reduce the chances that a male western burrowing owl will attract a mate and successfully reproduce (Remsen 1978). See Section 2.5.1 above for additional information on the current distribution and status of natural grasslands in the Central Valley portion of the species range.

Throughout their range, western burrowing owls require habitats with three basic attributes: open, well-drained terrain outside areas at risk of flooding; short, sparse vegetation generally lacking trees; and underground burrows (Gervais et al. 1997). Vegetative cover and height are significant factors due to the fossorial nesting and small size of the burrowing owl (Coulombe 1971; Green and Anthony 1989). These owls prefer open habitats that afford visibility of approaching predators or contain elevated perches for the same purpose (Green 1983). Nest predators are typically species that are capable of accessing burrowing owl nest chambers, and include foxes (*Vulpes* spp.), badgers, skunks, raccoons, and rattlesnakes (*Crotalus viridis*) (Coulombe 1971). Predators of burrowing owls above ground include prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk, ferruginous hawk, northern harrier, golden eagle *(Aquila chrysaetos),* foxes, coyotes, and domestic dogs and cats. Green (1983) found that burrowing owls in Oregon avoided habitat with vegetation that impaired the owls' horizontal visibility and did not provide elevated perches. Owls will perch on raised burrow mounds or other topographic relief such as rocks, tall plants, fence posts, and debris piles to attain better visibility. Tall or dense vegetative cover that prevents visibility of approaching predators puts burrowing owls at a severe disadvantage (Haug et al. 1993).

The presence of burrows is a critical component of suitable habitat for burrowing owls throughout their lifecycle because burrows provide security for nesting and shelter from predators and weather. Western burrowing owls typically adopt burrows or tunnels excavated by ground squirrels or prairie dogs, but dens dug by larger mammals may also be used (Trulio and Chromczak 2007). In softer soils, western burrowing owls may dig their own nest sites, and manmade structures (i.e., culverts, under-building space, and rubble piles) may also be used (Rosenberg et al. 1998). In agricultural landscapes, western burrowing owls will nest along roadsides, along water conveyance structures, by other features, and along the margins of crops (Rosenberg and Haley 2004; DeSante et al. 2007). In California's Central Valley, California ground squirrel (*Spermophilus beecheyi*) populations are particularly important to the ecology and conservation of burrowing owls, by creating and maintaining availability of nesting and satellite burrows.

Burrowing owls are opportunistic predators that primarily consume small mammals, insects, and crayfish, but also consume birds, amphibians, and reptiles (Haug et al. 1993; Gervais et al. 2008). Owls typically forage in habitats characterized by low-growing, sparse vegetation (Haug et al. 1993). Insects are often taken during the day, especially during the summer, while small mammals are taken at night. In California, crickets and meadow voles (Microtus sp.) were found to be the most common food items (Thomsen 1971). Burrowing owls are primarily crepuscular (i.e., dawn and dusk) foragers, but will hunt at any time (Rosenberg et al. 1988). Individuals often begin perching outside in the afternoon and begin foraging at dusk. Nesting adults return to the burrow at night (Thomsen 1971).

Activity data show that owls spent most of the daylight hours within 164 feet of their nest burrow and never traveled farther than 820 feet of the nest burrow during the day. Nocturnal activity data showed owls flew long distances to forage at night (maximum of 1.6 miles) from their nest, but 95 percent of nocturnal movements were within 0.4 mile from their nest (Haug and Oliphant 1990). Western burrowing owls concentrate their hunting in natural grasslands, agricultural lands, uncultivated fields, ungrazed areas, and open ruderal areas such as roadsides that support abundant small mammal and arthropod populations (Haug and Oliphant 1990; Gervais et al. 2003). In urban areas, burrowing owls are often attracted to street lights, where insect prey congregates. In a study conducted in California's San Joaquin Valley, burrowing owls did not appear to differentiate between grassland and cropland in their foraging habitat selection (Gervais et al. 2003). Burrowing owls often hunt from a perch. Foraging behavior is variable but generally consists of hunting while hovering or hover-gliding and returning to the perch. Burrowing owls also chase their prey on foot while walking, running, or hopping. Hunting behavior apparently depends on vegetation type and structure, time of day, and the type of prey pursued (Haug et al. 1993).

Burrowing owls may nest in a single pair, but they usually nest in loose colonies ranging from 4 to 10 pairs (Zarn 1974). Most pairs occupy a natal burrow and at least one additional satellite burrow (Haug et al. 1993; Todd and Skilnick 2002). Western burrowing owls in California have shown considerable nest-site fidelity between breeding seasons, with return nesting ranging from 32%-50% in large grasslands, and 57% in an agricultural landscape (Ronan 2002; Catlin 2004; Catlin et al. 2005). Second-year birds will often attempt to nest near (less than 0.2 mile) their natal sites (Rosenberg et al. 1998). For example, after the young fledge, family groups will sometimes move among burrows in the fall and juveniles may adopt their own nearby burrow (Thomsen 1971). These life history traits can make burrowing owl populations particularly sensitive to loss of occupied nesting habitat and permanent displacement of owls from nest sites.

Like other owls, burrowing owls usually breed once per year in an extended reproductive period; however, renesting and production of a second brood within a nesting season, after the first brood successfully fledged, has been documented in California (Gervais and Rosenberg 1999). Localized high densities of burrowing owls, along with the mobility of their young, facilitate brood amalgamation and mixing, and joint-nesting. In one study of burrowing owls near Sacramento, at least 37 percent of adults exhibited parental behavior toward offspring that were not their own (i.e., alloparenting) (B. Johnson 1997b). Both sexes reach sexual maturity at one year of age. The burrowing owl nesting season (including courtship, breeding, and fledging stages) is generally February through August. Most western burrowing owls in California begin pair formation and courtship in February or early March (Coulombe 1971). Burrowing owl pairs breed from March through May, although the peak breeding period is April through May. Eggs are incubated by both adults for 28 to 30 days. The average clutch size is seven eggs, which hatch asynchronously (Haug et al. 1993). Young owlets are brooded in the nest chamber for another two to three weeks, at the end of which time they may be seen at the burrow entrance in their natal-down plumage. Nestlings gradually become bolder, eventually spending more time outside near the burrow entrance. Older nestlings or fledglings may move to nearby satellite burrows as the natal burrow becomes crowded. Fledging occurs six to eight weeks after emergence. Fledglings typically remain near the burrow and accompany the adults in foraging flights at dusk (Rosenberg et al. 1998). Up to ten young per pair can be fledged in especially productive years (Gervais and Rosenberg 1999). The number of young fledged in central California has ranged between three and six, and was typically four or five (DeSante et al. 1997). Anecdotal information suggests that burrowing owl fledging success in the early 1900's was six to eight young per nest (Dawson 1923). The possible decline in burrowing owl fledging success in the Central Valley since the early 1900's corresponds with documented population declines of other avian predators occurring in Central Valley grassland habitats (e.g., loggerhead shrike, American kestrel [*Falco sparverius*]) (DeSante et al. 1997). Rosenberg and Haley (2004) reported that average fledging success in the Imperial Valley was 2.5 young per nest.

2.7.1.4 Status of Ferruginous Hawk

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

Ferruginous hawks nest in western North America, from southern Saskatchewan and Alberta south to central New Mexico and Arizona, east to the Great Plains, and west to central Nevada and Oregon (Bechard and Schmutz 1995). Ferruginous hawks do not regularly breed in California, with the most recent breeding being recorded in 1989 in northeastern California (Harlow and Bloom 1989).

The winter distribution includes the southwestern United States and northern Central America (Bechard and Schmutz 1995). Most individuals that winter in California are believed to have originated in the states west of the continental divide. In California, Garrison (1990) reported that 66 percent of band recoveries were from breeding populations west of the Rocky Mountains, while the remaining recoveries were from the north and east. In California, ferruginous hawks occur commonly in all of the eight geographic regions. Wintering ferruginous hawks are most commonly found in the Sierra Nevada, Cascades, and Inner Coast Range regions than other regions. Regions reporting moderate numbers of ferruginous hawks included the South Coast, Central Coast, and the Central Valley (Garrison 1990; Hunting 2001). Fidelity to wintering areas by migratory individuals is unknown (Bechard and Schmutz 1995).

Fall migration of juveniles to wintering sites begins in early August, while most adult ferruginous hawks migrate in September and October. Adult peak migration occurs in late October and early November. Migration of both juveniles and adults is completed by the end of November (Bechard and Schmutz 1995). In the spring migration returning to nesting areas, adults migrate earlier than juveniles. Adults migrate between mid-February and early April, with peak activity occurring during the month of March. First year juveniles start spring migration in early April, peak between mid-April and mid-May, and finish with the latest migrating individuals leaving in early June.

The ferruginous hawk is considered an "open country" species that inhabits the grasslands, shrub steppes, and deserts of western North America. During the winter, ferruginous hawks use grasslands and arid areas, particularly where pocket gophers, ground squirrels, rabbits, or prairie dogs are abundant. Characteristics of these grasslands and agricultural lands are that they support abundant prey and include friable soils (for prey burrowing), moderate to dense vegetative cover (particularly grasses), and some topographic variation. Ferruginous hawks also winter near cultivated fields and irrigated pastures that support populations of prey (Bechard and Schmutz 1995), and ferruginous hawks are known to use urban open space grasslands as long as prey is available (Berry et al. 1998; Brouse 1999).

Foraging habitat (e.g. grasslands) for ferruginous hawks has been lost to urbanization or converted to agricultural crops that do not support prey species or are not used for foraging. Conversion of grassland habitats to urban and agricultural uses proportionately exceeds the conversion of any other habitat type in California (Ewing et al. 1988; Hunting 2001). DeHaven (2000) quantified changes in California cropping patterns and found that ferruginous hawk "friendly" habitats such as rangelands, grassland, and pastures have decreased. These habitats have been replaced by a variety of other crops (e.g., fruit and nuts, cotton, and vineyards) that are not used by ferruginous hawks, or by crops (e.g., vegetables and melons, tomatoes, beans, potatoes, sugar beets) that are suspected as having lower quality foraging value. Unlike other wintering raptors in California, ferruginous hawks do not use agriculture areas as frequently. Instead, they are more frequently found using natural habitat types such as grasslands and vernal pool/grassland complexes for foraging (Final SSHCP Appendix B).

Prey selection by ferruginous hawks is determined primarily by availability (Steenhof and Kochert 1985 in Bechard and Schmutz 1995). Mammals are the most common food items with rabbits and hares *(Syvillagu*s and *Lepus* spp.) and ground squirrels (*Spermophilus* spp.) comprising most of the food consumed by adults and juveniles throughout the year. Bechard and Schmutz (1995) summarized ferruginous hawk prey reported from several studies throughout the species' range by percent occurrence and percent biomass. Mammals were most frequently preyed upon (83 percent) and constituted 95 percent of the food biomass, while birds were the second prey group most frequently eaten (13 percent), but only constituted 3.8 percent of the food biomass. Amphibians, reptiles, and insects were also consumed, but were found to be much less frequent and comprised less than one percent of the food biomass. Ferruginous hawks opportunistically forage at times during the day when their main prey items are active. Four types of prey pursuit have been described and include: 1) hunting from perches with flights of less than 100 meters to capture prey; 2) short-distance strikes originating from the ground; 3) aerial hunting; and 4) hovering.

Bechard and Schmutz (1995) suggest that the ferruginous hawk may defend winter territories. Winter densities in Utah have been reported at one individual per 3.60 square miles (Smith D. and Murphy 1978), while Plumpton and Andersen (1997) found a mean daily home range size of 1.36 square miles. However, 10 to 20 wintering ferruginous hawks have been observed standing or perching in the same general area (Bechard and Schmutz 1995).

The control of ground squirrel and prairie dog populations with pesticides (i.e., strychnine) may affect ferruginous hawks (Hunting 2001). Eradication programs have decimated populations of these rodents. In addition, secondary poisoning has been documented for several raptors species; however, no studies have been found that document secondary poisoning of ferruginous hawks. Ferruginous hawk potential longevity is believed to be 20 years of age (Lloyd 1937; Bechard and Schmutz 1995). The oldest known age of a wild ferruginous hawk is 17 years 11 months. Banding data from Schmutz and Fyge (1987) was used to estimate first year mortality at 65 percent, while nest re-occupancy data from Woffinden and Murphy (1989) has been used to estimate annual adult mortality at 25 percent.

2.7.1.5 Status of Swainson's hawk

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The Swainson's hawk breeds throughout western North America, including the central and western provinces of Canada and most U.S. states west of the Mississippi River (Dechant et al. 2001), but winters primarily in Central and South America. The winter range during the Austral summer in South America is grassland and agricultural regions primarily in northern Argentina, Paraguay, Uruguay, and southern Brazil (Palmer 1988; England et al. 1997). However, small populations of wintering Swainson's hawks have been noted in Boreal winter in southern Florida and in Texas (Browning 1974), and telemetry data (Browning 1974, Bradbury et al. in prep) have documented the presence of a wintering population based primarily in western Mexico, southern Mexico and Central America. Also, a small population (never observed to exceed 30 individuals), has wintered in the Sacramento–San Joaquin River Delta of California (Herzog 1996). While the breeding origins of many Mexican-wintering Swainson's Hawks are now know to be the Central Valley of California, it is also thought that the Mexican wintering population is also comprised of Swainson's Hawks from other parts of the breeding range (Bradbury et al. in prep; Holt pers. obs.). Wintering in western Mexico (Sinaloa, Nayarit) is a relatively recent phenomenon as the areas where foraging now occurs have only been cleared for agricultural production in the past four decades and had previously been extensive thorn forest, a habitat that would not provide any opportunities for Swainson's hawk foraging (Bradbury et al. in prep.). It also appears that the wintering habitats in Central America and South America where Central Valley Swainson's hawks have been discovered to be wintering are likewise landscapes that have been altered by clearing and agricultural cultivation at least within the past century.

Swainson's hawk nesting data in California has been compiled by the CDFW since 1979. Currently the distribution in California mainly consists of nesting populations in the Central Valley and the Great Basin in northeastern California. Nesting in the Central Valley occurs throughout the valley, extending from Tehama County in the north to Kern County in the south. However, the population is largely concentrated in the middle of the valley in a semi-circle around the Delta, primarily in Yolo, Solano, Sacramento, and San Joaquin counties. Roughly 60 to 65 percent of the statewide population and 70 to 75 percent of the Central Valley population occurs in this latter area. This distribution pattern conforms broadly to the distribution of agricultural habitats in the valley that are suitable for foraging. While alfalfa, irrigated pasture, mixed row, and field crops are found throughout the valley, they are concentrated in those same areas where Swainson's hawk's nests are shown to be concentrated in the middle of the valley. Less desirable vineyards, cotton, orchards, and dry native scrub dominate the landscape in the southern end of the valley, while rice and orchards are the dominant crops in the northern end of the valley.

An analysis of historical records and egg collection locations found that the current number and range of Swainson's hawk in California had been reduced drastically from its historical distribution. Bloom (1980) estimated the statewide historical population to be between 4,284 to 17,136 breeding pairs. As a result of human influences on foraging and nesting habitat, drastic declines of Swainson's hawk in California and the far western states began in the 1930's, accelerated through the 1940's, the 1950's; and into the early 1960's (Grinnell and Miller 1944; Small 1994). In the 1970's and 1980's, the California population remained at a fairly constant but diminished level, with sporadic migratory flocks of 100 to 300 still occasionally reported (Small 1994). The 1979 statewide survey estimated only 375 breeding pairs in California, with 280 of the breeding pairs within the Central Valley (Bloom 1980). Bloom (1980) estimated the 1997 population of 375 pairs represented a minimum 91% decline in California breeding pairs over an approximate 100 year period. This decline in Swainson's hawk breeding pairs is strongly correlated with the decline of grassland acres within California over this same period (see Sections 2.3 and 2.5.1 above). The loss of foraging habitat is recognized as the primary threat to the Swainson's hawk statewide population, but the loss of nesting habitat due to urbanization and agriculture drainage is also a factor (CDFW 2016). However, the Swainson's hawk Technical Advisory Committee (2000) estimated that as many as 900 pairs nest in the Central Valley, which could mean that the downward trend may have abated. Nonetheless, it is not possible to arrive at an accurate number without comprehensive surveys, and estimates of an increasing population trend must be verified with long-term data on populations and reproduction (Sauer et al. 2017; SSHCP Appendix B).

Swainson's hawk suitable nesting habitat is predominately tall, mature trees in riparian cover. As discussed in Section 2.6.1 above, between 94 to 98.5 percent of the historical riparian communities once in the Central Valley have been removed, and the majority of the remaining riparian habitat in the Central Valley is disturbed, degraded, or otherwise impacted by human activities (Smith F. 1977; Katibah 1981). Loss of riparian habitat is one of the factors contributing to the Swainson's hawk decline in the Central Valley (Bloom 1980; England et al. 1995).

Swainson's hawk nest trees are typically the tallest trees in a riparian strip or stand, and situated at the edges of stands and forests. However, lone trees, oak woodlands, and roadside trees are also commonly used (England et al. 1995; Estep 1989; Bloom 1980; CDFW 2016). A lookout-perch that affords a good vantage of potential threats or hunting opportunities in the surrounding area is a necessary component of a nest territory. Such a perch can often be in a tree that is not the nest tree (Wilkinson and Levy 1993; England et al. 1995). Swainson's hawks usually nest in large native trees such as valley oak (Quercus lobata), cottonwood (Populus fremontii), walnut (Juglans sp.), and large willow (Salix sp.) and generally do not utilize nonnative trees. Nest sites are always associated with high-quality foraging habitat. Selection of a poor nest site can be a factor in nesting failure, and competition exists for nest sites (Estep 1989). Reproductive success for the Swainson's hawk is directly correlated to the adults' ability to capture and deliver sufficient prey to successfully fledge young from the nest. Key components in this success involve prey densities, prey availability, and foraging distance to the nest site (Final SSHCP Appendix B).

The overall size of a nesting territory can vary substantially from year to year. Agricultural crop patterns directly influence the minimum foraging area for the Swainson's hawk (CDFW 2016). Home ranges for nesting Swainson's hawk throughout the Central Valley have been found to vary between 6,821 and 8,069 acres, although one study from the Butte Valley revealed a much smaller home range of about 1,000 acres (CDFW 2016). These large-sized home ranges are due to the fact that the best agricultural foraging habitats are fragmented. Estep (1989) and Babcock (1995) both observed Swainson's hawk home ranges to expand to include distant agricultural foraging areas when prey availability became superior at more distant locations. During periods of low prey availability, radio-tagged male Swainson's hawks were recorded to travel as far as 17 miles (Estep 1989) and 18 miles (Babcock 1995) from a nest to exploit more favorable agricultural foraging opportunities. Swainson's hawk dependence on agricultural land-use patterns presents a vulnerability to the Swainson's hawk population in the Central Valley, as an increasing amount of agricultural production involves the cultivation of vineyards, and orchards, and non-compatible crops (CDFW 2016).

The Swainson's hawk is considered to be largely insectivorous, especially in wintering areas. Locusts, grasshoppers, dragonflies, crickets, grubs, etc. are the major staple of the Swainson's hawk's diet (Palmer 1988; England et al. 1997). However, breeding Swainson's hawks switch to vertebrate prey due to the energetic demands of reproduction (C. Johnson et al. 1987). Estep (1989) found that California vole was the single most important prey item in his study areas in Yolo, Sacramento and San Joaquin counties. Eight species of small mammals were found among prey remains and regurgitated pellets, with the California vole (*Microtus californicus*) comprising 69.2 percent of all mammalian prey. Birds also represented a significant dietary component as well, with at least 15 different species found (including juvenile ducks and pheasants). Other species taken include Pacific gopher snake (*Pituophis catenifer*), western toad (*Bufo boreas*), crayfish species (*Pacifastacus* spp; *Procambarus* spp.), and numerous insects (mostly grasshoppers and crickets). Overall, Swainson's hawk is an opportunistic hunter that can take a variety of vertebrate prey depending upon the prey's availability in a given region, but the California vole is clearly the most important prey species of Swainson's hawks in the Central Valley (England et al. 1995; Estep 1989; Swolgaard 2004).

The Swainson's hawk takes much of its prey while foraging on the wing over open country. They snatch locusts and dragonflies out of the air with their talons and transfer the prey to their beaks while on the wing. Vertebrate prey is captured usually by descending upon the targeted animal from the air. Besides soaring over open country looking for available prey, Swainson's hawks also commonly stand on the ground and wait for a burrowing animal such as a gopher to reappear at the surface to pounce upon it (Bechard 1980; Bechard 1982; Bechard 1983). They also run after grasshoppers, crickets, and other prey (Bloom 1980; C. Johnson et al. 1987; Estep 1989).

Swainson's hawk is also well known for foraging in agricultural fields where mowing, harvesting, plowing, irrigation flooding, or wildfire is displacing small rodents, insects, and birds. These activities make prey available to predation by dislodging them or reducing their cover. Estep (1989) found that 12 radio-tagged Swainson's hawks spent 52.8 percent of their observed foraging time hunting in response to these agricultural activities. Swainson's hawks appear to look for and to key on these events knowing that they will produce available prey (Estep 1989).

In study plots in Sacramento, Yolo, and San Joaquin Counties, Estep (1989) analyzed agricultural habitats used between May and September. He then ranked Swainson's hawk agricultural foraging habitats in this descending order of importance: alfalfa, disked field, fallow field, dry-land pasture (aka Valley Grassland), beets, tomatoes, irrigated pasture, grains, and other row crops. Alfalfa is generally associated with the dairy industry. The process of harvesting alfalfa occurs four to seven times a year. The entire field is mowed and the cut hay is left to dry in a row. It is turned over on another day for further drying and on a later day, it is baled and removed. The field is then flood-irrigated and the whole process is repeated. Each of these activities provides a foraging opportunity for Swainson's Hawks. Alfalfa often stays in place for several years (three to seven years). This allows the population of voles and gophers to increase as the field becomes well established.

Disked fields are fields in a temporary state of dormancy and are between crops. Estep (1989) ranked disked fields highly because it was a daily activity for some Swainson's hawks to spend time running down grasshoppers and crickets in these fields. Fallow fields typically have significant weedy vegetation and therefore also have significant rodent populations. Dry pasture is annual grasses in the Valley Grasslands landcover, and is grazed by cattle during some part of the year. A large portion of the Swainson's hawk's historical habitat is believed to be similar to this current habitat, although the prey species, their abundance, and availability are likely quite different today because introduced grasses and forbs and introduced grazers now dominate these grassland landscapes (Estep 1989).

Sugar beets and tomatoes have been observed as Swainson's hawk foraging habitat, but only for a short time when they are being harvested. Sugar beets are an important foraging habitat for Swainson's hawks because they could be harvested at different times of the year, resulting in staggered availability throughout the nesting season. However, sugar beets no longer in production in Sacramento County. Tomatoes are harvested beginning in late July, and are an important foraging habitats for fledglings and pre-migratory adults (Final SSHCP Appendix B). Irrigated pasture is used for foraging when the pasture is being irrigated (Estep 1989), and when vegetative cover was is very low (grazed) (Swolgaard 2004).

Grains fields studied by Estep (1989) and Swolgaard (2004) included wheat, oats, and rice. Both Estep (1989) and Swolgaard (2004) observed limited foraging in wheat fields, which occurred during or immediately after harvest, and Estep found relatively low numbers of house mouse and deer mouse in wheat fields. Estep (1989) observed no foraging in rice fields. Corn and sunflower are the main component of "other row crops." Estep (1989) considered that the low preference for foraging in these crops is a feature of these crops' attaining a vegetative height that excludes Swainson's hawks Swolgaard (2004) also observed a low preference for foraging in these habitats. Estep trapped relatively low numbers of deer mouse in cornfields in early summer. However, as in other agricultural habitats, rodent populations build up during the growing season in cornfields. During the beginning of harvest, in September and early October, just prior to southern migration, Swainson's hawks take advantage of the foraging opportunity that corn harvesting offers (Herzog 1996; Holt pers. obs.). Therefore, corn and sunflower crops have some limited value to foraging Swainson's hawks. Also, when taken in combination with other foraging habitats that are rotated on a regular basis (wheat, oats, hay, tomatoes, alfalfa, disked field, etc.), the value of corn and sunflower acquires some added value as a piece in the over-all mosaic of suitable foraging habitats. The common agricultural crops in the Central Valley that are not thought to provide much, if any, foraging opportunities for Swainson's hawks include safflower, orchards, cotton, vineyards, and rice (Bloom 1980; Estep 1989; England et al. 1995; Babcock 1995).

In the Central Valley, Swainson's hawks arrive at nesting territories from mid-February to the first week in April. Mated pairs are largely reported to establish nesting territories that are in the same general area from where they were hatched (Woodbridge et al. 1995a; Gilmer and Stewart 1984; Bechard 1980; Bechard 1983). Pairs are monogamous and can remain together for many years (England et al. 1997). Site tenacity is evident, as the same individuals will return year after year to the same nesting territory (England et al. 1997). Nest building takes one to two weeks (Fitzner 1980). Eggs are laid April to mid-May and the incubation period is 34 to 35 days (Fitzner 1980). Chicks hatch asynchronously. The first chick is able to beg for food earlier than the younger chicks and therefore, gains extra strength so that in those years when food resources are short, the available supply will go only to the older chick(s). This strategy ensures the survival of the largest number of offspring that the food resources will allow when the abundance of food for chicks cannot be predicted at the time when eggs are laid. With asynchronous hatching, the smallest chick will survive only in years of abundant resources. Chicks develop in the nest for 27 to 33 days (Fitzner 1980) before they are able to walk onto nearby limbs (branching). First flight (fledging) takes place between 38 to 46 days (Fitzner 1980). For the first seven to 10 days after first flight the young stay in or near the nest (Fitzner 1980). The parents continue to feed the young for one month (Fitzner 1980). After that, the fledglings range widely in search of prey, covering up to one hundred miles in a day and associate in loose groups with other Swainson's hawk fledglings. The pair bond and parental bonds are then relinquished, and adults and juveniles migrate separately in autumn (Woodbridge et al. 1995b; Bradbury et al. in prep).

When fledglings no longer are dependent upon adults, Swainson's hawk adults become gregarious and nomadic. Nesting territories and local foraging areas are no longer defended. Large flocks of Swainson's hawks join together and range widely in pursuit of prey. They roost communally in trees at night. These flocks are loose associations joined primarily to exploit a common prey source. Communal foraging is observed when agricultural fields such as alfalfa undergo some form of cutting or harvesting (Babcock 1995).

Swainson's hawks remain gregarious and nomadic throughout the entire non-nesting period (C. Johnson et al. 1987).

2.7.1.6 Status of Northern Harrier

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

Breeding populations of northern harrier occur throughout most of Canada and Alaska; central, coastal, and southwestern California into the Baja Peninsula of Mexico; and the west-central and northeastern United States (MacWhirter and Bildstein 1996). In California, northern harriers historically bred throughout the state except in deserts, woodlands, and forested mountains above 3,600 feet. Breeding populations were probably concentrated in most of the Central Valley, Sacramento-San Joaquin River Delta, Suisun Marsh, and portions of the San Francisco Bay (Zeiner et al. 1990). The northern harrier's present California breeding range is similar to its historical distribution; however, extensive population declines continue as a result of habitat loss (Remsen 1978; Martin 1989; MacWhirter and Bildstein 1996; CPIF 2000). The northern harrier is a year-round resident of the California Central Valley (Zeiner et al. 1990; MacWhirter and Bildstein 1996).

The breeding season for Northern harrier is generally late March through mid-September. Northern harriers are primarily monogamous. Males arrive on the breeding grounds before females, typically in March or April. Courtship and pair formation occurs on the breeding grounds, usually in March or April, followed by nest site selection and nest construction. Adult northern harriers are primarily nomadic and exhibit low fidelity to breeding sites. When northern harriers do return to general nesting areas over consecutive years, they usually do not return to the same specific nest site (Hamerstrom 1969; Burke 1979; MacWhirter 1985; Hamerstrom 1986; MacWhirter and Bildstein 1996).

Northern harriers nest on the ground in open, vegetated habitats such as grasslands, emergent wetlands, lightly grazed pastures, and agricultural fields. Nests are typically built in dense, tall vegetation in areas that are undisturbed and are often wet areas. Western populations of northern harriers tend to use upland habitats (e.g., grasslands) disproportionately over wetlands, but in most nesting habitats, including dry uplands, a disproportionate number of nests are located in wet sites (Simmons and Smith 1985; Martin 1987; Grant et al. 1991). Where northern harriers nest in agricultural lands, practices such as mowing, haying, and disking during the nesting cycle cause nest destruction and these lands can function as population sinks (MacWhirter and Bildstein 1996). Without landowner commitments to avoid nest destruction, the attractiveness of some croplands to northern harriers early in the nesting period can significantly threaten regional population dynamics, particularly in the Central Valley where agricultural lands are abundant.

Egg-laying can occur in early April through July. The female incubates the eggs for 30 to 32 days, while the male delivers food to the female. Hatching usually occurs from April through June. Fledging occurs 30 to 35 days later. Both parents feed the young (Hamerstrom et al. 1985; Ehrlich et al. 1988). Fledged juveniles remain near the nest site and are fed by the parents for approximately 2–4 weeks, when the family group disperses (Bildstein 1992; MacWhirter 1994; MacWhirter and Bildstein 1996). In a Sacramento Valley, San Joaquin Valley, Suisun Marsh, and northeastern California study, nest success was 18 percent, 28 percent, 21 percent, and 16 percent, respectively

(CPIF 2000). Adult northern harriers are primarily nomadic and exhibit low fidelity to breeding sites. Northern harriers winter throughout California where suitable habitat occurs. Wintering habitat includes open areas dominated by herbaceous vegetation, including grasslands, pastures, croplands, coastal sand dunes, brackish and freshwater marsh, and estuaries (Grinnel and Miller 1944; Martin 1987; MacWhirter and Bildstein 1996).

In California, northern harriers primarily eat voles (*Microtus* spp,). Bernard et al. (1987) found that passerine birds constituted the second most important prey group for nesting northern harriers, especially blackbirds (red-winged blackbird and yellow-headed blackbird), and particularly nestlings and fledglings. Other important prey items were leporids (hares and rabbits), quail, and finches (Selleck and Glading 1943). They also eat small reptiles, amphibians, and some insects (e.g., grasshoppers, beetles, crickets, and locusts) (MacWhirter and Bildstein 1996).

Northern harriers hunt while flying and "patrolling" low above open ground. Harriers make low, quartering flights three to 30 feet (one to nine meters) above ground. Foraging individuals typically dive from flight and pounce on prey. Some agricultural lands also provide high-quality foraging habitat for northern harrier. Agricultural lands that are suitable for foraging are those that support abundant rodent populations (e.g., alfalfa and irrigated pasture). Northern harriers are generally opportunistic predators, and commonly shift their diets within a breeding season in response to prey availability and changes in local vegetation structure (MacWhirter 1985; Barnard et al. 1987). For example, Martin (1987) reported that northern harriers foraging in alfalfa fields preyed primarily on voles until vegetation height reached 18 inches (46 centimeters). Thereafter, harriers abandoned alfalfa and preyed on passerines and reptiles. After the alfalfa was cut, northern harriers switched their diet back to voles.

During the breeding season, reported average home range sizes from eight studies were 420.1 to 37,066.5 acres; while the median size was approximately 643 acres (Toland 1985; Martin 1987; Serrentino 1987). Females tend to hunt closer to the nest, and maintain smaller home ranges, than males (Martin 1987; Temeles 1987; MacWhirter and Bildstein 1996). Males reportedly will hunt 6 miles or more from the nest (Barnard 1983, Thompson-Hanson 1984). As the nestling period progresses, males and females can increase their home range by a factor of 2.5 or greater (MacWhirter and Bildstein 1996).

Most aspects of northern harrier's population ecology are closely linked to prey availability (CPIF 2000). Rodent populations often experience population cycles between years. Because small mammals (e.g., voles) typically comprise the majority of the harrier's diet during the breeding season, northern harrier populations are sensitive to these cycles. For example, Northern harriers will increase nest densities, clutch sizes, nest success rates, and frequency of polygyny during peaks in in rodent cycles (Hamerstrom et al. 1985; Simmons et al. 1986; MacWhirter and Bildstein 1996).

2.7.1.7 Status of White-tailed Kite

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The white-tailed kite is a resident of the California Central Valley and lowland coastal California (Polite 2005). In all, California comprises the core of the white-tailed kite's breeding range (Dunk

1995). A few instances of breeding have been documented in Oregon and Washington. The white-tailed kite also nests in southern Texas, and small nesting populations can be found in Florida. Outside the United States, white-tailed kites are found along the coastal areas of Mexico and Panama (Dunk 1995).

White-tailed kite populations have fluctuated greatly over the past century. This species was common and widespread in the Central Valley and foothills before 1895 but was rare or entirely gone from many areas by the 1940's. The declines in California populations during this period have been attributed to a combination of habitat loss, shooting (kites were considered a pest species), and possibly egg collecting (Waian and Stendell 1970). From the 1940's to the early 1980's California populations increased dramatically and their range expanded greatly (Waian and Stendell 1970; Dunk 1995), likely to reduced hunting, increased agricultural irrigation, and corresponding increases in prey populations in agricultural areas. However, since the early 1980's, white-tailed kite populations have steadily decreased again throughout much of their range in California. Increased habitat fragmentation due to urbanization, along with large increases in agricultural crops that provide little habitat for prey-species, are thought to be the principal causes of current declines (Dunk 1995; Sauer et al. 2017).

Both nesting and foraging habitat for white-tailed kites has been lost to urbanization or converted to agricultural crops that do not support prey species or that are used for foraging. DeHaven (2000) quantified changes in California cropping patterns and found that white-tailed kite "friendly" habitats such as rangelands, grassland, and pastures have decreased. These habitats have been replaced by a variety of other crops (e.g. orchards, cotton, and vineyards) that are not used by white-tailed kites, or by crops (e.g., vegetables and melons, tomatoes, beans, potatoes) that are lower quality habitats for foraging white-tailed kites.

White-tailed kites inhabit open grasslands, savanna-like habitats, oak woodlands, agricultural areas, and riparian areas (Dunk 1995). Most nests in the Sacramento Valley are found in riparian forests, valley oak woodlands, or other groups of trees that are usually associated with compatible agricultural foraging habitat, such as pasture and hay crops, compatible row and grain crops, or natural vegetation such as seasonal wetlands and annual grasslands (Erichsen 1995). They usually nest in trees with a dense canopy, but nest trees can vary from single, isolated trees to trees within large woodlands. Factors that influence nest site selection and nesting distribution include habitat structure and the availability and abundance of prey (Dixon et al. 1957; Erichsen 1995). Most nests in the Sacramento Valley are found in riparian forests, valley oak woodlands, or other groups of trees that are usually associated with compatible agricultural foraging habitat, such as pasture and hay crops, compatible row and grain crops, or natural vegetation such as seasonal wetlands and annual grasslands (Erichsen 1995).

The breeding season from pair bonding to juvenile independence occurs from approximately January to October with peak activity occurring from May through August (Dunk 1995). Pairs select nest sites and build stick nests in trees. Nests are primarily composed of small twigs, and lined with leaves, grass, or hay, and can take as long as 28 days to build (Dixon et al. 1957). Females incubate eggs exclusively and receive prey from the male over a 28-day incubation period (Dixon et al. 1957; Dunk 1995). Males continue to deliver prey to female when young hatch, although only female feeds prey to young (Dixon et al. 1957). Young fledge around four to five weeks after hatching (Waian 1973). Within two months of fledging, immature white-tailed kites are known to establish and hold territories (Dunk 1995).

Territory size is variable and regulated primarily by prey abundance and vegetation structure (Dunk 1995; Erichsen 1995). White-tailed kites are strongly correlated with the presence of voles (Stendell 1972). White-tailed kites forage in undisturbed, open grasslands, meadows, farmlands, emergent wetlands and fence rows (Dunk 1995). Cover types that appear to be preferred include alfalfa and other hay crops, irrigated pastures, and some cultivated habitats, particularly sugar beets and tomatoes, both of which can support relatively large populations of voles and which have been highly correlated with kite nest site densities (Estep 1989, Erichsen et al. 1994). Kites also forage in dry pastures, annual grasslands, rice stubble fields, and occasionally in orchards (Erichsen 1995).White-tailed kites generally hunt from a central perch over areas as large as 741 acres (Warner and Rudd 1975), but foraging usually occurs within 0.5 miles from the nest during the breeding season (Hawbecker 1942).

White-tailed kites hunt almost exclusively by hovering from 5 to 25 meters in height, with hovering bouts lasting up to 60 seconds. During this time, kites scan the ground searching for prey and watching for potential competitors or predators. The hovering bout ends in a dive to the ground for prey; flight to another location; soaring or interacting with another bird; or flight to the perch (Warner and Rudd 1975). The white-tailed kite preys mostly on voles, but also takes other small mammals, and occasionally birds, insects, reptiles, and amphibians. Small mammal prey comprises 95 percent of the kite diet (Dunk 1995).

The occurrence and abundance of white-tailed kites during the breeding and non-breeding seasons are strongly affected by the dynamics of local rodent prey populations. Because rodent population cycles are often irruptive, and kite populations are sensitive to the availability of rodent prey, the suitability of an area and its occupancy by white-tailed kites may vary during certain years.

2.7.1.8 Status of Greater Sandhill Crane

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

Greater sandhill cranes nest in southeastern Manitoba; northwestern Minnesota, the Rocky Mountain states; northeastern Nevada; southern British Columbia; southwestern Washington; central, eastern, and southeastern Oregon; and the Great Basin portion of northeastern California. In California, greater sandhill cranes nest in Lassen, Modoc, Plumas, Shasta, Sierra, and Siskiyou Counties (Littlefield 1989; CDFG 1997). Market hunting between 1880 and 1915 has been cited as having a severe impact on the greater sandhill crane population (Littlefield and Ivey 2000). In the 1920's, Dawson (1923, in Littlefield and Ivey 2000) reported there were no more than six nesting pairs left in California. Two decades later, in 1944, Walkinshaw (1949 in Littlefield and Ivey 2000) estimated only three to five nesting pairs in California. In 1988, 276 pairs were reported and by 2000, 465 pairs were recorded at 127 sites (i.e., an increase of 68 percent).

Greater sandhill cranes are migratory and leave their northern breeding areas in mid-September. Cranes migrate in small groups (20 to 50 individuals) composed of pairs and family groups. By late October, most of the greater sandhill cranes have left their northern breeding or staging areas and have arrived on the wintering grounds. Once on the wintering grounds, greater sandhill cranes use traditional areas throughout the winter. Migration back to the breeding areas starts in February and is completed by mid-March (Ivey and Herziger 2003). Migrating pairs and family groups consistently return to breeding areas and wintering sites if habitat conditions are suitable. Juveniles remain with adults during the first year in family groups, and juveniles do not disperse until they return to the breeding areas the following year (Tacha et al. 1992). Pairs of greater sandhill crane are known to live 20 years or more (Tacha et al. 1992).

Wintering sandhill cranes are found in the southern United States (Georgia and Florida, the Texas Gulf Coast, New Mexico, southeastern Arizona), northern Mexico, southeastern California, and the Central Valley of California. In California, greater sandhill cranes winter in southern Imperial County, Lake Havasu NWR, and the Colorado River Indian Reserve, and Central Valley, including the Sacramento-San Joaquin River Delta (the Delta) (Zeiner et al. 1990).

Wintering greater sandhill cranes occur in limited locations in the California Central Valley. A winter Central Valley population estimate of 8,500 individuals was reported in January 1993. Of this estimate, 61 percent were using the Butte Basin, while the other two major wintering areas were the Cosumnes River Floodplain and the Delta. In the mid-1980's, crane biologists believed 61 percent of the California wintering greater sandhill cranes were found in the Delta, but the number of greater sandhill cranes using the Cosumnes Floodplain increased to 23 percent (1,380 individuals) in 1984 (Littlefield and Ivey 2000). No recent detailed winter estimates are available for the Cosumnes River Floodplain, but Ivey (pers. comm.) estimated that around 1,000 individuals used the Cosumnes River Floodplain area during the 2002/2003 winter, while approximately 1,500 were documented using nearby Staten Island. Apparently, use of the Cosumnes River Floodplain increases during flood years (Pogson 1990).

Wintering sandhill cranes forage on a variety of food items by probing with their bills and gleaning food on the ground surface. They are considered omnivorous and have been reported to feed on cultivated grains, small mammals, insects, snails, reptiles, amphibians, and seeds. They also hunt for mice in taller grassland vegetation, but they appear to avoid grassland habitats when vegetation exceeds 10 inches (Littlefield and Ivey 2000).

Studies by Ivey and Herziger (2003) show that within the Communes River floodplain and adjacent Delta sites, wintering greater sandhill cranes feed in a variety of agriculture crop types, however, food items consumed in the study were not documented. Fields used for foraging included pastures, alfalfa, corn (chopped, disked, flooded, and stubble), tomatoes (flooded, ripped), and wheat (disked, ripped, flooded, stubble) (Ivey and Herziger 2003). In order of importance, Ivey rated agriculture rice and corn fields the highest, followed by winter wheat, and irrigated pasture. Alfalfa was the next highest rated crop, followed by hay, dryland pasture, and row crops. Sandhill cranes used these crop fields even though the crops had been harvested from the fields. However, allowing the crops to mature without harvesting (e.g., corn) serve as food plots for cranes and have been successful in attracting cranes to refuges (Littlefield and Ivey 2000). Habitats also important for greater sandhill cranes include flooded fields for roosting, and rocky uplands or gravel roads for collecting grit. Collection of grit by cranes is especially important when their diet is composed of grain seeds. Grit collected in dirt and gravel roads can be essential when none is available near foraging sites. Sandhill cranes in Sutter County have been reported flying up to five miles (eight kilometers) to obtain grit (Littlefield and Ivey 2000).

Winter home ranges of greater sandhill cranes using the Staten Island area averaged 0.66 square miles, varying from 0.07-2.12 square miles. Cranes using other areas (e.g., Tyler Island, Cosumnes River Floodplain) were found to not travel far during winter (Ivey and Herziger 2003). Average linear distances greater sandhill cranes traveled between daytime foraging areas and nighttime roost sites were found to be 0.88 mile (range 0.17-1.89 mile) by Ivey and Herziger (2003) and 1.74 miles by Pogson (1990).

Greater sandhill crane roosting areas are located in shallowly flooded areas where cranes loaf during the day and seek protection from terrestrial predators at night. Although they will select sites with emergent vegetation along the periphery of the wetland, they rarely use roosts with heavy emergent vegetation (Littlefield and Ivey 2000). Size and depth of roost sites are variable. Sandhill cranes roosting in Oregon used sites between 1 to 300 acres, with water depths averaging 4.5 inches. Littlefield (1993) reported cranes abandoning roost sites when water depths reached eight to 11 inches. He recommended roost sites should be at least 20 acres in size, with water maintained from early September to mid-March. Greater sandhill cranes generally use open areas without significant distances of fencing. Sandhill cranes run and flap when initiating flight and this behavior prevents them from gaining altitude quickly and avoiding fences.

Greater sandhill cranes do not tolerate regular disturbances, and human disturbance may play an important role in habitat selection. Ivey and Herziger (2003) found that aircraft, vehicles, hunting, and recreational activities (e.g., birding, walking, horseback riding, bicycling, boating) can cause cranes to run or fly away. When larger, more continuous tracks of lands are split and made smaller for other crops, vehicle traffic from farming operations often increases, and this increase in human activity negatively affects crane use. Cranes typically flush and are disturbed when automobiles approach within 300 feet. Ivey and Herziger (2003) also showed cranes are more tolerant to vehicles during mid-day compared to pre-dawn. Disturbance during pre-dawn hours, such as duck hunting activities, has caused cranes to leave roosts in darkness, increasing their risk for collisions with transmission lines or other obstructions. Only one pre-dawn disruption is usually necessary before cranes abandon a roosting site (Littlefield and Ivey 2000). Disturbance forces sandhill cranes to expend unnecessary energy that is needed for survival during winter and subsequent migration. Ivey and Herziger (2003) also found that cranes generally avoid suitable agricultural foraging habitat near occupied dwellings, and foraging areas within 300 feet of human structures should not be considered suitable.

Greater sandhill cranes are highly vulnerable to collisions with structures that interfere with flight takeoff (Pogson and Lindstedt 1988). Greater sandhill crane collisions with electrical distribution lines have been reported by several authors. These collisions typically occur in foggy or windy conditions and result in mortality (Tacha et al. 1978; Lewis 1974; Nesbitt and Gilbert 1976; Littlefield and Ivey 2000). Drewien (1973) found that collisions with power lines accounted for 37 percent of the observed sandhill crane mortality in his study population, while Pogson et al. (1988) concluded that power line collisions seem to be the largest source of unnatural mortality for California's Central Valley greater sandhill crane population. Limiting distribution lines in areas where sandhill cranes forage and roost during the breeding season is considered an effective means of minimizing mortality (Final SSHCP Appendix B).

2.7.1.9 Status of Loggerhead Shrike

The species is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The breeding range of loggerhead shrike included central Canada (Alberta, Saskatchewan, and Manitoba, most of the United States with the exception of the Pacific Northwest and most of the northeastern states; and most of Mexico. Northern populations of loggerhead shrike are migratory. Their winter distribution includes northern California, northern Nevada, northern Utah, central Colorado, Kansas, western Missouri, northern Kentucky, and northern Virginia south through the southern United States and Mexico (Yosef 1996). In California, loggerhead shrike is a year-round resident throughout the foothill and lowland regions in the Central Valley and southern portion of the state (Zeiner et al. 1990). The Central Valley may have historically functioned as a core area for interior populations of loggerhead shrike in California.

Loggerhead shrikes occur in dry, open habitats including grasslands, pastures with fence rows, agricultural fields, open woodlands (savannahs), scrub, and riparian areas. Suitable breeding habitat has the following characteristics: 1) short, sparse vegetation; 2) scattered or isolated low trees or large shrubs for nest sites; and 3) available hunting perches with an open view (Yosef 1996; Cade and Woods 1997). Loggerhead shrikes typically avoid completely treeless and shrubless areas (Cade and Woods 1997), as well as urbanized and densely wooded areas (Grinnell and Miller 1944). In the winter, loggerhead shrikes also forage in idle pastures and hayfields (Bartgis 1992). Loggerhead shrikes may also forage in areas where vegetation is tall and dense, although these areas are considered suboptimal (Yosef and Grubb 1993).

Hunting perches are especially important for loggerhead shrike foraging. Loggerhead shrikes hunt from perches such as fences, shrubs, trees, utility lines, and poles, hunting perches are especially important for loggerhead shrike foraging. In many areas, loggerhead shrike abundance is correlated with the amount of pastureland and available perches (Brooks and Temple 1990; Yosef and Grubb 1994). Yosef and Grubb (1994) found that productivity increased and territory size decreased in territories where perches were added compared to control sites. The authors concluded that habitats managed for loggerhead shrikes should include abundant hunting perches, as well as an adequate prey base and nest sites.

Loggerhead shrikes eat small to medium-sized animal matter, including arthropods, birds, amphibians, reptiles, and small mammals. They also eat roadkill and carrion. A loggerhead shrike is able to carry prey as heavy as its own mass with its feet, and carries smaller items in its bill. Shrikes kill their vertebrate prey by attacking the nape and tearing the cerebral vertebrae. They often impale their prey on barbed wire and other sharp objects (Yosef 1996). However, Shrikes forage primarily on large ground-dwelling insects that require little to no water (Miller and Stebbins 1964).

Loggerhead shrikes are territorial, and are aggressive during the breeding season. They maintain relatively large territories, and all activities associated with reproduction (i.e., mating, foraging, and brooding) occur within the territory. In California, the average size of territories averaged 21 acres and ranged between 11 acres and 40 acres (Yosef 1996). In central California, members of a pair are known to defend adjoining territories during the non-breeding season, and then defend a single nesting territory comprised of the adjoining winter territories during the breeding season (Lefranc 1997). Banding studies indicate that adult loggerhead shrikes exhibit site fidelity. In California, the return rate of adults to breeding sites is between 30 to 90 percent (Yosef 1996). After fledging, juvenile shrikes disperse widely.

The breeding season for loggerhead shrike generally begins in late January or early February, and extends to July. Non-migratory shrikes remain paired during the winter in California. Territory establishment probably begins between February and March. Nest construction lasts approximately six to 11 days. Loggerhead shrikes build open cup nests, placing them in well-hidden microsites on a tree or shrub. Eggs are typically laid between March and June. Females normally lay five to six eggs and incubate for 15 to 17 days. During the nestling period, the male provides the brooding female with food and participates in nest sanitation (e.g., removing fecal matter and regurgitated pellets). The female usually feeds the nestlings until they fledge at 16 to 20 days after hatching; however, the male will feed the nestlings if the female is absent from the nest for extended periods (Yosef 1996).

Prior to nesting, loggerhead shrikes are known to engage in "group meetings," where shrikes with neighboring territories convene to call and display. This behavior is thought to facilitate familiarity among neighboring territorial shrikes and minimize agonistic behavior among them during breeding activities. Shrikes interact with, and appear to dominate, many bird species that share their habitat (Yosef 1996).

Nest predators have included feral cats, black-billed magpies (*Pica hudsonia*), weasels (*Mustela* spp.), raccoons, and snakes. Potential nest predators are often mobbed by shrikes. These species include American crow (*Corvus brachyrhynchos*), red-tailed hawk (*Buteo jamaicensis*), and northern harrier (Yosef 1996).

2.7.2 Environmental Baseline of the Avian Covered Species

Historically, mature trees in the wide riparian areas and mature trees in the oak savannahs and oak woodlands of the Action Area would have provided seasonal nesting, perching, sheltering, or foraging habitats for most avian Covered Species, especially Cooper's hawk, Swainson's hawk, white-tailed kite, and loggerhead shrike. As discussed in Sections 2.3.2, 2.5.4, and 2.6.2 above, very little riparian or woodland habitat remains in the UDA portion of the Action Area. Relatively narrow bands of riparian habitat are present along the major waterways in the Action Area (e.g. the Consumes River, Deer Creek, and Snodgrass Slough). In addition, the Action Area includes approximately 640 acres of the anthropogenic Mine Tailing Riparian Woodland landcover (Final SSHCP Figure 3-1). As discussed above, much of the Action Area's pre-settlement Blue Oak Woodlands and Blue Oak Savanna remain, located along the eastern border of the Action Area. The current conditions of the riparian and woodland landcovers in the Action Area and the factors responsible for those conditions were discussed in sections above, and are not repeated here.

The intact landscapes of Valley Grassland remaining in the Action Area (see Sections 2.3.2, 2.3.5, and 2.5.2 above) provide important foraging habitat for nearly all of the avian Covered Species (tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, and loggerhead shrike). The current conditions of the grasslands in the Action Area and the factors responsible for those conditions were discussed in sections above, and are not repeated here.

The Action Area's Valley Grasslands have abundant populations of voles, ground squirrels, and other small mammals, as well as grasshoppers, dragonflies, crickets, and other insect prey. Within the Action Area's vernal pool Valley Grasslands, these avian species forage over the seasonally dry vernal pools, swales, and seasonal wetlands and drainages, as well as the Valley Grassland uplands. Small rodents are important prey for raptors, including Swainson's hawk, northern harrier, and white-tailed kite. Western burrowing owls consume a mix of insects, small rodents, arthropods, and other small animals. Loggerhead shrikes primarily prey on ground-dwelling insects but also take small rodents. Swainson's hawks switch to a diet of insects after the breeding season. Tricolored blackbird forages on invertebrates during the nesting season and plant material during the non-nesting season.

As discussed in Section 2.3.5 above, much of the western and southwestern portions of the Action Area are currently Cropland and Irrigated Pasture. An important ecological function of Cropland in the Action Area is to provide rodent and insect prey and plant material forage for a number of the avian Covered Species. Within the Irrigated Pasture-Grassland landcover, alfalfa fields provide by far the most productive foraging habitat for many of the raptor Covered Species especially Swainson's hawk, white-tailed kite, and northern harrier, but are also used by the greater sandhill crane and tricolored blackbird. As a perennial crop grown for several years before removal and replacement, alfalfa provides good cover for rodents and provides time for establishment of a good prey base. Farming operations during the alfalfa growing season consist of periodic flood irrigation, and haying/mowing four to six times. Both types of operations result in temporary increases in prey availability. Alfalfa and Irrigated Pasture is suitable tricolored blackbird foraging habitat if it is within two miles of a colony nesting site. Greater sandhill crane is a winter visitor to the Action Area and uses Irrigated Pasture, Cropland, and Grassland for roosting and foraging (Table 3-2 above).

Orchards are scattered throughout the Action Area, with the largest concentration along the western boundary of the Action Area (Final SSHCP Figure 3-1). The Orchard landcover has limited wildlife habitat value, but provides perches for raptors foraging in adjacent Cropland and Valley Grassland. In particular, larger nut trees and other trees at these edge areas may be used by "sight predators" such as Swainson's hawk for perches to find prey in adjacent fields. The Action Area's 26,460 acres of the Vineyard landcover has no habitat value for any of the avian Covered Species.

As stated in the Final SSHCP (pages 5-3, 6-32, 6-55), several properties within the UDA portion of the Action Area have already obtained local entitlements and have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations from the CDFW, the Service, and the USACE. These UDA properties total 21,413 acres, and include several small lots in PPU-8, several small lots located west of Excelsior Road (PPU-3 and PPU-4), properties in the Rio Del Oro Specific Plan area (PPU-1), properties in the Sunridge Specific Plan area (PPU-1), and properties within the Mather Field Specific Plan area (PPU-2). These properties are part of the 317,656-acre Action Area. However, because planned urban development on these properties have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations, these properties were not included in the SSHCP Chapter 6 effects analyses. Where planned urban development has already obtained (or is close to obtaining) ESA authorizations, this Opinion addresses the authorized loss of habitat and loss of species individuals as part of the Environmental Baseline of each avian Covered Species.

2.7.2.1 Cooper's Hawk Environmental Baseline

Cooper's hawk is uncommon but widely distributed in the Action Area. The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 20 sites where Cooper's hawk has been documented within the Action Area (Final SSHCP Table 3-6). Seven of the documented occurrences are within the UDA and 13 documented occurrences are outside of the UDA. SSHCP Figure 3-20 shows the documented locations of Cooper's hawk in the Action Area. However, most of the Action Area has not been surveyed for Cooper's hawk and the number of individuals and overall distribution in the Action Area is not known.

The vegetation communities preferred by nesting Cooper's hawks (oak woodlands and riparian woodlands) are well-represented in the Action Area, particularly in the eastern half of the Action Area. Due to the limited survey data and the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. The SSHCP landcovers that provide suitable foraging and nesting habitat based on life history description of Cooper's hawk include all areas of Blue Oak Woodland, Blue Oak Savanna, Mine Tailing Riparian Woodland, Mixed Riparian Woodland, and Mixed Riparian Scrub within the Action Area. Suitable nesting habitat is all Blue Oak Woodland, Mine Tailing Riparian Woodland, Mixed Riparian Woodland, and Mixed Riparian Scrub within the Action Area (Final SSHCP Table 3-2). The current conditions of the riparian landcovers remaining in the Action Area and the factors responsible for those conditions were discussed above in Sections 2.3 and 2.6.1, so are not repeated here.

The SSHCP identified 22,646 acres of Cooper's hawk modeled nesting and foraging habitat in the Action Area, including 9,132 acres of Blue Oak Woodland, 5785 acres of Mixed Riparian Woodlands, 5,637 acres of Blue Oak woodland, 5785 acres of Mixed Riparian Woodland; 1.451 acres of Mixed Riparian Scrub, and 641 acres of Mine Tailing Riparian. The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here. The majority of Cooper's hawk modeled habitat (21,923 acres) (97%) is located outside the UDA portions of the Action Area in riparian landcovers along the Consumes River, Deer Creek, and Snodgrass. SSHCP Figure 3-20 illustrates the location of Cooper's hawk modeled habitat in the Action Area.

2.7.2.2 Tricolored Blackbird Environmental Baseline

Observations and field studies of tricolored blackbirds have been ongoing in southern Sacramento County since 1991 as part of intensive, volunteer tricolored blackbird surveys throughout California (Cook 1999; Hamilton 2000; Meese 2014). Most Sacramento County tricolored blackbird colony records are within the approximately 400 square mile region bordered by U.S. Highway 50 to the north, U.S. Highway 99 to the west, and the Sacramento County line to the south and east (Final SSHCP Appendix B). This area includes most of the Action Area, except for the western halves of PPU-6 and PPU-4).

Between 1992 and 1994, an average of 22 active tricolored blackbird colonies was found in southern Sacramento County (Cook 1999). That number declined in 1997, 1998, and 1999 when the counts were 12, 11, and 9, respectively. Six formerly active colony sites were lost over this period, including a large colony of over 20,000 individuals in PPU-5 (Bozich Ranch), which was south of the county landfill property (Cook 1999). In addition, the number of individual birds in the Sacramento County nesting colonies also decreased over this period. For example, approximately 20,009 individuals were observed in the colony at Rancho-Seco in 1991, but only 2,400 individuals remained in 1999 (Final SSHCP Appendix B). The total number of tricolored blackbirds in Sacramento County also decreased over this period, from 86,142 birds in 1992 down to 16,671 birds in 1999. This decline in the number of breeding tricolored blackbirds in Sacramento County between 1992 and 1999 mirrored the species' state-wide population decline during that period. However, despite those declines, Sacramento County consistently supported 50 to 95 percent of the Sacramento Valley breeding population, and between 10 and 25 percent of the total statewide population during the 1992-1999 census years. In each of those census years, one or more of the state's 10 largest colonies was also located in southern Sacramento County (Cook 1996, 1999; Beedy and Hamilton 1997). In addition, the reproductive success of tricolored blackbird colonies in southern Sacramento County was consistently the highest of any region in the state during the 1992-1999 surveys (Cook 1999).

In a recent CDFW triennial Tricolored Blackbird Statewide Survey (2014) showed an increasing rate of decline in the total number of tricolored blackbirds in California since 2008, decreasing from 395,000 birds in 2008 to 145,000 birds in 2014, a 65% loss in numbers over 6 years (Meese 2014). However, unlike other regions in California, the number of tricolor blackbirds in the Sierra foothills region (Sacramento, Placer, Eldorado, Amador, and Calaveras counties) increased about 145% during the same 6-year interval (from about 22,500 birds to about 54,000 birds). In the Sierra foothills region, Sacramento County alone increased from 3,551 birds in 2008 to 29,272 birds in 2014. These numbers suggest either that (1) tricolors are moving into Sacramento County from other regions or (2) tricolors are breeding relatively more successfully in Sacramento County and the Sierra foothills region than they are in other regions of California (Meese 2014).

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 36 sites where tricolored blackbird have been documented as nesting or foraging in the Action Area (Final SSHCP Table 3-6). Twenty-two occurrences are within the UDA (three in PPU-2, 15 in PPU-3, one in PPU-4, and three that are not within a PPU), and fourteen occurrences are outside of the UDA (three in PPU-5, four in PPU-6, five in PPU-7, and two that are not within a PPU) (Final SSHCP Page 3-111). SSHCP Figure 3-26 illustrates the location of tricolored blackbird documented occurrences within the Action Area.

Due to the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. SSHCP landcovers that provide suitable habitat on the life history of tricolored blackbird include Cropland, Irrigated Pasture-Grassland, Valley Grassland, Vernal Pool, Seasonal Wetland, Swale, Freshwater Marsh, and Open Water (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

The SSHCP identified modeled foraging habitat for tricolored blackbird as all Cropland, Irrigated Pasture-Grassland, Valley Grassland, Vernal Pool, Seasonal Wetland, Swale, Freshwater Marsh, and Open Water present in the Action Area (Final SSHCP Table 3-2). SSHCP landcover mapping identified approximately 212,632 acres of tricolored blackbird foraging habitats in the Action Area, with approximately 41,231 acres of foraging habitat within the SSHCP UDAs, and 171,401 acres located outside the UDAs.

The SSHCP also identified modeled nesting habitat for tricolored blackbird as all Cropland, Valley Grassland, Seasonal Wetland, and Freshwater Marsh in the Action Area (Final SSHCP Table 3-2). SSHCP landcover mapping identified approximately 188,539 acres of tricolored blackbird nesting habitats in the Action Area, with approximately 36,380 acres of nesting habitat within the SSHCP UDAs, and approximately 152,159 acres located outside the UDAs. SSHCP Figure 3-26 illustrates the location of the total 212,632 aces of tricolored blackbird modeled habitat within the Action Area.

2.7.2.3 Western Burrowing Owl Environmental Baseline

Sacramento County and the Action Area are within the Middle California Central Valley portion of the species range. DeSante et al. (1996) estimated that the entire Central Valley supports approximately 14 percent of the total California burrowing owl population, with 79% of those birds found in the Middle Central Valley and the adjacent San Francisco Bay and Northern Central Valley areas combined. The burrowing owl winter population in California is large relative to other regions throughout the species' range, because owls from northern parts of the species range (e.g., Canada, Washington, Oregon, and Idaho) winter in California and augment resident Central Valley populations (Coulombe 1971).

Approximately half of all breeding groups known to occur in the Middle Central Valley during the 1980s had disappeared by the early 1990s (DeSante and Ruhlen 1995). Western burrowing owls in south Sacramento County are threatened by habitat loss and fragmentation as a result of conversion of habitat to urban uses and agriculture, particularly the conversion of natural grasslands to vineyards. Substantial losses of Valley Grassland and other suitable habitats for burrowing owls have occurred in the Action Area over the past several decades as a result of agricultural conversions and urban development (see discussion in Section 2.5.2 above), and it is assumed that western burrowing owl populations in the Action Area have also declined substantially over recent decades. One study found a population of owls near Sacramento to be inbred due to small population size rather than non-random mating (Johnson 1997a).

In the Middle Central Valley, including the Action Area, burrowing owls most commonly live in natural tunnels created by California ground squirrels. Accordingly, the quality of burrowing owl habitat in the Action Area is closely and positively related to the occurrence and population viability of California ground squirrels in an area. DeSante et al. (1996, 2003) found that the best predictor of burrowing owl re-occupancy of nest sites in California was ground squirrel presence. Burrowing owls and ground squirrels can co-inhabit the same burrow system, but the frequency with which this occurs has not been measured, and underground interactions have not been studied (Final SSHCP Appendix B). It is assumed that control of ground squirrels has reduced the extent and quality of burrowing owl habitat by reducing the number of suitable nesting burrows in the Action Area, and it is possible that the use of rodenticides and insecticides have reduced prey populations (Final SSHCP Appendix B).

Comprehensive surveys for western burrowing owl in the Action Area have not been conducted, and the existing occurrence data are based primarily on incidental observations. Since the 1950's, colonies of burrowing owls have been recorded at and the former Mather Air Force Base in PPU-2. Western burrowing owls have also been documented at the Sacramento Regional County Sanitation District Bufferlands in PPU-4, at the Nature Conservancy's Cosumnes River Preserve in PPU-6, as well occurrences in as the rolling grasslands in eastern Sacramento County in PPU-7 (Final SSHCP Appendix B). In addition, nesting colonies have been documented in urban areas near the Action Area boundaries, including the Meadowview and Pocket areas of Sacramento, at the Executive Airport, the former Sacramento Army Depot, the campus of the Cosumnes River College, and at the California State University campus (Final SSHCP Appendix B).

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 97 sites with documented western burrowing owl use in the Action Area (Final SSHCP Table 3-6). Thirty-six documented occurrences are within the UDAs (two in PPU-1, 16 in PPU-2, two in PPU-3, 12 in PPU-4, and four that are not within a PPU), and 61 documented occurrences are outside of the UDAs (three in PPU-1, one in PPU-5, 30 in PPU-6, 23 in PPU-7, and four that are not within a PPU). SSHCP Figure 3-27 illustrates the locations of the documented occurrences of western burrowing owl within the Action Area.

Due to the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. SSHCP landcovers that provide western burrowing owl foraging and nesting habitat are Valley Grassland, Blue Oak Savanna, Cropland, and Irrigated Pasture-Grassland throughout the Action Area. Suitable habitat for western burrowing owl foraging also includes seasonally dry Vernal Pools, Seasonal Wetlands, Swales, and the Stream/Creek-VPIH landcovers (Table 3-2 in County of Sacramento et al 2019, Henry *in litt.* 2019). The existing conditions of these landcovers within the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2, 2.3.5, and 2.5.1, and are not repeated here. SSHCP Figure 3-27 illustrates the location of modeled habitats for western burrowing owl within the Action Area. Although the existing distribution of the landcovers that comprise western burrowing owl modeled habitat can be mapped and are quantifiable, the SSHCP landcover mapping methods (see Section 2.3.3 above) could not identify and map sites with suitable burrows and nesting habitat, and the number of burrowing owl nests and nesting colonies in the Action Area are unknown.

2.7.2.4 Ferruginous Hawk Environmental Baseline

Ferruginous hawk is relatively uncommon in the Action Area, but occurrences are widely distributed. Much of the Action Area has not been surveyed for wintering ferruginous hawk, and the number of wintering individuals and overall distribution in the Action Area is not known. Observations of ferruginous hawk in the Action Area are primarily opportunistic sightings of individuals by birders or observations during annual Audubon Society Christmas bird counts. Most observations of ferruginous hawks have been reported from open grassland habitats in the eastern portion of the Action Area south of Interstate 50, including the existing Howard (Chance) Ranch Preserve. Observations have also been recorded at non-vineyard agricultural habitats in the south and southwestern portions of the Action Area (Final SSHCP Appendix B).

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 26 sites where Ferruginous hawk use has been documented within the Action Area (Final SSHCP Table 3-6). Eight of the documented occurrences are within the UDA (six in PPU-2 and two in PPU-4), and 18 documented occurrences are outside of the UDA. Outside the UDA, six documented occurrences are in PPU-5, four documented occurrences are in PPU-6, seven documented occurrences are in PPU-7, and one documented occurrences is not within a PPU. SSHCP Figure 3-21 shows the documented locations of ferruginous hawk in the Action Area.

Due to the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. The SSHCP landcovers that provide suitable winter foraging habitat are all Valley Grassland, Irrigated Pasture-Grassland, seasonally dry Vernal Pool, seasonally dry Seasonal Wetland, and seasonally dry Swale landcover located in the Action Area (Final SSHCP Table 3-2). The SSHCP identified 159,491 acres of ferruginous hawk modeled habitat in the Action Area, primarily in areas of Valley Grassland (135,112 acres. The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here. SSHCP Figure 3-21 illustrates the location of ferruginous hawk modeled habitat in the Action Area.

2.7.2.5 Swainson's Hawk Environmental Baseline

Swainson's hawk is widely distributed in the Action Area. However, most Swainson's hawk nest occurrences are aggregated in the south-central part of the Action Area near the floodplains of the Cosumnes River, Deer Creek, and Dry Creek. Documented occurrences of nesting Swainson's hawks are also known from Valley Grassland areas within the UDA and Valley Grasslands outside the UDA in the east half of PPU-7 and PPU-5, but in lower numbers. Swainson's hawks are typically not found at elevations above 500 feet in eastern Sacramento County (Gifford et al. 2012).

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 410 site where Swainson's hawk use has been documented within the Action Area (Final SSHCP Table 3-6). Approximately 348 documented occurrences (85%) are outside the UDA, including 284 occurrences in PPU-6, 28 occurrences in PPU-8, 35 occurrences in PPU-5, and three occurrence that in not within a PPU. Approximately 62 (15%) of the documented occurrences are within the UDAs, including 10 occurrences within PPU-1, five occurrences in PPU-2, eight occurrences in PPU-3, 17 documented occurrences in PPU-4, and 20 documented occurrences within the Galt UDA (PPU-8). SSHCP Figure 3-25 illustrates the location of the documented occurrences of Swainson's hawk within the Action Area.

SSHCP landcovers that provide suitable habitat for foraging based on Swainson's hawk life history include Cropland, Irrigated Pasture-Grassland, Valley Grassland, seasonally dry Vernal Pool, seasonally dry Seasonal Wetland, and seasonally dry Swale. Suitable habitat for nesting includes mixed Riparian Woodland and Mixed Riparian Scrub (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area were discussed above in Section 2.3.2 and 2.3.5, and are not repeated here.

Due to the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. SSHCP landcovers that provide suitable habitat for foraging based on life history descriptions include Cropland, Irrigated Pasture-Grassland, Valley Grassland, Vernal Pool, Seasonal Wetland, and Swale. Suitable habitat for nesting includes mixed Riparian Woodland and Mixed Riparian Scrub (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

The SSHCP modeled foraging habitat for Swainson's hawk is all Cropland, Irrigated Pasture-Grassland, Valley Grassland, Vernal Pool, Seasonal Wetland, and Swale landcovers in the Action Area that are at elevations below 500 feet. The SSHCP modeled nesting habitat for Swainson's hawk is all Mixed Riparian Woodland and Mixed Riparian Scrub in the Action Area that are at elevations below 500 feet. In total, the SSHCP identified 213,223 acres of Swainson hawk modeled habitat in the Action Area, including 7,234 acres of modeled nesting habitat and 205,989 acres of modeled foraging habitat (Final SSHCP Table 6-78). SSHCP Figure 3-25 illustrates the locations of Swainson's hawk modeled habitat within the Action Area.

The SSHCP also identified high-value modeled habitat for Swainson's hawk in the Action Area. High-value modeled habitat is in areas identified by CDFW and the Service as especially important for Swainson's hawk foraging and nesting in the Action Area, and also important for Swainson's hawks that are nesting within 18 miles of the Action Area (Final SSHCP Figure 3-25). The SSHCP defines high-value habitat for Swainson's hawk as modeled foraging habitat that is within the southwestern portions of the Action Area (i.e. within PPUs 4, 6, and 8). In total, the SSHCP identified 70,127 acres of Swainson hawk high-value modeled foraging habitat in the Action Area

(Final SSHCP Table 6-78). The majority of the high-value Swainson's hawk foraging habitat is outside the UDAs in PPU-4 and PPU-6 (62,393 acres), but 7,734-acres (11%) of the high-quality modeled foraging habitat is within the Galt UDA (i.e. PPU-8). SSHCP Figure 3-25 illustrates the locations of high-value foraging modeled habitat within the Action Area.

2.7.2.6 Northern Harrier Environmental Baseline

Northern harrier is widely distributed in the Action Area. The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 70 documented sites where Northern harrier use has been documented within the Action Area (Final SSHCP Table 3-6). Twelve of the documented occurrences are within the UDA and 58 documented occurrences are outside of the UDA, including five in PPU-5, 42 in PPU-6, and seven in PPU-7. SSHCP Figure 3-24 shows the documented locations of Northern harrier in the Action Area. However, the Action Area has not been surveyed for Northern harrier and the number of individuals and overall distribution in the Action Area is not known.

Due to the limited survey data and the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. The SSHCP landcovers that provide suitable foraging and nesting habitat based on life history description of Northern harrier include Freshwater Marsh, Valley Grassland and seasonally dry Vernal Pools, seasonally dry Swales, and seasonally dry Seasonal Wetlands, Cropland, and Irrigated Pasture-Grassland (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

During the breeding season, average home range sizes from eight studies were 420 to 37,067 acres, and males will hunt more than six miles from the nest (Barnard 1983; Thompson-Hanson 1984; MacWhirter and Bildstein 1996). Therefore, modeled foraging habitat is all Cropland, Irrigated Pasture-Grassland, Valley Grassland, Vernal Pool, Seasonal Wetland, Swale, and Freshwater Marsh throughout the Action Area. Western populations of northern harriers tend to use upland habitats (e.g., grasslands) disproportionately over wetlands, but in most nesting habitats, including dry uplands, a disproportionate number of nests are located in wet sites (Simmons and Smith 1985; Martin 1987; Grant et al. 1991). Therefore, the SSHCP modeled nesting habitat for northern harrier is all Valley Grassland, Cropland, Irrigated Pasture, and Valley Grassland throughout the Action Area.

The SSHCP identified 210,318 acres of northern harrier modeled nesting and foraging habitat in the Action Area, including 199,008 acres of nesting/foraging habitat (Valley Grassland, Cropland, and Irrigated-Pasture) and an addition 11,310 acres of foraging habitat (Freshwater Marsh, and seasonally dry Vernal Pools, Swales, and Seasonal Wetlands). The majority of Northern harrier modeled habitat (169,324 acres) (81%) is located outside the UDA portions of the Action Area (Final SSHCP Table 6-85). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here. SSHCP Figure 3-20 illustrates the location of Northern harrier modeled habitats in the Action Area.

2.7.2.7 White-tailed Kite Environmental Baseline

White-tailed kite is widely distributed in the Action Area, and are known to nest or forage in the UDA at Mather Lake, Mather Regional Park, along Laguna Creek, along Morrison Creek, and adjacent lands. Outside the UDA they are also known to nest or forage in the Cosumnes River corridor, The Nature Conservancy's Howard (Chance) Ranch in PPU-7, and nest at Stone Lakes National Wildlife Refuge in PPU-6 (Final SSHCP Appendix B).

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 62 sites where white-tailed kite use has been documented within the Action Area (Final SSHCP Table 3-6). Twenty documented occurrences are within the UDA, including two in PPU-1, seven in PPU-2, four in PPU-3, two in PPU-4, one in PPU-8, and four that are not within a PPU. Forty-two documented occurrences are outside the UDA, including five in PPU-5, 34 in PPU-6, and three that are not within a PPU. SSHCP Figure 3-28 illustrates the location of documented occurrences of white-tailed kite within the Action Area.

Due to the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. Modeled foraging habitat for white-tailed kite is all Cropland, Irrigated Pasture-Grassland, Valley Grassland, seasonally dry Vernal Pool, seasonally dry Swale, seasonally dry Seasonal Wetland, Mixed Riparian Scrub, and Blue Oak Savanna in the Action Area (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here. SSHCP Modeled nesting habitat for white-tailed kite is all Blue Oak Woodland, Mine Tailing Riparian Woodland, Mixed Riparian Woodland, and Mixed Riparian Scrub in the Action Area.

The SSHCP identified 230,042 acres of white-tailed kite modeled nesting and foraging habitat in the Action Area, including 15,558 acres of nesting habitat (Blue Oak Woodland, Mixed Riparian Woodland, and Mine Tailing Riparian), 1,451 acres of both nesting and foraging habitat (Mixed Riparian Scrub), and 213,033 acres of foraging habitat (Cropland, Irrigated-Pasture, Valley Grassland, dry Vernal Pools, dry Swales, dry Seasonal Wetlands, and Blue Oak Savanna). The majority of white-tailed kite modeled habitat (188,717 acres) (82%) is located outside the UDA portions of the Action Area (Final SSHCP Table 6-82). SSHCP Figure 3-28 illustrates the location of modeled habitat for white-tailed kite within the Action Area.

2.7.2.8 Greater Sandhill Crane Environmental Baseline

Greater sandhill cranes use within the Action Area principally occurs within the Cosumnes River floodplain and the Sacramento River floodplain in PPU-6 (191 documented occurrences in PPU-6), and in the areas adjacent to PPU-6 (including 11 occurrences in PPU-7, six occurrences in PPU-8, and one occurrence in PPU-4 at the water treatment plant). Clusters of daytime foraging areas are found in farm fields north of Twin Cities Road in PPU-6, farm fields west of Highway 99 in PPU-6 and 7, farm fields west of Snodgrass Slough and south of Lambert Road in PPu-6, and farm fields west of Clarksburg just outside the Action Area (in Yolo County). However, most of the nighttime roosting in the Action Area occurs in and near the Cosumnes River Preserve, in an area east of Interstate-5 and west of Highway 99 in PPU-6 (Final SSHCP Figure 3-22). The SSHCP's compilation of records and species-surveys conducted within the Action Area identified 210 sites where greater sandhill crane use has been documented in the Action Area (Final SSHCP Table 3-6).

Relatively recent habitat loss in and near the Action Area has affected greater sandhill cranes. Greater sandhill cranes have been displaced from suitable habitat associated with the East Franklin

Project (roughly 3,000 acres). Similarly, the conversion of approximately 1,200 acres of suitable habitat to vineyards at the Circle K Ranch has displaced cranes. Additional future expansion in the region (i.e., City of Elk Grove) could impact additional crane habitat (Final SSHCP Appendix B) Due to the programmatic nature of the proposed action, the environmental baseline for the greater sandhill crane in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. SSHCP landcovers that provide suitable habitat based on life history descriptions include Cropland, Irrigated Pasture-Grassland, Valley Grassland, Seasonal Wetland, Freshwater Marsh, and Vernal Pool, (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

The SSHCP defined greater sandhill crane modeled roosting habitat as Vernal Pool, Seasonal Wetland, and Freshwater Marsh landcovers within 2 miles of greater sandhill crane occurrences, per discussions with USFWS staff and CDFW staff (Gardner, pers. comm. 2010; Adelsbach, pers. comm. 2010). This element of the species' model is consistent with the Conservation Assessment for Greater Sandhill Cranes Wintering on the Cosumnes River Floodplain and Delta Regions of California (Littlefield and Ivey 2000). However, modeled roosting habitat extends beyond the Cosumnes River Floodplain within the Action Area. The SSHCP defined greater sandhill crane modeled foraging habitat as Cropland, Irrigated Pasture-Grassland, Valley Grassland, Seasonal Wetland, and Freshwater Marsh landcovers located within 1.75 miles of modeled roosting habitat (Final SSHCP Chapter 3.4.5). The SSHCP identified a total of 89,765 acres of greater sandhill crane modeled habitats within the Action Area, including 5,643 acres of roosting/foraging habitat, and 84,122 acres of foraging habitat. SSHCP Figure 3-22 illustrates the location of greater sandhill crane modeled habitat within the Action Area.

Within the total 89,765 acres of greater sandhill crane modeled habitat within the Action Area, the SSHCP also defined high-value habitat for greater sandhill crane. High-value modeled habitat is defined by the SSHCP as modeled foraging and roosting habitats that are above sea level and are outside the UDAs (i.e., modeled habitats within the UDA are not considered high-value). The SSHCP identified 81,473 acres of high-value greater sandhill crane modeled habitat within the Action Area (Final SSHCP Table 6-96). SSHCP Figure 3-22 also illustrates the locations of high-value greater sandhill crane modeled habitat within the Action Area.

2.7.2.9 Loggerhead Shrike Environmental Baseline

Loggerhead shrike is widely distributed in the Action Area, but is uncommon. Much of the Action Area has not been surveyed for loggerhead shrike, and the number of individuals and overall distribution in the Action Area is not known. Two or three loggerhead shrike nests are observed each year at Sacramento Regional County Sanitation District Bufferlands in PPU-4 and at nearby Stone Lakes National Wildlife Refuge in PPU-6). In central PPU-6, nesting pairs are usually observed at the Cosumnes River Ecological Preserve. Nesting has also been observed in PPU-5 south of Rancho Murrieta, and loggerhead shrikes occur regularly during summer at the Nature Conservancy's Howard (Chance) Ranch in eastern PPU-7 (Final SSHCP Appendix B).

The SSHCP's compilation of records and loggerhead shrike surveys conducted within the Action Area identified 34 site where loggerhead shrike use has been documented within the Action Area (Final SSHCP Table 3-6). Seven are within the UDA portion of the Action Area (two in PPU-1, one in PPU-2, two in PPU-3, one in PPU-4, and one in the Galt PPU-8). Most of the documented occurrences (27) seven occurrences are outside of the UDA, including three in PPU-5, fifteen in

PPU-6, seven in PPU-7, and two that are not within a PPU. SSHCP Figure 3-23 illustrates the location of the documented occurrences of loggerhead shrike within the Action Area.

Due to the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. Loggerhead shrike modeled foraging habitat is all Cropland, Irrigated Pasture-Grassland, Valley Grassland, seasonally dry Vernal Pool, seasonally dry Seasonal Wetland, and seasonally dry Swale landcovers in the Action Area. Loggerhead shrike modeled nesting habitat is all Mine Tailing Riparian Woodland, Mixed Riparian Scrub, and Valley Grassland landcovers in the Action Area (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

The SSHCP identified 215,246 acres of loggerhead shrike modeled nesting and foraging habitat within the Action Area, including 15,558 acres of nesting habitat (Mixed Riparian Woodland, Mixed Riparian Scrub, and Mine Tailing Riparian), 135,112 acres of both nesting and foraging habitat (Valley Grassland), and 72,284 acres of foraging-only habitat (Cropland, Irrigated-Pasture, seasonally dry Vernal Pools, and seasonally dry Swales). The majority of loggerhead shrike modeled habitat (173,966 acres) (81%) is located outside the UDA portions of the Action Area (Final SSHCP Table 6-91). SSHCP Figure 3-28 illustrates the location of modeled habitat for loggerhead shrike within the Action Area.

2.7.3 General Effects of the Action on the Avian Covered Species

To minimize repetition, mechanisms by which SSHCP Covered Activities could affect each of the nine avian Covered Species (i.e. Cooper's hawk, tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, and loggerhead shrike) are discussed here in Section 2.7.3. General effects of the Action on all Covered Species, previously described in Section 2.5.4 above, are not repeated here. The effects to the individual avian Covered Species that are in addition to those described previously or here in Section 2.7.3 are discussed in Section 2.7.4 below.

The SSHCP quantified removal (loss) of avian Covered Species modeled habitat using the GIS methodologies as discussed above in Section 2.5.3. Most removal of avian Covered Species modeled habitat will occur inside the UDA from the construction of the urban development Covered Activities. A relatively small amount of modeled habitat for each avian species will be removed outside the UDA by the construction of the rural-transportation Covered Activities and the recycled water project Covered Activities. In total, approximately 45,300 acres (14%) of the grasslands, woodlands, and riparian landcovers that provide habitat for one or more of the avian Covered Species will be removed by Covered Activities implement in the Action Area (Table 25 below).

Urban development and rural transportation Covered Activities typically begin construction in the spring and summer months, when many of the avian Covered Species are mating, nesting, and rearing young in the Action Area. Covered Activity removal of active nesting or foraging habitat used by nesting individuals during this period has the potential to directly kill or injure nesting individuals, young, or eggs, cause nest abandonment, or change reproductive behaviors. Environmental stressors to avian Covered Species from ground disturbing Covered Activities include construction noise, construction lighting, construction dust, increased human presence during construction, and construction trash and debris. As discussed in Section 2.7.4 below, Covered

Activities implemented within or near modeled habitat for tricolored blackbird, western burrowing owl, or Swainson's hawk must implement AMMs specific for those avian species, and Covered Activities implemented within or near modeled habitat for Cooper's hawk, loggerhead shrike, northern harrier, and white-tailed kite must implement the SSHCP raptor AMMs to avoid direct impacts to individuals.

In addition to removal of habitat and direct effects to individuals, the SSHCP qualitatively assessed and analyzed the indirect effects of SSHCP Covered Activities on modeled habitat for each avian species. The edge areas of preserved or avoided modeled habitat will be exposed to environmental stressors produced by the urban development Covered Activities within the UDA and the rural transportation Covered Activities outside the UDAs. Potential changes include effects from increased urban runoff and roadway runoff that may contain pollutants and toxins, including pesticides, herbicides, fertilizers, fuel, oil, and lubricants. Individuals that consume insect or small mammal prey contaminated with urban and roadside pollutants may be sickened or killed, or produce fewer offspring. The close proximity of new urban development avian foraging and nesting habitat that is preserved or avoided within the UDA increases the likelihood that watershed hydrology changes and water quality changes could affect foraging habitat. The SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs), discussed in Section 2.5.4 above and in SSHCP Chapter 5.4.1, would minimize landscape hydrology changes, and assure that stormwater runoff will not enter UDA preserves or other UDA open spaces that provide foraging habitat for the avian Covered Species. The potential effects to the individual avian Covered Species are discussed in Section 2.7.4 below.

As discussed in Section 2.5.4 above, urban development Covered Activities will result in increased human presence near Covered Species habitats preserved within the UDAs. Increased human presence can have a profound indirect effect on birds. For example, a single pedestrian passing through a bird's territory in some cases, may reduce singing of passerine birds, and has the potential to lower reproductive fitness (Gutzwiller et al. 1994). Human disturbance could also have profound effects on successful nesting of certain bird species. Flushing parents from nests decreases parental attendance and increases the likelihood of nest abandonment predicating inadequate heat regulation and increased predation (Safina and Burger 1983; Hunt 1972). Human intrusion could be particularly disruptive to bird colonies (Klein 1993), including tricolored blackbirds. As discussed further in Section 2.7.4 below, the SSHCP EDGE, NATURE TRAIL, and ROAD AMMS will minimize the effects of human presence on foraging and nesting avian Covered Species individuals.

The increased human presence and associated pet population can increase the risk of disease transmission to native wildlife in the Action Area, as discussed in Section 2.5.4 above. Diseases transmitted from humans and pets also may affect raptors, such as Cooper's hawk (*Accipiter cooperii*). Boal and Mannan (1999) found that mortality of nestling Cooper's hawks in urban settings primarily was from trichomoniasis, which is caused by the parasitic protozoan Trichomonas gallinae that occurs in the digestive and urogenital tracts of many animals and humans. This parasite causes lesions in the mouth, throat, and crop of birds and prevents infected individuals from eating. An important vector of trichomoniasis in urban areas may be domestic pigeons and potentially wild doves, which are preyed on by hawks and other raptors (Boal et al. 1998). Stabler (1941), for example, found that of 242 pigeons originating from Pennsylvania, Maryland, and New Jersey, 64.5% were infected with Trichomonas gallinae. West Nile virus has been identified as a potential factor in loggerhead shrike (*Lanius ludovicianus*) declines in the Central Valley based on a correlation between higher infection rates of the virus and greater declines in shrike abundance in Central Valley counties compared to other counties (Pandolfino 2008).

As discussed in Section 2.5.4 above, increased wildfire frequency is an expected indirect effect of human activity associated with the urban development and rural-transportation Covered Activities. Wildfire in active foraging habitat would displace and expose prey species, and may temporarily increase foraging opportunities for raptor Covered Species during and immediately after the wildfire. However, habitat for prey-species in the burned areas could be removed for months, limiting foraging opportunities in the burned area until vegetation regrowth and suitable habitat for prey species returns. Repeated or intense wildfires would affect foraging habitat quality through mortality and elimination of prey (e.g., small mammals, insects, small birds, and reptiles) and degradation of prey habitat. To address the increased risk of wildfire in avian modeled habitats, the SSHCP Preserve System Management Program will develop Memoranda of Understanding with all applicable fire agencies. Individual Preserve Management Plans (PMPs) will identify appropriate responses to wildfire and identify appropriate fire-suppression techniques, including identification, installation, and maintenance of fuel breaks, use of prescribed fire, pre-incident planning, and public education campaigns. Each Preserve Manager will work closely with responding fire agencies to ensure fire response and suppression is consistent with the Memorandum of Understanding and with the individual Preserve PMP to minimize impacts to sensitive areas, including raptor nest trees, tricolored blackbird nesting colony site, and western burrowing owl colonies (Final SSHCP Chapter 11.4.3.2). In addition, the potential for increased wildfires will be minimized through the implementation of AMMs that reduce the open space–urban interface within the UDA, reduce thatch buildup on each SSHCP Preserve, and control public access within the SSHCP Preserves. However, the construction and maintenance of fire breaks can reduce the functionality of foraging habitat in the fire break by permanently removing vegetation, rodent holes, and reducing prey numbers within the firebreak areas.

Aboveground utilities such as transmission towers, utility poles, and powerlines constructed in the UDA as part of the urban development Covered Activities pose a general risk to several avian Covered Species, and are expected to cause mortalities and injuries of some individuals over the Permit Term from collisions (powerlines), entanglements, or electrocutions. Avian Covered Species known to be at particular risk of collisions with aboveground utilities in the Action Area include ferruginous hawk, Swainson's hawk, and greater sandhill crane, as discussed in more detail in Section 2.7.4 below. Implementation of the UTILITY-1 and RAPTOR-1 AMMs will require Covered Activities that include above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 7-76).

The sudden and unexpected onset of lighting (e.g., from increased vehicle traffic in the UDA and along rural transportation Covered Activity roadways) may startle diurnally-active avian Covered Species, causing them to become disoriented. Urban nighttime lighting within the UDAs may affect raptor Covered Species by disrupting normal nighttime rest and sleep patterns and increasing stress level. Effect on species and individuals would depend on several factors, including light intensity, height of lighted structures, and physical shielding or vegetation shielding. As discussed below, Covered Activities that include lighting in the UDA will minimize light pollution into preserves, except where a Plan Permittee determines lighting is necessary for public safety or security. During Covered Activity construction periods, ground disturbing Covered Activities will direct all temporary construction lighting away from adjacent natural habitats to avoid disorienting effects to the avian Covered Species.

SSHCP Covered Activities will result in higher traffic densities and speeds on improved roads inside and outside the UDAs. Because Swainson’s hawk, western burrowing owl and other raptor species forage disproportionally forage in roadside edges and median strips that are used by voles and mice as dispersal corridors (Getz et al 1978; Estep 1989; Keran 1981; Swolgaard 2004), they have a higher risk of vehicle collision. Implementation of urban development and rural transportation Covered Activities are likely to increase the number of vehicle strikes and number of window strikes by the avian Covered Species. The SSHCP will minimize effects associated with vehicle collisions by locating planned road projects in the least environmentally sensitive location relative to raptor foraging habitat, and by preserving large, interconnected Preserves that are not fragmented by large roadways (Final SSHCP Table 6-76).

Table 25. Permanent Upland Landcover Losses in the Action Area.

SSHCP Landcover	Permanent Direct Effects (acres)	Permanent Indirect Effects (acres)	Total Permanent Effects (acres)	Total Existing in Action Area (acres)	Percent of Plan-Area Total Acres Affected
Grassland					
Valley Grassland (in the Vernal Pool Ecosystem)	16,472	Qualitative Assessment	16,472	97349	17%
Valley Grassland (outside the Vernal Pool Ecosystem)	5,542	Qualitative Assessment	5,542	37,803	15%
Grassland Total	22,014	Qualitative Assessment	22,014	135,152	16%
Riparian Landcovers					
Mixed Riparian Woodland	184	Qualitative Assessment	184	5,856	3%
Mixed Riparian Scrub	189	Qualitative Assessment	189	1,454	13%
Mine Tailing Riparian Woodland	218	Qualitative Assessment	218	641	34%
Riparian Total	591	Qualitative Assessment	591	7,951	7%
Woodland Landcovers					
Blue Oak Woodland	9	Qualitative Assessment	9	9,132	0.1%
Blue Oak Savanna	38	Qualitative Assessment	38	5,637	1%
Woodland Total	47	Qualitative Assessment	47	14,769	0.3%
Upland Totals	45,304	Qualitative Assessment	45,304	315,744	14%

The SSHCP Conservation Strategy includes several measures that will benefit the avian Covered Species. For example, SSHCP Objective AG2 will establish and manage 9,696 acres of Agricultural Preserves in the Action Area, with at least 2,000 of those acres of high-quality foraging crops (such as corn, alfalfa, or wheat) preferred by tricolored blackbird, greater sandhill crane, and provide high-quality habitat for preferred prey of the raptor Covered Species (western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, and loggerhead shrike). The 2,000 acres of avian Covered Species foraging habitat will be distributed in strategic locations throughout PPUs

4, 5, or 6, at a minimum of 10 different locations, none of which will be less than 20 acres (Final SSHCP Table 7-1).

SSHCP Objective AG3 will also maintain or increase prey availability and improve avian Covered Species foraging habitat by strategically planting 10,000 linear feet of shrub or other vegetation substrate that provides cover and refugia for fossorial mammals and other small prey (e.g., amphibians, reptiles) within and on the borders of each Cropland Preserves. This measure will permanently increase prey availability for the raptor Covered Species. Acceptable hedgerow plants include native trees, shrubs, and grasses as approved by the SSHCP TAC. Hedgerows will be at least 5 feet in width and must be located on upland areas not prone to inundation from normal irrigation practices. Providing refuge habitat for prey species adjacent to agricultural settings will allow areas that have been harvested or with temporarily reduced or eliminated populations of prey to re-establish more quickly (Final SSHCP Table 7-1).

2.7.4 Effects of the Action on Avian Species.

The species-level effects described below build on Section 2.5.4, *General Effects of the Action on All Covered Species* and on Section 2.7.3 *General Effects of the Action on the Avian Covered Species*. Effects previously described in those sections of the Opinion are not repeated below.

The SSHCP assumes that the landcovers included in modeled habitat for each of the five avian Covered Species could be occupied by adults, juveniles, or eggs of the species. Therefore, the SSHCP did not quantify effects to individual occurrences of the avian Covered Species. The effects analysis in this Opinion also assumes that the landcovers included in the modeled habitat of each Covered Species could be occupied by the species.

2.7.4.1 Effects on Cooper's Hawk

Effects of SSHCP Covered Activities on Cooper's hawk include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on Cooper's hawk individuals.

As discussed in Section 2.7.2.1 above, most of the Cooper's hawk modeled habitat in the Action Area (97%) is located outside the UDAs. Of the total 22,646 acres of Cooper's hawk modeled habitat in the Action Area, Covered Activities will remove up to 638 acres (3%) of the species modeled habitat (Table 26 below). Most of the removal of Cooper's hawk modeled habitat (552 acres, or 76% of the expected loss) will result from implementation of urban development Covered Activities in the UDA. Outside the UDA, only 82 acres of Cooper's hawk modeled habitat will be removed by implementation of rural transportation Covered Activities and the recycled-water pipeline Covered Activities (Final SSHCP Table 6-72).

Modeled habitat that supports Cooper's hawk feeding, sheltering, and breeding behaviors will be permanently removed in approximately 3% of the Action Area's suitable Cooper's hawk habitat. However, because Cooper's hawk is known to use urbanized and fragmented habitat, habitat removed in the UDAs may eventually provide some hunting or nesting habitat in the future, if planted with trees that grow to provide suitable hunting-perches and nesting sites for Cooper's hawk, and the developed landcover also supports populations of prey species (rock doves, other birds, and small mammals).

Implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, construction and paving, will remove trees and other perch sites used for hunting, remove prey species, will remove habitat used by Cooper's hawk prey-species, and will remove woodlands and tree-groves that provide nest sites. If implemented when Cooper's hawk are nesting in the Action Area, Covered Activities could remove active nests, which would injure or kill nesting individuals, nestlings, and eggs. AMMs RAPTOR-1 and RAPTOR-2 will require Covered Activity projects to survey and map potential Cooper's hawk nesting habitat within and near the project site. SSHCP Covered Activities will not remove Cooper's hawk active nests, which will avoid or minimize direct injury or death of individuals, nestlings, and eggs.

SSHCP Covered Activities implemented in the vicinity of an avoided nest may adversely affect the nesting birds. Construction equipment, noise, vehicles, and human activity could disturb nesting adults and young present in areas outside of a Covered Activity project footprint. Repeated disruptions to nesting and feeding behaviors could affect the fitness of nestlings, increasing the chances of mortality before nestlings fledge or before young reach maturity. Less fit nestlings could be more susceptible to disease or predation. Repeated disruptions in nesting behaviors can also result in the adults abandoning eggs or nestling, causing injury, or mortality. Repeated disturbance could cause Cooper's hawk pairs to relocate within the Action Area or move out of the Action Area, reducing or eliminating the likelihood of successful reproduction that year. Disturbance of nesting Cooper's hawks will be minimized by the SSHCP construction BMP AMMs (Final SSHCP Table 6-100) and by the RAPTOR AMMs. AMM RAPTOR-2 requires pre-construction surveys within and near the project footprint during the Cooper's hawk breeding season. Pre-construction surveys will occur within 30 days of any ground disturbing activities, and again within 3 days of any ground disturbing activities. If an active nest is present, the approved biologist will inform the Land-Use Authority Permittee and the SSHCP Implementing Entity of the species locations, and they in turn will notify the Service and CDFW. The Covered Activity project will then implement AMMs RAPTOR-3 and RAPTOR-4 at the project site. AMM RAPTOR-3 requires the Covered Activity project to establish a 0.25 mile buffer-zone around an active Cooper's hawk nest that is within the project footprint or within 0.25 mile of the project footprint. No project activities (vehicle use, machinery use, ground disturbance, human activity) will occur within this temporary nest-disturbance buffer established around the active nest until the young have fledged and have left the nest site. AMM RAPTOR-4 requires an approved biologist experienced with raptor behavior will be retained by the Third Party Project Proponent to monitor the nest throughout the nesting season and to determine when the young have fledged. The approved biologist will be on site daily while construction-related activities are taking place within the 0.25-mile disturbance buffer. If nesting raptors begin to exhibit agitated behavior, such as getting up from a brooding position, flying off the nest, or defensive flights at intruders, the approved biologist/monitor will have the authority to shut down project activities. If agitated behavior is exhibited, the biologist, the Third Party Project Proponent, the SSHCP Implementing Entity, the Service and CDFW will meet to determine the best course of action to avoid nest abandonment or take of individuals. The approved biologist also will train construction personnel on the required avoidance procedures, disturbance buffer zones, and protocols in the event that a covered raptor species flies into an active project site from outside the buffer zone. With implementation of the RAPTOR AMMs, we expect construction disturbance effects to Cooper's hawk will be avoided or minimized.

Indirect effects of SSHCP Covered Activities on Cooper's hawk were assessed and analyzed qualitatively by the SSHCP (Final SSHCP Tables 6-72, 6-73). The potential for indirect effects would be greatest within the UDA portions of the Action Area because of the closer and more extensive contact between urban development Covered Activities and SSHCP Preserves planned in the UDA

(Final SSHCP page 6-255). However, because only 3% of the Action Area's Cooper's hawk modeled habitat is present inside the UDAs, relatively little Cooper's hawk modeled habitat present in the Action Area would be indirectly affected by urban development within the UDAs.

Most Cooper's hawk modeled habitat in the Action Area (97%) is located outside the UDAs in the riparian areas along Snodgrass Slough, the Cosumnes River, Deer Creek, and in the oak woodlands and oak savannas that are near the eastern border of the Action Area (Final SSHCP Figure 3-20), and many of the rural transportation Covered Activities will be adjacent to or will cross through Cooper's hawk modeled habitat (see Figures 3-20 and 5-5 in the *Erratum to the Final SSHCP*). The close proximity of the road improvement projects to Cooper's hawk modeled habitat increases the likelihood that road runoff (including pollutants, toxins, fuel, oil, and lubricants) will enter Cooper's hawk modeled habitat and may adversely affect Cooper's hawk prey species (small mammals and birds). Rural transportation Covered Activities in Cooper's hawk modeled habitat will increase traffic on these roadways, increasing disturbance from traffic noise, lighting, human activities, exposure of prey species to roadside trash, and may increase collisions with vehicles. The SSHCP's LID-, EDGE-, BMP- and ROAD-AMMs discussed in Section 2.5.4 above would minimize these indirect effect to Cooper's hawk modeled habitat and Cooper's hawk individuals.

Aboveground utilities such as transmission towers, utility poles, and powerlines pose a general risk to all raptors, with mortalities and injuries from collisions, entanglements, and electrocutions (Franson et al. 1995; Lehman et al. 2007). Implementation of the UTILITY-1 and RAPTOR-2 AMMs will require Covered Activities that include above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 6-73). Diseases transmitted from humans and pets could affect Cooper's hawk, and the risk of such transmission is expected to increase in the Action Area from urban development build out of the UDAs over the Permit Term, increased human activity, and additional human use of rural roadways outside the UDA. As discussed in Section 2.7.1.1 above, Cooper's hawk is susceptible to avian flu and the protozoan *Trichomonas gallinae*. Potential transmission of diseases from humans and human pets to Cooper's hawk prey species (doves, small mammals) within the SSHCP Preserves will be minimized by the EDGE, ROAD, and NATURE TRAIL AMMs. However, the SSHCP will not be able to directly control potential disease transmission from prey ingested by Cooper's hawk outside the SSHCP preserves (Final SSHCP Table 6-73).

Table 26. Cooper's Hawk Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Blue Oak Woodland	9	Qualitative Assessment	9	0	9
Blue Oak Savanna	38	Qualitative Assessment	38	47	38
Mixed Riparian Woodland	184	Qualitative Assessment	184	477	293
Mixed Riparian Scrub	189	Qualitative Assessment	189	487	298
Mine Tailing Riparian Woodland	218	Qualitative Assessment	218	0	0
Totals	**638**	Qualitative Assessment	**638**	**1,011**	**638**

To mitigate the adverse direct and indirect effects to Cooper's hawk individuals and Cooper's hawk suitable-habitat, the SSHCP will preserve least 1,011 acres of high-quality suitable habitat for Cooper's hawk in the Action Area, including the Mixed Riparian Woodland, Mixed Riparian Scrub, Blue Oak Savanna, and Blue Oak Woodland landcovers. Direct impacts to the Mine Tailing Riparian Woodland landcover will be mitigated by preserving any combination of Mixed Riparian Woodland and Mixed Riparian Scrub landcovers.

The characteristics and locations of suitable habitat preserved for Cooper's hawk will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5 and consistent with the SSHCP biological goals and objectives for Cooper's hawk (Final SSHCP Table 7-1 and 7-68). Consistent with SSHCP Conservation Action CH1.1, selection of SSHCP Preserve sites with nesting and foraging habitat will be prioritized based on the availability of dense Blue Oak Woodland with trees approximately 26 to 49 feet high and in close proximity to foraging habitat with dense populations of prey-species, all of which are located outside the UDA portions of the Action Area. To the maximum extent possible, newly preserved lands acquired by the SSHCP will be adjacent to and contiguous with existing preserves, enhancing the ecological value of the SSHCP Preserves to Cooper's hawk.

The SSHCP Monitoring and Management Program will maintain or improve the quality of Cooper's hawk nesting and foraging habitat within the SSHCP Preserves. The SSHCP Monitoring and Management Program also will increase the amount of Cooper's hawk nesting and foraging habitat in the SSHCP Preserve System to support expansion of Cooper's hawk nesting and foraging activities into areas not currently used by Cooper's hawk. The SSHCP preserve management objectives that will benefit Cooper's hawk include are those that maintain and enhance nesting and foraging habitat, include monitoring the groundwater table as it relates to the health of preserved riparian habitats (SSHCP Objective RIP5), and ensuring that edge effects, such as invasive weeds, trash, and litter, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). Preservation of high quality habitat within large Preserves coupled with careful management and monitoring, is expected to increase the number and distribution of Cooper's hawk within the Action Area will be maintained or increased in the Action Area.

In addition to the preservation of 1,011 acres of modeled habitat for Cooper's hawk, the SSHCP also will establish or re-establish 638 acres of Cooper's hawk modeled aquatic-habitat within the SSHCP Preserve System, with a priority on re-establishment before establishment. Sites selected for the establishment or re-establishment of Cooper's hawk nesting and foraging habitat will be prioritized following SSHCP Conservation Action CH2.1 to select sites located near known Cooper's hawk nesting territories, sites that connect disjunct segments of riparian habitat, and sites that provide close proximity to modeled foraging areas with abundant prey populations. Site selected for Mixed Riparian Woodland and Mixed Riparian Scrub establishment and re-establishment will occur only where Cooper's hawk non-habitat landcovers will be converted to Mixed Riparian Woodland or Mixed Riparian Scrub. In addition, tree will be planted to provide dense canopy closure of the mature stand, and survivorship of at least six trees in each planted a stand is a success criterion for the habitat re-establishment/establishment site.

We expect the SSHCP Conservation Strategy for Cooper's hawk, including the habitat re-establishment, habitat preservation, and habitat enhancement and management in perpetuity, to fully offset Covered Activity adverse effects on the species.

2.7.4.2 Effects on Tricolored Blackbird

Effects of SSHCP Covered Activities on tricolored blackbird include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on tricolored blackbird individuals.

SSHCP Covered Activities will remove up to 31,058 acres (15%) of the total 212,632 acres of tricolored blackbird modeled habitat available in the Action Area (Table 27 below). Most effects and loss of tricolored blackbird modeled habitat will occur inside the UDAs where urban development Covered Activities will remove 29,823 acres (72%) of the 41,231 acres of the modeled habitat within the UDAs. Outside the UDAs, rural transportation and recycled water pipeline Covered Activities will remove only 1,235 acres (0.7%) of the available 171,401 acres of tricolored blackbird modeled habitat (Final SSHCP Table 6-98).

Implementation of Covered Activities, including the use of earth moving equipment, grading, construction, and paving, will remove modeled nesting habitat and modeled foraging habitat within each project site. If implemented when tricolored blackbirds are nesting in the Action Area, Covered Activities could remove active sites and nesting colonies, which would crush or injure nesting individuals, nestlings, and eggs. AMMs TCB-1 and TCB-2 will require Covered Activity projects to survey and map potential tricolored blackbird nesting and foraging habitat within and near the project site, and to survey for presence of nesting tricolored blackbirds. SSHCP Covered Activities will not remove active nests during the months that tricolored blackbirds nest in Sacramento County (March 1 through September 15), which will avoid direct injury or death of individuals.

SSHCP Covered Activities implemented in the vicinity of an avoided nest or nesting colony may adversely affect the nesting birds. Construction noise, equipment use, human activities, and dust generated by Covered Activities may disturb individuals, increase stress, and disrupt normal breeding and nesting behaviors of adults, and may cause abandonment of eggs or nestlings and nesting failure. Disturbance of nesting tricolored blackbird individuals will be minimized by the SSHCP construction BMP AMMs (Final SSHCP Table 6-100) and by the species-specific TCB AMMS for tricolored blackbird. AMM TCB-2 requires pre-construction surveys during the tricolored blackbird breeding season. The pre-construction surveys will occur within 30 days of any ground disturbing activities, and again within 3 days of any ground disturbing activities. If an active nest is found, the approved biologist will inform the Land-Use Authority Permittee and the SSHCP Implementing Entity of the nest location, and they in turn will notify the Service and CDFW. The Covered Activity project will then implement AMMs TCB-3 and TCB-4 at the project site. AMM TCB-3 requires the Covered Activity project to establish a 500-foot buffer-zone around any active tricolored blackbird nest that is within the project footprint or within 500 feet of the project footprint. No project activities (vehicle use, machinery use, ground disturbance, human activity, etc.) will occur within this temporary nest-disturbance buffer established around the active nest until the young are fledged and have left the nest site. AMM TCB-4 requires an approved biologist experienced with tricolor blackbird behavior be retained by the Third Party Project Proponent to monitor the nest throughout the nesting season and to determine when all young have fledged and left the colony. The approved biologist will be on site daily while construction-related activities are taking place near the 500-foot disturbance buffer. Work within the nest disturbance buffer will not be permitted. If the approved biologist determines that tricolored blackbirds are exhibiting agitated behavior, construction will cease until the buffer size is increased to a distance necessary to result in no disturbance to the nesting tricolored blackbirds. If the biologist determines that a colony is at risk, a meeting with the Third Party Project Proponent, Implementing Entity, and Wildlife Agencies will be held to

determine the best course of action to avoid nest abandonment or take of individuals. The approved biologist also will train construction personnel on the required avoidance procedures, buffer zones, and protocols in the event that a tricolored blackbird flies into an active project site from outside the buffer zone. With implementation of the TCB AMMs, we expect construction disturbance effects to tricolored blackbirds will be avoided or minimized.
Covered Activity removal of 31,058 acres (15%) of the available tricolored blackbird habitat will further fragment the tricolored blackbird modeled habitat present in the Action Area. Most of the habitat fragmentation will occur inside the UDAs, where 29,823 acres (72%) of the available tricolored blackbird modeled habitat will be removed, and the patch-size of the remaining habitat will be smaller in size (see Section 2.5.4 above). The TCB AMMs will avoid or minimize Covered Activity effects to active nests or colonies in a Covered Activity project site, or within 500 feet of the project site. However, there are no SSHCP AMMs that will avoid or minimize loss of active foraging areas during the months that tricolored blackbirds nest in Sacramento County (March 1 through September 15), and we expect urban development Covered Activities to remove active foraging areas during tricolored blackbird nesting season. Urban development Covered Activity removal of active foraging areas within 3 miles of a nesting site or colony will diminish or eliminate food sources that are available to support that nesting colony. We expect that a reduction in foraging habitat and food availability near active nest sites would require breeding adults to fly greater distances and expend more energy foraging, and would require adults to spend more time away from the nest when tricolored blackbird nestlings are vulnerable to many native and non-native predators. Tricolored blackbird clutches hatch asynchronously (Section 2.7.1.2 above), and we expect that a reduction in the amount or the quality of food the parents bring to the nest would reduce the number of young that fledge from the nest, would reduce the reproductive success of that breeding pair, reduce the reproductive success of that nesting colony, and would reduce recruitment of young into the tricolored blackbird population. The cost in energy and reproductive success of nesting tricolored blackbird individuals and nest colonies from the removal of active foraging habitat in the UDA would be difficult to quantify and qualify, but is expected to occur during the Permit Term.

As discussed in Section 2.7.2.2 above, most of the Action Area's documented nesting colonies (active and inactive colonies) are within the UDAs, especially in PPU-2 (in the northern UDA) and in PPU-8 (the southern UDA near the City of Galt) (Final SSHCP Figure 3-26, Section 2.7.2.2 above). Within PPU-2, Covered Activities over the Permit Term will remove all tricolored blackbird modeled habitat and all documented colony-sites currently located west of Excelsior Boulevard. This includes a persistent colony of tricolored blackbirds located at Elder Creek and Bradshaw Road, which is consistently identified as one of the State's "top 20" largest colonies and typically supports 2,500 or more birds (Kyle and Kelsey 2011). This colony has been large in each year surveyed, even in years when breeding conditions are poor throughout the species range. In addition, this colony is located on native and naturalized landcovers (not ephemeral cropland habitat). Several studies have demonstrated that breeding colonies exhibit site fidelity and traditionally use many of the same areas year after year if the site continues to provide essential resources, including secure nesting substrates, water, and suitable foraging habitats (Beedy et al. 1991; Hamilton et al. 1995; Beedy and Hamilton 1997; Hamilton 2000). The large nesting colony at Elder Creek and Bradshaw Road (and other UDA nesting colony sites) may be partially preserved by the 100-foot wide Stream Setbacks that will be required along Elder Creek by AMM STREAM-2 (Final SSHCP Table 5-1). However, as discussed above, much of the existing foraging habitat within 3 miles of this nesting colony site (and other UDA nesting colony sites) will be removed by urban development Covered Activities, and loss of foraging habitat within 3 miles of a colony may reduce the reproductive success of the colony, and result in abandonment of the colony. The SSHCP will preserve approximately 6,944 acres of tricolored blackbird modeled foraging and nesting habitat within in the UDAs, including 584 acres of tricolored blackbird modeled habitats within PPU-2 (Final SSHCP Tables 7-3, 7-4, and 7-5). When considering the 4,700 acres of tricolored blackbird modeled habitat present in existing UDA preserves together with the SSHCP preservation of tricolored blackbird modeled habitat in the UDAs, approximately 11,514 acres of tricolor blackbird modeled habitat will be preserved and managed within the SSHCP UDAs. Therefore, breeding tricolored blackbirds returning to a lost UDA colony site in the spring may shift the colony location to nearby nesting habitat present within the 11,514 acres of tricolored blackbird habitat preserved in the UDA, or the retuning birds may relocate the colony to suitable nesting sites located outside the UDAs, or the colony may disband.

Although 72% of the UDA tricolored blackbird modeled habitat will be removed by SSHCP Covered Activities, we expect the preservation and management of 11,514 acres of tricolored blackbird habitat within the UDAs will continue to support one or more tricolored blackbird nesting colonies inside the UDAs. As discussed below, the SSHCP Conservation Strategy for tricolored blackbird emphasizes the protection and management of modeled foraging habitat and occupied nesting sites outside the UDAs, where larger and contiguous areas of tricolored blackbird modeled habitat remain, and future land use will be compatible with tricolored blackbird behaviors and habitat needs.

The indirect effects of Covered Activity environmental stressors on tricolored blackbird habitat and individuals were assessed qualitatively by the SSHCP (Final SSHCP Tables 6-98, 6-99, 7-86). The edge areas of preserved or avoided tricolored blackbird modeled habitat will be exposed to environmental stressors produced by the Covered Activities, especially within the UDA portions of the Action Area where urban development Covered Activities will be adjacent to SSHCP preserves. Changes to existing landscape hydrology would transport urban pollutants into foraging and nesting areas, as discussed above. The SSHCP's General AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs), discussed in Section 2.5.4 above and in SSHCP Chapter 5.4.1, will avoid or minimize effects to tricolored blackbird nesting and foraging habitat in the edge areas of the SSHCP Preserve System inside the UDA, and adjacent to rural transportation Covered Activities outside the UDA. Other indirect effects to tricolored blackbird individuals may result from other environmental stressors produced by the urban development Covered Activities, including disorientation of individuals from outdoor lighting, and increased disturbance and increased stress resulting from human activities, including feral pets and invasive animals. As discussed above in Section 2.5.4, the SSHCP's EDGE, NATURE TRAIL, and ROAD AMMS will minimize these indirect effects on tricolored blackbird habitat and individuals within the SSHCP Preserves. In addition, the size of the larger UDA Core Preserves will provide interior areas where tricolored blackbird habitat is not exposed to these edge effects.

Tricolored blackbirds have been demonstrated to be sensitive to pesticides (see Section 2.7.1.2 above). Although pesticide use (including herbicides and rodenticides) is not a SSHCP Covered Activity (Final SSHCP page 5-63), pesticide use will occur in urban development Covered Activity sites, including include uses in landscaping, pest control, mosquito abatement activities, and roadside weed maintenance. In addition, the stormwater-channel maintenance Covered Activities inside the UDA are expected to continue using pesticides for aquatic and upland weed control (Final SSHCP Page 5-7). To avoid or minimize pesticide drift onto tricolored blackbird nesting and foraging habitat, the SSHCP will post signs along road shoulders to identify pesticide use restrictions and other roadside maintenance restrictions adjacent to SSHCP Preserves and other sensitive areas, and the SSHCP will coordinate with the appropriate SSHCP Permittee (see Final SSHCP Chapter 5.2.5) to ensure that roadside pesticide application will comply with the pesticide label (AMM ROAD-3).

Although pesticide use (including herbicides and rodenticides) is not a SSHCP Covered Activity, the SSHCP will allow limited pesticide use in the SSHCP Preserve System when necessary to meet SSHCP Biological Goals and Objectives for invasive plant and animal control (Final SSHCP Page 5-54, page 5-61, page 5-63). Pesticide use would be allowed under the conservation easements that will establish most Cropland Preserves in the SSHCP Preserve System outside the UDAs (Final SSHCP Chapters 5.3 and 9.4.3). These uses of pesticides are not expected to adversely affect tricolored blackbirds because pesticide use will be limited, and pesticide use will comply with the pesticide label and all other applicable federal, state, and local laws pertaining to the use, safety, storage, disposal, and reporting of pesticide use. If the SSHCP determines that pesticide use is appropriate on an individual SSHCP Preserve, it will include that allowance within the individual Preserve Management Plan (PMP) for that Preserve. The PMP will be subject to review and approval by the SSHCP Technical Advisory Committee (TAC), which would include members from the environmental community, the Service, and CDFW (Final SSHCP Chapter Section 9.3.4). However, the SSHCP expects the use of pesticides will not be warranted or allowed on most SSHCP Preserves (Final SSHCP page 5-64). If the SSHCP TAC approves an individual PMP that includes the use of pesticides, the allowed pesticide uses will be subject to limitations and restrictions specified in the PMP for timing and area of application, amounts to be used, and acceptable pesticide type (Final SSHCP Page 5-63), which will avoid direct and indirect effects of Preserve pesticide use on tricolored blackbird nesting habitat, insect prey, and other food items. In addition, AMM TCB-5 restricts application of pesticides (including herbicides and rodenticides) on all SSHCP Cropland Preserves between January 1 and July 15, when most tricolored blackbird are foraging or nesting in the Action Area (Final SSHCP Chapter 5.4.2). In addition, under AMM TCB-5, harvesting of wildlife food crops on SSHCP Cropland Preserves will not occur between January 1 and July 15, to protect active tricolored blackbird colonies and nests within the crop fields. Pesticide use is also expected along public roadways that border SSHCP Preserves outside the UDA. Under AMM ROAD-3 the SSHCP will post signs along road shoulders near tricolored blackbird colony sites and tricolor blackbird foraging areas to identify pesticide-use restrictions in those areas, and coordinate with the County of Sacramento to ensure that roadside pesticide application will comply with the pesticide label.

As discussed in Section 2.5.4 above, increased wildfire frequency is an expected indirect effect of human activity associated with the urban development and rural-transportation Covered Activities. However, most wildfires in the Action Area typically occur after June 30, when most itinerant-nesting tricolored blackbirds have already left the Action Area, making it unlikely that increased wildfire frequency could directly affect tricolored blackbird individuals. However, wildfires may indirectly affect tricolored blackbirds by burning and removing nesting substrates (e.g. Himalayan blackberry stands), and by burning and removing suitable foraging habitat and insect prey-species. Suitable foraging habitat my regrow within a year, but suitable nesting habitat may take several years to regrow. To address the increased risk of wildfire, the SSHCP Preserve System Management Program will develop Memoranda of Understanding with all applicable fire agencies. Individual Preserve Management Plans (PMPs) will identify appropriate responses to wildfire and identify appropriate fire-suppression techniques, including identification, installation, and maintenance of fuel breaks, use of prescribed fire, pre-incident planning, and public education campaigns. Each Preserve Manager will work closely with responding fire agencies to ensure fire response and suppression is consistent with the Memorandum of Understanding and with the individual Preserve PMP to minimize impacts to sensitive areas, including tricolored blackbird colony sites (Final SSHCP Chapter 11.4.3.2). In addition, the potential for increased wildfires will be minimized through the implementation of the SSHCP AMMs that reduce the open space–urban interface, reduce thatch buildup on SSHCP Preserves, and control public access within the SSHCP Preserves.

In accordance with SSHCP Objective TB6, the SSHCP will conduct studies to identify habitat management actions that can reduce exposure of tricolored blackbird nesting colonies to environmental stressors, including predation. The studies will test management actions that may reduce predation in nesting colonies (e.g., different types of coarse netting to reduce nest predation, removing trees, or bushes around colonies to reduce perches for avian predators; trapping and removing urban mesopredators). One or more existing tricolored blackbird colonies in the Action Area may be selected as an experimental colony. If a large colony is available, the SSHCP may test more than one potential management-actions within that colony. Experimental treatments will be evaluated as to whether they produced a measurable and biologically significant decrease in nest predation, or increased fledgling success (Final SSHCP Conservation Action TB7.1). These tricolored blackbird colony-protection studies will be initiated within 2 years of SSHCP Permit issuance, and completed within 5 years of SSHCP permit issuance (Final SSHCP Table 7-7).

Table 27. Tricolored Blackbird Habitat-Effects and Habitat-Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Nesting and Foraging Habitat					
Cropland	5,285	Qualitative Assessment	5,285	6,947	0
Valley Grassland	22,014	Qualitative Assessment	22,014	22,014	270[a]
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Freshwater Marsh	127	Qualitative Assessment	127	127	127
Total Nesting Habitat	**27,531**	Qualitative Assessment	**27,531**	**29,193**	**502**
Foraging Habitat					
Irrigated Pasture	2,749	Qualitative Assessment	2,749	2,749	0
Vernal Pool	389	Qualitative Assessment	389	966	389
Swale	234	Qualitative Assessment	234	278	234
Open Water	155	Qualitative Assessment	155	155	155
Total Foraging Habitat	**3,527**	Qualitative Assessment	**3,527**	**4,148**	**778**
Totals	**31,058**	Qualitative Assessment	**31,058**	**33,341**	**1,280**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

To mitigate the adverse direct and indirect effects of Covered Activities on tricolored blackbird individuals and modeled habitat, the SSHCP will preserve least 33,341 acres of modeled foraging and nesting habitats for tricolored blackbird in the Action Area. The characteristics and locations of the 33,341 acres of modeled habitat preserved for tricolored blackbird will be consistent with the SSHCP Preserve System assembly-criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, and will be consistent with the SSHCP biological goals and objectives for tricolored blackbird (Final SSHCP Table7-1 and 7-87). Sites selected for Preserves will prioritize sites with active or previously active nesting colonies, and where high quality foraging habitat is within one mile of active or previously active nesting colonies. To the maximum extent possible, SSHCP Preserves will be established adjacent to and contiguous with existing preserves to enhance the functional value of the SSHCP Preserves for tricolored blackbird, and to minimize the effects of habitat fragmentation and edge effects.

The 33,341 acres of modeled foraging and nesting habitats preserved for tricolored blackbird will include a minimum of 232 acres of aquatic nesting habitat (Freshwater Marsh and Seasonal Wetlands) that have suitable tricolored blackbird nesting substrate (e.g. cattails, tules) and are within 3 miles of suitable foraging habitat (SSHCP Objective TB2.1). Management of this aquatic nesting/foraging habitat will include periodic thinning or removal of tules or cattails after the nesting season to allow for growth of new tules and cattails, which are strongly preferred by nesting blackbirds. In addition, trees and other potential perching sites within 50 feet of this aquatic nesting/foraging habitat will be removed as necessary to prevent predators from taking eggs or nestlings from active colonies (Final SSHCP page 7-292).

Upland foraging and nesting habitat preserved for tricolored blackbirds will include 6,947 acres of Cropland Preserve planted with suitable nesting substrate (e.g. alfalfa, triticale), or planted with suitable forage crops (e.g. sunflower). Upland foraging and nesting habitat preserved for tricolored blackbird also will include 22,014 acres of Valley Grassland with minimum 2-acre stands of Himalayan blackberry to accommodate large nesting colonies (SSHCP Objective TB2.2).

The SSHCP Preserve System will preserve and manage at least five of the extant tricolored blackbird nesting colonies in the Action Area that were observed to be active in the last two triannual statewide surveys (Final SSHCP page 7-294, Objective TB5). Each of the preserved colonies must have supported a minimum of 200 breeding adults during one or both of the last two statewide surveys, and must be within one mile of at least 500 acres of a known-foraging site, or at least 500 acres of SSHCP landcovers that provide tricolored blackbird modeled foraging or modeled foraging/nesting habitat (Final SSHCP Conservation Action TB5.1). The analysis in this Opinion assumes that the SSHCP will assure that the 500 acres of foraging habitat that is located within one mile of each preserved tricolored blackbird nesting-colony will be protected by the SSHCP Preserve System, is already protected by an existing preserve, or otherwise will be protected to assure that each preserved tricolored blackbird nesting-colony will always have an available food source.

In addition, the SSHCP Preserve System also will preserve and manage at least one very large tricolored blackbird nesting colony that currently supports a minimum of 1,500 breeding adults, or is documented to have previously supported a minimum of 1,500 breeding adults (SSHCP Objective TB7). The site selected for preservation must contain an amount of tricolored blackbird nesting-substrates that could support a colony of 1,500 birds (i.e. has thorny or spiny vegetation, or vegetation that appears to be spiny, and/or is a flooded site with suitable vegetation), and must be within one mile of at least 500 acres of SSHCP landcovers that provide high-quality habitat for insect prey-species (e.g. Valley Grassland and vernal pool grasslands, alfalfa fields, or Freshwater Marsh and Seasonal Wetlands) (Final SSHCP Conservation Action TB7.1). The analysis in this Opinion assumes that the SSHCP will assure that the 500 acres of high-quality modeled foraging habitat that is located within one mile of the large nesting-colony site will be protected by the SSHCP Preserve System, or is already protected by an existing preserve, or otherwise will be protected to assure that the large preserved nesting-colony has an assured food source that is adequate for the size of that colony.

Prior to a Covered Activity removal of an active tricolored blackbird nesting-colony (i.e. any colony site occupied at any time since 2008), the SSHCP Conservation Strategy will first acquire, preserve, and manage one tricolored blackbird nesting colony that has supported a minimum of 200 breeding adults in the past, and was active during one or both of the preceding survey years (Conservation Action TB5.1). The site of the protected nesting colony must be within one mile of a 500-acre known foraging site, or be within one mile of 500 acres of SSHCP landcovers that provide tricolored blackbird modeled foraging or modeled foraging/nesting habitat (Final SSHCP Conservation Action TB5.1). The analysis in this Opinion assumes that the SSHCP will assure that the 500 acres of foraging habitat will be protected by the SSHCP Preserve System, or is already protected by an existing preserve, or otherwise will be protected to assure that the preserved tricolored blackbird nesting-colony will always have an available food source. The analysis in this Opinion also assumes that the size of the preserved nesting colony will not be substantially smaller than size of the nesting colony that will be removed by the Covered Activity. In addition, the SSHCP also will re-establish or establish three new tricolored blackbird breeding colonies in the Action Area for each active breeding colony removed by a Covered Activity (SSHCP Objective TB8; Conservation Action TB8.1, and Conservation Action TB8.2).

Tricolored blackbirds in the Action Area also will benefit from implementation of other SSHCP Biological Objectives. SSHCP Objective AG1 will preserve a total of 9,696 acres of Cropland and Irrigated Pasture landcovers in SSHCP Cropland Preserves. Objective AG2 requires that at least 2,000 of those acres be crops preferred by foraging tricolored blackbirds, including alfalfa, corn, or wheat. These food-plots will be distributed throughout PPUs 4, 5, and 6 at a minimum of 10 different locations, and each food plot will be 20 acres or larger.

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques that will maintain and improve tricolored blackbird foraging and nesting habitats within the individual SSHCP Preserves (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). These actions are expected to increase reproductive success and productivity of the species in the Preserve System. The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve, especially the UDA Preserves (SSHCP Objectives HAB4 and HAB5). The preservation of high quality tricolored blackbird habitat, coupled with careful habitat management and monitoring, is expected to maintain or increase the number and distribution of tricolored blackbirds within the Action Area.

In addition to the preservation of 33,341 acres of modeled habitat for tricolored blackbird the SSHCP Conservation Strategy also will establish or re-establish 1,280 acres of tricolored blackbird modeled habitat in the SSHCP Preserve System, with a priority on re-establishment before establishment (Table 27 above). Sites selected for the establishment or re-establishment of 232 acres of tricolored blackbird aquatic nesting/foraging habitat will be prioritized following the requirements of SSHCP Objective TCB4.

2.7.4.3 Effects on Western Burrowing Owl

Effects of SSHCP Covered Activities on western burrowing owl include the removal of modeled foraging and nesting habitat, the reduction or loss of habitat functions in avoided habitat, and effects on western burrowing owl individuals.

Of the total 213,106 acres of western burrowing owl modeled habitat available in the Action Area (Final SSHCP Table 6-88), SSHCP Covered Activities will remove up to 30,836 acres (15%) of the species modeled habitat (Table 28 below). Most loss of western burrowing owl modeled habitat will occur inside the UDAs. Of the total 30,978 acres of expected habitat loss, 29,706 acres (96%) of loss will occur inside the UDAs, and only 1,272 acres (4.0%) will be lost outside the UDA (Table 6-88 in the *Erratum to the Final SSHCP*; Henry *in litt.* 2019). Most species habitat loss will be modeled foraging and nesting habitat, primarily Valley Grassland (22,014 acres).

Activities related to the implementation of Covered Activities (including the use of earth moving equipment, mass grading, construction, and paving), will remove western burrowing owl foraging habitat and will remove the fossorial burrows used for nesting and sheltering. If implemented during western burrowing owl nesting season, the removal of nesting burrows could kill or injure individual eggs, nestlings, juvenile, and adult birds. The removal of active nesting burrows would also disrupt breeding behavior in the adults, causing them to relocate within the Action Area or move out of the Action Area, which could reduce or eliminate the likelihood of their successful reproduction that year. Noise, human activity, and equipment use during implementation of Covered Activities in the vicinity of active nests can also directly affect nesting western burrowing owls by increasing stress levels and by disrupting normal nesting behaviors. Disruption of nesting behaviors may result in abandonment of the nesting site, forcing pairs to relocate and build a new nest (likely resulting in fewer offspring that year), or pairs may completely abandon nesting that year without reproducing. Abandonment of nests that contain eggs or nestlings would also result in death of the eggs or nestlings. Repeated disruptions in adult nesting and feeding behaviors could affect the growth and health of nestlings, increasing the chances of mortality before fledging or before young reaching maturity. Weaker and smaller young would be more susceptible to disease and predation, and are less likely to mature and reproduce.

Covered Activity removal of foraging habitat within the home range of nesting adults may force adults to alter their foraging behaviors, force adults to fly greater distances, and/or force adults to search for prey in new and unfamiliar areas, or may result in the abandonment of active burrows. Although western burrowing owls are able to fly over unsuitable landcovers, their foraging home range is relatively small. Burrowing owl daytime foraging occurs within 0.2 mile (1,056 feet) of their burrow, and 95% of nocturnal foraging is within 0.4 mile (2,112feet) of their burrow. Therefore, western burrowing owls will be more sensitive to loss of habitat in their home range, when compared to other raptor Covered Species. Flying greater distances to forage would increase energetic demands of juvenile and adult birds, increase time away from their burrows, and would increase other risks, such as collisions with vehicles and collisions with man-made structures. Removal of active foraging areas and available prey during the western burrowing owl incubation and fledging period is expected to reduce reproductive success.

Direct effects to western burrowing owl individuals will be avoided or minimized by the construction BMP AMMs and by the species-specific WBO AMMS (Final SSHCP Chapter 5.4). If modeled habitat for western burrowing owl is present within a Covered Activity's project footprint or within 0.25 mile of a project footprint, AMM WBO-1 requires an approved biologist to survey the project site using current survey protocols at the time the Covered Activity is implemented, to map all burrows, and to identify burrows that may be occupied. If suitable or occupied burrows are identified under the initial site surveys, AMM WBO-2 requires minimum 250-foot buffers around the burrows, and requires at least two pre-construction surveys of a project site. If western burrowing owl individuals, or evidence of western burrowing owl individuals, are observed in the project site or within 250 feet of the project site during the initial or the pre-construction surveys, then the project also will implement AMM WBO-3 to avoid active burrows during the nesting and the non-breeding seasons. AMM WBO-4 requires an approved biologist be on-site during project construction to monitor and maintain buffers established around western burrowing owl burrows. In addition, AMM WBO-6 requires maintenance Covered Activities to be seasonally timed, when safety permits, to avoid or minimize adverse effects of the Covered Activity on occupied nesting burrows in adjacent preserves, Preserve Setbacks, and Stream Setbacks. As described in AMM WBO-5, the passive relocation of individual burrowing owls from occupied burrows may be allowed under some circumstances, if approved in writing by the Service and CDFW.

In addition to causing direct effects to western burrowing owls, the removal of 30,836 acres (15%) of available modeled habitat from the Action Area will further fragment western burrowing owl habitat within the Action Area, primarily within the UDAs. Some fragmented patches of foraging and nesting habitat may become unsuitable or inaccessible to ground squirrels, eliminating ground squirrel burrows and western burrowing owl nesting in those areas. Some existing nest burrows may become isolated from suitable foraging habitat by distance or by urban landcovers, leading to reduced nesting success or the abandonment of existing nest burrows. Fragmented patches of burrowing owl foraging habitat may become less suitable to voles and other prey species, permanently reducing hunting success within an existing home range of some western burrowing owls. However, the three large SSHCP Core Preserves will continue to provide relatively large landscapes of suitable foraging and nesting habitat for western burrowing owls in the UDA, and the habitat connectivity preserved in the UDA by the SSHCP Preserve System will further minimize the effects of habitat loss and habitat fragmentation on western burrowing owls. As discussed below, the 29,211-acre portion of SSHCP Preserve System located outside the UDAs will protect large landscapes of western burrowing owl modeled foraging and nesting habitats.

The SSHCP qualitatively assessed and analyzed indirect effects of SSHCP Covered Activities on western burrowing owl modeled habitat (Tables 6-88 and 6-89 in County of Sacramento et al. 2019; Henry *in litt.* 2019). The edge areas of preserved or avoided modeled habitats will be exposed to environmental stressors produced by the Covered Activities, especially within the UDA portions of the Action Area. As discussed in Section 2.5.4 above, the close proximity of new urban development to modeled habitat may increase exposure of occupied burrows, foraging habitat, and prey species to fertilizers, herbicides, pesticides, fuel, oil, lubricants, and other toxins. Western burrowing owl individuals exposed to these pollutants could be sickened or killed, and individuals that consume prey contaminated with these pollutants could be sickened or killed (Gervais et al. 2000). If indirect changes to existing hydrology cause grasslands and borders of wetlands to become dryer, suitable habitat for insect prey species and voles (a favored prey of western burrowing owl) could be permanently removed. However, the SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs) will prevent roadside and urban runoff from entering preserved foraging and nesting habitats, will avoid indirect changes to the existing hydrology of preserved foraging habitats, and will minimize exposure of western burrowing owl individuals and prey to urban and roadside pollutants.

Indirect effects to western burrowing owls may result from other environmental stressors produced by Covered Activities, including increased ground vibration, disorientation of individuals from outdoor lighting; increased disturbance and stress resulting from human activities; increased competition for prey-species by feral pets; and increased predation of eggs and young by urban mesopredators and feral pets. As discussed above in Section 2.5.4, the SSHCP EDGE, NATURE TRAIL, and ROAD AMMS will minimize these indirect effects on western burrowing owl individuals that nest and forage within the SSHCP Preserves. The UTILITY-1 and WBO-1 AMMs will require Covered Activities that install above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 6-89). In addition, the size of the UDA Core Preserves will provide interior areas where western burrowing owl foraging and nesting habitats are not exposed to environmental stressors produced by the Covered Activities.

AMMs WBO-7 and CTS-7 will minimize the effects of rodenticide use on western burrowing owls in the Action Area. Use of pesticides (including rodenticides and herbicides) is not an SSHCP Covered Activity. However, pesticide uses specified in Final SSHCP Chapter 5.3 are allowed as land management tools, provided the applications are otherwise legal and conforms to all conditions in SSHCP Chapter Section 5.4. Rodent control will be allowed only within the developed portions of an urban development Covered Activity project site, and will not be allowed within SSHCP Preserves that are within the UDAs. Under some circumstances, Agricultural Preserves outside the UDA may allow rodent control measures. Where rodenticides are allowed, the individual conservation easement and the individual Preserve Management Plan for the Agricultural Preserve will assure that the rodent control measures comply with the methods of rodent control that are discussed in the 4(d) Rule published in the U.S. Fish and Wildlife Service's (2004c) final listing rule for tiger salamander, and include limitations on timing and area of application, amounts to be used, and acceptable rodenticides (Final SSHCP Page 6-340).

Outside the UDA, indirect effects to western burrowing owl modeled habitats may result from the rural transportation Covered Activities. The one mile extension of Valensin Road will further fragment western burrowing owl foraging and nesting habitat in PPU-7. Because western burrowing owls disproportionally forage in roadside edges and median strips used by voles and mice as dispersal corridors (Estep 1989; Swolgaard 2004), western burrowing owls have a higher risk of vehicle collision and exposure to roadside environmental stressors than most of Covered Species. The Covered Activity improvements to existing roadways outside the UDA will increase traffic densities and increase vehicle speeds on those roadways, which are expected to result in more vehicle collisions, and are expected to increase exposure of individuals to roadside trash, roadside pollutants, and human activities. However, the increased numbers of vehicle collisions in the Action Area are expected to be relatively minor because of the limited number of road widening projects that will be implemented outside the UDA (Final SSHCP Chapter 5.2.3).

To mitigate the adverse direct and indirect effects to western burrowing owl individuals and western burrowing owl modeled habitat, the SSHCP will preserve at least 33,132 acres of modeled habitat for western burrowing owl in the Action Area, including 31,757 acres of modeled foraging and nesting habitat and 1,375 acres of other landcovers that provide seasonal foraging habitat (Table 28 above). As much as possible, SSHCP Preserves will be established adjacent to and contiguous with the existing preserves in the Action Area, to minimize habitat fragmentation and to increase the functional value of each SSHCP Preserve for western burrowing owl. The locations and characteristics of the 33,132 acres of modeled habitat preserved for western burrowing owl will be consistent with the Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, and will be consistent with the SSHCP Biological Objectives and Conservation Actions for western burrowing owl (Final SSHCP Table 7-1 and 7-80).

Table 28. Western Burrowing Owl. Habitat-Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Foraging and Nesting Habitat					
Valley Grassland	22,014	Qualitative Assessment	22,014	22,014	270[a]
Blue Ok Savanna	38	Qualitative Assessment	38	47	38[b]
Cropland	5,285	Qualitative Assessment	5,285	6,947	0
Irrigated Pasture-Grassland	2,749	Qualitative Assessment	2,749	2,749	0
Total Nesting/Foraging Habitat	**30,086**	Qualitative Assessment	**30,086**	**31,757**	**308**
Foraging Habitat					
Vernal Pool	389	94	483	966	389
Seasonal Wetland	105	Qualitative Assessment	105	105	1050
Swale	234	44	278	278	234
Stream/Creek-VPIH	22	4	26	26	0[c]
Total Foraging Habitat	**750**	**142**	**892**	**1,375**	**728**
Totals	**30,836**	**142**	**30,978**	**33,132**	**766**

[a.] SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

[b.] Impacts to Blue Oak Woodland or Blue Oak Savanna can be mitigated by re-establishing or establishing any combination of Blue Oak Woodland and Blue Oak Savanna.

[c.] Re-establishment/establishment to mitigate effects to Stream/Creek (VPIH) will be in the form of Swale, which has been added to the 234 acres necessary to mitigate effects to Swale.

During the assembly of the SSHCP Preserve System, the SSHCP will ensure that a minimum of 33,132 acres of modeled foraging/nesting habitat for western burrowing owl are preserved. The SSHCP will ensure that the preserved lands include (1) sites known to support breeding western burrowing owls, or are within 3 miles of known nesting sites; sites known to support high populations of rodents (prey) during the western burrowing owl breeding season; (2) sites known to support populations of ground squirrels or other animals that create burrows; (3) sites with well drained soils and have a low risk of flooding; (4) sites are preserved in parcels of 20 acres or greater and/or occur within a larger open-space area that will remain open space; and (5) are sites that would expand upon or link already preserved lands and will not be bisected by new roadways or other infrastructure development (SSHCP Objectives BO3 and BO4 in Table 7-1 of the *Erratum to the Final SSHC*P). Additionally, the SSHCP Conservation Strategy will re-establish or establish 38 acres of Blue Oak Savanna to create additional foraging/nesting habitat for western burrowing owl.

The SSHCP will permanently protect at least seven occupied western burrowing owl nesting colonies, and protect at least 200 acres of modeled habitat surrounding each of the seven nesting colonies. The SSHCP will intensively manage each of the seven nesting sites/colonies and the surrounding habitat for the benefit of the nesting adults, the nestlings, and flightless young in the nesting colony (SSHCP Objective BO1). This intensive habitat management is expected to increase the number of young fledged and increase the reproductive rate of adult birds in each of the nine protected nesting sites/colonies. The increased fledging success is expected to maintain the nine nesting sites/colonies from year to year, and also allow each to function as a source of juvenile birds that may disperse to colonize unoccupied modeled habitat within and near the Action Area, or disperse to re-colonize habitat that becomes unoccupied after a random event.

To maintain the existing distribution of western burrowing owls in the Action Area (Biological Goal 5), the SSHCP will ensure that Covered Activity removal of western burrowing owl modeled habitat in PPU-4, PPU-6, and PPU-7 are mitigated by the preservation and management of western burrowing owl modeled habitat of modeled habitat in the same PPU (Final SSHCP Conservation Action BO3.2 in Table 7-1 of the *Erratum to the Final SSHC*P).

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques that will maintain or improve the 33,132 acres of western burrowing owl foraging habitat and nesting habitat protected in the SSHCP Preserve System (Objectives HAB1, HAB2, HAB3, and HAB7). The grassland monitoring and management provided by Objective HAB7 are expected to increase prey detectability and foraging success of western burrowing owls by providing areas with the shorter vegetation height preferred by western burrowing owls, by removing dense thatch from grasslands in the SSHCP Preserve System, and by improving grassland habitat suitability for burrowing owl prey species (voles, mice, grasshoppers, and other insects) (Final SSHCP page 7-273; Section 2.7.1.3 above). In addition, the individual Preserve Management Plans will assure that that potential adverse edge effects (such as invasive weeds, trash, litter, lighting, noise, and human activity) are monitored and addressed in each SSHCP Preserve (Final SSHCP page 7-273). To create additional burrowing owl nesting habitat in the Action Area, the SSHCP will establish artificial burrows at appropriate locations throughout the 36,282-acre SSHCP Preserve System, using CDFW's artificial burrow guidelines (SSHCP Objective BO3 and Table 7-1 in the *Erratum to the Final SSHC*P). These artificial burrows also will provide new sheltering habitat for the migrant burrowing owls that overwinter in the Action Area (see Section 2.7.1.5 above). Because western burrowing owls frequently hunt from a short perch (see Section 2.7.1.3 above), the SSHCP also will enhance western burrowing owl foraging success by installing sentinel posts at appropriate locations in the SSHCP Preserve System. Therefore, the SSHCP Conservation Strategy is expected to increase western burrowing owl foraging success and reproduction within the SSHCP Preserve System.

SSHCP Covered Activities are not expected to remove any sites where western burrowing owl use has been documented the Action Area (Final SSHCP Figure 3-27; CNDDB 2018), but undocumented nesting and foraging sites are presumed to be present within the 30,836 acres of western burrowing owl modeled habitat that will removed by SSHCP Covered Activities. For each active burrow or burrowing owl pair that will be passively relocated from a Covered Activity project site (see AMM WBO-5), Biological Objective BO2 requires the SSHCP to first protect and enhance 200 acres of western burrowing owl modeled habitat by (1) establishing a new ground squirrel colony on those acres, (2) creating artificial burrows, (3) managing the 200 acres to provide the short, sparse vegetation preferred by western burrowing owl, and (4) installing sentinel posts, mounds, or rock piles (Table 7-1 in the *Erratum to the Final SSHC*P). SSHCP Objective BO3 will assure that suitable burrows are available for burrowing owl individuals or pairs before the birds are passively removed from an occupied/active burrow. In this manner, Objective BO2 will assure that the SSHCP Conservation Strategy avoids temporal impacts to resident and migrant western burrowing owls, which would occur if there was a delay between the time of a Covered Activity impact to an occupied/active burrow, and the time when the benefits of SSHCP Conservation Strategy become available to the affected individuals or pairs.

The habitat preservation, enhancements, monitoring, and management that will be provided in perpetuity on the 33,132 acres of species modeled habitat in the SSHCP Preserve System is expected to maintain or increase the number of western burrowing owl individuals in the Action Area and maintain or expand the existing distribution of western burrowing owls in the Action Area.

When considering together the 33,132 acres of western burrowing owl modeled habitat preserved and managed by the SSHCP, together with the 52,471 acres of western burrowing owl modeled habitat already protected in existing Action Area preserves (Final SSHCP Chapter 3.5), approximately 85,603 acres of western burrowing owl modeled habitat will be permanently preserved and managed in perpetuity within the Action Area for the benefit of resident western burrowing owls. As discussed in Section 2.7.2.3, the Action Area is within the Middle California Central Valley portion of the species range, which supports a relatively large number of overwintering western burrowing owls from Canada, Washington, Oregon, and Idaho. The 85,603 acres of western burrowing owl modeled habitat preserved and managed in the Action Area also will maintain the winter foraging and sheltering habitat required by the overwintering population of burrowing owls that nest in the northern portions of the species range.

2.7.4.4 Effects on Ferruginous Hawk

Effects of SSHCP Covered Activities on ferruginous hawk include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on ferruginous hawk individuals.

Of the total 159,491 acres of ferruginous hawk winter foraging modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 25,491 acres (16%) of the species modeled habitat (Table 29 below). Most species habitat removed (22,014 acres) will be Valley Grassland and other landcovers that provide ferruginous hawk foraging habitat (Final SSHCP Table 6-75). Most loss of ferruginous hawk modeled habitat will occur within the UDA portions of the Action Area, where 24,628 acres (70%) of the existing 35,121 acres of ferruginous hawk modeled habitat available in the UDAs will be removed. Outside the UDAs, only 863 acres (0.7%) of the existing 124,370 acres of ferruginous hawk modeled habitat will be removed by the rural transportation Covered Activities and the recycled-water pipeline Covered Activities.

Activities related to the implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, and paving will remove ferruginous hawk foraging habitats. When SSHCP Covered Activities are implemented during the winter residency period of ferruginous hawks (mid-August to late May), the noise, human activity, and equipment used during implementation of Covered Activities in the vicinity of foraging areas could directly affect ferruginous hawks by disrupting normal foraging behaviors and increasing stress levels. Because the ferruginous hawk does not nest in the Action Area, the RAPTOR AMMs do not apply to Covered Activities implemented in or near ferruginous hawk winter-foraging modeled habitat. The increased energy demands and stress from interrupted foraging behaviors would be difficult to quantify and qualify. However, direct disturbances from construction activities and operations and maintenance Covered Activities in the UDA are expected to have a very small effect on ferruginous hawk winter foraging behaviors in the Action Area, and would not reach the scale where take occurs.

Covered Activity removal of 25,491 acres of ferruginous hawk winter foraging habitat will further fragment the ferruginous hawk winter foraging habitat present within the Action Area. Although ferruginous hawks are able to fly over unsuitable landcovers to access suitable foraging areas, increased habitat fragmentation will make ferruginous hawks fly farther between suitable foraging areas, which may increase other risks, such as collisions with vehicles and collisions with man-made structures. We expect that the removal of existing foraging habitat would increase competition for suitable foraging-territories in the Action Area. Competition for foraging sites would occur between individual ferruginous hawks and between other Action Area raptors, including Swainson's hawks, northern harriers, and white-tailed kites. Competition for foraging sites is expected to increase stress levels in individual ferruginous hawks and may increase energetic demands.

As discussed above in Section 2.7.3, indirect effects to ferruginous hawks individuals may also result from other environmental stressors produced by the urban development Covered Activities, including disorientation of individuals from outdoor lighting, increased disturbance and increased stress resulting from human activities, increased completion for prey-species by feral pets and other invasive animals. As discussed above in Section 2.5.4, the EDGE, NATURE TRAIL, ROAD AMMS will minimize these indirect effects on ferruginous hawk habitat and individuals within the SSHCP Preserves in the UDA. Implementation of the UTILITY-1 and RAPTOR-1 AMMs will require Covered Activities that include above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 7-76). In addition, the size of the larger UDA Core Preserves will provide interior areas where ferruginous hawk foraging habitat is not exposed to these edge effects.

Outside the UDA, indirect effects to ferruginous hawk modeled habitat are expected from the rural transportation Covered Activities. The improved roadways will increase traffic densities and vehicle speeds, resulting in increased human activity, roadway trash, and increased risk of vehicle collisions and utility collisions. However, these indirect effects on the ferruginous hawk are expected to be relatively minor because of the limited number of rural transportation projects implemented outside the UDAs and the large areas of ferruginous hawk modeled habitat located outside the UDAs.

Table 29. Ferruginous Hawk Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Habitat Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Valley Grassland	22,014	Qualitative Assessment	22,014	22,014	270[a]
Vernal Pool	389	Qualitative Assessment	389	966	389
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Swale	234	Qualitative Assessment	234	278	234
Irrigated Pasture	2,749	Qualitative Assessment	2,749	2,749	0
Totals	**25,491**	Qualitative Assessment	**25,491**	**26,112**	**998**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

To mitigate the adverse direct and indirect effects to ferruginous hawk individuals and ferruginous hawk modeled habitat, the SSHCP will preserve least 26,112 acres of suitable foraging habitat for ferruginous hawk in the Action Area (Table 29 above). The majority of habitat preservation for ferruginous hawk will occur in outside the UDA (19,625 acres), primarily Valley Grasslands in PPU-5 and PPU-7. The characteristics and locations of modeled habitat preserved for ferruginous hawk will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, consistent with the SSHCP biological goals and objectives for ferruginous hawk (Final SSHCP Table 7-1 and 7-71). SSHCP Preserves of ferruginous hawk foraging habitat will include grasslands with topographic variation and moderate to dense vegetation cover and are known to already support populations of prey species, including rabbits, ground squirrels, and pocket gophers (SSHCP Objective FH1). SSHCP Preserves established for ferruginous hawk will be adjacent to existing preserves, enhancing the functional value of the SSHCP Preserves for ferruginous hawk, and to minimize the effects of habitat fragmentation and edge effects.

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques for maintaining and improving ferruginous hawk winter foraging habitat within the individual SSHCP Preserve (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). The preservation of high quality foraging habitat within large Preserves, coupled with careful management and monitoring, is expected to maintain or increase the number and distribution of ferruginous hawks within the Action Area.

2.7.4.5 Effects on Swainson's Hawk

Effects of SSHCP Covered Activities on Swainson's hawk include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on Swainson's hawk individuals.

Of the total 213,223 acres of Swainson's hawk modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 31,112 acres (15%) of the modeled habitat (Table 30 below). Most habitat lost (30,739 acres) will be modeled foraging habitat, primarily Valley Grassland. In addition, 373 acres of Swainson's hawk nesting habitat will be removed (Table 30 below). Of the 31,112 acres of Swainson's hawk foraging habitat removed, 29,882 acres (96%) will be removed inside the UDAs. Of the total 378 acres of Swainson's hawk nesting habitat removed, 332 acres (89%) will be inside the UDAs (Final SSHCP Table 6-78). There are currently 36 known Swainson's hawk nest trees within the UDAs (Final SSHCP page 7-41), and most of the UDA nest trees are expected to be removed by urban development Covered Activities over the Permit Term.

Of the total 70,127acres of Swainson's hawk modeled habitat in the Action Area that are also categorized as "high value" foraging habitat, SSHCP Covered Activities will remove 7,413 acres (11%) of the "high-value" habitat. Most loss of "high value" Swainson's hawk habitat (87%) will occur within the Galt UDA (PPU-8). Outside the UDAs (in PPU-4 and PPU-6), the rural transportation and recycled water pipeline Covered Activities will remove 659 acres (1.0%) of the existing 62,393 acres of "high-value" habitat (Final SSHCP Table 6-79).

Activities related to the implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, construction, and paving, will remove Swainson's hawk foraging habitat and nesting habitats. If implemented during Swainson's hawk nesting season, the removal of nesting trees could kill or injure eggs and young. The removal of active nesting-sites would disrupt breeding behavior in the adults, causing them to relocate within the Action Area or move out of the Action Area, which could reduce or eliminate the likelihood of successful reproduction that year.

The noise, human activity, and equipment use during implementation of Covered Activities in the vicinity of active nests can also directly affect nesting Swainson's hawks by increasing stress levels and by disrupting normal nesting behaviors. Disruption of nesting behaviors may result in abandonment of the nesting site, forcing pairs to relocate and build a new nest (likely resulting in fewer offspring that year), or pairs may completely abandon nesting that year without reproducing. Abandonment of nests that contain eggs or nestlings would also result in death of the eggs or nestlings. Repeated disruptions in nesting and feeding behaviors could affect the growth and health of nestlings, increasing the chances of mortality before fledging or before young reaching maturity. Weaker and smaller young would be more susceptible to disease and predation.

Covered Activity removal of foraging habitat within the home-range of nesting adults may force adults to alter their foraging behaviors, force adults to fly greater distances, and/or force adults to search for prey in new and unfamiliar areas. Removal of foraging areas and available prey during the Swainson's hawk incubation and fledging period would require the adults to expend more energy hunting to feed their young, and can reduce hunting success. Less successful hunting during the nesting season can reduce the number of eggs laid by the female, and would reduce the amount or the quality of food fed to young—slowing the growth of nestlings, and reducing the number of young that fledge and survive to maturity.

Direct effects to Swainson's hawk individuals will be avoided or minimized by the construction BMP AMMs (Final SSHCP Table 6-81) and by the SWHA AMMS. If modeled habitat for Swainson's hawk is present within a Covered Activity's project footprint or within 0.25 mile of a project footprint, AMM SWHA-1 requires an approved biologist to conduct field surveys to determine if existing or potential Swainson's hawk nesting-sites are present within the project footprint, or within 0.25 mile of the project footprint. Existing or potential Swainson's hawk nesting sites must be noted on all project plans that are submitted to the local Land-Use Authority Permittee or the SSHCP Implementing Entity for approval. If existing or potential nest sites are identified during these initial field surveys, and if project activities will occur within the project footprint during the Swainson's hawk breeding season (March 1 to September 15), AMM SWHA-2 also requires the pre-construction surveys be conducted during the Swainson's hawk breeding season. The pre-construction surveys will occur within 30 days of any ground disturbing activities, and again within 3 days of any ground disturbing activities. If a nest is present, the approved biologist will inform the Land-Use Authority Permittee and the SSHCP Implementing Entity of the nest location, and they in turn will notify the Service and CDFW. The Covered Activity project will then implement AMMs SWHA-3 and SWHA-4 at the project site. AMM SWHA-3 requires the Covered Activity project to establish a 0.25 mile buffer-zone around any active Swainson's hawk nest that is within the project footprint or within 0.25 mile of the project footprint. No project activities (vehicle use, machinery use, ground disturbance, human activity, etc.) will occur within this temporary nest-disturbance buffer established around the active nest until the young are fledged and have left the nest site. However, if project-related activities are determined to be necessary within the temporary 0.25-mile disturbance buffer during the breeding season, AMM SWHA-4 allows work within the temporary nest disturbance buffer to occur with the written permission of the SSHCP Implementing

Entity, the Service, and CDFW. An approved biologist experienced with raptor behavior will be retained by the Third Party Project Proponent to monitor the nest throughout the nesting season and to determine when all young have left the nest site. The approved biologist will be on site daily while construction-related activities are taking place within the 0.25-mile disturbance buffer. If nesting adult raptors or young in the nest begin to exhibit agitated behavior, such as vocalizing, getting up from a brooding position, flying off the nest, or defensive flights at intruders, the approved biologist/monitor will have the authority to shut down project activities. If agitated behavior is exhibited, the biologist, the Third Party Project Proponent, the SSHCP Implementing Entity, the Service and CDFW will meet to determine the best course of action to avoid nest abandonment or injury of individuals. The approved biologist also will train construction-personnel on the required avoidance procedures, the disturbance-buffer zones, and protocols in the event that a covered raptor species flies into an active project site from outside the buffer zone.

The Covered Activity removal of 31,112 acres (15%) of existing Swainson's hawk modeled habitat will further fragment the Swainson's hawk habitat within the Action Area. Although Swainson's hawks are able to fly over unsuitable landcovers to access suitable foraging areas, increased habitat fragmentation will make Swainson's hawks fly farther between suitable foraging and nesting areas, increasing energetic demands and time away from nest sites, and increasing other risks, such as collisions with vehicles and collisions with man-made structures. The cost in energy and reproductive success of direct disturbances to Swainson's hawk nesting habitat and nesting individuals would be difficult to quantify and qualify, but with implementation of the SSHCP AMMs, these direct disturbances from Covered Activity construction activities and from Covered Activity operations and maintenance activities will be minimized.

In addition to direct effects, the implementation of SSHCP Covered Activities will indirectly affect Swainson's hawk habitat and individuals within the Action Area. The SSHCP qualitatively assessed and analyzed the indirect effects of SSHCP Covered Activities on Swainson's hawk modeled habitat (Final SSHCP Table 6-80). The edge areas of preserved or avoided Swainson's hawk modeled habitat will be exposed to environmental stressors produced by the Covered Activities, especially within the UDA portions of the Action Area. Swainson's hawk individuals that consume prey contaminated with urban or roadside pollutants may be sickened or killed. Indirect changes to the existing hydrology of riparian nesting-habitat may remove riparian landcovers or active nest-trees from the Action Area. If indirect changes in hydrology cause grasslands and borders of wetlands to become dryer, suitable habitat for voles (a favored prey of Swainson's hawk) could be permanently removed. The SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs), discussed in Section 2.5.4 above, and in SSHCP Chapter 5.4.1, would minimize changes to the existing hydrology of riparian habitat and minimize urban runoff and roadway runoff into areas that provide foraging habitat for Swainson's hawk and Swainson's hawk prey-species.

Indirect effects to Swainson's hawks individuals may result from other environmental stressors produced by the urban development Covered Activities, including increased amounts of wind-blown trash, disorientation of individuals from outdoor lighting, increased disturbance and increased stress resulting from human activities, and increased completion for prey-species by feral pets and other invasive animals. As discussed above in Section 2.5.4, the EDGE, NATURE TRAIL, and ROAD AMMS will minimize these indirect effects on Swainson's hawk habitat and individuals within the SSHCP Preserves. Implementation of the UTILITY-1 and SWHA-1 AMMs will require Covered Activities that include above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 6-80). In addition, the size of the larger UDA Core

Preserves will provide interior areas where Swainson's hawk habitat is not exposed to these edge effects.

Outside the UDA, indirect effects to Swainson's hawk modeled habitat are expected from the rural transportation Covered Activities. The improved roadways will increase traffic densities and vehicle speeds, resulting in increased human activity, roadway trash, and increased risk of vehicle collisions and utility collisions. Because Swainson's hawks forage disproportionally forage in roadside edges and median strips that are used by voles and mice as dispersal corridors (Getz et al. 1978; Estep 1989; Swolgaard 2004), Swainson's hawks have a higher risk of vehicle collision. However, these indirect effects on the Swainson's hawk are expected to be relatively minor because of the large amount of Swainson's hawk foraging habitat present outside the UDAs, and the limited number of rural transportation projects planned in that foraging habitat.

Table 30. Swainson's Hawk Habitat-Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Nesting Habitat					
Mixed Riparian Woodland	184	Qualitative Assessment	184	368	184
Mixed Riparian Scrub	189	Qualitative Assessment	189	378	189
Total Nesting Habitat	**373**	Qualitative Assessment	**373**	**746**	**373**
Foraging Habitat					
Cropland	5,285	Qualitative Assessment	5,285	6,947	0
Irrigated Pasture	2,749	Qualitative Assessment	2,749	2,749	0
Valley Grassland	21,997	Qualitative Assessment	21,977	22,014	270[a]
Vernal Pool	389	Qualitative Assessment	389	966	389
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Swale	234	Qualitative Assessment	234	278	234
Total Foraging Habitat	**30,759**	Qualitative Assessment	**30,739**	**33,059**	**998**
Totals	**31,132**	Qualitative Assessment	**31,132**	**33,805**	**1,371**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

To mitigate the adverse direct and indirect effects to Swainson's hawk individuals and Swainson's hawk modeled habitat, the SSHCP will preserve least 33,805 acres of modeled foraging and nesting habitat for Swainson's hawk in the Action Area, including 30,059 acres of modeled foraging habitat and 746 acres of modeled nesting habitat (Table 30 above). The characteristics and locations of the 33,805 acres of modeled habitat preserved for Swainson's hawk will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, and

consistent with the SSHCP biological goals and objectives for Swainson's hawk (Final SSHCP Table 7-1 and 7-74). To the maximum extent possible, SSHCP Preserves will be established adjacent to and contiguous with existing preserves to enhance the functional value of the SSHCP Preserves for Swainson's hawk, and to minimize the effects of habitat fragmentation and edge effects.
The majority of foraging and nesting habitat preservation for Swainson's hawk will occur in outside the UDAs, primarily in PPU-5 and PPU-7. Properties preserved for Swainson's hawk foraging habitat will be prioritized to select properties that are within 3 miles of an active Swainson's hawk nest site (active within last five years), are close to riparian corridors with large trees and potential nesting sites, and are close to large, contiguous areas that have foraging habitat (Final SSHCP Conservation Action SH1.1). The SSHCP Conservation Strategy for Swainson's hawk includes the establishment Cropland Preserves (Final SSHCP Chapter 7.2.2), which will include a minimum of 9,695 acres of Cropland and Irrigated Pasture that provide suitable foraging habitat for Swainson's hawk (Final SSHCP Table 7-72). Criteria for agricultural lands selected for Cropland Preserves include presences of irrigation systems that are engineered to provide alfalfa production; and existing trees suitable for Swainson's hawk nesting; or could support plantings of additional trees for future Swainson's hawk use (Conservation Action SH1.1). Cropland Preserves can be established in sites supporting vineyard and orchard landcovers, provided the vines and trees are removed within 2 years of acquisition to provide Swainson's hawk foraging habitat (Conservation Action SH1.1).

The SSHCP Conservation Strategy also requires that any impacts to Swainson's hawk "high value" foraging habitat be mitigated by protecting "high-value" foraging habitat (SSHCP Objective SH1). At least 8,158 acres of "high-value" Swainson's hawk foraging habitat will be protected in the SSHCP Preserve System (Final SSHCP Table 7-73). In addition, SSHCP Objective SH2 requires that at least 2,000 acres of "high value" Cropland Preserves be preserved in fee title to assure that intensively managed Swainson's hawk foraging habitat will be provided in the Preserve System. The 2,000 acres must be within two miles of at least two active Swainson's hawk nests, and must maintain, at minimum, 50% of their crop cover-type in alfalfa over a period of 5 years (Final SSHCP Conservation Action SH2.1).

Swainson's hawks also will benefit from implementation of other SSHCP Biological Objectives. SSHCP Objective AG1 will preserve a total of 9,696 acres of Cropland and Irrigated Pasture landcovers in SSHCP Cropland Preserves. Objective AG2 requires that at least 2,000 of those acres be prey species food-plots, including alfalfa, corn, or wheat. The prey species food-plots will be distributed throughout PPUs 4, 5, and 6 at a minimum of 10 different locations, and each food plot will be 20 acres or larger. The alfalfa planted under Objective AG1 may also fulfill the requirements of Objective SH2 if the Cropland Preserve was preserved in fee title and is located within 2 miles of at least two active Swainson's hawk nests. The SSHCP wildlife food plots planted with corn, wheat, sunflower, and other dry grains will also provide some foraging value to Swainson's hawks (Estep 1989, Swolgaard 2004, SSHCP Appendix B).

In addition, SSHCP Objective AG3 will help to maintain or increase Swainson's hawk prey-base in the SSHCP Cropland Preserves by strategically planting 10,000 linear feet of hedgerows within and on the borders of the Cropland Preserves. Hedgerows will be a minimum of 5 feet wide and be planted with native shrubs, trees, and grasses to provide cover and refugia for fossorial mammals, voles, and other Swainson's hawk prey species. Providing hedgerow prey-species refuge habitat adjacent to protected Cropland and Irrigated Pastures will allow prey species to return more quickly to fields after they are mowed or are re-planted after harvesting (Final SSHCP Conservation Action AG3.1).

The SSHCP Conservation Strategy for Swainson's hawk also includes preserving a minimum of 746 acres of Swainson's hawk modeled nesting habitat in the SSHCP Preserve System (SSHCP Objective SH3; SSHCP Table 7-72). Preservation of Swainson's hawk modeled nesting habitat will prioritize sites with active nest trees, sites with mature trees taller than 50 feet, sites located adjacent to or within 4.2 miles of productive farmland (e.g. Prime Farmland or Statewide Farmland), sites with existing alfalfa crop-cover or are suitable sites for alfalfa production, and sites also in rural areas unlikely to have high levels of human activities (Final SSHCP Conservation Action SH 4.1). To the maximum extent possible, SSHCP Preserves established for Swainson's hawk nesting habitat will be adjacent to or have habitat links to existing preserves, enhancing the functional value of the SSHCP Preserves for Swainson's hawk, and to minimize the effects of habitat fragmentation and edge effects.

The SSHCP effects analysis identified 36 documented Swainson's hawk nesting-trees present in the UDAs that will be removed over the Permit Term (Final SSHCP Table 7-74). For each of the 36 nesting trees present within the UDA, the SSHCP Conservation Strategy will plant 10 trees within the SSHCP Preserves in PPUs 4, 6, or 8, which will grow to provide suitable Swainson's hawk nest trees (SSHCP Objective SH5). Planted nest trees will be close to protected Swainson's hawk foraging habitat, and will be native tree species known to provide suitable Swainson's hawk nest trees. A mix of fast and slow growing native species will be planted to more quickly provide new nest trees in the Action Area. Clusters of five trees must be established and maintained for every 40 acres of agricultural cropland preserved (Final SSHCP Conservation Action SH6.1).

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques that will maintain and improve Swainson's hawk foraging and nesting habitats within the individual SSHCP Preserve (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). These actions are expected to increase reproductive success and productivity of the species in the Action Area. The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve, especially the SSHCP Cropland Preserves (SSHCP Objectives HAB4 and HAB5). The preservation of high quality Swainson's hawk habitat, coupled with careful habitat management and monitoring, is expected to maintain or increase the number and distribution of Swainson's hawks within the Action Area.

In addition to the preservation of 33,805 acres of modeled habitat for Swainson's hawk, the SSHCP Conservation Strategy also will establish or re-establish 1,371 acres of Swainson's hawk modeled habitat in the SSHCP Preserve System, with a priority on re-establishment before establishment. Sites selected for the establishment or re-establishment of 373 acres of Swainson's hawk riparian nesting habitat will be prioritized following the requirements of SSHCP Objective SH4. Riparian establishment or re-establishment sites will be selected along stream or river channels, and will be near Swainson's hawk nesting territories. The re-establishment and establishment of riparian nesting habitat will target areas that will connect disjunct segments of riparian habitat, and will be monitored for a 10-year period (Final SSHCP Conservation Action SH4.1). The SSHCP Conservation Strategy also will establish or re-establish of 728 acres of Swainson's hawk foraging habitat (SSHCP Objective SH6). Planned re-established or established Swainson's hawk foraging habitat is 723 acres of seasonally-dry Vernal Pools, Swales, and Seasonal Wetland landcovers (Final SSHCP Table 7-72). SSHCP Conservation Action SH6.1 (Final SSHCP Table 7-1) identifies priorities for selecting sites for the establishment or re-establishment of 728 acres of Swainson's hawk foraging habitat. However, these priorities (e.g. prioritize agricultural lands that have irrigation systems for alfalfa production and could support planting of nest-trees) are not possible in re-established or established Vernal Pools, Swales, and Seasonal Wetland landcovers.

2.7.4.6 Effects on Northern Harrier

Effects of SSHCP Covered Activities on northern harrier include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on northern harrier individuals.

Of the total 210,318 acres of northern harrier modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 30,903 acres (15%) of the modeled habitat (Table 31 below). Most of the habitat lost (71%) will be Valley Grassland (22,014 acres) (Final SSHCP Table 6-85).

Most loss of northern harrier modeled habitat will occur within the UDA portions of the Action Area, where urban development Covered Activities will remove 29,669-acres (72%) of the existing 40,994 acres of northern harrier modeled habitat available in the UDAs. Outside the UDAs, only 1,234 acres (4%) of the existing 169,324 acres of northern harrier modeled habitat will be removed by the rural transportation Covered Activities and the recycled-water pipeline Covered Activities. Activities related to the implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, paving, and construction will remove northern harrier nesting and foraging habitats. If implemented during northern harrier nesting season, these activities may crush or cover active nests, killing or injuring eggs, nestlings, and pre-flight juveniles. Removal of nesting habitat during nesting season also will disrupt breeding behavior in the paired adults, causing them to relocate within the Action Area or move out of the Action Area, reducing, or eliminating the likelihood of successful reproduction that year.

The home range of nesting male northern harriers is typically within a 650-acre area around the nest, while females tend to hunt closer to the nest in a smaller home range. Covered Activity removal of foraging habitat within the home range of nesting northern harriers may force the nesting adults to alter their foraging behaviors, require adults to fly greater distances, or require adults to search for prey in new and unfamiliar areas to feed their young. Northern harrier young require up to 35 days to fledge, and fledged juveniles remain near the nest site and are fed by the parents for an additional 2–4 weeks. Removal of foraging habitat and prey availability during this period would require adults to expend more energy hunting, require adults to spend more time away from the nest when young are vulnerable to predators and may reduce hunting success. Less successful hunting during the nesting season can reduce the number of eggs laid by the female, and can reduce the amount or the quality of food fed to young—slowing the growth of nestlings and fledglings, and reducing the number of young that survive to maturity.

The noise, human activity, equipment use, and ground vibration that occur during implementation of urban development Covered Activities in the vicinity of active nests may directly affect nesting northern harriers by increasing stress levels and by disrupting normal nesting behaviors. Nesting sites may be abandoned, causing pairs to relocate and build a new nest, likely resulting in fewer offspring that year; or pairs may completely abandon nesting behaviors and not reproduce that year. In some cases, nests that already have eggs or nestlings may be abandoned, also resulting in the mortality of the eggs or nestlings.

Direct effects to northern harrier individuals will be avoided or minimized by the RAPTOR AMMs. If modeled habitat for northern harrier is present within a Covered Activity's project footprint or within 0.25 mile of a project footprint, AMMs RAPTOR-1 require an approved biologist to conduct field surveys to determine if existing or potential northern harrier nesting-sites are present within the project footprint, or within 0.25 mile of the project footprint. Existing or potential northern harrier nesting sites must be noted on all project plans that are submitted to the local Land-Use Authority Permittee or the SSHCP Implementing Entity for approval. If existing or potential nest sites are identified during these initial field surveys, and if project activities will occur within the project footprint during the northern harrier breeding season (March 1 to September 15), AMM RAPTOR-2 also requires pre-construction surveys be conducted by an approved biologist within the project footprint and within 0.25 miles of the project footprint during the northern harrier breeding season. Pre-construction surveys will occur within 30 days of any ground disturbing activities, and again within 3 days of any ground disturbing activities. If an active nest is present, the approved biologist will inform the Land-Use Authority Permittee and the SSHCP Implementing Entity of the species locations, and they in turn will notify the Service and CDFW. The Covered Activity project will then implement AMMs RAPTOR-3 and RAPTOR-4 at the project site. AMM RAPTOR-3 requires the Covered Activity project to establish a 0.25 mile buffer-zone around an active northern harrier nest that is within the project footprint or within 0.25 mile of the project footprint. No project activities (vehicle use, machinery use, ground disturbance, human activity) will occur within this temporary nest-disturbance buffer established around the active nest until the young are fledged and have left the nest site. However, if project-related activities are determined to be necessary within the temporary 0.25-mile disturbance buffer during the nesting season, AMM RAPTOR-4 allows work within the temporary nest disturbance buffer to occur with the written permission of the SSHCP Implementing Entity, the Service, and CDFW. An approved biologist experienced with raptor behavior will be retained by the Third Party Project Proponent to monitor the nest throughout the nesting season and to determine when all young have left the nest site. The approved biologist will be on site daily while construction-related activities are taking place within the 0.25-mile disturbance buffer. If nesting adult raptors or young in the nest begin to exhibit agitated behavior, such as vocalizing, getting up from a brooding position, flying off the nest, or defensive flights at intruders, the approved biologist/monitor will have the authority to shut down project activities. If agitated behavior is exhibited, the biologist, the Third Party Project Proponent, the SSHCP Implementing Entity, the Service and CDFW will meet to determine the best course of action to avoid nest abandonment or injury of individuals. The approved biologist also will train construction personnel on the required avoidance procedures, disturbance buffer zones, and protocols in the event that a covered raptor species flies into an active project site from outside the buffer zone.

In addition to direct effects, the implementation of SSHCP Covered Activities will indirectly affect northern harrier habitat and individuals within the Action Area. The SSHCP qualitatively assessed and analyzed the indirect effects of SSHCP Covered Activities on northern harrier modeled habitat (Final SSHCP Tables 6-85, 6-86). The edge areas of preserved or avoided northern harrier modeled habitat will be exposed to environmental stressors produced by the Covered Activities, especially within the UDA portions of the Action Area. Northern harrier individuals that consume prey contaminated with urban and roadside pollutants may be sickened or killed. Indirect changes to in hydrology cause grasslands and borders of wetlands to become dryer, suitable habitat for voles (a favored prey of northern harrier) could be permanently removed. The SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs) discussed in Section 2.5.4 above and in SSHCP Chapter 5.4.1, would assure that landscape hydrology and micro-watershed hydrology-changes in the UDA are minimized, and assure that stormwater runoff will not enter UDA preserves, other open spaces, or waterways that provide habitat for northern harrier and northern harrier prey-species.

The close proximity of new urban development and urban roads to preserved or avoided habitat increases the possibility that changes to existing landscape-level hydrology could occur, including increased exposure of nesting habitat, foraging habitat, and prey species to urban runoff or roadway runoff containing fertilizers, herbicides, pesticides, fuel, oil, lubricants, paints, release agents, or other toxins, as discussed in Section 2.5.4 above. Northern harrier individuals exposed to these toxins may be sickened or killed, and individuals that consume prey contaminated with urban and roadside pollutants may be sickened or killed. Conversely, if indirect changes to existing hydrology cause adjacent grasslands and borders of wetlands to become dryer, suitable habitat for voles (a favored prey of northern harrier) and other prey species could be permanently removed. The SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs) will avoid indirect changes to the existing landscape hydrology and to the micro-watershed hydrology of northern harrier foraging and nesting habitats in existing and future UDA preserves.

The SSHCP qualitatively assessed and analyzed indirect effects of SSHCP Covered Activities on northern harrier modeled habitat (Tables 6-88 and 6-89 in County of Sacramento et al. 2019; Henry *in litt.* 2019). The edge areas of preserved or avoided modeled habitats will be exposed to environmental stressors produced by the Covered Activities, especially within the UDA portions of the Action Area. As discussed in Section 2.5.4 above, the close proximity of new urban development or improved rural roadways to modeled habitat may increase exposure of foraging habitat and prey species to fertilizers, pesticides, fuel, oil, and other toxins. Northern harrier individuals exposed to these pollutants could be sickened or killed, and individuals that consume prey contaminated with these pollutants could be sickened or killed. If indirect changes to existing hydrology cause grasslands and borders of wetlands to become dryer, suitable habitat for voles (a favored prey species) could be permanently removed. However, the SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs) will prevent roadside and urban runoff from entering preserved foraging and nesting habitats, will avoid indirect changes to the existing hydrology of preserved foraging habitats, Therefore, we expect that the increased exposure of northern harrier individuals and prey to urban and roadside pollutants will be relatively small.

Indirect effects to northern harriers individuals may result from other environmental stressors produced by the urban development Covered Activities, including increased amounts of wind-blown trash, disorientation of individuals from outdoor lighting, increased disturbance and increased stress resulting from human activities, increased completion for prey-species by feral pets and other invasive animals, increased predation of their ground-nests, eggs, and young by feral pets or urban mesopredators. As discussed above in Section 2.5.4, the EDGE, NATURE TRAIL, ROAD AMMS will minimize these indirect effects on northern harrier habitat and individuals within the SSHCP Preserves. Implementation of the UTILITY-1 and RAPTOR-1 AMMs will require Covered Activities that include above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 6-86). In addition, the size of the larger UDA Core Preserves will provide interior areas where northern harrier habitat is not exposed to these edge effects.

The loss of 30,903 acres of northern harrier modeled habitat from SSHCP Covered Activities will further fragment the northern harrier habitat within the Action Area. Although northern harriers are able to fly over unsuitable landcovers to access suitable foraging areas, their low-flying "patrolling" foraging behaviors require relatively large, open areas. Therefore, smaller fragments of modeled habitats that have suitable foraging-vegetation and suitable prey-species (including the smaller SSHCP preserves), may no longer be used by foraging northern harriers. In addition, increased habitat fragmentation will make northern harriers fly farther between suitable foraging and nesting areas, increasing energetic demands and time away from nest sites, and increasing other risks, such as collisions with vehicles and collisions with man-made structures.

Additional indirect effects to northern harrier modeled habitat outside the UDA are expected from the rural transportation Covered Activities. The improved roadways will increase traffic densities and vehicle speeds, resulting in increased ground vibration, human activity, roadway trash, and increased risk of vehicle collisions and utility collisions. However, these indirect effects on the northern harrier are expected to be relatively minor because of the limited number of rural transportation Covered Activities outside the UDA.

Table 31. Northern Harrier Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Cropland	5,285	Qualitative Assessment	5,825	6,947	0
Irrigated Pasture	2,749	Qualitative Assessment	2,749	2,749	0
Valley Grassland	22,014	Qualitative Assessment	22,014	22,014	270[a]
Vernal Pool (when dry)	389	Qualitative Assessment	389	966	389
Seasonal Wetland (dry)	105	Qualitative Assessment	105	105	105
Swale (when dry)	234	Qualitative Assessment	234	278	234
Freshwater Marsh	127	Qualitative Assessment	127	127	127
Totals	**30,903**	Qualitative Assessment	**31,443**	**33,186**	**1,125**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

To mitigate the adverse direct and indirect effects to northern harrier individuals and northern harrier suitable-habitat, the SSHCP will preserve least 33,186 acres of suitable foraging and nesting habitat for northern harrier in the Action Area (Table 31). The majority of habitat preservation for northern harrier will occur outside the UDA, in PPU-6 and PPU-7. The characteristics and locations of suitable habitat preserved for northern harrier will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, consistent with the SSHCP biological goals and objectives for northern harrier (Final SSHCP Table 7-1 and 7-78), including SSHCP Objectives NH1, NH2 and NH3.

Sites selected for preservation of northern harrier nesting and foraging habitat will include large, open sites with dense, tall (12 to 38 inches) grass or herbaceous vegetation that is known to support high numbers of prey species. Northern harrier preserves also will include wet or moist sites preferred by northern harrier for nesting (Final SSHCP Conservation Action NH2.1). To the maximum extent possible, SSHCP Preserves will be adjacent to and contiguous with existing preserves, enhancing the functional value of the SSHCP Preserves for northern harrier, and to minimize the effects of habitat fragmentation and edge effects. The SSHCP Conservation Strategy for northern harrier includes the establishment Cropland Preserves (Final SSHCP Chapter 7.2.2) which will preserve 9,696 acres of Cropland landcovers and Irrigated Pasture that provide suitable foraging habitat (Objective AG-1). In addition, at least 2,000 acres in the Cropland Preserves will be alfalfa and dryland grains, which will provide high quality foraging habitat that is close to modeled nesting habitat (SSHCP Objective AG2). These prey-species food plots will be distributed throughout PPUs 4, 5, and 6 at a minimum of 10 different locations, and each food plot will be 20 acres or larger. To increase prey availability for northern harriers, the SSHCP Cropland Preserves also will be planted with 10,000 feet of strategically placed hedgerows (minimum 5-foot wide borders of shrubs, trees, and other vegetation) to provide cover and refugia for fossorial mammals and other prey species. Providing hedgerow refuge-habitat for prey species adjacent to Cropland and Irrigated Pastures will allow prey species to return more quickly to fields after they are mowed or are re-planted after harvesting (SSHCP Objective AG3).

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques for maintaining and improving northern harrier foraging and nesting habitats within the individual SSHCP Preserve (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). These actions are expected to increase reproductive success and productivity of the species in the Action Area. The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). The preservation of high quality habitat within large Preserves, coupled with careful management and monitoring, is expected to maintain or increase the number and distribution of northern harriers within the Action Area.

In addition to the preservation of 33,186 acres of modeled habitat for northern harrier, the SSHCP Conservation Strategy also will establish or re-establish 1,125 acres of northern harrier modeled habitat in the SSHCP Preserve System, with a priority on re-establishment before establishment. Sites selected for the establishment or re-establishment of northern harrier nesting and foraging habitat will be prioritized following the requirements of SSHCP Conservation Action NH3. Re-establishment and/or establishment sites will prioritize sites that historically contained intact foraging habitat in open-space areas, in parcels of 20 acres or larger, and where management can be used to enhance or re-establish natural ecosystem processes.

2.7.4.7 Effects on White-tailed Kite

Effects of SSHCP Covered Activities on white-tailed kite include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on white-tailed kite individuals.

Of the total 230,042 acres of white-tailed kite modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 31,319 acres (14%) of the modeled habitat (Table 32 below). Most of the modeled habitat removed (30,943 acres) will be Valley Grassland, and approximately 564 acres of white-tailed kite modeled nesting habitat will be removed (Final SSHCP Table 6-82).

Most loss of white-tailed kite modeled habitat will occur within the UDA portions of the Action Area, where urban development Covered Activities will remove 30,102 acres (73%) of the existing

41,325 acres modeled habitat present in the UDAs. Outside the UDAs, only 1,217 acres (0.6%) of the existing 188,717 acres of white-tailed kite modeled habitat will be removed by the rural transportation Covered Activities and the recycled-water pipeline Covered Activities. Activities related to the implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, paving, and construction will remove white-tailed kite nesting and foraging habitats. If implemented during white-tailed kite nesting season, the removal of nesting trees could kill or injure eggs and young. The removal of active nesting-sites could disrupt breeding behavior in the adults, causing them to relocate within the Action Area or move out of the Action Area, which could reduce or eliminate the likelihood of successful reproduction that year.

The noise, human activity, and equipment use during implementation of Covered Activities in the vicinity of active nests can also directly affect nesting white-tailed kites by increasing stress levels and by disrupting normal nesting behaviors. Nesting sites may be abandoned, causing pairs to relocate and build a new nest, likely resulting in fewer offspring that year; or pairs may completely abandon nesting that year without reproducing. Abandonment of nests with eggs or young also results in death of the eggs and young.

Covered Activity removal of foraging habitat within 0.5 miles of nesting white-tailed kites may force the nesting adults to alter their foraging behaviors, require adults to fly greater distances, or require adults to search for prey in new and unfamiliar areas to feed their young. Removal of foraging habitat and prey availability during the 63 to 68 day incubation and fledging period would require the male to expend more energy hunting, and may reduce hunting success. Less successful hunting during the nesting season can reduce the number of eggs laid by the female, and can reduce the amount or the quality of food fed to young—slowing the growth of nestlings, and reducing the number of young that fledge and survive to maturity.

Direct effects to white-tailed kite individuals will be avoided or minimized by the RAPTOR AMMs. If modeled habitat for white-tailed kite is present within a Covered Activity's project footprint or within 0.25 mile of a project footprint, AMMs RAPTOR-1 require an approved biologist to conduct field surveys to determine if existing or potential white-tailed kite nesting-sites are present within the project footprint, or within 0.25 mile of the project footprint. Existing or potential white-tailed kite nesting sites must be noted on all project plans that are submitted to the local Land-Use Authority Permittee or the SSHCP Implementing Entity for approval. If existing or potential nest sites are identified during these initial field surveys, and if project activities will occur within the project footprint during the white-tailed kite breeding season (February 1 to September 30), AMM RAPTOR-2 also requires pre-construction surveys be conducted by an approved biologist within the project footprint and within 0.25 miles of the project footprint during the white-tailed kite breeding season. Pre-construction surveys will occur within 30 days of any ground disturbing activities, and again within 3 days of any ground disturbing activities. If an active nest is present, the approved biologist will inform the Land-Use Authority Permittee and the SSHCP Implementing Entity of the species locations, and they in turn will notify the Service and CDFW. The Covered Activity project will then implement AMMs RAPTOR-3 and RAPTOR-4 at the project site. AMM RAPTOR-3 requires the Covered Activity project to establish a 0.25 mile buffer-zone around an active white-tailed kite nest that is within the project footprint or within 0.25 mile of the project footprint. No project activities (vehicle use, machinery use, ground disturbance, human activity) will occur within this temporary nest-disturbance buffer established around the active nest until the young are fledged and have left the nest site. However, if project-related activities are determined to be necessary within the temporary 0.25-mile disturbance buffer during the nesting season, AMM RAPTOR-4 allows work within the temporary nest disturbance buffer to occur with the written permission of the SSHCP Implementing Entity, the Service, and CDFW. An approved biologist experienced with raptor behavior will be retained by the Third Party Project Proponent to monitor the nest throughout the nesting season and to determine when all young have left the nest site. The approved biologist will be on site daily while construction-related activities are taking place within the 0.25-mile disturbance buffer. If nesting adult raptors or young in the nest begin to exhibit agitated behavior, such as vocalizing, getting up from a brooding position, flying off the nest, or defensive flights at intruders, the approved biologist/monitor will have the authority to shut down project activities. If agitated behavior is exhibited, the biologist, the Third Party Project Proponent, the SSHCP Implementing Entity, the Service and CDFW will meet to determine the best course of action to avoid nest abandonment or injury of individuals. The approved biologist also will train construction personnel on the required avoidance procedures, disturbance buffer zones, and protocols in the event that a covered raptor species flies into an active project site from outside the buffer zone.

The loss of 31,319 acres of white-tailed kite modeled habitat from SSHCP Covered Activities will further fragment the white-tailed kite habitat within the Action Area. Although white-tailed kites are able to fly over unsuitable landcovers to access suitable foraging areas, increased habitat fragmentation will make white-tailed kites fly farther between suitable foraging and nesting areas, increasing energetic demands and time away from nest sites, and increasing other risks, such as collisions with vehicles and collisions with man-made structures. The cost in energy and reproductive success of direct disturbances to white-tailed kite nesting habitat and nesting individuals would be difficult to quantify and qualify, but with implementation of the SSHCP AMMs, these direct disturbances from Covered Activity construction activities and from Covered Activity operations and maintenance activities will be minimized.

In addition to direct effects, the implementation of SSHCP Covered Activities will indirectly affect white-tailed kite habitat and individuals within the Action Area. The SSHCP qualitatively assessed and analyzed the indirect effects of SSHCP Covered Activities on white-tailed kite modeled habitat (Final SSHCP Tables 6-85, 6-86). The edge areas of preserved or avoided white-tailed kite modeled habitat will be exposed to environmental stressors produced by the Covered Activities, especially within the UDA portions of the Action Area. The close proximity of new urban development and urban roads to white-tailed kite habitat that is preserved or avoided within the UDA increases the likelihood that watershed hydrology changes and water quality changes could affect white-tailed kite habitat. Hydrology changes include effects from increased urban runoff and roadway runoff that may contain trash, debris, pollutants, and toxins, including fertilizers, herbicides, pesticides, fuel, oil, lubricants, paints, and release agents. White-tailed kite individuals exposed to these pollutants may be sickened or killed, and individuals that consume prey contaminated with urban and roadside pollutants may be sickened or killed. If indirect changes in hydrology cause grasslands and borders of wetlands to become dryer, suitable habitat for voles (a favored prey of white-tailed kite) could be permanently removed. The SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs), discussed in Section 2.5.4 above, and in SSHCP Chapter 5.4.1, would assure that landscape hydrology and micro-watershed hydrology-changes in the UDA are minimized, and assure that stormwater runoff will not enter UDA preserves or other open spaces that provide habitat for white-tailed kite and white-tailed kite prey-species.

Indirect effects to white-tailed kites individuals may result from other environmental stressors produced by the urban development Covered Activities, including disorientation of individuals from outdoor lighting, increased disturbance and increased stress resulting from human activities, increased completion for prey-species by feral pets and other invasive animals, increased predation of white-tailed kite nests, eggs, and young by feral pets and urban mesopredators. As discussed above in Section 2.5.4, the EDGE, NATURE TRAIL, ROAD AMMS will minimize these indirect effects on white-tailed kite habitat and individuals within the SSHCP Preserves. Implementation of the UTILITY-1 and RAPTOR-1 AMMs will require Covered Activities that include above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 6-83). In addition, the size of the larger UDA Core Preserves will provide interior areas where white-tailed kite habitat is not exposed to these edge effects.

Outside the UDA, indirect effects to white-tailed kite modeled habitat are expected from the rural transportation Covered Activities. The improved roadways will increase traffic densities and vehicle speeds, resulting in increased human activity, roadway trash, and increased risk of vehicle collisions and utility collisions. Because white-tailed kite often hover and forage in grassland and fields along roadways, they have a higher risk of vehicle collision than other bird Covered Species. However, these indirect effects on the white-tailed kite are expected to be relatively minor because of the limited number of rural transportation projects implemented outside the UDA.

To mitigate the adverse direct and indirect effects to white-tailed kite individuals and white-tailed kite modeled habitat, the SSHCP will preserve least 32,199 acres of suitable foraging and nesting habitat for white-tailed kite in the Action Area (Table 32). The majority of habitat preservation for white-tailed kite will occur in outside the UDA, primarily Valley Grasslands in PPU-7. The characteristics and locations of modeled habitat preserved for white-tailed kite will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, consistent with the SSHCP biological goals and objectives for white-tailed kite (Final SSHCP Table 7-1 and 7-75), including SSHCP Objectives WK1, WK2, WK3 and WK4. To the maximum extent possible, SSHCP Preserves established for white-tailed kite will be adjacent to or have habitat links to existing preserves, enhancing the functional value of the SSHCP Preserves for white-tailed kite, and to minimize the effects of habitat fragmentation and edge effects.

Table 32. White-tailed kite Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Nesting Habitat					
Blue Oak Woodland	9	Qualitative Assessment	9	0	9
Mixed Riparian Woodland	149	Qualitative Assessment	149	368	184
Mine Tailing Riparian	218	Qualitative Assessment	218	218	218
Total Nesting Habitat	**376**	Qualitative Assessment	**376**	**586**	**411**
Nesting and Foraging Habitat					
Mixed Riparian Scrub	189	Qualitative Assessment	189	169	189
Total Nesting/Foraging	189	Qualitative Assessment	189	169	189
Foraging Habitat					
Blue Oak Savanna	38	Qualitative Assessment	38	47	37
Cropland	5,285	Qualitative Assessment	5,285	5,285	0
Irrigated Pasture	2,749	Qualitative Assessment	2,749	2,749	0
Valley Grassland	21,954	Qualitative Assessment	21,954	22,014	270[a]
Vernal Pool	389	Qualitative Assessment	389	966	389
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Swale	234	Qualitative Assessment	234	278	234
Total Foraging	**30,754**	Qualitative Assessment	**30,754**	**31,444**	**1,035**
Totals	**31,319**	Qualitative Assessment	**31,319**	**32,199**	**1,635**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

SSHCP Preserves of white-tailed kite foraging habitat will include agricultural lands that can support perennial crops (e.g. alfalfa rather than annual row crops) in areas known to be used by white-tailed kite for foraging. Preserved white-tailed kite foraging habitat will be on parcels 20 acres or greater, surrounded by large open spaces (Final SSHCP Conservation Action WK1.1). The SSHCP Conservation Strategy for white-tailed kite includes the establishment Cropland Preserves (Final SSHCP Chapter 7.2.2) and will include a minimum of 8,034 acres of Cropland landcovers and Irrigated Pasture that provide suitable foraging habitat for white-tailed kite (Table 32). In addition, at least 2,000 acres in the Cropland Preserves will be alfalfa and dryland grains, which will provide high quality foraging habitat that is close to modeled nesting habitat (SSHCP Objective AG2). These prey-species food plots will be distributed throughout PPUs 4, 5, and 6 at a minimum of 10 different locations, and each food plot will be 20 acres or larger. To increase prey availability for white-tailed kites, the SSHCP Cropland Preserves also will be planted with 10,000 feet of strategically placed hedgerows (minimum 5-foot wide borders of shrubs, trees, and other vegetation) to provide cover and refugia for fossorial mammals and other prey species. Providing hedgerow refuge-habitat for prey species adjacent to Cropland and Irrigated Pastures will allow prey species to return more quickly to fields after they are mowed or are re-planted after harvesting (SSHCP Objective AG3).

The SSHCP Conservation Strategy for white-tailed kite also includes preserving a minimum of 974 acres of modeled nesting and nesting/foraging habitat. Preserves for white-tailed kite will include Blue Oak Woodland, Mixed Riparian Woodland, and Mixed Riparian Scrub landcovers with mature trees, in parcels that are 20 acres or greater in size, and will have habitat connections to Valley Grassland, Cropland, or Irrigated Pasture areas that are known to support high prey densities (Final SSHCP Conservation Action WK2.1). To the maximum extent possible, SSHCP Preserves established for white-tailed kite will be adjacent to or have habitat links to existing preserves, enhancing the functional value of the SSHCP Preserves for white-tailed kite, and to minimize the effects of habitat fragmentation and edge effects.

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques for maintaining and improving white-tailed kite foraging and nesting habitats within the individual SSHCP Preserves (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). These actions are expected to increase reproductive success and productivity of the species in the Action Area. The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). The preservation of high quality habitat within large Preserves, coupled with careful management and monitoring, is expected to maintain or increase the number and distribution of white-tailed kite individuals within the Action Area.

In addition to the preservation of 32,199 acres of modeled habitat for white-tailed kite, the SSHCP Conservation Strategy also will establish or re-establish 1,635 acres of white-tailed kite modeled habitat in the SSHCP Preserve System, with a priority on re-establishment before establishment. Sites selected for the establishment or re-establishment of white-tailed kite habitat will be prioritized following the requirements of SSHCP Objectives WK3 and WK4. Re-established and/or established nesting sites will prioritize mixed riparian woodlands that include large trees such as cottonwood and valley oak, are within 0.5 miles of modeled foraging habitat, and are at least 500 feet from urban land uses, including structures and roads. Re-established or established white-tail kite foraging habitat will replace habitat and vegetation modeled for voles where they historically occurred but no longer exists due to habitat loss. White-tailed kite foraging habitat re-establishment or establishment will occur only where non-modeled habitat would be converted to modeled habitat.

2.7.4.8 Effects on Greater Sandhill Crane

Effects of SSHCP Covered Activities on greater sandhill crane include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided habitat, and effects on greater sandhill crane individuals.

Of the total 89,765 acres of greater sandhill crane modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 7,935 acres (9%) of the modeled habitat (Table 33 below). Most removal of greater sandhill crane modeled habitat (7,109 acres or 90%) will occur inside the UDA, (PPU-8 and PPU-4) (Final SSHCP Table 6-94). Of the total 81,473 acres of greater sandhill crane modeled habitat in the Action Area categorized as "high value" foraging habitat, SSHCP Covered Activities will remove 819 acres (1%) (Final SSHCP Table 6-95).

Activities related to the implementation of SSHCP Covered Activities (including the use of earth moving equipment, mass grading, construction, and paving), will remove greater sandhill crane winter foraging and roosting habitats in the Action Area. Covered Activities implemented within active habitat between September 1 and March 15 would likely cause individuals and family groups to abandon those sites, forcing birds to search for other suitable foraging or roosting sites within the Action Area, or the birds may move out of the Action Area completely. Greater sandhill cranes do not tolerate regular disturbances (Ivey and Herziger 2003). Where Covered Activities are implemented near active foraging or active roosting sites, the equipment noise, human activity, and equipment movements could increase stress levels of individual birds, causing alerted or agitated behaviors (such as running or flying away), which interrupts normal behaviors and forces individuals to unnecessary expend energy. Frequent noise and activities near active foraging sites would likely cause individuals and family groups to permanently abandon the foraging site. Repeated disturbances of foraging behaviors reduces the ability of wintering birds to feed and to store energy needed for survival, for spring migration, and for nesting and reproduction in the next breeding season. Therefore, less successful foraging during the winter can reduce the number of eggs laid by the female in the nest nesting season, reducing the number of young that fledge and survive to maturity. Flushing of greater sandhill cranes during the night or in foggy conditions is known to increase their risk of injury or mortality from collisions with transmission lines or other obstructions. Only one disruption of a nighttime roosting site is usually necessary before greater sandhill cranes will abandon the roosting site (Littlefield and Ivey 2000).

Direct effects to greater sandhill crane individuals will be avoided or minimized by the construction BMP AMMs and by the GSC AMMS (Final SSHCP Table 6-97). If modeled habitat for greater sandhill crane is present within a Covered Activity's project footprint, or present within 0.5 mile of a project footprint, AMM GSC-1 requires an approved biologist to conduct field surveys to determine if existing or potential roosting sites are present within the project footprint, or present within 0.5 mile of the project footprint. Existing or potential greater sandhill crane roosting sites must be noted on all project plans that are submitted to the local Land-Use Authority Permittee or to the SSHCP Implementing Entity for approval. If potential roosting sites are identified during the AMM GSC-1 initial field surveys, and if project activities will occur when greater sandhill cranes are wintering in the Action Area (September 1 to March 15), AMM GSC-2 then requires a pre-construction survey also be conducted The pre-construction survey must occur within 15 days prior to any ground disturbing activities implemented between September 1 and March 15. An approved biologist will conduct the pre-construction surveys in the project footprint, and all lands within 0.5 miles of the project footprint, to determine use by roosting sandhill cranes. If sandhill crane use is observed, the approved biologist will inform the Land-Use Authority Permittee and the SSHCP Implementing Entity, and they in turn will notify the Service and CDFW. The project will then implement AMMs GSC-3 and GSC-5. AMM GSC-3 requires the Covered Activity project to establish a 0.5 mile temporary buffer-zone around any greater sandhill crane roosting sites that are within the project footprint, or within 0.5 mile of the project footprint. No project activities (vehicle use, machinery use, ground disturbance, human activity, noise, etc.) will occur within the 0.5.mile temporary buffers until greater sandhill cranes have left the Action Area. If the AMM GSC-1 or AMM GSC-2 surveys find greater sandhill crane roosting sites within the project footprint or within 0.50 miles of any project-related activity, AMM GSC-5 requires the Covered Activity project proponent to retain an approved biologist to monitor the roosting site throughout the roosting season, and to determine when greater sandhill cranes have left the Action Area.

However, if project-related activities are determined to be necessary within the 0.5-mile disturbance-buffer between September-1 to March 15, additional AMMs will be implemented. Under GSC-5, project-related activities within the 0.5-mile buffer would only occur with written permission of the Implementing Entity, the Service, and CDFW. If work within the buffer is approved, AMM-GSC-4 requires the Covered Activity project proponent to construct a visual barrier that will prevent birds using the roosting site from seeing vehicle movements, machinery, and human activities associated with the Covered Activity. Under AMM GSC-5, the Covered Activity project proponent also will retain an approved biologist experienced with greater sandhill crane behavior, and the approved biologist must be on-site daily while Covered Activities are taking place within the 0.5-mile buffer zone. The approved biologist will monitor the roosting site and the effectiveness of the visual barrier throughout the roosting season (September 1 to March 15). Under AMM GSC-5, if the approved biologist observes sandhill cranes exhibiting agitated behavior or abandoning the roosting and/or forage sites, the approved biologist will have the authority to shut down construction activities). If greater sandhill cranes abandon a roosting and/or forage site, the approved biologist, the Third Party Project Proponent, the SSHCP Implementing Entity, the Service, and CDFW will meet to determine the best course of action (see AMM GSC-5). Under AMM GSC-5, the approved biologist also will train construction personnel on the avoidance procedures, buffer zones, and protocols in the event that greater sandhill cranes move into an active construction zone from outside the buffer zone.

The Covered Activity removal of 7,935 acres (9%) of existing greater sandhill crane modeled habitat will further fragment greater sandhill crane wintering-habitat within the Action Area. Although greater sandhill cranes are able to fly over unsuitable landcovers to access suitable foraging areas, the increased habitat fragmentation may require greater sandhill cranes to fly farther each day between suitable roosting sites and suitable foraging sites, which would increase energetic demands and would increasing other risks, such as collisions with vehicles and collisions with man-made structures. Greater sandhill crane family groups return to their traditional foraging and roosting sites when they overwinter in the Central Valley (Ivey and Herziger 2003). The removal of traditional winter foraging sites or traditional winter roosting sites may disorient family groups returning to the Action Area, and would force family groups to seek other suitable foraging and roosting habitats, which may be located outside the Action Area.

In addition to direct effects, the implementation of SSHCP Covered Activities also will indirectly affect greater sandhill crane habitat and individuals within the Action Area. The SSHCP qualitatively assessed and analyzed the indirect effects of SSHCP Covered Activities on greater sandhill crane modeled habitat (Final SSHCP Table 9-96). The edge areas of preserved or avoided greater sandhill crane modeled habitat will be exposed to environmental stressors produced by the urban development Covered Activities, especially where existing modeled habitat is adjacent to the UDA in PPU-8, and the UDA in PPU-4. The close proximity of new urban development to greater sandhill crane modeled habitat increases the likelihood that hydrology changes and water quality changes could adversely affect greater sandhill crane foraging or roosting habitat. Increased urban runoff and roadway runoff may contain trash, debris, pollutants, and toxins (including fertilizers, herbicides, pesticides, fuel, oil, lubricants, paints, and release agents). Greater sandhill crane individuals exposed to these pollutants may be sickened or killed, and individuals that consume prey contaminated with urban and roadside pollutants may be sickened or killed. Indirect changes that alter the existing hydrology of modeled habitat may decrease water depth of roosting areas, making them unsuitable. Conversely, additional runoff could flood areas to depths that are unsuitable for greater sandhill crane roosting or foraging. The SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs), discussed in Section 2.5.4 above, and in SSHCP Chapter 5.4.1, would assure that landscape hydrology and micro-watershed hydrology-changes in the UDAs are minimized, and assure that stormwater runoff will not enter preserves or other open-spaces that provide habitat for greater sandhill crane. Indirect effects to greater sandhill cranes individuals may result from other environmental stressors produced by the urban development Covered Activities, including increased amounts of wind-blown trash, disorientation of individuals from outdoor lighting, increased disturbance and increased stress resulting from human activities, and increased completion for prey-species by feral pets and other invasive animals. As discussed above in Section 2.5.4, the EDGE, NATURE TRAIL, and ROAD AMMS will minimize these indirect effects on greater sandhill crane habitat and individuals within the SSHCP Preserves.

Buildout in the Galt UDA and UDA buildout of PPU-4 will result in more roadways, higher traffic densities, and greater vehicle and speeds in the UDA that are expected to increase disturbance of greater sandhill cranes inside and adjacent to the UDAs. Outside the UDAs, indirect effects to greater sandhill crane modeled habitat are expected from the rural transportation Covered Activities that will be implemented within greater sandhill crane modeled habitat, especially the improvements that permanently widen rural roadways and those that establish 4-lane arterial roadways (see Table 1b above). The rural transportation Covered Activity projects within greater sandhill crane modeled habitat include Twin Cities Road between State Route-99 and Interstate-5 (8 miles), New Hope Road between the Mokelumne River and Kost Road, Franklin Boulevard between Kammerer Road and Twin Cities Road (6 miles), Arno/Riley Road between State Route-99 and Valensin Road (3.3 miles), Valensin Road between Arno Road and Colony Road (3.5 miles), Dillard Road between SR-99 and Alta Mesa Road, and Alta Mesa Road between Dillard Road and Twin Cities Road (8.5 miles) (Final SSHCP Chapter 5.2.3). The rural roadway improvements are expected to increase traffic densities, increase vehicle speeds, increase traffic noise, increased headlights at night, and increased human activity along the improved roadways. These indirect changes to traffic and human activity may increase disturbance to foraging or roosting greater sandhill cranes, increase risk of vehicle collisions, and increase collisions with utility structures. Greater sandhill cranes do not tolerate regular disturbances, and typically flush (fly away) when vehicles approach within 300 feet, and they seldom forage within 300 feet of structures (Ivey and Herziger 2003). Therefore, suitable roosting and foraging habitat located within 300 feet of the improved roadways may no longer be used by greater sandhill cranes after the implementation of the rural transportation improvement Covered Activities. Implementation of the UTILITY-1 and the GSC-1 AMMs will require Covered Activities that include above-ground utilities to incorporate the most current practices for avoiding avian powerline collisions (Final SSHCP Table 96).

To mitigate the adverse direct and indirect effects to greater sandhill crane individuals and modeled habitats, the SSHCP will preserve least 10,320 acres of modeled foraging and roosting habitat for greater sandhill crane in the Action Area (Table 33 above), including 9,399 acres of "high value" greater sandhill crane roosting and foraging modeled habitats (Final SSHCP Table 7-84). The characteristics and locations of the 10,320 acres of modeled habitat preserved for greater sandhill crane will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, and consistent with the SSHCP biological goals and objectives for greater sandhill crane (Final SSHCP Table 7-1 and 7-85). To the maximum extent possible, SSHCP Preserves will be established adjacent to and contiguous with existing preserves to enhance the functional value of the SSHCP Preserves for the greater sandhill crane, and to minimize the effects of habitat fragmentation and edge effects. Modeled habitat preserved for greater sandhill crane will occur outside the UDAs in PPUs 4, 6, and 8, with a minimum of 75% (7,740 acres) within PPU-6.

Table 33. Greater Sandhill Crane. Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Foraging and Roosting Habitat					
Seasonal Wetland	51	Qualitative Assessment	51	105	52
Freshwater Marsh	73	Qualitative Assessment	73	127	73
Total Habitat	**124**	Qualitative Assessment	**124**	**232**	**125**
Roosting Only Habitat					
Vernal Pool	59	7	66	37	59
Total Roosting Only	**59**	7	**66**	**37**	**59**
Foraging Only Habitat					
Cropland	3,764	Qualitative Assessment	3,764	6,700	0
Irrigated Pasture	1,519	Qualitative Assessment	1,519	1,671	0
Valley Grassland	2,469	Qualitative Assessment	2,469	1,680	270 [a]
Total Foraging	**7,752**	Qualitative Assessment	**7,752**	**10,051**	
Totals	**7,935**	7	**7,942**	**10,320**	**184**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established as Valley Grassland uplands.

Properties preserved by the SSHCP to provide 257 acres of greater sandhill crane roosting habitat or roosting/foraging habitat will be prioritized to select properties that have documented roost sites, are 20 acres or greater in size, are at least 1,000 feet from disturbances such as roads or other operations or actions that may disturb roosting, are without powerlines, seasonally holds water between September to mid-March, are within 2 miles of modeled foraging habitat, are outside the UDAs, and are outside the 100-year floodplain (Final SSHCP Conservation Action GS1.1).

The SSHCP will strategically plant woody vegetation near documented and potential roost-sites in PPU-6to create screens of vegetation that hide existing human structures (buildings, roads, and bridges) from the view of greater sandhill cranes that may use the roost-site. Plant species used to create the visual screens will have appropriate height and structure that does not to interfere with foraging or interfere with the initiation of flight or landing (SSHCP Objective GS4).

In addition, the SSHCP will re-establish two new roosting sites (minimum of 90 acres of Freshwater Marsh/Seasonal Wetland complex each, totaling 180 acres) every 2 miles in the gap between the Cosumnes Preserve roosting sites located in the southern part of PPU-6 and the Stone Lakes NWR roosting sites in the north eastern portion of PPU-6 (SSHCP Objective GS3) (Final SSHCP Figure 3-22). Sites selected for the re-establishment of new roosting sites will have landcovers that do provide low-quality habitat for greater sandhill crane and other SSHCP Covered Species, such as orchards or vineyards. Human disturbances and structures that could cause collisions during flight

(electrical lines, fences, and structures) will be removed, and suitable seasonal-hydrology will be re-established or established at the site (Final SSHCP Conservation Action GS3.1).
Properties preserved by the SSHCP to provide the 10,051 acres of greater sandhill crane foraging habitat will be prioritized to select properties 20 acres or greater in size that are surrounded by larger, open-space areas; are located within 2 miles of documented roosting sites or modeled rooting habitat; are without powerlines; has an available source of "grit," (e.g. rocky uplands, gravel or dirt roads); are outside the UDAs, and are outside the 100-year floodplain (Final SSHCP Conservation Action GS2.1). Of the 10,051 acres of greater sandhill crane modeled foraging habitat protected in the SSHCP Preserve System, a minimum of 1,000 acres will be "high value" modeled foraging habitat that is also outside of the 100-year flood plain (SSHCP Objective GS6).

Greater sandhill cranes also will benefit from implementation of other SSHCP Biological Objectives in the Action Area. SSHCP Objective AG1 will preserve a total of 9,696 acres of Cropland and Irrigated Pasture landcovers in SSHCP Cropland Preserves. Objective AG2 requires that at least 2,000 of those acres be crops preferred by foraging tricolored blackbird and greater sandhill crane, including alfalfa, corn, or wheat. These food-plots will be distributed throughout PPUs 4, 5, and 6 at a minimum of 10 different locations, and each food plot will be 20 acres or larger (Final SSHCP Conservation Action AG2.1). Under SSHCP Objective GS5, a minimum of 200 acres among the 10 food plots will be located in PPU-6 and will be maintained as irrigated pasture or crops preferred by greater sandhill crane. Crops targeting greater sandhill crane may include alfalfa, corn, wheat, or rice, with preference given to corn or rice. The 10 food plots will be distributed throughout PPU-6 at a minimum of five locations. Food plots must be within 1.5 miles of Irrigated Pasture-Grassland or other pasture lands used by greater sandhill crane, and within 2 miles of documented roosting sites. Crops will not be harvested or removed until March. However, tall crops such as corn will be knocked over at a height and as early as possible in the season to maximize access to greater sandhill cranes (while still impeding geese from exploiting the crop).The SSHCP also will coordinate with the Service, CDFW, and relevant conservation entities when determining the most effective property acquisitions under Objective GS5, and to anticipate potential geographic shifts in greater sandhill crane wintering use of the SSHCP Action Area as a result of expected sea-level rise (Final SSHCP Conservation Action GS5.1).

In addition, SSHCP Objective AG3 will help to maintain or increase greater sandhill crane prey-species base in SSHCP Cropland Preserves by strategically planting 10,000 linear feet of hedgerows within and on the borders of the Cropland Preserves. Hedgerows will be a minimum of 5 feet wide and be planted with native shrubs, trees, and grasses to provide cover and refugia for voles and other small mammals that greater sandhill crane can consume. Providing hedgerow prey-species refuge habitat adjacent to protected Cropland and Irrigated Pastures will allow prey species to return more quickly to fields after they are mowed, re-planted after harvesting, or flooded to provide roosting habitat (Final SSHCP Conservation Action AG3.1).

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques that will maintain and improve greater sandhill crane foraging and roosting habitats within the individual SSHCP Preserves (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve, especially the SSHCP Cropland Preserves (SSHCP Objectives HAB4 and HAB5). The preservation of high quality greater sandhill crane habitat, coupled with careful habitat management and monitoring, is expected to maintain or increase the number and distribution of greater sandhill cranes within the Action Area.

2.7.4.9 Effects on Loggerhead Shrike

Effects of SSHCP Covered Activities on loggerhead shrike include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on loggerhead shrike individuals.

Of the total 215,246 acres of loggerhead shrike modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 31,367 acres (15%) of the species modeled habitat (Table 34 below). Most of the loggerhead shrike modeled habitat removed (29,550 acres or 94%) will be Valley Grassland and other landcovers that provide foraging habitat. Approximately 550 acres of loggerhead shrike nesting modeled habitat will also be removed (Final SSHCP Table 6-91).

Most loss of loggerhead shrike modeled habitat will occur within the UDA portions of the Action Area, where urban development Covered Activities will remove 30,100 acres (73%) of the existing 41,280 acres of loggerhead shrike modeled habitat. Outside the UDAs, only 1,267 acres (0.7%) of the existing 173,966 acres of loggerhead shrike modeled habitat will be removed by the rural transportation Covered Activities and the recycled-water pipeline Covered Activities. Activities related to the implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, paving, and construction will remove loggerhead shrike nesting and foraging habitats.

If implemented during loggerhead shrike nesting season, the removal of nesting trees or shrubs could kill or injure eggs and young. The removal of active nesting-sites would disrupt breeding behavior in the adults, causing them to relocate within the Action Area or move out of the Action Area, which could reduce or eliminate the likelihood of successful reproduction that year. The noise, human activity, and equipment used during implementation of Covered Activities in the vicinity of active nests may directly affect nesting loggerhead shrikes by increasing stress levels and by disrupting normal nesting behaviors. Nesting sites may be abandoned, causing pairs to relocate and build a new nest, likely resulting in fewer offspring that year; or pairs may completely abandon nesting that year without reproducing. Abandonment of nests that have eggs or young would result in death of the eggs and young.

Covered Activity removal of foraging habitat within 0.5 miles of nesting loggerhead shrikes may force the nesting adults to alter their foraging behaviors. Adults may be forced to forage inside an adjoining territory, increasing aggressive interactions with other loggerhead shrikes; adults may be forced to fly greater distances to forage, and adults may be forced to search for prey in new and unfamiliar areas to feed their young. Removal of foraging habitat and prey availability during the 31 to 37-day incubation and fledging period would require the adults to expend more energy hunting, and may reduce hunting success. Less successful hunting during the nesting season is can reduce the total number of eggs laid by the female, and can reduce the amount or the quality of food fed to young—slowing the growth of nestlings, and reducing the number of nestlings that fledge and survive to maturity.

Loggerhead shrikes are known to maintain their territories year round in California. The removal of foraging habitat within a loggerhead shrike's 11-acre to 40-acre non-breeding territory may force individuals or established pairs to abandon their territories. Birds displaced from established territories may be forced to search for a new territory in unfamiliar areas, or they may be forced to aggressively challenge neighboring loggerhead shrikes for their territory. The loss of a territory with its familiar foraging-sites is expected to adversely affect hunting success and food consumption of the displaced birds, until a suitable new-territory is established. Displaced birds also will experience higher stress levels, especially if they must challenge other loggerhead shrikes or other bird species to establish a new territory. The reduction in successful foraging coupled with increased stress and energy-requirements of establishing a new territory can reduce the health and fitness of the affected individuals, reducing their ability to form a pair-bond at the start of the next breeding season, or reducing their nesting success in the next breeding season.

Direct effects to loggerhead shrike individuals will be avoided or minimized by the RAPTOR AMMs. If modeled habitat for loggerhead shrike is present within a Covered Activity's project footprint or within 0.25 mile of a project footprint, AMMs RAPTOR-1 require an approved biologist to conduct field surveys to determine if existing or potential loggerhead shrike nesting-sites are present within the project footprint, or within 0.25 mile of the project footprint. Existing or potential loggerhead shrike nesting sites must be noted on all project plans that are submitted to the local Land-Use Authority Permittee or the SSHCP Implementing Entity for approval. If existing or potential nest sites are identified during these initial field surveys, and if project activities will occur within the project footprint during the loggerhead shrike breeding season (February 1 to July 31), AMM RAPTOR-2 also requires pre-construction surveys be conducted by an approved biologist within the project footprint and within 0.25 miles of the project footprint during the loggerhead shrike breeding season. Pre-construction surveys will occur within 30 days of any ground disturbing activities, and again within 3 days of any ground disturbing activities. If an active nest is present, the approved biologist will inform the Land-Use Authority Permittee and the SSHCP Implementing Entity of the species locations, and they in turn will notify the Service and CDFW. The Covered Activity project will then implement AMMs RAPTOR-3 and RAPTOR-4 at the project site. AMM RAPTOR-3 requires the Covered Activity project to establish a 0.25 mile buffer-zone around an active loggerhead shrike nest that is within the project footprint or within 0.25 mile of the project footprint. No project activities (vehicle use, machinery use, ground disturbance, human activity) will occur within this temporary nest-disturbance buffer established around the active nest until the young are fledged and have left the nest site. However, if project-related activities are determined to be necessary within the temporary 0.25-mile disturbance buffer during the nesting season, AMM RAPTOR-4 allows work within the temporary nest disturbance buffer to occur with the written permission of the SSHCP Implementing Entity, the Service, and CDFW. An approved biologist experienced with raptor behavior will be retained by the Third Party Project Proponent to monitor the nest throughout the nesting season and to determine when all young have fledged and left the nest site. The approved biologist will be on site daily while construction-related activities are taking place within the 0.25-mile disturbance buffer. If nesting adult raptors or young in the nest begin to exhibit agitated behavior, such as vocalizing, getting up from a brooding position, flying off the nest, or defensive flights at intruders, the approved biologist/monitor will have the authority to shut down project activities. If agitated behavior is exhibited, the biologist, the Third Party Project Proponent, the SSHCP Implementing Entity, the Service and CDFW will meet to determine the best course of action to avoid nest abandonment or injury of individuals. The approved biologist also will train construction personnel on the required avoidance procedures, disturbance buffer zones, and protocols in the event that a covered raptor species flies into an active project site from outside the buffer zone.

The loss of 31,367 acres of loggerhead shrike modeled habitat from SSHCP Covered Activities will further fragment the loggerhead shrike habitat within the Action Area. Although loggerhead shrikes are able to fly over unsuitable landcovers to access suitable foraging areas, increased habitat fragmentation will make loggerhead shrikes fly farther between suitable foraging and nesting areas, increasing energetic demands and time away from nest sites, and increasing other risks, such as collisions with vehicles and collisions with man-made structures.

Table 34. Loggerhead shrike Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Nesting Habitat					
Mixed Riparian Woodland	184	Qualitative Assessment	184	368	184
Mixed Riparian Scrub	189	Qualitative Assessment	189	378	189
Mine Tailing Riparian	218	Qualitative Assessment	218	218	218
Total Nesting Habitat	**591**	Qualitative Assessment	**591**	**964**	**591**
Nesting and Foraging Habitat					
Valley Grassland	22,014	Qualitative Assessment	22,014	22,014	270[a]
Total Nesting/Foraging	**22,014**	Qualitative Assessment	**22,014**	**22,014**	**270**
Foraging Habitat					
Cropland	5,285	Qualitative Assessment	5,285	6,947	0
Irrigated Pasture	2,749	Qualitative Assessment	2,749	2,749	0
Vernal Pool	389	Qualitative Assessment	389	966	389
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Swale	234	Qualitative Assessment	234	278	234
Total Foraging	**8,762**	Qualitative Assessment	**8,762**	**11,045**	**728**
Totals	**31,367**	Qualitative Assessment	**31,367**	**34,023**	**1,589**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established as Valley Grassland uplands.

To mitigate the adverse direct and indirect effects to loggerhead shrike individuals and loggerhead shrike modeled habitat, the SSHCP will preserve least 34,023 acres of suitable foraging and nesting habitat for loggerhead shrike in the Action Area (Table 84 above). The majority of habitat preservation for loggerhead shrike will occur in outside the UDA, primarily Valley Grasslands in PPU-6and PPU-7. The characteristics and locations of modeled habitat preserved for loggerhead shrike will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, consistent with the SSHCP biological goals and objectives for loggerhead shrike (Final SSHCP Table 7-1 and 7-82), including SSHCP Objectives LS1, LS2, and LS4.

Preserved loggerhead shrike foraging and nesting habitat will be on parcels that are 20 acres or greater in size and occur in larger, open areas with grassland or herbaceous vegetation for hunting interspersed with scattered or isolated trees or shrubs that provide hunting perches and provide nesting trees (Final SSHCP Conservation Actions LS1.1 and LS2.1). Sites selected for preservation would be in areas known to support loggerhead shrike and other Covered Species. To the maximum extent possible, SSHCP Preserves established for loggerhead shrike will be adjacent to or have habitat links to existing preserves, enhancing the functional value of the SSHCP Preserves for loggerhead shrike, and to minimize the effects of habitat fragmentation and edge effects.

The SSHCP Conservation Strategy for loggerhead shrike includes agricultural lands that can support perennial crops (e.g. alfalfa rather than annual row crops) in areas known to be used by loggerhead shrike for foraging. These Cropland Preserves (Final SSHCP Chapter 7.2.2) and will include a minimum of 9,696 acres of Cropland landcovers and Irrigated Pasture that provide suitable foraging habitat for loggerhead shrike (Table 34). In addition, at least 2,000 acres in the Cropland Preserves will be alfalfa and dryland grains, which will provide high quality foraging habitat that is close to modeled nesting habitat (SSHCP Objective AG2). These prey-species food plots will be distributed throughout PPUs 4, 5, and 6 at a minimum of 10 different locations, and each food plot will be 20 acres or larger. To increase prey availability for loggerhead shrikes, the SSHCP Cropland Preserves also will be planted with 10,000 feet of strategically placed hedgerows (minimum 5-foot wide borders of shrubs, trees, and other vegetation), which provide hunting perches for loggerhead shrike, and provide refugia for small mammals and other prey species. Providing hedgerow refuge-habitat for prey species adjacent to Cropland and Irrigated Pastures will allow prey species to return more quickly to fields after they are mowed or are re-planted after harvesting (SSHCP Objective AG3). Additionally, where trees are planted in hedgerows, they will provide loggerhead shrike potential nesting habitat, in addition to increased prey habitat values. The Individual PMP for the Cropland Preserves also will include invasive species control and pesticide restrictions.

The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques for maintaining and improving loggerhead shrike foraging and nesting habitats within the individual SSHCP Preserves (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). Monitoring vegetation height in grasslands (Objective HAB7) would maintain quality of loggerhead shrike foraging habitat by improving habitat suitability for prey, and by removing dense thatch that interferes with hunting. The individual Preserve PMPs will include strategic planting or maintenance of existing trees and shrubs to increase the number of loggerhead shrike hunting perching, as appropriate. These actions are expected to increase reproductive success and productivity of loggerhead shrikes in the Action Area. The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). The preservation of high quality habitat within large Preserves, coupled with careful management and monitoring, is expected to increase the number and distribution of loggerhead shrike individuals within the Action Area.

In addition to the preservation of 34,023 acres of modeled habitat for loggerhead shrike, the SSHCP Conservation Strategy also will establish or re-establish 1,589 acres of loggerhead shrike modeled habitat in the SSHCP Preserve System, with a priority on re-establishment before establishment (Table 34 above). Sites selected for the establishment or re-establishment of loggerhead shrike habitat will be prioritized following the requirements of SSHCP Objectives LS3 and LS5. Re-established and/or established nesting sites will be on lands that can be planted with scattered or isolated trees or large shrubs for nest sites and hunting perches. Loggerhead shrike foraging habitat re-establishment or establishment will occur where habitat historically occurred but no longer exists, and only where non-modeled habitat landcovers would be converted to modeled habitat.

2.7.5 Cumulative Effects on Avian Covered Species

As described in Section 1.0 of this Opinion, the SSHCP was developed in part to respond to biological opinions issued by the Service in 1999 and 2004, and to address the indirect and cumulative effects of those large-scale water infrastructure projects in south Sacramento County.

Cumulative effects in a section 7 analysis are the effects of future state, tribal, county, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Several reasonably certain projects in the Action Area, such as the California High-Speed Train System and the California Waterfix, will require will require future federal actions and separate consultations under the ESA, and are not considered in this Opinion's cumulative effects analysis.

Reasonably certain activities in the Action Area, unrelated to the SSHCP and with no federal nexus, include the continued expansion of low-density rural development (see Section 2.3.4 above) within the approximately 19,600 acres of PPU-7 and PPU-6 that are designated as Agriculture Residential areas in the Sacramento County General Plan (County of Sacramento 2011). Construction of new residential structures or barns may occur, along with associated grading, landscaping, and accessory structures such as corrals and fences. In many cases, these activities will occur on large lots with existing grassland, woodland, and riparian landcovers that provide suitable habitat for the SSHCP avian Covered Species.

Land use changes and construction of structures within the Agricultural Residential areas may not obtain authorizations under ESA, CESA, and the CWA, particularly at project sites that are not subject to CEQA. Projects that are not subject to CEQA would not prepare a CEQA document to identify potential environmental impacts, and the project proponent may not have the expertise to identify biological resources or understand the regulations, and the project impacts to species or habitat is beyond the purview of the County regulators that review building plans. Effects to the avian Covered Species individuals and suitable habitats from projects within the Agricultural Residential areas would result in the types of effects similar to those discussed above in in Sections 2.5.4, 2.7.3, and 2.7.4 of this Opinion.

Additional conversion of existing natural grassland, woodland, and riparian landcovers to the cropland, irrigated pasture, orchard, or vineyard landcovers is expected to occur outside the UDA, in the portions of the Action Area zoned for agricultural uses by the County's General Plan (County of Sacramento 2011). In addition, additional conversions of existing cropland and irrigated pasture landcovers to the more intensively managed vineyard and orchard landcovers is also expected to occur outside the UDA, in the portions of the Action Area zoned for agricultural uses by the County's General Plan (County of Sacramento 2011). It is not possible, however, to predict how agricultural uses and crop types may change over the 50-year Permit Term. Nonetheless, some conversion of existing grassland, woodland, and riparian landcovers to a irrigated pasture and cropland, as well as conversions to the more intensively managed agricultural uses (such as vineyards and orchards) is expected over the 50-year study period. The conversion of existing landcovers that provide suitable habitat for the individual avian Covered-Species to landcovers with more intensively managed agricultural uses would result in the types of effects similar to those discussed above in Sections 2.5.4, 2.7.3, and 2.7.4.

Other non-Federal actions that may occur in the Action Area are considered too speculative to evaluate at this point in time.

2.7.6 Conclusion for the Avian Covered Species

After reviewing the current status of the Cooper's hawk, the tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, and the loggerhead shrike (the avian Covered Species); the environmental baselines for the Action Area; the effects of the proposed actions, including all measures to avoid, minimize, and mitigate adverse effects; and the cumulative effects; it is the Service's conference opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to jeopardize the continued existence of the avian Covered Species. The Service reached this conclusion because the project-related effects to the avian Covered Species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of any avian Covered Species. We reached this conclusion based on the following reasons:

- Because ferruginous hawk and greater sandhill crane do not breed in the Action Area, Covered Activity removal of wintering habitat would not appreciably reduce the rangewide reproduction or distribution of ferruginous hawk and greater sandhill crane. In addition, a relatively small amount of the winter foraging and roosting habitat for each species would be removed in the Action Area (16% and 9 % respectively), and winter foraging and roosting habitat for ferruginous hawk and greater sandhill crane will remain in amounts sufficient to support the current and expected future use of the Action Area by both species.
- Cooper's hawk, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, and the loggerhead shrike occupy a large geographic range outside of the Action Area, and the SSHCP Covered Activities would affect a relatively small portion of each avian Covered Species overall distribution.
- SSHCP Covered Activities would remove a relatively small amount of avian Covered Species modeled habitats, primarily foraging habitat (vernal pool grasslands) lost within the UDAs (i.e. 2% of Cooper's hawk modeled habitat, 15% of tricolored blackbird modeled habitat, 15% of western burrowing owl modeled habitat, 15% Swainson's hawk modeled habitat; 15% of northern harrier modeled habitat; 14% of white-tailed kite, and 15% of loggerhead shrike modeled habitat). Impacts to identified "high-value" foraging habitat will be mitigated by preserving an equal or greater amount of high-value foraging habitat.
- The SSHCP Preserve System would protect and manage a relatively large amount of the existing avian Covered Species modeled habitat in the Action Area (i.e. 7.3% of Cooper's hawk modeled habitat, 16% of tricolored blackbird modeled habitat, 16% of western burrowing owl modeled habitat; 16% of Swainson's hawk modeled habitat, 16% of northern harrier modeled habitat, 15% of white-tailed kite modeled habitat, and 16% of loggerhead shrike modeled habitat).We expect the large and interconnected SSHCP Preserve System to a long-term stabilizing benefit to each avian Covered species in the Action Area. The protection and management of large habitat preserves in perpetuity, and the protection of known nest sites and known occurrences will help ensure each avian Covered Species persists.
- SSHCP will establish at least 2,000 acres of "high value" Cropland Preserves, which will be planted with crops preferred by foraging tricolored blackbird and greater sandhill crane (alfalfa, corn, wheat, sunflower), and will be intensive managed to increase populations of voles and

other prey of Swainson's hawk, loggerhead shrike, and the other raptor Covered Species. SSHCP will strategically plant 10,000 linear feet of hedgerows in the Cropland Preserves to provide cover and refugia for prey species during crop harvesting or alfalfa mowing. The individual Cropland Preserve will be located within two miles of active Swainson's hawk nests.

- SSHCP Covered Activities are not expected to remove sites where western burrowing owl use has been documented the Action Area, but undocumented nesting and foraging sites are presumed to be present within the modeled habitat that will removed by SSHCP Covered Activities. The SSHCP will establish the new burrowing owl nesting habitat by: establishing new ground squirrel colonies in SSHCP grassland preserves, augmenting SSHCP preserves with artificial burrows, and installing sentinel posts near ground squirrel colony sites.
- We do not anticipate the Covered Activity removal of modeled nesting habitat from the Action Area would result in the direct injury or death of Cooper's hawk, the tricolored blackbird, western burrowing owl, Swainson's hawk, northern harrier, white-tailed kite, or and loggerhead shrike; because the SSHCP avian species AMMs will preclude impacts to nesting individuals and their young during the breeding season of each avian Covered Species.
- All 15,282 acres of grassland foraging habitat protected in the SSHCP Preserve System will be monitored and managed in perpetuity under a single cohesive adaptive management program to maintain or improve foraging habitat for western burrowing owls, ferruginous hawks, Swainson's hawks, northern harriers, white-tailed kites, loggerhead shrikes, and tricolored blackbirds. The grassland management provided by the SSHCP is expected to increase prey detectability and foraging success of all avian Covered Species by removing dense thatch from grasslands and managing grass height in the SSHCP Preserve System, and by improving grassland habitat suitability for avian prey species (voles, mice, ground squirrels, grasshoppers, and other insects). In addition, the individual Preserve Management Plans will monitor and ameliorate the effects of edge stressors (such as invasive weeds, trash, litter, lighting, noise, human activity, wildfire risk, and non-point source pollution) in each SSHCP Preserve.

No critical habitat has been designated for Cooper's hawk, the tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, or the loggerhead shrike; therefore, none will be affected.

2.8 Valley Elderberry Longhorn Beetle

2.8.1 Status of the Species/Critical Habitat

The Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) (beetle) was federally listed as a threatened species on August 8, 1980 (USFWS 1980). For the most recent comprehensive assessment of the range-wide status of the beetle, please refer to the Withdrawal of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened Wildlife (USFWS 2014b). Threats discussed in the withdrawal continue to act on the beetle, with loss of habitat being the most significant effect. While there continue to be losses of beetle habitat throughout its range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the beetle.

On August 8, 1980 (USFWS published the final rule listing the valley elderberry longhorn beetle as a threatened species, and designating Critical Habitat within two areas within Sacramento (USFWS 1980). The valley elderberry longhorn beetle Critical Habitat was designated in two units: the Sacramento Zone and the American River Parkway Zone. These two Critical Habitat units lie outside the Action Area, so are not considered further in the SSHCP.

A Recovery Plan for the valley longhorn elderberry beetle was completed on June 28, 1984; however, due to a lack of information regarding the species' life history, distribution, and habitat requirements, the 1984 Recovery Plan only described interim actions and not precise recommendations. The 1984 Recovery Plan identified the need to protect riparian habitats along several Central Valley rivers, including the American, Sacramento, Feather, Stanislaus, Mokelumne, Calavera, Cosumnes, and San Joaquin. The Mokelumne and Cosumnes Rivers are located in the central and southern portions of the Action Area. The primary components of the Valley Elderberry Longhorn Beetle Recovery Plan include: surveys for presence of the valley elderberry longhorn beetle; development of habitat protection plans; restoration of preserved sites (including exotics removal); and management and maintenance, including minimizing the use of herbicides and insecticides, preventing removal of riparian vegetation, and preventing riprapping of riparian habitat (USFWS 1984).

The valley elderberry longhorn beetle is completely dependent upon its host plant, the elderberry shrub, the only recorded larval host plant *(Sambucus glauca, S. mexicana, S. caerulea*) (Barr 1991; Collinge et al. 2001; Eng 1984; Linsley and Chemsak 1972, 1997; USFWS 2006b). This shrub is a component of riparian forests throughout the Central Valley. Although elderberry shrubs occasionally occurs outside of riparian areas, shrubs supporting the greatest valley elderberry longhorn-beetle densities are where the shrubs are abundant and interspersed among dense riparian forest (Barr 1991; Collinge et al. 2001; USFWS 1999c). Valley elderberry longhorn beetle spends most of its life in the larval stage, living within the stems of the elderberry plant. Adults eat the elderberry foliage until about June when they mate. The females lay eggs in crevices in the bark. Upon hatching, the larvae then begin to tunnel into the elderberry shrub, where they will spend 1 to 2 years eating the interior wood, which is their sole food source. Pupae can be found between January and April, and the pupal stage lasts about one month (Burke 1921). After pupation, the teneral adult remains in the pupal cell for several weeks prior to emergence (Burke 1921). The adult eventually emerges from the pupal chamber, through the exit hole (Barr 1991). Recently made exit holes can be identified and are commonly used as an indicator of species presence. The adults are active from March to early June, and readily fly from elderberry shrub to elderberry shrub (Barr 1991).

2.8.2 Environmental Baseline for Valley Elderberry Longhorn Beetle

The CNDDB has records for seven occurrences of valley elderberry longhorn beetle (VELB) in the Action Area. One CNDDB occurrence is along State Highway-50 in Rancho Cordova (PPU-1). The CNDDB (2018) describes this occurrence along State Highway 50 as experiencing a decreasing trend because Argentine ants are present, and have killed two newly emerged VELB (Calderaro pers. obs.). There are also several VELB exit-holes documented on elderberry shrubs in the Mine-tailing Riparian Woodland landcovers on the former Aerojet property in Rancho Cordova (in PPU-1 and the UDA), which have not been recorded in the CNDDB (Talley et al. 2007). Outside the UDAs, five CNDDB occurrences are located along the Cosumnes River/Deer Creek riparian corridor that crosses PPU-6 and PPU-5. There are also several VELB exit-holes documented on elderberry shrubs along the headwaters of the Cosumnes River near the city of Rancho Murieta (PPU-5), which may not be recorded in the CNDDB (Talley 2003). There are no documented occurrences of VELB in Sacramento River floodplains in western PPU-6 (CNDDB 2018). In total, the SSHCP's compilation of records and valley elderberry longhorn beetle surveys conducted within the Action Area identified 156 sites where valley elderberry longhorn beetle and exit holes have been documented in the Action Area (Final SSHCP Table 3-6). However, much of the remaining riparian landcovers in the Action Area are privately owned, and most have not been surveyed for elderberry plants or for the presence of valley elderberry longhorn beetle, and the total extent of elderberry shrubs in the Action Area is unknown. Therefore, there is a high probability that future surveys will identify additional valley elderberry longhorn beetle occurrences within the Action Area. SSHCP Figure 3-13 illustrates the location of the documented occurrences for valley elderberry longhorn beetle within the Action Area.

Due to the programmatic nature of the proposed action, the environmental baseline for the valley elderberry longhorn beetle in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.1. The SSHCP landcovers that provide suitable habitat for elderberry shrubs also provide suitable habitat for the valley elderberry longhorn beetle. Therefore, the SSHCP landcovers that provide suitable habitat for the valley elderberry longhorn beetle are all Mine Tailing Riparian Woodland, Mixed Riparian Woodland, and Mixed Riparian Scrub landcovers in the Action Area that are below 900 meters elevation (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Section 2.3.2, Section 2.3.5, and Section 2.7.1 above, and are not repeated here.

The SSHCP identified a total of 7,877 acres of valley longhorn elderberry-beetle modeled habitat within the Action Area, including 5,785 acres of Mixed Riparian Woodland, 1,451 acres of Mixed Riparian Scrub, and 641 acres of Mine Tailing Riparian landcovers. The majority of the existing valley elderberry longhorn beetle modeled habitat (7,172 acres or 91%) is located outside the UDA portions of the Action Area (Final SSHCP Table 6-53). The current conditions of the riparian landcovers remaining in the Action Area and the factors responsible for those conditions were discussed above in Sections 2.3 and 2.6.1, so are not repeated here. Although the distribution of the SSHCP riparian landcovers can be mapped and quantified, the number elderberry shrubs and the quality of the habitat that the shrubs provide (including sizes of stems), is generally unknown for the Action Area. SSHCP Figure 3-13 illustrates the location of modeled habitat for the valley elderberry longhorn beetle within the Action Area.

As stated in the Final SSHCP (pages 5-3, 6-32, 6-55), several properties within the UDA portion of the Action Area have already obtained local entitlements and have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations from the CDFW, the Service, and the USACE. These UDA properties total 21,413 acres, and include several small lots in PPU-8, several small lots located west of Excelsior Road (PPU-3 and PPU-4), properties in the Rio Del Oro Specific Plan area (PPU-1), properties in the Sunridge Specific Plan area (PPU-1), and properties within the Mather Field Specific Plan area (PPU-2). These properties are part of the 317,656-acre Action Area. However, because planned urban development on these properties have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations, these properties were not included in the SSHCP Chapter 6 effects analyses. Where planned urban development has already obtained (or is close to obtaining) ESA authorizations, this Opinion addresses the authorized loss of habitat and loss of species individuals as part of the Environmental Baseline of the valley elderberry longhorn beetle.

2.8.3 Effects of the Action on Valley Elderberry Longhorn Beetle

The species-level effects described below build on Section 2.5.4, *General Effects of the Action on All Covered Species*. Effects previously described in that section of the Opinion are not repeated below. The SSHCP assumes that all acres of the landcovers included in modeled habitat for valley elderberry longhorn beetle could support elderberry shrubs that are occupied by adults, pupa, larvae, or eggs of the species. Therefore, the SSHCP did not quantify effects to individual occurrences of the beetle. The effects analysis in this Opinion also assumes that the landcovers included in the modeled habitat for valley elderberry longhorn beetle could be occupied by the beetle.

Effects of SSHCP Covered Activities on valley longhorn elderberry beetle include the removal of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on valley longhorn elderberry beetle individuals.

Modeled habitats for valley elderberry longhorn beetle are limited to the three SSHCP riparian landcovers: Mixed Riparian Woodland, Mixed Riparian Scrub, and Mine Tailing Riparian Woodland. SSHCP Covered Activities will remove up to 591 acres (8%) of the total 7,877 acres of valley elderberry longhorn beetle modeled habitat present in the Action Area (Table 35 below). Most loss of modeled habitat will occur in the UDAs (550 acres, or 93% of the habitat loss). Outside the UDAs, the implementation of the rural transportation Covered Activities and the recycled-water pipeline Covered Activities will remove 41 acres of valley elderberry longhorn beetle modeled habitat (Final SSHCP Table 6-53). Activities related to the implementation of SSHCP Covered Activities and the conversion of riparian landcovers, such as the use of earth moving equipment, mass grading, paving, and construction, will result in the death of all eggs, larvae, pupa, and adult valley elderberry longhorn beetle individuals that are present within the total 591 acres of riparian modeled habitat that will be removed. The activities and equipment use likely will crush, expose, burry, or otherwise destroy the individual valley elderberry longhorn beetles present in the removed riparian landcovers.

Direct effects to valley elderberry longhorn beetle modeled habitat and individuals will be minimized by the general SSHCP AMMs, including the BMP AMMs. The BMPs will prevent inadvertent damage to riparian vegetation that is outside of a Covered Activity footprint, assure that construction dust will not affect elderberry shrubs or riparian water-quality, and assure that construction lighting is directed away from riparian areas where it could affect the behavior of adult valley elderberry longhorn beetles. The STREAM AMMs will require urban development Covered Activity projects to avoid and to permanently protect riparian vegetation present within 100 feet of Elder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, Sun Creek, and within 300 feet of the Laguna Creek Wildlife Corridor (STREAM-1, STREAM-2, and STREAM-3).

SSHCP Conservation Action VELB1.1 requires Covered Activity projects to conduct protocol level surveys for valley elderberry longhorn beetles if an elderberry shrub is present within or near the Covered Activity project footprint, and requires Covered Activity projects to fully avoid all direct effects and all indirect effects to occupied elderberry shrubs that are located near the Covered Activity project footprint. The analysis in the Opinion assumes that the SSHCP will require individual Covered Activity projects to survey for elderberry shrubs and valley elderberry longhorn beetles following the "riparian" and "non-riparian" assumptions and survey protocols outlined in *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* (USFWS 2017d), or following the current Service protocols at the time that the Covered Activity is implemented. The analysis in the Opinion also assumes that the SSHCP will require individual Covered Activity projects to follow the Avoidance and Minimization Measures described in the *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* (USFWS 2017d), or the current Avoidance and Minimization Measures recommended by the Service at the time that the Covered Activity is implemented

When elderberry shrubs are present within or near the footprint of a Covered Activity, SSHCP Objective VELB1 and SSHCP Conservation Action VELB1.1 require the Covered Activity project to relocate (transplant) or replace elderberry shrubs if the elderberry shrub cannot be avoided, or if indirect effects result in the death of stems or the entire shrub. The impacted elderberry shrub will be relocated or replaced in a suitable location identified by the SSHCP Technical Advisory Committee. The analysis in the Opinion assumes that the SSHCP will require individual Covered Activity projects to comply with the guidance on transplanting elderberry shrubs described in the *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* (USFWS 2017d), or the current guidance recommended by the Service at the time that the Covered Activity is implemented.

SSHCP Objective VELB1 and SSHCP Conservation Action VELB1.1 also require Covered Activity projects to compensate for the loss of elderberry shrubs. The analysis in the Opinion assumes that the SSHCP will require Covered Activity projects to provide compensatory mitigation for the loss of elderberry shrubs according to the *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* (USFWS 2017d), or the current compensatory mitigation requirements recommended by the Service at the time that the Covered Activity is implemented.

In addition to direct effects on valley elderberry longhorn beetle modeled habitat and individuals, potential indirect effects of SSHCP Covered Activities on valley elderberry longhorn beetle modeled habitat were assessed and analyzed qualitatively by the SSHCP (Final SSHCP Table 6-53, 6-54). Potential indirect effects on valley elderberry longhorn beetle include altered hydrology in their riparian habitats; increased exposure to pollutants, toxins, pesticides, and fertilizers; altered fire regime; and increased habitat fragmentation and isolation. As discussed above in Section 2.5.4, the potential for indirect effects would be greatest within the UDA portions of the Action Area because of the closer and more extensive contact between urban development Covered Activities and the SSHCP Preserves and SSHCP Stream Setbacks. If urban development Covered Activities altered the existing hydrology of riparian areas, it could facilitate the spread of Argentine ants, which prey on valley elderberry longhorn beetle larvae (Huxel 2000). The SSHCP's LID, EDGE, ROAD, and STREAM-AMMs will avoid changes to the existing hydrology in UDA riparian landcovers and waterways. The EDGE-8 AMM will avoid or minimize the installation of permanent outdoor lighting in urban development projects where the lighting could affect valley elderberry longhorn beetle behaviors by attracting flying adults or disrupting biological cycles. However, most valley elderberry longhorn beetle modeled habitat in the Action Area (91%) is located outside the UDAs, in riparian landcovers located along Snodgrass Slough, the Cosumnes River, Deer Creek, Dry Creek, and in areas of Mine Tailing Riparian located in PPU- and PPU-5 (Final SSHCP Figure 3-13). Some of the recycled water pipeline Covered Activities proposed in PPU-6 will extend into riparian areas located outside the UDA, and several of the rural transportation Covered Activities planned in PPU-1, PPU-5, PPU-6, and PPU-7 will cross through riparian landcovers outside the UDA (Final SSHCP Figures 3-13 and 5-5). The close proximity of the rural road improvement Covered Activities to valley elderberry longhorn beetle modeled habitats increases the likelihood that road runoff (including pollutants, toxins, fuel, oil, and lubricants) could enter valley elderberry longhorn beetle modeled habitat, and adversely affect riparian water quality, riparian habitat (including elderberry shrubs), or could sicken or kill individual valley elderberry longhorn beetles. The SSHCP's LID-EDGE-, BMP- and ROAD-AMMs discussed in Section 2.5.4 above would minimize these potential indirect effect to valley elderberry longhorn beetle modeled habitat and individual valley elderberry longhorn beetles.

Increased wildfire frequency is also an expected indirect effect of increased human activity in the urban development Covered Activities and along the rural transportation Covered Activities. Because most of the riparian forests remaining in the Action Area are narrow corridors of riparian vegetation, wildfires can quickly easily burn the width of the riparian landcover, killing mature trees and shrubs and temporarily or permanently increasing habitat fragmentation. Wildfires that affect occupied elderberry shrubs would likely kill or injure all larvae, pupa, and adult valley elderberry longhorn beetle individuals present in the affected elderberry shrubs. As discussed in Section 2.5.4, the potential for increased wildfires will be minimized through the implementation of the SSHCP AMMs that reduce the open space–urban interface, reduce thatch buildup on SSHCP Preserves, and control public access within the SSHCP Preserves. In addition, the SSHCP Preserve System Management Program will develop Memoranda of Understanding with all applicable fire agencies. Individual Preserve Management Plans (PMPs) will identify appropriate responses to wildfire and identify appropriate fire-suppression techniques in riparian habitat, including identification, installation, and maintenance of fuel breaks, use of prescribed fire in adjacent grasslands, pre-incident planning, and public education campaigns. Each Preserve Manager will work closely with responding fire agencies to ensure fire response and suppression is consistent with the Memorandum of Understanding and with the individual Preserve PMP to minimize impacts to riparian areas (Final SSHCP Chapter 11.4.3.2). In addition, the potential for increased wildfires will be minimized through the implementation of AMMs that reduce the open space–urban interface, reduce thatch buildup on SSHCP Preserves, and control public access within the SSHCP Preserves.

In total, the SSHCP Covered Activities will remove 591 acres (8%) of the existing valley elderberry longhorn beetle habitat available in the Action Area, further reducing and fragmenting the already limited amount of riparian habitat that remains in the Action Area. After emergence, adult valley elderberry longhorn beetles readily fly from shrub to shrub to feed on leaves and flowers, to find mates, and to reproduce (Barr 1991). Removal of even a relatively small amount of the remaining riparian landcovers in the Action Area may fragment existing patches of elderberry shrubs, decreasing the ability of adult valley elderberry longhorn beetles to move between elderberry shrubs to feed, shelter, and reproduce. Removal of suitable habitat (whether occupied or unoccupied) also will increase the distance between occupied and unoccupied patches of elderberry shrubs in the Action Area. Because its physical dispersal capability of adult valley elderberry longhorn beetles is limited (Collinge et al. 2001), habitat fragmentation decreases the ability of adult valley elderberry longhorn beetles to move between patches of elderberry shrubs, and decreases the likelihood of successful colonization of unoccupied suitable habitat. As a consequence, occupied elderberry shrubs in the Action Area could become isolated, making those elderberry longhorn beetles more vulnerable to stochastic events. Species surveys and the avoidance and minimization measures provided by SSHCP Objective VELB1 and Conservation Action VELB1.1 will minimize the effects of habitat loss and fragmentation on valley elderberry longhorn beetles in the Action Area. I addition, the SSHCP Conservation Strategy will compensate for Covered Activity impacts to elderberry shrubs, as discussed below.

Table 35. Valley Elderberry Longhorn Beetle Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Mine Tailing Riparian Woodland	218	Qualitative Assessment	218	218	218[a]
Mixed Riparian Woodland	184	Qualitative Assessment	184	368	184
Mixed Riparian Scrub	189	Qualitative Assessment	189	378	189
Totals	**591**	Qualitative Assessment	**591**	**964**	**591**

[a] Effects to Mine Tailing Riparian Woodland will be mitigated by preserving any combination of Mixed Riparian Woodland and Mixed Riparian Scrub (Final SSHCP page 7-205).

To mitigate the adverse direct and indirect effects to valley elderberry longhorn beetle individuals and suitable-habitat, the SSHCP will preserve and link 964 acres of Mixed Riparian Woodland and Mixed Riparian Shrub landcovers that provide high-quality habitat for valley elderberry longhorn beetle in the Action Area (direct effects to the Mine Tailing Riparian Woodland landcover will be mitigated by preserving any combination of Mixed Riparian Woodland and Mixed Riparian Scrub landcovers) (Table 35 above).

The characteristics and locations of riparian habitat preserved for valley elderberry longhorn beetle will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5 and consistent with the SSHCP biological goals and objectives for valley elderberry longhorn beetle (Final SSHCP Table 7-1 and 7-54). The SSHCP Conservation Strategy for valley elderberry longhorn beetle is focused outside the UDAs in PPU-5 and PPU-6, including the riparian areas along the Cosumnes River and Deer Creek. SSHCP Preserves established to benefit valley elderberry longhorn beetle will be prioritized to (1) protect occupied valley elderberry longhorn beetle habitat; (2) capture long stretches of Mixed Riparian Woodland or Mixed Riparian Scrub landcovers; (3) select parcels adjacent to existing preserves to increase the functional size of the SSHCP Preserve, and to minimize habitat fragmentation and edge effects; and (4) preserve habitat connections to existing riparian preserves that are currently isolated from each other (Final SSHCP Page 7-207). By preserving existing occurrences of valley elderberry longhorn beetle within long, interconnected riparian areas that are protected from edge effects, the beetle will be less affected by future stochastic events and more likely to exchange genetic material between occupied patches of elderberry shrubs.

The SSHCP Monitoring and Management Program will maintain or improve the quality of the 964 acres of valley elderberry longhorn beetle modeled habitat that is within the SSHCP Preserves through the preparation of individual Preserve Management Plans (PMPs) that maintaining and enhancing valley elderberry longhorn beetle habitats in the riparian landcovers in a Preserve (Objectives HAB1, HAB2), through the monitoring the groundwater table as it relates to the status and trends in the preserved riparian habitat (Objective RIP5), and by ensuring that adverse edge effects, such as invasive weeds, trash, and litter, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). The individual Preserve Management Plans also will increase the number of elderberry shrubs in the SSHCP Preserve System, which will encourage the dispersal of valley elderberry longhorn beetle into riparian areas not currently used by valley elderberry longhorn beetle. The preservation of high quality habitat within interconnected Preserves, coupled with careful habitat management and monitoring, are expected to increase the occurrences and distribution of valley elderberry longhorn beetle within the Action Area.

To maximize beneficial effects to valley elderberry longhorn beetle, the SSHCP also will establish or re-establish 591 acres of valley elderberry longhorn beetle modeled habitat within the SSHCP Preserve System, with a priority on re-establishment before establishment. Re-established and established SSHCP landcovers that provide habitat for the valley longhorn elderberry beetle include Mixed Riparian Woodland and Mixed Riparian Scrub landcovers, and Valley Grassland with elderberry shrubs planted along a riparian corridor. Under SSHCP Objective VELB2, and Conservation Action VELB2.1, the SSHCP will strategically include elderberry shrub in the planting palette of the riparian landcovers that are re-established or established by the SSHCP under Objectives RIP2 and RIP4. The analysis in the Opinion assumes that the elderberry shrubs planted by the SSHCP will follow the *Site Selection and Development* guidance, the *Planting Plan* guidance, the *Success Standards*, and the *Monitoring Protocols* described in the *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* (USFWS 2017d), or the current guidance recommended by the Service at the time that the Covered Activity is implemented. With implementation of Objective VELB1 and Objective VELB2, the SSHCP ensures that there will be no net loss of elderberry shrubs from the implementation of the SSHCP, and no net loss of the total acreage of valley elderberry longhorn beetle habitat in the Action Area (Final SSHCP page 7-208).

The SSHCP Conservation Strategy for the valley elderberry longhorn beetle will support several recovery objectives narratives presented in the Valley Elderberry Longhorn Beetle Recovery Plan (USFWS 1984):

1. Surveys for presence of valley elderberry longhorn beetle will be conducted in all SSHCP Covered Activity project sites within the species modeled habitat, surveys for presence in each SSHCP Preserve System, and surveys for presence along the planned SSHCP Cosumnes River/Deer Creek Wildlife Movement Corridor, located along the length of the Consumes River in the Action Area. The survey information will be incorporated into the SSHCP Monitoring and Management Program to provide long-term management and enhancement of the valley elderberry longhorn beetle habitat in the SSHCP Preserve System;

2. The monitoring and adaptive management of the valley elderberry longhorn beetle habitat in the SSHCP Preserve System will provide information on the ecological requirements and management needs of valley elderberry longhorn beetle. As discussed on page 7-210 of the Final SSHCP, this recovery action could be conducted throughout the SSHCP Preserve System, as part of the SSHCP Monitoring and Management Program, which will be developed in the early years of SSHCP implementation.

3. The SSHCP AMMs for valley elderberry longhorn beetle (described in the Erratum to the Final SSHCP) will preserve and protect newly discovered valley elderberry longhorn beetle individuals, and the SSHCP Conservation Strategy for valley elderberry longhorn beetle will permanently preserve and protect suitable habitat for the species. This recovery objective discusses minimizing further degradation, development, or modification of habitat; protecting newly discovered populations; minimizing use of insecticides, herbicides, and other toxic substances; and minimizing other activities that are incompatible with habitat maintenance. These actions are all Conservation Actions of the SSHCP.

4. The SSHCP will re-establish 591 acres of valley elderberry longhorn beetle habitat within the species' historical range. This recovery objective includes protecting re-establishment sites and developing and implementing a management program for each site. These actions are all Conservation Actions of the SSHCP.

5. Public outreach provided by the SSHCP and the South Sacramento Conservation Agency over the Permit Term will increase public awareness of all SSHCP Covered Species (including the valley elderberry longhorn beetle) through public education and information programs. This recovery action discusses signage at county parks; various audio-visual programs, publications, brochures, and press releases; and distribution of information to local parks, schools, newspapers, radio, and television. As discussed on page 7-210 of the Final SSHCP, the SSHCP Preserve System Monitoring and Management Program will include this action.

2.8.4 Cumulative Effects

As described in Section 1.0 of this Opinion, the SSHCP was developed in part to respond to biological opinions issued by the Service in 1999 and 2004, and to address the indirect and cumulative effects of those large-scale water infrastructure projects in south Sacramento County.

Cumulative effects in a section 7 analysis include the effects of future state, tribal, county, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Several reasonably certain projects in the Action Area, such as the California High-Speed Train System and the California Waterfix, will require will require future federal actions and separate consultations under the ESA, and are not considered in this Opinion's cumulative effects analysis.

Reasonably certain activities in the Action Area, unrelated to the SSHCP and with no federal nexus, include the continued expansion of low-density rural development (see Section 2.3.4 above) within the approximately 19,600 acres of PPU-7 and PPU-6 that are designated as Agriculture Residential areas in the Sacramento County General Plan (County of Sacramento 2011). Construction of new residential structures or barns may occur, along with associated grading, landscaping, and accessory structures such as corrals and fences. In many cases, these activities will occur on large lots with streams or creeks that support riparian habitat, or other areas that support individual elderberry shrubs that may be occupied by the valley elderberry longhorn beetle.

Land use changes and construction of structures within the Agricultural Residential areas may not obtain authorizations under ESA, CESA, and the CWA, particularly at project sites that are not subject to CEQA. Projects that are not subject to CEQA would not prepare a CEQA document to identify potential environmental impacts, and the project proponent may not have the expertise to identify elderberry shrubs, or understand the regulations, and the project impacts to species or habitat is beyond the purview of the County regulators reviewing building plans. Effects to valley elderberry longhorn beetle individuals and suitable habitat from projects and activities within the Agricultural Residential areas would result in the types of effects similar to those discussed in Sections 2.5.4, and 2.8.3 of this Opinion.

Additional conversion of natural landcovers to vineyards, cropland, orchards, irrigated pasture, and other farmland uses is also expected to occur in the future outside the UDAs, in the portions of the Action Area zoned for agricultural uses by the County's General Plan (County of Sacramento 2011).

It is not possible, however, to predict how crop types or agricultural uses may change over the 50-year Permit Term. Nonetheless, some conversion of riparian landcovers to an intensively managed agricultural use can be expected over the 50-year study period. Changes to more intensively managed agricultural uses would result in the types of effects to valley elderberry longhorn beetle individuals and suitable habitat that are similar to the effects discussed above in Sections 2.5.4 and 2.8.3.

Other non-Federal actions that may occur in the Action Area are considered too speculative to evaluate at this point in time.

2.8.5 Conclusion

After reviewing the current status of the valley elderberry longhorn beetle; the environmental baselines for the Action Area; the effects of the proposed actions, including all measures to avoid, minimize, and mitigate adverse effects; and the cumulative effects; it is the Service's biological opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to jeopardize the continued existence of the valley elderberry longhorn beetle. The Service reached this conclusion because the project-related effects to the valley elderberry longhorn beetle, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the valley elderberry longhorn beetle. We reached this conclusion based on the following reasons:

- The SSHCP Covered Activities would affect a very small amount portion of the existing valley elderberry longhorn beetle habitat present in the Action Area.
- The SSHCP Conservation Strategy will protect and manage a relatively large amount of valley elderberry longhorn beetle habitat present in the Action. The amount of suitable habitat preserved and managed in perpetuity by the SSHCP and the preservation of known occurrences in the Action Area will help ensure valley elderberry longhorn persists.
- The SSHCP Covered Activities will implement best management practices and implement other avoidance and minimization measures that will minimize effects to valley elderberry longhorn beetle.

No critical habitat exists for valley elderberry longhorn beetle in the Action Area, therefore, none will be affected.

2.9 American Badger

2.9.1 Status of the Species

The American badger is not currently listed under the ESA, nor does it have designated critical habitat.

A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

American Badger is a medium size, semi-fossorial mammal that occurs in a variety of open habitats, including grasslands, shrublands, savannahs, and meadows (Long 1973; Zeiner et al. 1990). The

American badger is distributed in North America from the south-central Canadian provinces throughout the western and central United States, and south to central Mexico (Williams 1986). Its range in California includes open habitat throughout the state, including the Central Valley (Williams 1986). The CNDDB currently has records for 558 presumed-extant occurrences of American badger in California. Although there is very little empirical information about American badger population status and trends in California, badger populations have clearly declined or were extirpated in several areas of California (Williams 1986). Badger populations in some parts of California may be stable; however, in the middle Central Valley, the population size and number of locations occupied by American badger have declined. The overall population decline and local extirpations in the middle Central Valley are probably greater than in any other portion of California (Larsen 1987).

In California, the primary threat to American Badger is habitat loss and degradation as a result of urbanization, development, and agricultural conversion (Williams 1986; Neal and Cheeseman 1996). The conversion of pasture and grasslands to farmland has led to a decline in the number of individuals as suitable foraging and denning habitat is reduced. Farming operations, reduction of prey base as a result of rodent control activities, and mortality from vehicles are other likely contributors to the downward trend of this species (Williams 1986; Apps et al. 2002; Newhouse and Kinley 2000; Scobie 2002). Furthermore, badgers have a history of persecution, and are often perceived by humans as a pest species, for which they are shot or poisoned (Rahmea et al. 1995); and shooting and trapping may have been important factors in population declines historically (Williams 1986).Vehicular accidents are currently a major cause of American badger mortality (USFS 2008). The peak in the number of American badger road casualties in California occurs February through March (CROS 2010).

American badgers are active year-round, and non-migratory (Long 1973; Zeiner et al. 1990). Badgers dig their own burrows in friable soils, and typically reuse their old burrows, although some males may dig a new den each night, especially in summer. American badgers typically create dens by enlarging ground squirrel or other animal burrows (Messick and Hornocker 1981). Badgers range more frequently in the summer and autumn. Summer burrowing patterns reflect 1 to 3 burrows created each day, used for a day to a week, and then abandoned, with possible returns later, and other wildlife utilizing the abandoned burrows in the interim. An abandoned badger burrow may be occupied by mammals of similar size, such as foxes, as well as animals as diverse as skunks, burrowing owls, California tiger salamanders, and California red-legged frogs (Long 1983). Where prey is particularly plentiful, American badgers will reuse dens, sometimes for a few days at a time. In winter, a single den may be used for most of the season (Long 1972). Natal dens are dug by the female and are used for extended periods, but litters may be moved, probably to allow the mother to forage in new areas close to the nursery. Natal dens are usually larger and more complex than diurnal dens (Lindzey 1982).

Badgers are solitary and exhibit a simple social structure (Lindzey 1982; Messick 1987; Minta 1993). Badgers mate in late summer and early fall. Natal burrows are dug typically in dry, sandy soil in areas with sparse overstory cover (Zeiner et al. 1990). Young are born in March to early April in burrows, and are raised by the female (Long 1973; Minta 1993). An average litter is size is one to five young, averaging about three. Young first appear at the den opening at five to six weeks old, and families usually break up and the juvenile young disperse approximately three to four months following birth, from the end of June to August (Minta 1993). Juvenile dispersal movements are erratic. Dispersing young females may move greater than 32 miles, whereas males may move greater than 63 miles (Messick and Hornocker 1981). American badgers are somewhat tolerant of human activity (Zeiner et al. 1990).

Suitable habitat for the American badger includes food availability, presence of friable soils, and uncultivated ground (Williams 1986). Badgers are mostly carnivorous and prey primarily on smaller fossorial mammals by excavating them from their burrows. American badgers typically feed on ground squirrels and pocket gophers (Whitaker 1989), but they also prey on snakes, rats, mice, chipmunks, worms, insects, eggs, birds, and carrion. Badgers shift their diet seasonally and annually in response to prey availability (Zeiner et al. 1990).

Female home range size has been estimated at 340 to 751 acres, and male home range sizes have been estimated at 600 to 1,549 acres (Lindzey 1978; Messick and Hornocker 1981). Minimum patch size is 25 acres (Laudenslayer and Parisi 2007). American badgers are generally nocturnal; however, in areas with little human encroachment they are routinely observed foraging during the day. Seasonally, a badger observed during daylight hours in the spring months of March to early May often represents a female foraging during daylight and spending nights with her young (Long 1973; Lindzey 1982).

2.9.2 Environmental Baseline

The Action Area is positioned within the center of American badger's range in California. The CNDDB has records for four occurrences of American badgers in Sacramento County, all located in or near the Action Area. In 2015 an American badger was killed on a roadway in the city of Folsom, outside the Action Area but directly north of PPU-1. The CNDDB also has a record for an occurrence outside the Action Area near northeastern boundary of PPU-4 (along Power Inn Road south of Jackson Highway), which is presumed extant (CNDDB 2018).

The SSHCP's compilation of records and species-surveys conducted within the Action Area was able to document a total of 9 records of American badger individuals in the Action Area, including eight documented individuals in the UDA. Inside the UDA, 7 occurrences are from a site in PPU-2 directly south of the former Mather Air Force Base (Mike Henry pers. comm. 2018), and there is one extirpated occurrence now within the site of the Anatolia development project (CNDDB 2018). There is a historical occurrence near the city of Hood in western PPU-6, which is from a 1938 museum record (CNDDB 2018). In addition, an American badger has been observed at the Valensin Ranch area of the Cosumnes River Preserve near the center of PPU-6 (Final SSHCP Appendix B). SSHCP Figure 3-29 illustrates the location of the documented occurrences of American badger within the Action Area. However, most of the Action Area has not been surveyed for American badger, and the number of individuals and the distribution of American badgers in the Action Area are not known.

Because the American badger requires large areas of relatively undisturbed grasslands, the SSHCP believes that important habitat for American badger occurs in the rural eastern half of the Action Area (Final SSHCP page 3-122). The SSHCP also assumes that the distribution of American badger in the Action Area is closely associated with the distribution of California ground squirrel colonies in the Action Area (Final SSHCP Appendix B).

Due to the limited survey data for this species and the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.6. SSHCP landcovers that provide suitable habitat based on the American badger life history description includes the Blue Oak Savanna and Valley Grassland landcovers, and seasonally dry Vernal Pools, Swales, and Seasonal Wetlands within the Valley Grassland landcover (Final SSHCP Table 3-2). The existing conditions of these landcovers in the

Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here.

The SSHCP modeled foraging and denning habitat for the American badger is all of the Blue Oak Savanna, Valley Grassland, Vernal Pool, Swale, and Seasonal Wetland landcovers present within in the Action Area. SSHCP Figure 3-29 illustrates the locations of American badger modeled habitat within the Action Area. The SSHCP identified a total 149,137 acres of American badger modeled habitat available in the Action Area. The majority of the available American badger modeled habitat (117,215 acres) (79%) is located outside the UDA portions of the Action Area (Final SSHCP Table 6-101). SSHCP Figure 3-28 illustrates the location of modeled habitat for American badger within the Action Area.

As stated in the Final SSHCP (pages 5-3, 6-32, 6-55), several properties within the UDA portion of the Action Area have already obtained local entitlements and have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations from the CDFW, the Service, and the USACE. These UDA properties total 21,413 acres, and include several small lots in PPU-8, several small lots located west of Excelsior Road (PPU-3 and PPU-4), properties in the Rio Del Oro Specific Plan area (PPU-1), properties in the Sunridge Specific Plan area (PPU-1), and properties within the Mather Field Specific Plan area (PPU-2). These properties are part of the 317,656-acre Action Area. However, because planned urban development on these properties have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations, these properties were not included in the SSHCP Chapter 6 effects analyses. Where planned urban development has already obtained (or is close to obtaining) ESA authorizations, this Opinion addresses the authorized loss of habitat and loss of species individuals as part of the Environmental Baseline of the American Badger.

2.9.3 Effects of the Action on American Badger

The species-level effects described below build on Section 2.5.4, *General Effects of the Action on All Covered Species*. Effects previously described in that section of the Opinion are not repeated below. Because the home-range of individual American badgers is estimated to be between 340 to 1,549 acres, the SSHCP assumes that all acres of the landcovers included in modeled habitat for American badger could be occupied by American badgers. The effects analysis in this Opinion also assumes that all areas included in the modeled habitat for American badger could be occupied. Effects of SSHCP Covered Activities on the American badger include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on individual American badgers.

SSHCP Covered Activities will remove up to 22,780 acres (15%) of the of the total 149,137acres of American badger modeled habitat available in the Action Area (Table 36 below). Approximately 97% of the American badger habitat removed by Covered Activities (22,014 acres) will be Valley Grassland (Final SSHCP Table 6-101).

Most of the American badger modeled habitat removed by SSHCP Covered Activities will be in the UDA portions of the Action Area, where urban development Covered Activities and surface mining Covered Activities will remove 22,036 acres (69%) of the available 31,922 acres of American badger modeled habitat present in the UDAs. Outside the UDAs, only 744 acres (0.6%) of the 117,215 acres of the species modeled habitat outside the UDAs will be removed by the rural transportation Covered Activities and the recycled-water pipeline Covered Activities.

Activities related to the implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, construction, and paving, will remove American badger modeled habitat. If implemented in areas with occupied dens, these activities may collapse active dens and crush or suffocate juvenile or adult badgers. The noise, human activity, equipment use, lighting, and ground vibration that occur during implementation of urban development Covered Activities in the vicinity of foraging individuals or active dens may directly affect American badgers by increasing stress levels, and by disrupting normal nocturnal and diurnal foraging and denning behaviors. Ground vibration, noise, and human activities may cause nearby natal den sites to be abandoned, which would force mothers to find and excavate a new natal den, and then relocate her young. If disruptions in foraging and denning behaviors occur, the disruptions would decrease the mother's nurturing and feeding of the litter, slowing the rate of growth, and the reducing survivorship of young in that litter. The young in the litter would also be more vulnerable to larger predators during the relocation of a natal den (Lindzey 1982). These effects could injure or kill young in that litter, reducing the lifetime reproductive output of the parents, and eventually reduce the size of the American badger population that uses the Action Area. Direct effects to American badger individuals will be minimized by the BMP AMMs, as discussed above in Section 2.5.4 and in SSHCP Table 6-103. Under SSHCP BMP-7, if a Covered Activity includes ground disturbance within American badger modeled habitat, an approved biologist will be on site during the period of ground disturbance, and may need to be on site during other construction activities. After ground disturbing project activities are complete, the approved biologist will train an individual to act as the on-site construction monitor for the remainder of construction, with the concurrence of the Service and CDFW. The approved biologist and the on-site monitor will oversee project implementation of the required SSHCP AMMs, and the on-site monitor will have the authority to stop activities if any of the requirements associated with those measures are not met. Under SSHCP BMP-7, the approved biologist and/or on-site monitor will record all observations of SSHCP Covered Species at the project site, and submit records or those observation to the CNDDB, including any observations of American badger or observations of an active American badger den. Under BMP-8, a mandatory Worker Environmental Awareness Program will be conducted by the approved biologist for all construction workers, including contractors, prior to the commencement of construction activities. The training will include how to identify the SSHCP Covered Species that might be enter the construction site, including identification of American badgers and American badger dens within the project footprint. In addition, the SSHCP also will require each Covered Activity project to establish a construction non-disturbance setback of at least 200 feet around all American badger natal dens until the young have dispersed from the den site (Final SSHCP page 6-388, Table 6-103). The SSHCP also will require each Covered Activity project to establish a construction non-disturbance setback of at least 50 feet around other active American badger dens, including winter dens (Final SSHCP page 6-388, Table 6-103).

Covered Activity removal of 22,780 acres (15%) of the available modeled habitat will further fragment American badger modeled habitat present in the Action Area. As discussed above, most of the species habitat loss and fragmentation will occur inside the UDAs, where 69% of the available American badger modeled habitat will be removed, and the patch-size of the remaining habitat will be smaller in size (see Section 2.5.4 above). The BMP AMMs will avoid or minimize Covered Activity effects to active dens in Covered Activity project footprint, or within 50 feet of the project footprint. However, there are no SSHCP AMMs that will avoid or minimize loss of foraging areas supporting active natal dens, winter dens, or day dens. The removal of suitable foraging habitat within the home range of a denning female may reduce hunting success, force the denning female to alter foraging behaviors, forage over greater distances, forage in unfamiliar areas, or require the denning female to relocate the natal den and young. All of these would cause the mother to expend more energy, and require the mother to spend more time away from the den when young are nursing and when young are more vulnerable to predators. The greater expenditures of energy by the mother, reduced foraging success by the mother, reduced nurturing, and increased predation risks would likely reduce the number of young in the UDA litters that survive to maturity and reproduce.

In addition to direct effects, the implementation of SSHCP Covered Activities will indirectly affect American badgers. Habitat fragmentation in the UDA may increases exposure to various risks, including encounters with humans and dogs, exposure to urban and road chemicals, and vehicle collisions. The SSHCP qualitatively assessed and analyzed the permanent indirect effects of SSHCP Covered Activities on American badger modeled habitat and individuals (Final SSHCP Table 6-101, Table 6-102). The edge areas of preserved or avoided American badger modeled habitat will be exposed to different environmental stressors produced by the Covered Activities, especially within the UDA portions of the Action Area. The close proximity of urban development in the UDAs and improved rural roadway Covered Activities to preserved or avoided American badger modeled habitat increases the likelihood that habitat will be exposed to urban runoff and roadway runoff that contains pollutants and toxins. American badgers individuals exposed to these pollutants may be sicken or killed, and American badgers that consume prey contaminated with urban and roadside pollutants may be sickened or killed. However, the SSHCP's general AMMs (e.g. the LID, EDGE, BMP, and ROAD AMMs) will prevent roadside and urban runoff from entering SSHCP Preserves in the UDA, minimizing exposure of prey species to urban and roadside pollutants.

As discussed above in Sections 2.1.4 and 2. 5.4, pesticide use is not a Covered Activity under the proposed Permit, but pesticide use in the Action Area is expected to increase from implementation of the urban development Covered Activities. Pesticides (including rodenticides) may indirectly enter American badger modeled habitat through rodent control programs (e.g., ground squirrels), from irrigated landscape runoff and stormwater runoff, from roadside weed control activities, especially if applied under windy conditions or other incorrect application methods that result drift or overspray into SSHCP Preserves and other open-spaces. Because American badgers prey on ground squirrels, gophers, and other small fossorial animals, rodent controls measures can expose badgers to toxic chemicals. Quinn et al. (2012) found American badger tissue often contained anticoagulant rodenticides Brodifacoum and Bromadiolone, commonly used to control rodent pests. Rodent control measures also reduce prey abundance, adversely affecting food availability for American badgers. SSHCP AMMS, including ROAD-3, WBO-7, and CTS-7 will avoid or minimize American badger exposure to pesticides. Under AMMs, WBO-7 and CTS-7, rodent control will be allowed only in developed portions of a Covered Activity project site that is implemented within the Valley Grassland, Vernal Pool Ecosystem, and Blue Oak Savana landcovers. Where rodent control is allowed, the methods of pesticide use will comply with the methods discussed in the 4(d) Rule published in the U.S. Fish and Wildlife Service's (2004c) final listing rule for the California tiger salamander.

The American badger is primarily nocturnal, so permanent lighting could have an adverse effects on this species, reducing habitat suitability near urban development. AMM EDGE-8 requires all outdoor lighting in urban development Covered Activity projects be designed to minimize light pollution into existing and planned Preserves, including directing lights away from UDA preserves, and use of light shields.

Habitat loss and fragmentation in the UDA will be the primary indirect effect of the SSHCP on American badgers. The American badger is a mobile species that uses a large home range, and is known to disperse long distances. Fragmentation of suitable grassland and savanna landcovers can inhibit American badger long-distance movements and inhibit their normal mating and social behaviors. Because American badgers are solitary and naturally occur in low population densities, habitat fragmentation and isolation can result in local extirpations (Larsen 1987). The SSHCP Conservation Strategy will minimize the effects of habitat fragmentation in the UDA by preserving a wildlife corridor along Laguna Creek. However, the size and shape of the SSHCP Preserves in the UDA will be constrained by existing land-use and zoning designations. The SSHCP will maximize the functional size of American badger modeled habitat preserved inside the UDA by establishing three large "Core" sized Preserves in the UDA, by placing SSHCP preserves adjacent to existing UDA preserves, and by preserving habitat linkages between all preserves inside the UDA. In addition, the SSHCP's LID and EDGE AMMs will increase the functional size of the UDA Preserves by locating compatible land uses adjacent to preserves, by locating single-loaded streets adjacent to preserves, and by requiring minimum 50-foot wide Preserve Setbacks between new urban development Covered Activities and the UDA preserves. Because American badgers are known to use patches of suitable habitat 25 acres or larger in size (Laudenslayer and Parisi 2007), we expect some of the SSHCP Preserve system inside the UDA to provide suitable habitat for American badgers. The habitat connectivity provided by the UDA's Minor, Linkage, and Satellite Preserves, and the size of the UDA Core Preserves should allow movement behaviors of American badgers to continue inside the UDA portion of the Action Area.

In addition, the effects of habitat loss and fragmentation in the UDA will be minimized the by SSHCP ROAD AMMs. AMM ROAD-2 requires all UDA road projects that are part of an urban development Covered Activity (including the Capital Southeast Connector project) to install an adequate number of under-road Wildlife Crossing Structures including, but not limited to, the locations depicted in SSHCP Figure 5-10. Each Wildlife Crossing Structures will be sized to accommodate movement and dispersal of the coyote, a highly mobile native indicator-species for this Action Area. By designing and sizing the UDA Wildlife Crossing Structures to meet the movement and dispersal requirements of coyote, the SSHCP anticipates that the Wildlife Crossing Structures also will be used by American badgers and the other native wildlife species that currently occupy the UDA and occupy the portion of the Action Area outside the UDA. Where an existing stream, creek, or intermittent drainage occurs at the site of a Wildlife Crossing Structure, specialized features will be included in that crossing structure, such as elevated platforms, to allow continued wildlife passage throughout the winter rainy season. SSHCP Wildlife Crossing Structures will be comprised of structures with open-bottoms, such as bridges, arches, large box culverts, or large pipe culverts. Vegetation leading up to the entrance of a crossing structure and the substrate leading into and within the crossing structure will be natural and appropriate to provide continuity of the adjacent habitat, designed to attract American badgers and other target native wildlife species to the crossing structure, and designed to facilitate crossing structure use by American badger and other native wildlife. SSHCP Wildlife Crossing Structures under six-lane roads or larger also will be designed to provide ambient light and ambient temperature in the longer crossing structures (e.g., either by providing a larger opening or a grate at the top of the structure to improve the attractiveness of the crossing to native wildlife that may hesitate to cross through dark, confined structures, or hesitate to cross through a structure with a temperature gradient (Jackson and Griffin 2000). Lighting will not be placed at or near the entrance of the SSHCP Wildlife Crossing Structures to maintain natural ambient light conditions at night, and to increase use by nocturnal animals such as the American badger. However, the SSHCP may allow lighting where it is necessary for human health or safety. An adequate number and the strategic placement of Wildlife Crossing Structures within the UDA are expected to allow continued movement and dispersal of American badgers into and out of the UDA.

Vehicle strikes are currently a major cause of American badger mortality (USFS 2008, CROS 2010), and many of the occurrences for American badger in California are of individuals found dead along roadways (CNDDB 2018). Habitat fragmentation associated with Covered Activities will increase the risk of vehicle collisions in the Action Area as American badgers attempt to cross the new urban roadways constructed inside the UDA, and attempt to cross existing rural roadways that have been improved to provide higher traffic densities and greater traffic speeds. It is difficult to predict precise locations where vehicle collisions are most likely to occur in the Action Area because American badgers are solitary, uncommon in the Action Area, and their spatial movement patterns in the Action Area are unknown. However, the wildlife crossing structures required by AMM ROAD-2 and the other SSHCP AMMs that reduce habitat fragmentation are expected to avoid or minimize the increased risk of vehicle collisions that would result from urban roadway and rural transportation Covered Activity projects in the Action Area.

American badgers are especially susceptible to harassment by dogs, and free-ranging domestic pets have been known to transmit diseases to wild animals. Quinn et al. (2012) found that American badgers near urban areas had been exposed to several bacterial infectious agents associated with pets and wildlife, and had been exposed to canine distemper virus. Domestic dogs can transmit canine distemper to directly American badgers, or can transmit canine distemper to coyotes and other native wildlife that may interact with American badgers (Deem et al. 2000). The SSHCP AMMs will minimize American badger exposure to domestic pets and human activities, including the LID and EDGE AMMs that will provide setbacks between preserved habitat and urban development Covered Activities in the UDAs. The NATURE TRAIL AMMs will restrict public access in SSHCP preserves, and will locate preserve nature trails away from American badger foraging and denning areas inside the UDAs.

Table 36. American Badger Habitat Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Blue Oak Savanna	38	Qualitative Assessment	38	38	38
Valley Grassland	22,014	Qualitative Assessment	22,014	22,014	270[a]
Vernal Pool	389	0	389	966	389
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Swale	234	0	234	278	234
Totals	**22,780**	Qualitative Assessment	**22,780**	**23,401**	**1,036**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

To fully offset the adverse direct and indirect effects to American badger individuals and American badger suitable-habitat, the SSHCP will preserve least 23,401 acres of suitable foraging and nesting habitat for American badger in the Action Area (Table 36). The majority of habitat preservation for American badger will occur outside the UDA, in PPU-7. Especially, the large SSHCP Landscape Preserve planned in PPU-7 will preserve 10,500 acres of Valley Grassland and Oak Savanna adjacent to the existing 12,500-acre Howard (Chance) Ranch Preserve, which will preserve and maintain a large continuous area of American badger modeled habitat within PPU-7.

Because the range of the American badger in the Action Area is not well understood, and the Action Area observations are generally older, the SSHCP Conservation Strategy for American badger does not target the areas where occurrences have been recorded. Rather, the SSHCP Conservation Strategy will establish large, interconnected Preserves that can best support this wide-ranging and highly mobile species. SSHCP Preserves benefiting American badger will be established to (1) capture large continuous areas of American badger modeled habitat that are relatively undisturbed by human activity, (2) have friable soils (3) support populations of prey species, especially ground squirrels and pocket gophers, (4) include a diversity of landcovers that provide American badger modeled habitat, (3) add parcels onto existing preserves that increase preserve size and minimize habitat fragmentation and edge effects, and (4) provide connections to existing preserves that are currently isolated from each other (Final SSHCP Conservation Action AB1.1, page 7-298).

To the maximum extent possible, SSHCP Preserves will be adjacent to and contiguous with existing preserves, enhancing the functional value of the SSHCP Preserves for American badger, and to minimize the effects of habitat fragmentation and edge effects. The SSHCP Monitoring and Management Program and the individual Preserve Management Plans (PMPs) will include prescriptive habitat management techniques for maintaining and improving American badger foraging and denning habitats within the individual SSHCP Preserve (SSHCP Objectives HAB1, HAB2, HAB3, and HAB7). The individual Preserve Management Plans also will assure that that potential adverse edge effects, such as invasive weeds, trash, litter, lighting, noise, and human activity, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). The SSHCP Preserve Management and Monitoring Program will monitor SSHCP Preserves for use by American badgers, and include monitoring observations in each Annual Report. The SSHCP also will conduct occupancy surveys for American badgers in the SSHCP Preserve System every 5 years. American badger survey methodology may include the use of wildlife cameras (Final SSHCP Table 8-4, page 8-143). The preservation of high quality habitat within large Preserves, coupled with careful management and monitoring, is expected to maintain or increase the number of American badgers within the Action Area.

The characteristics and locations of modeled habitat preserved for American badger in the Action Area will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5, consistent with the SSHCP biological goals and objectives for American badger (Final SSHCP Table 7-1 and 7-89), including SSHCP Objectives AB1 and AB2.

In addition to the preservation of 23,401acres of modeled habitat for American badger, the SSHCP Conservation Strategy also will establish or re-establish 1,036 acres of SSHCP landcovers that provide American badger modeled habitat, with a priority on re-establishment before establishment. Sites selected for the establishment or re-establishment of American badger foraging habitat and denning habitat will be prioritized following the requirements of SSHCP Conservation Action AB2.1. Re-establishment and/or establishment sites will prioritize sites that are larger than 25 acres, contain friable soils that could support high densities of prey species, and where habitat management can be used to enhance or re-establish natural ecosystem processes.

2.9.4 Cumulative Effects

As described in Section 1.0 of this Opinion, the SSHCP was developed in part to respond to biological opinions issued by the Service in 1999 and 2004, and to address the indirect and cumulative effects of those large-scale water infrastructure projects in south Sacramento County.

Cumulative effects in a section 7 analysis are the effects of future state, tribal, county, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Several reasonably certain projects in the Action Area, such as the California High-Speed Train System and the California Waterfix, will require will require future federal actions and separate consultations under the ESA, and are not considered in this Opinion's cumulative effects analysis.

Reasonably certain activities in the Action Area, unrelated to the SSHCP and with no federal nexus, include the continued expansion of low-density rural development (see Section 2.3.4 above) within the approximately 19,600 acres of PPU-7 and PPU-6 that are designated as Agriculture Residential areas in the Sacramento County General Plan (County of Sacramento 2011). Construction of new residential structures or barns may occur, along with associated grading, landscaping, and accessory structures such as corrals and fences. In many cases, these activities will occur on large lots with grasslands or savannah habitat, or other areas that support suitable foraging or denning habitats for the American badger. Land use changes and the construction of structures within the Agricultural Residential areas may not obtain authorizations under ESA, CESA, and the CWA, particularly at project sites that are not subject to CEQA. Projects that are not subject to CEQA would not prepare a CEQA document to identify potential environmental impacts, and the project proponent may not have the expertise to identify American badger habitats, or understand the regulations, and evaluating project impacts to species or habitat is beyond the purview of the County regulators reviewing building plans. Effects to American badger individuals and suitable habitat from projects and activities within the Agricultural Residential areas would result in the types of effects similar to those discussed in Sections 2.5.4, and 2.9.3 of this Opinion.

Additional conversion of grassland and savanna landcovers to vineyards, cropland, orchards, irrigated pasture, and other farmland uses is also expected to occur in the future outside the UDAs, in the portions of the Action Area zoned for agricultural uses by the County's General Plan (County of Sacramento 2011). It is not possible, however, to predict how crop types or agricultural uses may change over the 50-year Permit Term. Nonetheless, some conversion of grassland landcovers to an intensively managed agricultural use is expected over the 50-year study period. Changes to more intensively managed agricultural uses would result in the types of effects to American badger individuals and suitable habitat that are similar to the effects discussed in Section 2.5.4, 2.9.3. Other non-Federal actions that may occur in the Action Area are considered too speculative to evaluate at this point in time.

2.9.5 Conclusion

After reviewing the current status of the American badger; the environmental baselines for the Action Area; the effects of the proposed actions, including all measures to avoid, minimize, and mitigate adverse effects; and the cumulative effects; it is the Service's conference opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to jeopardize the continued existence of the American badger. The Service reached this conclusion because the project-related effects to the American badger, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the American badger. We reached this conclusion based on the following reasons:

- The American badger is a highly mobile species that occupies a large geographic range outside of the Action Area, and the SSHCP Covered Activities would affect a relatively small portion of the species habitat rangewide.
- The SSHCP Conservation Strategy will protect and manage a relatively large amount of American badger modeled habitat that is within the Action Area. The amount of suitable habitat preserved and managed in perpetuity by the SSHCP and the preservation of known occurrences in the Action Area will help ensure the American badger persists.
- The SSHCP Covered Activities will implement best management practices and implement other avoidance and minimization measures that will minimize effects to the American badger.
- We do not anticipate the Covered Activity removal of modeled habitat would result in the direct injury or death of American badger individuals, because the SSHCP AMMs will preclude impacts to individuals present in project sites.

No critical habitat has been designated for the American badger, therefore, none will be affected.

2.10 Western Red Bat

2.10.1 Status of the Species

The western red bat is not currently listed under the ESA, nor does it have designated critical habitat. A detailed summary of its current legal status, life history, reproductive needs, ecology, current distribution, population trends, existing threats, information gaps, and uncertainties are presented in SSHCP Appendix B.

The western red bat ranges from southern British Columbia south to Baja California and Mexico, and east to Wyoming (Hall 1981). This species regularly occurs in California, Arizona, and New Mexico, and western and central Mexico (Baker et al. 1988; Cryan 2003; Hall 1981). In California, breeding females are highly associated with lower elevation riparian habitats west of the Sierra Nevada crest, particularly relatively intact stands of cottonwood and sycamore in the Central Valley (Pierson et al. 2002). There are records for western red bat in the Central Valley counties of Tehama, Sutter, Butte, Yolo, Yuba, Sacramento, Solano, San Joaquin, Merced, Madera, Fresno, Tulare, Kings, and Kern. Although there is evidence of a substantial north-south seasonal migration for eastern red bats, there is no comparable evidence for the western red bat. In California, museum records and survey data strongly suggest that western red bats undergo seasonal shifts in distribution between summer and winter ranges, but there is no indication of mass migration (Zigler et al. 1990, Pierson et al. 2004). Seasonal dispersal from California is apparently limited, and western red bats may be year-round residents in the Bay Area (Orr 1950, Constantine 1998, Cryan 2003). The majority of sites for which there are winter records in California are in areas that rarely experience freezing winter temperatures (Pierson et al. 2004).

Western red bat densities are at their peak in the Central Valley during July and August, and decline in the fall. The California Central Valley appears to be of primary importance to breeding populations of western red bat, with western red bats concentrating along the California coast in the winter (Pierson et al. 2004).

Aspects of the western red bat's life history (i.e., roosting individually or in small groups in inconspicuous locations) make it difficult to study. Pierson et al. (2004) were able to infer western red bat roost locations, as well as migratory and foraging activity by observing riparian woodland at sunset and visually and acoustically monitoring bats as they emerged. Carter et al. (2003) noted that indices of abundance such as submissions to health agencies for rabies testing and trends in habitat are the present means to indirectly assess western red bat population trend. Anecdotal observations suggest that the historical abundance of western red bat was likely much greater than at present (O'Shea et al. 2003).

The western red bat in California appears to be strongly associated with riparian habitats, particularly mature stands of cottonwood and sycamore, and relies on riparian forest for both roosting and foraging (Pierson et al. 1999). Roost trees are commonly adjacent to streams or open fields, in orchards, and sometimes in urban areas with mature trees (WBWG 1998). Pierson et al. (1999) describe roosting habitat as large diameter riparian cottonwoods and sycamores, and older orchard trees (particularly walnuts). Mature orchards with dense canopies provide alternate roosting sites and may also provide foraging habitat (Pierson et al. 1999). Orchards, particularly the walnut orchards that flank the Sacramento River, serve as alternative habitat, and to some extent may compensate for the loss of large cottonwoods, sycamores, and oaks. However, the extent to which fruit orchards are used by breeding females is unknown (Pierson and et al. 2004).

Western red bats forge over a variety of habitats, but rely on riparian forest for both roosting and foraging, and are strongly associated with riparian habitats (Pierson et al. 2004). Foraging has been noted in mature orchards, oak woodland, low elevation conifer forest, and non-native trees in urban and rural residential areas. In addition, this species may forage in habitats adjacent to streams, rivers, and over open water when insects are emerging (Harvey et al. 1999, WBWG 1998, Pierson et al. 2004). The home range of foraging western red bats is thought to be between 0.3 miles to 0.6 miles of the day roost (Zigler et al. 1990). No dietary information is available for western red bats in California (Pierson et al. 2002); however, eastern red bats prey on moths, flies, beetles, and tiny wasps (WBWG 1998). Western red bats may forage all night, but there is often an initial foraging period after sunset and a minor secondary activity period before sunrise that corresponds to periods of increased insect activity (WBWG 1998). Water features are a vital habitat component because bats often drink immediately after emergence, and water is an important source of concentrated insects. Studies comparing mature riparian habitat extending greater than 50 meters back from the Sacramento River to areas with less extensive or degraded riparian habitat suggest that this species prefers the mature, extensive riparian habitat (Pierson et al. 1999). As discussed in Section 2.6.1 above, between 94 to 98.5 percent of the historical riparian communities that once occurred in the Central Valley have been removed (Smith F. 1977, Katibah 1981), and loss of lowland riparian forests appears to be a factor contributing to declines of western red bat abundance (Pierson et al. 1999, O'Shea et al. 2003).

The life history of the western red bat centers on reproduction and on meeting the high energetic demands of a small insectivorous mammal. Several aspects of this species' life history are uncommon among bats, namely its roosting, social, and reproductive habits. The western red bat is usually solitary and roosts in trees on the underside of overhanging leaves during the day. The western red bat uses torpor to conserve energy during the day when it is inactive, and it hangs by one foot in a compact position using its furred tail membrane as a blanket. Hanging from one foot it closely resembles a dead leaf and the wing markings are thought to add to the camouflage. Roosting individuals are usually found on the south or southwest side of a roost tree, four to 10 feet above the ground (Barbour and Davis 1969, Shump and Shump 1982; Willis and Brigham 2001).

Western red bat most often roosts individually; however, females with dependent young are known to roost together in nursery colonies, and family groups roost together within a nursery colony (Zigler et al. 1990). In addition, migrating individuals are sometimes found in clusters roosting in the same tree (Zigler et al. 1990, Shump and Shump 1982; Willis and Brigham 2001). During winter cold-periods, western red bats may enter extended torpor (hibernation) (Pierson et al. 2002). Western red bats have been seen foraging at temperatures as low as 44 degrees Fahrenheit, but are typically active at temperatures above 68 degrees Fahrenheit (Zigler et al. 1990).

Pups are born from late spring to early summer (Pierson et al. 2002). In California, western red bat pups are born from late May through early July (Zeiner et al. 1990). Three pups are usual in a litter, but there may be as many as five. Lactation of young will last for four to eight weeks of age (Allen 1939; Zeiner et al. 1990, Pierson et al. 2002), and young may begin to fly at three to six weeks of age (Zeiner et al. 1990). It is thought that red bats have more young than other bat species because their roosting habits in foliage expose them to greater predation (Allen 1939; Pierson et al. 2002). Females may move the young between roost sites, and grounded mothers have often been found unable to fly due to the weight of the clinging pups (Allan 1947; Stains 1965, Zigler et al. 1990, SSHCP Appendix B).

The literature contains numerous accounts of birds attacking red bats and their young, including jays and crows (Allan 1947; Constantine 1958, 1959; Downing and Baldwin 1961; Elwell 1962; Hoffmeister and Downes 1964; Wilks and Laughlin 1961). Terrestrial predators may capture bats roosting in low-growing branches, and include opossums, skunks, weasels (*Mustela* spp.), rats, snakes, and cats (Sperry 1933, Allen 1939). Mortality may result from pesticide use in orchards, and the intensive use of pesticides in fruit orchards significantly reduces the amount of insect prey (WBWG 1998, Pierson et al 2002).

2.10.2 Environmental Baseline

Museum records for western red bat in Sacramento County include four locations: (1) a ranch located south of Sacramento, (2) a location two miles northwest of Folsom, and (3) locations in Sacramento, including two museum specimens taken in 1952 and in 1990, and a dead western red bat was found on a sidewalk in downtown Sacramento in 1995 (Final SSHCP Appendix B). However, most western red bat records in Sacramento County are documented from bat specimens submitted each year to the Sacramento County Public Health Laboratory for rabies testing, including fifty-six records collected from 1977 to 2002. More than 30 of the Sacramento County specimens in this period were from locations in the Action Area, including locations in the cities of Sacramento, Elk Grove, Folsom, Rancho Cordova (PPU-2), Wilton (PPU-5) and Galt (PPU-8). In addition, a bat monitoring project conducted at the Cosumnes River Preserve has detected western red bats within PPU-6. The Sacramento County Public Health Laboratory specimens include females and immature individuals, indicating the presence of a reproductive population in the Action Area (Final SSHCP Appendix B).

The SSHCP's compilation of records and species-surveys conducted within the Action Area identified seven sites where western red bat roosting or foraging has been documented in the Action Area, including five occurrences within the UDAs (one in PPU-2, one in PPU-8 and three that are not within a PPU), and two occurrences outside of the UDAs (one in PPU-5 and one in PPU-7) (Final SSHCP Table 3-6). However, the Action Area has not been surveyed for western red bat, and the total number of occurrences in the Action Area is unknown. SSHCP Figure 3-30 illustrates the location of the documented occurrences of western red bat within the Action Area.

Due to the limited survey data and the programmatic nature of the proposed action, the environmental baseline for the species in the Action Area relies heavily on the species habitat model described in SSHCP Chapter 3.4.5. The SSHCP landcovers that provide modeled roosting and foraging habitat for western red bat include all Blue Oak Woodland, Blue Oak Savanna, Mine Tailing Riparian Woodland, and Mixed Riparian Woodland, and Orchard landcovers in the Action Area. The SSHCP landcovers that provide modeled foraging habitat include all Valley Grassland, Blue Oak Woodland, Blue Oak Savanna, Orchard, Mine Tailing Riparian Woodland, Mixed Riparian Woodland, Mixed Riparian Scrub, Vernal Pool, Seasonal Wetland, Swale, Freshwater Marsh, Open Water, and Stream/Creek landcovers in the Action Area (Final SSHCP Table 3-2). The existing conditions of these landcovers in the Action Area and the primary factors responsible for those conditions were discussed above in Sections 2.3.2 and 2.3.5, and are not repeated here. The SSHCP identified a total of 177,732 acres of western red bat modeled habitat within the Action Area, including 152,891 acres of foraging habitat, and 24,841 acres of roosting and foraging habitat (Final SSHCP Table 6-104). SSHCP Figure 3-30 illustrates the location of modeled habitat for the western red bat within the Action Area.

As stated in the Final SSHCP (pages 5-3, 6-32, 6-55), several properties within the UDA portion of the Action Area have already obtained local entitlements and have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations from the CDFW, the Service, and the USACE. These UDA properties total 21,413 acres, and include several small lots in PPU-8, several small lots located west of Excelsior Road (PPU-3 and PPU-4), properties in the Rio Del Oro Specific Plan area (PPU-1), properties in the Sunridge Specific Plan area (PPU-1), and properties within the Mather Field Specific Plan area (PPU-2). These properties are part of the 317,656-acre Action Area. However, because planned urban development on these properties have obtained, or are close to completing, individual CESA, ESA, and CWA authorizations, these properties were not included in the SSHCP Chapter 6 effects analyses. Where planned urban development has already obtained (or is close to obtaining) ESA authorizations, this Opinion addresses the authorized loss of habitat and loss of species individuals as part of the Environmental Baseline of the western red bat.

2.10.3 Effects of the Action

The SSHCP assumes that the landcovers included in modeled habitat for western red bat could be occupied by adults or juveniles of the species. Therefore, the SSHCP did not quantify effects to individual occurrences of western red bat. The effects analysis in this Opinion also assumes that the landcovers included in the modeled habitat for western red bat could be occupied by the species.

The species-level effects described below build on Section 2.5.4, *General Effects of the Action on All Covered Species* and on Section 2.7.3 *General Effects of the Action on the Avian Covered Species*. Effects previously described in those sections of the Opinion are not repeated below. Effects of SSHCP Covered Activities on western red bat include the conversion and loss of modeled habitat, the reduction or loss of habitat functions in avoided areas, and effects on western red bat individuals.

Of the total 177,732 acres of western red bat modeled habitat available in the Action Area, the SSHCP Covered Activities will remove up to 23,986 acres (14%) of the existing modeled habitat

(Table 37 below). Most species habitat loss (92%) will be Valley Grassland (22,014 acres), which provides foraging habitat for western red bat (Final SSHCP Table 6-104). The SSHCP Covered Activities will remove 656 acres of western red bat modeled roosting habitat from the Action Area.

Outside the UDAs, only 844 acres (0.6%) of the existing 144,102 acres of western red bat modeled habitat will be removed by the rural transportation Covered Activities and recycled-water pipeline Covered Activities. Most loss of western red bat modeled habitat will occur within the UDA portions of the Action Area, where urban development Covered Activities will remove 23,142 acres (69%) of the existing 33,630 acres of western red bat modeled habitat in the UDAs. The STREAM AMMs will reduce the loss of western red bat modeled roosting habitat inside the UDAs. The SSHCP will require all UDA Covered Activities to establishing minimum 100-foot-wide Stream Setbacks on both banks of Eder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, and Sun Creek (AMM STREAM-2), and also will require UDA Covered Activities to establish 150-foot-wide Stream Setback along both banks of Laguna Creek as part of the Laguna Creek Wildlife Corridor (AMM STREAM-1). In addition, minimum 25-foot wide Stream Setbacks will be established on both banks of first-order and second-order tributaries that flow into those seven UDA streams (see AMM STREAM-3 and Objective W6). The UDA Stream Setbacks will preserve the riparian landcovers that are present along these seven UDA streams, including areas of with suitable western red bat roosting trees and foraging habitat. However, certain SSHCP Covered Activities also will be allowed within the Stream Setbacks, including the construction of bioswales, fencing, riparian plantings, and new stream crossings (Final SSHCP Chapter 5.2.6). In addition, 16-foot-wide paved trails, interpretive signs, benches, shade structures, and planted shade-trees will be allowed within the 100-foot-wide Stream Setbacks along Eder Creek, Frye Creek, Gerber Creek, Morrison Creek, Paseo Central, and Sun Creek. These activities will reduce the number of potential roosting trees for western red bat, and slightly reduce the area of suitable foraging habitat in each of the UDA Stream Setbacks. In addition, the SSHCP Conservation Strategy does not require owners of the Stream Setbacks to maintain or to enhance the western red bat habitat within in the Stream Setback areas.

Activities related to the implementation of SSHCP Covered Activities, including the use of earth moving equipment, mass grading, paving, and construction, will remove western red bat roosting habitats and foraging habitats. If roosting habitat is removed when pre-flight young are present, or if roosting habitat is removed when adults and juveniles are in a state of torpor or hibernation, individual young, juveniles, and adults present in the roosting habitat may be injured or killed when trees are cut down, bulldozed, or otherwise removed. Other direct effects of Covered Activities on western red bat could result from construction noise, construction vibration, construction lighting at night, construction dust, and increased human presence. The potential direct effects of these construction-related environmental stressors were qualitatively described and analyzed by the SSHCP (Final SSHCP Table 6-106).

Direct effects of implementing SSHCP Covered Activities on western red bat modeled habitat will be minimized by the general SSHCP AMMs, as discussed above in Section 2.5.4. In addition, direct effects may be minimized by BMP-7. Under SSHCP BMP-7, if a Covered Activity will occur within western red bat modeled roosting/foraging habitat, an approved biologist will be on site during the period of ground disturbance, and the approved biologist may need to be on site during other construction activities. After ground disturbing project activities are complete, the approved biologist will train an individual to act as the on-site construction monitor for the remainder of construction, with the concurrence of the Service and CDFW. The approved biologist and the on-site monitor will oversee project implementation of the required SSHCP AMMs, and the on-site monitor will have the authority to stop activities if any of the requirements associated with those measures are not met. Under SSHCP BMP-7, the approved biologist and/or on-site monitor also will record observations of all SSHCP Covered Species at the project site and submit records to the CNDDB, including any observations of western red bat individuals, and any observations of western red bat roosting sites. Under BMP-8, a mandatory Worker Environmental Awareness Program will be conducted by the approved biologist for all construction workers, including contractors, prior to the commencement of construction activities. The training will include how to identify the SSHCP Covered Species that might be enter the construction site, including identification of adult or pre-flight western red bats that may fall to the ground or fly into the project footprint from nearby summer roost trees, or from nearby winter hibernaculum trees.

The SSHCP Conservation Strategy includes three BAT AMMs, which require Covered Activity projects to survey for roosting western red bats, and to establish work buffers around roost trees (see Chapter 5.4.2 in the *Erratum to the Final SSHCP*, County of Sacramento et al. 2019). As discussed in Section 2.10.1 above, most Central Valley western red bats migrate to coastal areas of California in September to overwinter, and return to the Central Valley (including the Action Area) in early May to forage and reproduce. AMM BAT-1 and AMM BAT-2 require Covered Activities projects implemented within or near western red bat modeled habitat conduct surveys for roosting western red bats between May 1 and August 31. If a roost is identified, the project proponent will design the Covered Activity project to avoid all areas within a 300-foot buffer around the roost site(s) (AMM BAT-1). If the Third-Party Project Proponent elects not to change the project design, additional surveys for potential maternity roosts are required to determine the presence of maternity roost sites (AMM BAT-2). If an active maternity roost is present, the Covered Activity project must establish a 300-foot temporary disturbance buffer around the active maternity roost site until bats have vacated the roost and the Wildlife Agencies concur that the roost is vacant (AMM BAT-3).

If an active day or a night roost is identified, but is not a maternity roost or a winter hibernaculum roost, and removal of the non-maternity and non-hibernaculum roost cannot be avoided; the Third-Party Project Proponent will prepare a bat eviction plan, and the SSHCP will provide the bat eviction plan to the Service and CDFW for their review and approval (AMM BAT-4). Western red bats are known to enter a state of reduced metabolic activity (torpor) in the summer months to conserve energy when roosting (Willis and Brigham 2001). Torpor is a chemically induced stupor that prevents a bat from moving quickly, and red bats are slow to arouse from torpor in response to threats (Scesny 2006). Individuals that are prematurely aroused from daytime torpor will experience stress, expend additional energy, and will be disoriented. These individuals are more likely to fall to the ground, strike manmade structures, or be killed by predators during daytime arousal flights. Therefore, each bat eviction plan must proposed safe-eviction methods, and details of the eviction methods must be approved by the Service and CDFW (AMM BAT-4).

In addition to direct effects on western red bat modeled habitat and individuals, potential indirect effects of SSHCP Covered Activities on western red bat modeled habitat were assessed and analyzed qualitatively by the SSHCP (Final SSHCP Tables 6-104, 6-105). Potential indirect effects include altered hydrology; roosting and foraging habitat degradation (including introduction of pollutants, toxins, pesticides, and fertilizers), habitat fragmentation and isolation, increased human activity, ground vibration, altered fire regime; increased predation. The potential for indirect effects would be greatest within the UDA portions of the Action Area because of the closer and more extensive contact between urban development Covered Activities and SSHCP Preserves planned in the UDA (Final SSHCP page 6-390).

Indirect changes to existing hydrology of riparian roosting habitat or adjacent aquatic and upland foraging landcovers could alter the suitability of the roosting habitat (including death or thinning of cottonwood and sycamore stands), or reduce the suitability of habitats used by insect prey species. The LID-, EDGE-, BMP- and ROAD-AMMs discussed in Section 2.5.4 above would avoid or minimize changes to the existing hydrology of western red bat roosting habitats and foraging habitats. Pesticides are of particular concern for western red bats because they roost in trees and orchards where pesticides are applied, and they feed on insects that are targeted by pesticide use (Pierson et al. 2004). Pesticide can directly poison roosting western red bat individuals, and pesticides can indirectly reduce the abundance of insect prey. A reduction in the abundance of prey would require western red bats to forage greater distances from their roost tree, require greater expenditures of energy, and reduce foraging success. Therefore, reductions in insect prey base could result in individuals abandoning suitable roost sites, or cause individuals to move out of the Action Area. The indirect effects will be minimized by the EDGE and ROAD AMMs, which restrict pesticide use. In addition, limited pesticide use will be allowed in the SSHCP Preserve System when necessary to meet SSHCP Biological Goals and Objectives for invasive plant and animal control. (Final SSHCP Page 5-54, page 5-61, page 5-63). SSHCP Preserve uses of pesticides are not expected to adversely affect western red bats because the pesticide use will be limited, and use will comply with the pesticide label and all other applicable laws. If the SSHCP determines that pesticide use is appropriate on an individual SSHCP Preserve, the type of pesticide use will be prescribed by the individual Preserve Management Plan (PMP) for that Preserve, including measures to avoid direct and indirect effects of the pesticide use on western red bat roosting habitats, foraging habitats, insect prey base within the SSHCP Preserve.

Western red bats prefer roosting in riparian areas with dense canopies, and they forage close to their roost site. The removal of 656 acres of modeled roosting habitat will further fragment the remaining riparian and woodland landcovers in the Action Area that can be used by western red bats for sheltering and the nurturing of young. Smaller roosting habitat patch-size will increase exposure of western red bat maternity colonies and roosting individuals to predators, reducing the number of western red bats in the Action Area. Smaller roosting habitat patch-size may also increases exposure of individuals to several environmental stressors of urban development, including increase lighting, traffic, ground vibration, and increased human activity. The SSHCP STREAM, EDGE, and ROAD AMMs will reduce these edge effect by placing compatible land uses between western red bat roosting habitat and urban development Covered Activities, requiring setbacks, by minimizing lighting in the UDA, and by directing lighting away from the UDA preserves.

In addition, the removal of foraging habitat and prey availability within 0.6 miles of a nursery roost-tree would force the mother to hunt over new areas, expend more energy hunting, and require the mother to spend more time away from the nest when young are vulnerable to nocturnal predators. Less efficient hunting during the lactation and nurturing period can reduce the amount or the quality of food fed to young—slowing the growth of young, and reducing the number of young from a litter that survive to maturity. There are no SSHCP AMMs that will avoid or minimize loss of active foraging areas during the months that western red bats are reproducing in Sacramento County. The cost in energy and reproductive success of western red bat individuals from the removal of active foraging habitat in the UDA would be difficult to quantify and qualify, but is an expected indirect effect of implementing Covered Activities in the UDAs.

Table 37. Western Red Bat Habitat-Effects and Habitat Conservation

SSHCP Landcovers in the Species Modeled Habitat	Direct Effects (acres)	Indirect Effects (acres)	Total Effects (acres)	Preservation (acres)	Habitat Re-establishment or Establishment (acres)
Foraging Habitat					
Mixed Riparian Scrub	189	Qualitative Assessment	189	378	189
Valley Grassland	22,014	Qualitative Assessment	22,014	22,014	270[a]
Vernal Pool	389	Qualitative Assessment	389	966	389
Seasonal Wetland	105	Qualitative Assessment	105	105	105
Swale	234	Qualitative Assessment	234	278	234
Freshwater Marsh	127	Qualitative Assessment	127	127	127
Open Water	155	Qualitative Assessment	155	155	155
Streams/ Creeks	117	Qualitative Assessment	117	117	117
Total Foraging Habitat	**23,330**	Qualitative Assessment	**23,330**	**24,140**	**1,586**
Roosting and Foraging Habitat					
Blue Oak Woodland	9	Qualitative Assessment	9	0	9
Blue Oak Savanna	38	Qualitative Assessment	38	47	38
Mine Tailing Riparian	218	Qualitative Assessment	218	218	0
Mixed Riparian Woodlands	184	Qualitative Assessment	184	368	402
Orchards	207	Qualitative Assessment	207	207	0
Total Roosting/Foraging Habitat	**656**	Qualitative Assessment	**656**	**840**	**449**
Total	**23,986**	Qualitative Assessment		**23,986**	**2,035**

[a]SSHCP Objective VP6 requires the re-establishment of at least 300 acres of functional Vernal Pool Ecosystem within or adjacent to the Mather Core Area, much of which will consist of Valley Grassland. This will be accomplished by converting existing cropland or disturbed areas within the UDA to functional Vernal Pool Ecosystem (Final SSHCP page 7-120). As required by the RE-ESTABLISHMENT/ ESTABLISHMENT AMMs, no more than 10% of the 300 acres of re-established Vernal Pool Ecosystem will be vernal pools and swales, so approximately 270 acres will be re-established Valley Grassland uplands.

To mitigate the adverse direct and indirect effects to Western red bat individuals and western red bat suitable-habitat, the SSHCP will preserve least 24,980 acres of high-quality suitable habitat for western red bat in the Action Area, including 840 acres of modeled roosting habitat (Mixed Riparian Woodland, Blue Oak Savanna and Blue Oak Woodland landcovers). The characteristics and locations of suitable habitat preserved for western red bat will be consistent with the SSHCP Preserve System assembly criteria and requirements outlined in SSHCP Chapter 7.4 and 7.5 and consistent with the SSHCP biological goals and objectives for western red bat (Final SSHCP Table 7-1 and 7-90). Most of the modeled foraging and roosting habitat preserved under the SSHCP will be outside the UDA and concentrated in PPUs 5, 6, and 7. PPUs 5 and 6 include the Cosumnes River and Deer Creek Wildlife Corridor, which contain the riparian habitat known to support western red bat. The SSHCP also includes planned riparian re-establishment/establishment along the Cosumnes River in PPUs 5 and 6, which is expected to improve and expand roosting habitat for western red bat in the Action Area.

Consistent with SSHCP Conservation Action WR2.1, selection of SSHCP Preserve sites with modeled foraging habitat for western red bat will be prioritized to select active roost sites, especially maternity roost sites, and sites that are near known foraging areas and permanent water. Consistent with Conservation Action WR 1.1, the selection of SSHCP Preserve sites with modeled foraging habitat for western red bat will be prioritized to select sites where western red bat are known to forage, are known to support high prey densities, and are located near permanent water. To the maximum extent possible, newly preserved lands acquired by the SSHCP will be adjacent to and contiguous with existing preserves, enhancing the ecological value of SSHCP Preserves to western red bat.

The SSHCP Monitoring and Management Program will maintain or improve the quality of western red bat roosting and foraging habitats within the SSHCP Preserves. The SSHCP Monitoring and Management Program also will increase the amount of western red bat nesting and foraging habitat in the SSHCP Preserve System to support expansion of western red bat nesting and foraging activities into areas not currently used by western red bat. The SSHCP preserve management objectives that will benefit western red bat include are those that maintain roosting habitat, include monitoring the groundwater table as it relates to the health of preserved riparian habitats (SSHCP Objective RIP5), and ensuring that adverse edge effects, such as invasive weeds, trash, and litter, are monitored and addressed in each SSHCP Preserve (SSHCP Objectives HAB4 and HAB5). Monitoring vegetation height in grasslands (Objective HAB7) should help maintain foraging habitat quality by improving habitat suitability for prey and increasing prey detectability (e.g., by controlling dense thatch).

Preservation of high quality habitat within large Preserves coupled with careful management and monitoring, will assure that the number and distribution of western red bat within the Action Area will be maintained or increased in the Action Area. In addition to modeled habitat preservation, the Implementing Entity also will establish or re-establish 1,765 acres of western red bat modeled habitat in the Action Area, with a priority on re-establishment before establishment.

In addition to the preservation of 23,330 acres of modeled foraging habitat and the preservation of 656 acres of modeled roosting/foraging habitat for western red bat, the SSHCP Conservation Strategy also will establish or re-establish 2,035 acres of western red bat modeled habitat within the SSHCP Preserve System, with a priority on re-establishment before establishment (Table 37 above). Sites selected for the establishment or re-establishment of western red bat roosting habitat will be prioritized following SSHCP Conservation Action WR4.1 to select suitable sites that connect disjunct segments of riparian habitat, and sites that provide close proximity to modeled foraging areas with abundant prey populations.

2.10.4 Cumulative Effects

As described in Section 1.0 of this Opinion, the SSHCP was developed in part to respond to biological opinions issued by the Service in 1999 and 2004, and to address the indirect and cumulative effects of those large-scale water infrastructure projects in south Sacramento County.

Cumulative effects in a section 7 analysis are the effects of future state, tribal, county, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Several reasonably certain projects in the Action Area, such as the California High-Speed Train System and the California Waterfix, will require will require future federal actions and separate consultations under the ESA, and are not considered in this Opinion's cumulative effects analysis.

Reasonably certain activities in the Action Area, unrelated to the SSHCP and with no federal nexus, include the continued expansion of low-density rural development (see Section 2.3.4 above) within the approximately 19,600 acres of PPU-7 and PPU-6 that are designated as Agriculture Residential areas in the Sacramento County General Plan (County of Sacramento 2011). Construction of new residential structures or barns may occur, along with associated grading, landscaping, and accessory structures such as corrals and fences. In many cases, these activities will occur on large lots with streams or creeks that support trees, or other areas that may be occupied by the western red bat.

Land use changes and construction of structures within the Agricultural Residential areas may not obtain authorizations under ESA, CESA, and the CWA, particularly at project sites that are not subject to CEQA. Projects that are not subject to CEQA would not prepare a CEQA document to identify potential environmental impacts, and the project proponent may not have the expertise to identify western red bat habitats, or understand the regulations, and identifying project impacts to species or species habitat is beyond the purview of the County regulators reviewing building plans. Effects to western red bat individuals and species modeled habitat from projects and activities within the Agricultural Residential areas would result in the types of effects to western red bat similar to those discussed in Sections 2.5.4 and Sections 2.7.3 of this Opinion.

Additional conversions of natural landcovers to vineyards, cropland, orchards, irrigated pasture, and other farmland uses is also reasonably certain to occur outside the UDAs, in the portions of the Action Area zoned for agricultural uses by the County's General Plan (County of Sacramento 2011). It is not possible, however, to predict how crop types or agricultural uses may change over the 50-year Permit Term. Nonetheless, some conversion of natural riparian, woodland, and grassland landcovers to an intensively managed agricultural use can be expected over the 50-year study period. Changes to more intensively managed agricultural uses would result in the types of effects to western red bat individuals and suitable habitat that are similar to the effects discussed above in Sections 2.5.4 and 2.7.3 of this Opinion.

Other non-Federal actions that may occur in the Action Area are considered too speculative to evaluate at this point in time.

2.10.5 Conclusion

After reviewing the current status of the western red bat; the environmental baselines for the Action Area; the effects of the proposed actions, including all measures to avoid, minimize, and mitigate adverse effects; and the cumulative effects; it is the Service's conference opinion that issuance of an incidental take permit pursuant to section 10(a)(1)(B) of the ESA, the implementation of the SSHCP, and the approval and implementation of the SSHCP CWA 404 Permit Strategy, as proposed, are not likely to jeopardize the continued existence of the western red bat. The Service reached this conclusion because the project-related effects to the vernal pool Covered Species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the western red bat. We reached this conclusion based on the following reasons:

- Western red bat is a highly mobile species that occupies a large geographic range outside of the Action Area, and the SSHCP Covered Activities would affect a relatively small portion of the western red bat's breeding habitat and summer-foraging habitat.
- The SSHCP Conservation Strategy will protect and manage in perpetuity a relatively large amount of the western red bat modeled habitat that is within the Action Area.
- The SSHCP Covered Activities will implement best management practices and implement other avoidance and minimization measures that will minimize effects to western red bat modeled habitat.
- We do not anticipate the Covered Activity removal of modeled foraging habitat or modeled roosting habitat would result in the direct injury or death of western red bat individuals because the SSHCP western red bat AMMs will preclude impacts to roosting individuals and maternity roosts present in Covered Activity project sites.

No critical habitat has been designated for the western red bat, therefore, none will be affected.

3.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The proposed SSHCP and its associated documents clearly identify anticipated impacts to Covered Species likely to result from the proposed taking, and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed SSHCP, together with the terms and conditions described in the SSHCP Implementing Agreement and the terms and conditions described in the section 10(a)(1)(B) permits issued with respect to the proposed Plan, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) to apply. If the permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse.

Note: To avoid duplication, this biological opinion also analyzes the USACE’s proposed Section 404 Clean Water Act Permit Strategy Aligned with the SSHCP (Final Draft) (See Description of the Proposed Action Section 2.1). The USACE has been coordinating with the Service, Plan Partners, and others since 2004 to develop and implement a “streamlined” approach to permitting under section 404 of the Clean Water Act that encompasses a number of different permit types and processes. The alignment of the USACE’s Clean Water Act Permit Strategy with the SSHCP has allowed the Service to conduct one formal consultation that addresses both covered activities under the SSHCP and the USACE's Permit Strategy, and develop one biological opinion addressing these actions. The USACE's proposed SSHCP CWA 404 Permit Strategy describes the USACE's process for issuing CWA 404 permits and authorizations for SSHCP Covered Activity projects and activities that discharge dredge or fill materials into waters of the United States (WOUS), including wetlands. The SSHCP CWA 404 Permit Strategy will rely, at each tier of the Permitting Strategy, on the SSHCP Conservation Strategy (as mirrored in the final SSHCP ARP) to implement measures to avoid and minimize impacts to Action Area aquatic resources, and to address compensatory mitigation requirements (including ratios) for individual SSHCP Covered Activities with unavoidable impacts to aquatic resources.

Based on the foregoing analyses and conclusions presented above, this Incidental Take Statement addresses incidental take resulting from the USACE's proposed action as well as from the Service's issuance of a section 10 permit for the SSHCP in accordance with section 7(b)(4) of the ESA.

Section 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

3.1 Amount or Extent of Take

Listed Species

Based on the findings presented in the *Effects of the Action* section above, the Service anticipates incidental take of the following wildlife Covered Species, currently listed under the ESA, during the 50-year Permit Term as a result of habitat loss and degradation (inclusive of human and vehicular activity and equipment use) caused by HCP Covered Activities, including those needing authorization under the USACE's Permit Strategy: the vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, California tiger salamander Central Valley DPS, and the giant garter snake. However, the level of incidental take of these species in terms of numbers of individuals is likely to be difficult to detect due to the species' population dynamics, small body size, seasonal fluctuations in populations, or the habitat type utilized (e.g., underground burrows). Rapid carcass deterioration, and the likelihood that remains will be removed by a scavenger or will be indistinguishable amongst disturbed soil debris, also lowers the detectability of taken individuals. For these reasons, it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species.

Alternatively, the level of habitat loss and degradation (inclusive of human and vehicular activity and equipment use) caused by the proposed actions (see Table 38 below) that are likely to cause take of listed species can be used as a surrogate to clearly express the amount or extent of anticipated take because such habitat alterations are likely to kill, injure, or otherwise significantly disrupt the essential breeding, feeding, or sheltering activities of the listed species referenced above to an extent that actually kills or injures listed species, or creates the likelihood of their injury. The levels of habitat loss and degradation presented in Table 38 also clearly establish a clear standard for determining when the authorized level of anticipated take has been exceeded. Habitat alterations caused by Covered Activities will be reported annually under the SSHCP in order to track incidental take of the vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, California tiger salamander Central Valley DPS, and the giant garter snake throughout the Permit Term. The loss of modeled habitat for any individual species exceeding levels in Table 38 would require an amendment of the ESA Incidental Take Permit and reinitiation of this consultation, as discussed below in Section 3.6 of this Opinion.

The SSHCP Covered Activities undertaken by the prospective Permittees or their Third Party Project Proponents are reasonably likely to take all life stages of the vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, California tiger salamander Central Valley DPS, and the giant garter snake, through direct mortality or injury from human activity, vehicles, and equipment use, and through harm by other forms of habitat modification and loss. This amount of incidental take will not prevent the viability and persistence within the Action Area of each listed Covered Species. By implementing the SSHCP, the prospects for Action Area populations of the vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, California tiger salamander Central Valley DPS, and the giant garter snake to contribute to the overall recovery of each species are high.

Currently Non-Listed Species

The Service anticipates effects (inclusive of human and vehicular activity and equipment use) to the following wildlife Covered Species, currently not listed under the ESA, that conform to take during the 50-year Permit Term: the mid-valley fairy shrimp, Ricksecker's water scavenger beetle, western spadefoot, western pond turtle, Cooper's hawk, tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, loggerhead shrike, western red bat, and the American badger. However, the amount or extent of such take in terms of numbers of individuals is likely to be difficult to detect because of population dynamics, small body size, seasonal fluctuations in populations, or habitat type utilized (i.e. underground burrows). Rapid carcass deterioration, and the likelihood that remains will be removed by a scavenger or will be indistinguishable amongst disturbed soil debris, also lowers detectability of take. Avian and mobile terrestrial species may move some distance when injured and source of injury may be difficult to determine. For these reasons, it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of these Covered Species.

Alternatively, the level of habitat loss and degradation (inclusive of human and vehicular activity and equipment use) caused by the proposed actions (see Table 38 below) that are likely to cause take of listed species can be used as a surrogate to clearly express the amount or extent of anticipated take because such habitat alterations are likely to kill, injure, or otherwise significantly disrupt the essential breeding, feeding, or sheltering activities of the listed species referenced above to an extent that actually kills or injures listed species, or creates the likelihood of their injury. The levels of habitat loss and degradation presented in Table 38 also clearly establish a clear standard for determining when the authorized level of anticipated take has been exceeded. Habitat alterations caused by Covered Activities will be reported annually under the SSHCP in order to track incidental take of the of the mid-valley fairy shrimp, Ricksecker's water scavenger beetle, western spadefoot, western pond turtle, Cooper's hawk, tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, loggerhead shrike, western red bat, and the American badger throughout the Permit Term. The loss of modeled habitat for any individual species exceeding levels in Table 38 would require an amendment of the ESA

Incidental Take Permit and reinitiation of this consultation, as discussed below in Section 3.6 of this Opinion.

The SSHCP Covered Activities undertaken by the prospective Permittees or their Third Party Project Proponents are reasonably likely to take all life stages of the mid-valley fairy shrimp, Ricksecker's water scavenger beetle, western spadefoot, western pond turtle, Cooper's hawk, tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, loggerhead shrike, western red bat, and the American badger, through direct mortality or injury from human activity, vehicles, and equipment use, and through harm by other forms of habitat modifications and loss. This amount of incidental take will not prevent the viability and persistence within the Action Area of each non-listed Covered Species. By implementing the SSHCP, the prospects for Action Area populations of the above Covered Species to contribute to the overall recovery of each species are high.

Incidental take authorization of the currently non-listed Covered Species will become effective concurrent with their listing as threatened or endangered under the ESA, to the extent that their take is prohibited by the ESA.

Table 38. Maximum Permanent Effects on Wildlife Covered Species Modeled Habitats

Covered Species and Modeled Habitat Type	Maximum Allowable Permanent Effect on Modeled Habitat (acres)
Vernal pool tadpole shrimp	
Aquatic Vernal Pool Ecosystem Habitats	787
Upland Vernal Pool Ecosystem Habitats	16,472
Total Modeled Habitat	**17,259**
Vernal pool fairy shrimp	
Aquatic Vernal Pool Ecosystem Habitats	787
Upland Vernal Pool Ecosystem Habitats	16,472
Total Modeled Habitat	**17,259**
Mid-valley fairy shrimp	
Aquatic Vernal Pool Ecosystem Habitats	**633**
Upland Vernal Pool Ecosystem Habitats	**12,006**
Total Modeled Habitats	**12,639**
Valley elderberry longhorn beetle	
Total Modeled Habitat	**591**
Ricksecker's water scavenger beetle	
Aquatic Vernal Pool Ecosystem Habitats	761
Upland Vernal Pool Ecosystem Habitats	16,472
Total Modeled Habitats	**17,233**
California tiger salamander (Central California Distinct Population Segment)	
Aquatic Habitats	80
Upland Habitats	1,677
Total Modeled Habitat	**1,757**
Western spadefoot	
Aquatic Habitats	1,164
Upland Habitats	22,043
Total Modeled Habitat	**23,207**
Western pond turtle	
Aquatic Habitats	316
Upland Habitats	10,656

Total Modeled Habitat	**10,972**
Giant garter snake	
High Value Aquatic Habitats	104
Other Aquatic Habitats	65
High Value Upland Habitats	502
Other Upland Habitats	1,687
Total Modeled Habitat	**2,358**
Cooper's hawk	
Nesting/Foraging Habitats	600
Foraging Habitats	38
Total Modeled Habitat	**638**
Tricolored blackbird	
Nesting/Foraging Habitats	27,531
Foraging Habitats	3,527
Total **Modeled Habitat**	**31,058**
Western burrowing owl	
Nesting/Foraging Habitats	30,086
Foraging Modeled Habitats	892
Total Modeled Habitat	**30,978**
Ferruginous hawk	
Total Modeled Habitat	**25,491**
Swainson's hawk	
Nesting Habitats	373
High Value Foraging Habitats	7,413
Other Foraging Habitats	23,326
Total Modeled Habitat	**31,112**
Northern harrier	
Nesting/Foraging Habitats	30,048
Foraging Habitats	855
Total Modeled Habitat	**30,903**
White-tailed kite	
Nesting Habitats	376
Nesting/Foraging Habitats	189
Foraging Modeled Habitat	30,754
Total Modeled Habitat	**31,319**
Greater sandhill crane	
High Value Roosting Habitats	19
Other Roosting Habitats	47
High Value Roosting/Foraging Habitats	2
Other Roosting/Foraging Habitats	122
High Value Foraging Habitats	799
Other Foraging Habitats	6,953
Total Modeled Habitat	**7,942**
Loggerhead shrike	
Nesting Habitats	591
Nesting/Foraging Habitats	22,014
Foraging Habitats	8762
Total Modeled Habitat	**31,367**
American badger	
Total Modeled Habitat	**22,780**
Western red bat	

Roosting/Foraging Habitat	656
Foraging Habitat	23,330
Total Modeled Habitat	**23,986**

3.2 Effect of the Take

The Service has determined that the above anticipated levels of take of the Covered Species are not likely to result in jeopardy to the SSHCP Covered Species or destruction or adverse modification of critical habitat.

3.3 Reasonable and Prudent Measures and Terms and Conditions

The SSHCP Permit contains all measures necessary to avoid, minimize, and mitigate the incidental take of the vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, California tiger salamander Central Valley DPS, giant garter snake, mid-valley fairy shrimp, Ricksecker's water scavenger beetle, western spadefoot, western pond turtle, Cooper's hawk, tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, loggerhead shrike, western red bat, and the American badger, to the maximum extent practicable and requires the that the SSHCP be fully implemented. Monitoring will be conducted as stated in SSHCP Chapter 5.4 (conditions on Covered Activities), SSHCP Chapter 7 (Conservation Strategy), SSHCP Chapter 8 (Final SSHCP Monitoring and Management Programs), and SSHCP Chapter 9 (Final SSHCP Implementation). Therefore, no additional reasonable and prudent measures and terms and conditions are necessary to minimize and monitor the impacts of the anticipated taking on the vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, California tiger salamander Central Valley DPS, giant garter snake, mid-valley fairy shrimp, Ricksecker's water scavenger beetle, western spadefoot, western pond turtle, Cooper's hawk, tricolored blackbird, western burrowing owl, ferruginous hawk, Swainson's hawk, northern harrier, white-tailed kite, greater sandhill crane, loggerhead shrike, western red bat, and the American badger.

Monitoring and reporting by the prospective Permittees pursuant to the terms and conditions of the Clean Water Act permits issued by the USACE under the Permit Strategy Aligned with the SSHCP will serve as evidence that the USACE is complying with the monitoring and reporting requirements of this Incidental Take Statement in accordance with 50 CFR §402.14(i).

3.5 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service has no conservation recommendations for the proposed actions considered in this Opinion.

3.6 Reinitiation Notice

This concludes formal consultation and conference on the proposed issuance of a section 10(a)(1)(B) permit to implement the SSHCP in Sacramento County, California, and implementation of the USACE proposed Section 404 Clean Water Act Permit Strategy Aligned with the SSHCP (Final Draft). As provided in 50 CFR §402.16, reinitiation of formal consultation under section action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; (4) a new species is listed or critical habitat designated that may be affected by the action; or (5) if future renewals, extensions, or revisions, or withdrawal to/of the Section 404 Clean Water Act Permit Strategy Aligned with the SSHCP may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion. In instances where the amount or extent of incidental take is exceeded, any activities causing such take must cease, pending reinitiation. A reinitiated consultation shall take into consideration the assurances that the SSHCP Permittees will receive in accordance with the "No Surprises" regulations [50 CFR §17.22(b)(5) and §17.32(b)(5)]. The "No Surprises" regulations are not applicable to the USACE action.

The Service may confirm a conference opinion as a biological opinion issued through formal consultation if currently non-listed Covered Species are listed or critical habitat is designated. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference opinion, the Service will confirm a conference opinion as a biological opinion and no further section 7 consultation would be necessary (50 CFR §402.10).

In the event that a currently non-listed Covered Species becomes listed, or new critical habitat is designated within the SSHCP Plan Area, the USACE may ask the Service to confirm this conference opinion as a biological opinion issued through formal consultation. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion and no further section 7 consultation will be necessary.

The Incidental Take Statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the Service will review the project determine whether any take of the non-listed Covered Species has occurred. Modifications of the Biological Opinion and the Incidental Take Statement may be appropriate to reflect that take. No take of the non-listed Covered Species may occur between the listing of these species and the Service's adoption of the conference opinion as a biological opinion through formal consultation, or the completion of a subsequent formal consultation.

If you have any questions regarding this Opinion, please contact Nina Bicknese, Senior Fish and Wildlife Biologist, or Jan Knight, Deputy Field Supervisor, at the letterhead address, by telephone (916) 414-6700, or by electronic mail at Jan_Knight@fws.gov.

Sincerely,

Jennifer M. Norris, Ph.D.
Field Supervisor

4.0 LITERATURE CITED

Al-Tikrity, M.R. and J.N.R. Grainger. 1990. The effect of temperature and other factors on the hatching of the resting eggs of *Tanymastix stagnalis* (L.) (Crustacea, Anostraca). *Journal of Thermal Ecology*, 15(1): 87-90.

Allan, P.F. 1947. Blue jay attacks red bats. *Journal of Mammalogy* 28(2):180.

Allen, G.M. 1939. Bats. Harvard University Press, Cambridge, Massachusetts. 368 p.

Anderson, J.D. 1968a. Comparison of the food habits of *Ambystoma macrodactylum sigillatum, Ambystoma macrodactylum croceum*, and *Ambystoma tigrinum californiense. Herpetologica,* 24(4): 273-284.

Anderson, P.R. 1968b. The reproductive and developmental history of the California tiger salamander. Master of Science Thesis. Department of Biology, Fresno State College, Fresno, California. 82pp.

Anderson, S.H., L.W. Ayers, J.A. Dechant, M.T. Green, W.H. Howe, S.L. Jones, D.S. Klute, D.K. Rosenberg, S.R. Sheffield and T.S. Zimmerman. 2001. Draft status assessment and conservation plan for the Western Burrowing Owl in the United States. Administrative Report. U.S. Department of Interior, Fish and Wildlife Service, Denver, Colorado.

AOU (American Ornithologists' Union). 1957. Check-list of North American birds. American Ornithologists' Union, Washington, D.C.

Apps, C.D., N. J. Newhouse, and T.A. Kinley. 2002. Habitats associations of American badgers in southeastern British Columbia. *Canadian Journal of Zoology*, 80:1228-1239.

Asay, C.E. 1987. Habitat and productivity of Cooper's hawks nesting in California. *California Fish and Game* 73:80.

Ashton, D.T., A. J. Lind, and K.E. Schlick. 1998. WPT (*Clemmys marmorata*). Natural History. Unpublished report. USDA Forest Service, Pacific Southwest Research Station, Redwood Sciences Laboratory, Arcata, California.

Barbour, M.G., N.H. Berg, G.F. Kittel, and M.E. Kunz. 1991. Snowpack and the distribution of a major vegetation ecotone in the Sierra Nevada of California. *Journal of Biogeography*, 18:141-149.

Babcock, K.W. 1995. Home range and habitat use of breeding Swainson's Hawks in the Sacramento Valley of California. *Journal of Raptor Research*, 29: 193- 197.

Baker, R.J., J.C. Patton, H.H. Genoways, and J.W. Bickham. 1988. Genic studies of *Lasiurus* (Chiroptera: Vespertilionidae). Occasional Papers of the Museum at Texas Tech University 117:1-15.

Baldwin, K.S. 1988. Effects of pond quality on the life history features of the western spadefoot toad. *American Zoologist* (abstract) 28:87A.

Balfour, P.S. and S.R. Morey. 1999. Prey selection by juvenile bullfrogs in a constructed vernal pool complex. *Transactions of the Western Section of the Wildlife Society*, 35:34-40.

Barbour, R.W., and W.H. Davis. 1969. Bats of America. University of Kentucky Press, Lexington, 285 pp.

Barnard, P.E. 1983. Foraging behavior and energetics of northern harriers *Circus cyaneus* (L.). Honor's thesis, Acadia University, Wolfville, NS.

Barnard, P.E., R.B. MacWhirter, R.E. Simmons, G.L. Hansen, and P.C. Smith. 1987. Timing of breeding and the seasonal importance of passerine prey to Northern Harriers. *Canadian Journal of Zoology*, 65:1942-1946.

Barr, C. B. 1991. The Distribution, Habitat, and Status of the Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* Fisher (Insecta: Coleoptera: Cerambycidae). USFWS, Sacramento, California.

Barry, S.F. 1998. Managing the Sacramento vernal pool landscape to sustain native flora. Pp. 236-240 *in:* C. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Eds.). Ecology, Conservation, and Management of Vernal Pool Ecosystems. Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, California.

Barry, S.J., and H.B. Shaffer. 1994. The status of the California tiger salamander (*Ambystoma californiense*) at Lagunita: A 50-year update. *Journal of Herpetology,* 28(2): 159-164.

Barry, S.J. 1995. Vernal Pools on California's Annual Grasslands. *Rangelands* 17(5):173–175. Barry, S.J. 1998. Managing the Sacramento Vernal Pool Landscape to Sustain Native Flora. Pages 236–240 *in*: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren, Jr., and R. Ornduff, editors. Ecology, conservation, and management of vernal pool ecosystems: proceedings from a 1996 conference. California Native Plant Society, Sacramento, California. 285 pages.

Bartgis, R. 1992. Loggerhead Shrike. P. 281-297 *in* Migratory nongame birds of management concern in the northeast (K. J. Schneider and D. M. Pence, Eds.). U.S. Fish and Wildlife Service, Region 5, Newton Corner, Massachusetts.

Bates, C. 2006. Burrowing Owl (Athene cunicularia). In The Draft Desert Bird Conservation Plan: a strategy for reversing the decline of desert-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/desert.html.

Bauder, E.T. 1987. Threats to San Diego Vernal Pools and a Case Study in Altered Pool Hydrology. *In*: Elias, T.S. (Ed.). Conservation and Management of Rare and Endangered Plants. Proceedings of a California Conference on the Conservation and Management of Rare and Endangered Plants. *California Native Plant Society*. 1987:209–213.

Bechard, M.J. 1980. Factors affecting nest productivity of Swainson's Hawk (*Buteo swainsoni*) in southeastern Washington. Ph.D. diss., Washington State University, Pullman WA.

Bechard, M.J. 1982. Effect of vegetative cover on foraging site selection by Swainson's hawk. *Condor,* 84: 153-159.

Bechard, M.J. 1983. Food supply and the occurrence of brood reduction in Swainson's hawk. *Wilson Bulletin*, 95: 233-242.

Bechard, M.J., and J.K. Schmutz. 1995. Ferruginous hawk (*Buteo regalis*). *In* The Birds of North America, No. 172 (A. Poole and F. Gill, Eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Beebe, F.L. 1974. Field studies of the Falconiformes of British Columbia. Brit. Col. Prov. Mus. Occas. Paper No. 17. 163 pp.

Beedy, E.C. 2008. Tricolored Blackbird. Pages 437-443 *in* W.D. Shuford and T. Gardali, editors. California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. Studies of Western Birds 1.

Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Beedy, E.C., S.D. Sanders, and D. Bloom. 1991. Breeding status, distribution, and habitat associations of the Tricolored Blackbird (*Agelaius tricolor*) 1859-1989. Prepared for U.S. Fish and Wildlife Service, Sacramento California.

Beedy, E.C., and A. Hayworth. 1992. Tricolored Blackbird nesting failures in the Central Valley of California: general trends or isolated phenomena? Pages 33-46 in D.F. Williams, S. Byrne, and T.A. Rado (Eds.), Endangered and sensitive species of the San Joaquin Valley, California. California Energy Commission. Sacramento, California.

Beedy, E.C., and W.J. Hamilton III. 1997. Tricolored Blackbird status update and management guidelines; Prepared for U.S. Fish and Wildlife Service, Migratory Birds and Habitat Programs, and California Department of Fish and Game, Bird and Mammal Conservation Program. Jones & Stokes Associates, Inc., Sacramento, California.

Beedy, E.C., and W.J. Hamilton III. 1999. Tricolored Blackbird (*Agelaius tricolor*) *In* A. Poole and F. Gill (eds.), the birds of North America, No. 423. The Birds of North America, Inc., Philadelphia, Pennsylvania.

Beedy, E.C., W.J. Hamilton, III, R.J. Meese, D.A. Airola, and P. Pyle. 2017. Tricolored Blackbird (*Agelaius tricolor*), version 3.0. *In* The Birds of North America Online, P.G. Rodewald, editor. Cornell Laboratory of Ornithology, Ithaca, New York. Accessed online April 5, 2018, at: https://birdsna.org/Species-Account/bna/species/tribla

Behnke, R.J., and R.F. Raleigh. 1978. Grazing and the riparian zone: Impacts and management perspectives. Pages 263-267, *In*: R.R. Johnson and J.F. McCormick (technical coordinators) Strategies for Protection and Management of Floodplain Wetlands and Other Riparian Ecosystems. U.S.D.A. Forest Service General Technical Report WO-12.

Bleak, D. 1977. Zoogeography of the Arizona fairy shrimps (Crustacea: Anostraca). *Journal of the Arizona Academy of Science* 12: 70-78.

Belk, D., and M.L. Fugate. 2000. Two new *Branchinecta* (Crustacea: Anostraca) from the southwestern United States. *The Southwestern Naturalist* 45(2):111-117.

Bleak, D. and T.S. Nelson. 1995. Observations on the effects of incubation at inhibitory temperature on subsequent hatching of Anostracan cysts. *Hydrobiologia* 298:179-181.

Belk, D., and D.C. Rogers. 2002. A confusing trio of *Branchinecta* (Crustacea: Anostraca) from the western North America with a description of a new species. *Hydrobiologia* 486:49–55.

Berry, M.E., C.E. Bock, and S.L. Haire. 1998. Abundance of diurnal raptors on open space grasslands in an urbanized landscape. *Condor* 100: 601-608.

Berven, K.A., and T.A. Grudzien. 1990. Dispersal in the wood frog (*Rana sylatica*) – Implications for genetic population-structure. *Evolution* 44 (8): 2047-2056.

Bird, B.L., L.C. Branch, and D.L. Miller. 2004. Effects of coastal lighting on foraging behavior of beach mice. *Conservation Biology*: 1435-1439.

Bloom, P.H. 1980. The status of the Swainson's hawk in California, 1979. Final Report II-8.0, USDI Bureau Land Management and Federal Aid in Restoration, Project. W-54-R-12, California Department of Fish and Game, Sacramento, California.

Boal, C.W. and R.W. Mannan. 1998. Nest-site selection by Cooper's hawks in an urban environment. *Journal of Wildlife Management* 62:864-871.

Boal, C.W. and R.W. Mannan. 1999. Comparative breeding ecology of Cooper's Hawks in urban and exurban areas of southeast Arizona. *Journal of Wildlife Management* 63:77-84.

Boal, C.W., R.W. Mannan, and K. S. Hudelson. 1998. Trichomoniasis in Cooper's Hawks from Arizona. *Journal of Wildlife Diseases* 34:590-593.

Bosakowski, T., R. Speiser, and L.J. Niles. 1993. Loss of Cooper's Hawk nesting habitat to suburban development: inadequate protection for a state-endangered species. *Journal of Raptor Research* 27:26-30.

Bossard, C.C., J.M. Randall, and M.C. Hoshovsky. 2000. *Invasive Plants of California's Wildlands.* Berkeley, California: University of California Press.

Bowen, S.T., M.R. Buoncirstiani and J.R. Carl. 1988. *Artemia* habitats: ion concentrations tolerated by one superspecies. *Hydrobiologica*, 158: 201-214.

Bowles, A.E. 1995. Responses of Wildlife to Noise. In R.A. Knight (Ed.), Wildlife and recreationists: coexistence through management and research (pp. 109-156). Covelo, California: Island Press.

Boyer, D. R. 1965. Ecology of the basking habitat in turtles. *Ecology* 46:99-118.

Bradbury, M., Estep, J.A., and D. Anderson. *In Preparation*. Migratory patterns and wintering range of the Central Valley Swainson's hawk.

Bragg, A.N. 1962. Predation on arthropods by spadefoot tadpoles. *Herpetologica* 18:144.

Bragg, A.N. 1964. Further study of predation and cannibalism in spadefoot tadpoles. *Herpetologica.* 20(1):17-24.

Brattstrom, J.W., and D.F. Messer. 1988. Current status of the southwestern pond turtle, *Clemmys marmorata pallida*, in southern California. Final Report, Contract C-2044. California Department of Fish and Game, Sacramento. 62 pp.

Breden, F. 1987. The effect of post-metamorphic dispersal on the population genetic structure of Fowler's toad, (*Bufo woodhousei fowleri). Copeia.* 987:386-395.

Broch, E.S. 1969. The osmotic adaptation of the fairy shrimp *Branchinecta campestris (*Lynch) to saline astatic waters. *Limnology and Oceanography*. 14:485-492.

Broch, E.S. 1988. Osmoregulatory patterns of adaptation to inland astatic waters by two species of fairy shrimps, *Branchinecta gigas* Lynch and *Branchinecta mackini* Dexter. *Journal of Crustacean Biology.* 8(3)383-391.

Brode, J. 1988. Natural history of the Giant Garter Snake (*Thamnophis couchii gigas*). Pages 25- 28, *In* Proceedings of the conference on California herpetology, H.F. DeListe, P.R. Brown, B. Kaufman, and B.M. McGurty (Eds). Southwestern Herpetologists Society, Special Publication No. 4.

Brode, J. 1990. Guidelines for procedures and timing of activities related to the modification or relocation of Giant Garter Snake habitat. CDFG Inland Fisheries Division, October 1990.

Brode, J., and G. Hansen. 1992. Status and future management of the giant garter snake (*Thamnophis gigas*) within the southern American Basin, Sacramento, and Sutter counties, California. CDFG, Inland Fisheries Division.

Brooks, B.L., and S.A. Temple. 1990. Habitat availability and suitability for loggerhead shrikes in the upper Midwest. *American Midland Naturalist.* 123:75-83.

Brouse, P. 1999. Twenty year change in the raptor community in northern Utah during the non- breeding season. *Journal of Raptor Research.* 33(4):317-322.

Brown, H.A. 1966. Temperature adaptation and evolutionary divergence in allopatric populations of the spadefoot toad, *Scaphiopus hammondii*. Doctor of Philosophy Dissertation, University of California, Riverside, California.

Brown, L.R., and L.H. Capelan. 1971. Egg hatching and life history of a fairy shrimp *Branchinecta mackini* Dexter (Crustacea: Anostraca) in a Mohave desert playa (Rabbit Dry Lake). *Ecology.* 52(1):41-54.

Brown, R.J. 1972. A study of the mechanisms of osmotic and ionic regulation of the fairy shrimp, *Branchinecta mackini* (Crustacea, Branchiopoda). Ph. D. thesis. University of Toronto. Toronto, Canada. 215 pp.

Browning, M.R. 1974. Comments on the winter distribution of Swainson's Hawks (*Buteo swainsoni*) in North America. *American Birds*, 28:865-867.

Burgess, R.C., Jr. 1950. Development of spade-foot toad larvae under laboratory conditions. *Copeia* 1950(1):49-51.

Burk, V.J., and J.W. Gibbons. 1995. Terrestrial buffer zones and wetland conservation: a case study of freshwater turtles in a Carolina bay. *Conservation Biology* 9:1365-1369.

Burke, C.J. 1979. Effect of prey and land use on mating systems of harriers. Master's thesis, University of Wisconsin, Stevens Point.

Burke, H. E. 1921.Biological notes on *Desmocerus*, a genus of roundhead borers, the species of which infest various elders. *Journal of Economic Entomology*, 14:450-452.

Bury, R.B. 1986. Feeding ecology of the turtle, *Clemmys marmorata*. Journal of *Herpetology*. 20(4):515-521.

Cade, T.J., and C.P. Woods. 1997. Changes in distribution and abundance of the loggerhead shrike. *Conservation Biology,* 11:21-31.

California Burrowing Owl Consortium. 1993. Burrowing Owl Survey Protocol and Mitigation Guidelines. (April 1993) California Department of Fish and Game, Sacramento, California. Accessed online at http://www.dfg.ca.gov/wildlife/nongame/ docs/boconsortium.pdf.

Carter, T.C., M.A. Menzel, and D.A. Saugey. 2003. Population trends of solitary foliage-roosting bats. *In* T. J. O'Shea and M. A. Bogan, editors. Monitoring trends in bat populations of the United States and territories: problems and prospects. United States Geological Survey, Biological Resources Division, Information and Technology Report. Washington, D. C., USA.

Catlin, D.H. 2004. Factors affecting within-season and between-season breeding dispersal of burrowing owls in California. Thesis, Oregon State University, Corvallis, Oregon.

Catlin. D.H., D.K. Rosenberg, and K.L. Haley. 2005. The effects of nesting success and mate fidelity on breeding dispersal in burrowing owls. Canadian Journal of Zoology 83:1574-1580.

CBD (Center for Biological Diversity). 2001. Petition to list the midvalley fairy shrimp as an endangered species under the Endangered Species Act with concurrent designation of critical habitat. Center for Biological Diversity, PO 40090, Berkeley, California 94704-4090.

CBD (Center for Biological Diversity), Santa Clara Valley Audubon Society, Defenders of Wildlife, San Bernardino Valley Audubon Society, California State Park Rangers Association and Tri-County Conservation League. 2003. Petition to the State of California Fish and Game Commission and Supporting Information for Listing the California Population of the Western Burrowing Owl (*Athene cunicularia hypugaea*) as an Endangered or Threatened Species under the California Endangered Species Act. Submitted April 7, 2003.

CDFG (California Department of Fish and Game). 1994. Staff report regarding mitigation for impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California. Sacramento, California.

CDFG (California Department of Fish and Game). 1997. Annual report on the status of California State listed threatened and endangered plants and animals. Sacramento, California.

CDFG (California Department of Fish and Game). 2004. Evaluation of Petition: Request of the Center for Biological Diversity et al. (2004) to list the California tiger salamander (*Ambystoma californiense*) as endangered. Sacramento, California. 81 pp.

CDFG (California Department of Fish and Game). 2009. Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities. California Natural Resources Agency. November 24, 2009.

CDFW (California Department of Fish and Wildlife). 2016. Status review: Swainson's hawk (*Buteo swainsoni*) in California. Nongame Wildlife Program, California Department of Fish and Wildlife, Sacramento, California. 29 pages.

CDFW (California Department of Fish and Wildlife). 2018. A status review of the tricolored blackbird (*Agelaius tricolor*) in California. Report to the Fish and Game Commission, February. California Department of Fish and Wildlife, Sacramento, California. 122 pages plus appendices.

Central Valley Joint Venture. 2006. Central Valley Joint Venture Implementation Plan–Conserving Bird Habitat. U.S. Fish and Wildlife Service, Sacramento, CA

Churcher, P.B. and Lawton, J.H. 1987. "Predation by Domestic Cats in an English Village." *Journal of Zoology, London* 212: 439–455

City of Galt. 2008. City of Galt General Plan Update 2030 Environmental Impact Report. Prepared by Environmental Science Associates. Sacramento, California: July 2008.

City of Galt. 2009. The 2030 Galt General Plan: Policy Document. Final. Prepared by Mintier Harnish, in association with ESA and Omni Means. Sacramento, California. April 2009.

City of Rancho Cordova. 2006. Rancho Cordova General Plan. City of Rancho Cordova Public Works Department, Rancho Cordova, California. Adopted June 26, 2006.

Clark, G.M., T.J. Roscoe, M. J. van Ess, and N. Wymer. 1998. Management considerations for small vernal pool preserves: the Phoenix vernal pools. Pages 250-254 *In*: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren, Jr., and R. Ornduff, (editors). Ecology, conservation, and management of vernal pool ecosystems: proceedings from a 1996 conference. California Native Plant Society, Sacramento, California. 285 pages.

CNDDB (California Natural Diversity Database). 2018. RAREFIND 5. California Natural Diversity Data Base. Natural Heritage Division, California Department of Fish and Game, State of California. Sacramento, California. Accessed between January 2018 and June 2018 at: https://www.wildlife.ca.gov/Data/CNDDB/Maps-and-Data

CNPS (California Native Plant Society). 2010. Inventory of Rare and Endangered Plants (online edition, v7-10b). California Native Plant Society. Sacramento, California. Accessed online April 2010 at http://www.cnps.org/inventory.

Collinge, S.K., M. Holyoak, C.B. Barr, and J.T. Marty. 2001. Riparian habitat fragmentation and population persistence of the threatened valley elderberry longhorn beetle in central California. *Biological Conservation,* 100:103-113.

Constantine, D.G. 1958. Ecological observations on lasiurine bats in Georgia. *Journal of Mammalogy* 39(1):64-70.

Constantine, D.G. 1959. Ecological observations on lasiurine bats in the north bay area of California. *Journal of Mammalogy* 40(1):13-15.

Constantine, D.G. 1998. Range extensions of ten species of bats in California. *Bulletin of Southern California Academy of Sciences* 97(2):49-75.

Cook, L. 1996. Nesting adaptations of tricolored blackbirds (*Agelaius tricolor*). Master's thesis, University of California, Davis.

Cook, L. 1999. Tricolored Blackbird (*Agelaius tricolor*) conservation plan for southern Sacramento County. Unpublished report submitted to Jones & Stokes, in cooperation with the southern Sacramento County Habitat Conservation Plan.

Corbin, B. and G. Schoolcraft, A. Sanger, and J Molter. 1994. *Gratiola heterosepala* Conservation Strategy. Unpublished report to Lassen National Forest, Modoc National Forest, Alturus Resource Area BLM, and Redding Resource Area BLM.

Corbin, Beth. District Botanist USDA, Bureau of Land Management (formerly with Lassen National Forest).

Coulombe, H.N. 1971. Behavior and population ecology of the burrowing owl, *Speotyto cunicularia*, in the Imperial Valley of California. *Condor* 73:162-176.

County of Sacramento. 2011. Sacramento County General Plan of 2005–2030. Sacramento, California. Amended November 9, 2011. County of Sacramento Office of Community Planning and Development Department, Sacramento California.

County of Sacramento, the Sacramento County Water Agency, the Sacramento Regional County Sanitation District, and the U.S. Fish and Wildlife Service. 2004. Memorandum of Agreement on the resolution of issues associated with existing biological opinion regarding the so-called Zone 40/Fazio Water (the "Zone 40 Biological Opinion") issued on March 11, 1999 (a formal consultation on Bureau of Reclamation water service contracts with the Sacramento County Water Agency, the San Juan Water District, the City of Folsom, and Sacramento County). Memorandum signed on September 13, 2004.

County of Sacramento Office of Economic Development and Marketing. 2014. Final South Mather wetlands management plan. Prepared by the County of Sacramento Office of Economic Development and Marketing. July 2014. Available at: http://www.economic.saccounty.net/LocateHere/Mather/Pages/Mather-Wetlands-Management-Plan.aspx

County of Sacramento, City of Rancho Cordova, City of Galt, Sacramento County Water Agency, Sacramento Regional County Sanitation District, and the SouthEast Connector Joint Powers Authority. 2016. Administrative Final Draft South Sacramento Habitat Conservation Plan. Unpublished manuscript. January 2016.

County of Sacramento, City of Rancho Cordova, City of Galt, Sacramento County Water Agency, Sacramento Regional County Sanitation District, and the SouthEast Connector Joint Powers Authority. 2018. Final South Sacramento Habitat Conservation Plan. Available from: County of Sacramento Office of Planning and Environmental Review. Sacramento, California. February 2018.

County of Sacramento, City of Rancho Cordova, City of Galt, Sacramento County Water Agency, Sacramento Regional County Sanitation District, and the SouthEast Connector Joint Powers Authority. 2019. Erratum to the Final South Sacramento Habitat Conservation Plan. Available from: County of Sacramento Office of Planning and Environmental Review. Sacramento, California.

Sacramento County Department of Economic Development. 2013. South Mather Wetlands Management Plan. http://economic.saccounty.net/LocateHere/Mather/Documents/(3)%20Wetlands%20Management%20Plan%20 Nov2013.pdf#search=stinkwort .

CPIF (California Partners in Flight). 2000. Version 1.0. The draft grassland bird conservation plan: a strategy for protecting and managing grassland habitats and associated birds in California (B. Allen, lead author). Point Reyes Bird Observatory, Stinson Beach, California. http://www.prbo.org/calpif/plans.html.

CPIF (California Partners in Flight). 2002. The oak woodland bird conservation plan: a strategy for protecting and managing oak woodland habitats and associated birds in California (S. Zack, lead author). Point Reyes Bird Observatory, Stinson Beach, California. http://www.prbo.org/calpif/plans.html.

Crampton, B. 1959. The grass genera *Orcuttia* and *Neostapfia*: A study in habitat and morphological specialization. *Madrono* 15 pp. 97-110.

Crampton, B. 1976. Rare grasses in a vanishing habitat. *Fremontia* 4: 22-23.

Crase, F.T., and R.W. DeHaven. 1977. Food of nestling Tricolored Blackbirds. *Condor*. 79: 265-269.

Crase, F.T., and R.W. DeHaven. 1978. Food selection by five sympatric California blackbird species. *California Fish and Game,* 64:255-267.

Crooks, K.R., and M.E. Soulé. 1999. “Mesopredator Release and Avifaunal Extinctions in a Fragmented System.” *Nature* 400:563–566.

CROS (California Roadkill Observation System), University of California at Davis. 2010. https://www.wildlifecrossing.net/california/ . Accessed on line in December 2010.

Cryan, P.M. 2003. Seasonal distribution of tree bats. *Journal of Mammalogy* 84(2):579-593. Downing, S.C., and D.H. Baldwin. 1961. Sharp-shinned hawk preys on red bat. *Journal of Mammalogy* 42:540-541.

Davidson, C., H.B. Shaffer, and M.R. Jennings. 2002. Spatial tests of the pesticide drift, habitat destruction, UV-B and climate change hypotheses for California amphibian declines.

Davies, C.P., M.A. Simovich, and S.A. Hathaway. 1997. Population genetic structure of a California endemic branchiopod, *Branchinecta sandiegonensis*. Hydrobiologia 359:149–158.

Dawson, W.L. 1923. The birds of California. South Moulton Co., San Francisco, California.

Debinski, D.M., and R.D. Holt. 2000. A survey and overview of habitat fragmentation experiments. *Conservation Biology* 14(2):342-355.

Dechant, J.A., M.F. Dinkins, D.H. Johnson, L.D., and C.M. Goldade. 2001. Effects of management practices on grassland birds: Swainson's hawk. Paper 119, 2001. USGS Northern Prairie Wildlife Research Center.

Deem, S.L., L.H. Spelman, R.A. Yates, and R.J. Montali. 2000. Canine distemper in terrestrial carnivores: a review. *Journal of Zoo and Wildlife Medicine* 31(4).

DeHaven, R.W. 1975. Plumages of the Tricolored Blackbird. *Western Bird Bander,* 50:59-61.

DeHaven, R.W. 2000. Tricolored Blackbird discussion modified for outside FWS use – for typical HCP development. Unpublished report, U.S. Fish and Wildlife Service, Sacramento, California.

DeHaven, R.W., F.T. Crase, P.D. Woronecki. 1975. Breeding status of the Tricolored Blackbird, 1969-1972. *California Department Fish and Game,* 61:166-180.

DeHaven R.W., F.T. Crase, and P.P. Woronecki. 1975. Movements of Tricolored Blackbirds Banded in the Central. *Bird Banding.* 46, 220-229.

DeHaven, R.W., and J. A. Neff. 1973. Recoveries and returns of Tricolored Blackbirds, 1941- 1964. *Western Bird Bander,* 48:10-11.

DeSante, D.F., and E.D. Ruhlen. 1995. A census of burrowing owls in California, 1991-1993. Institute for Bird Populations, Point Reyes Station, California.

DeSante, D.F., E.D. Ruhlen, and D.K. Rosenberg. 1996. The distribution and relative abundance of burrowing owls in California: evidence for a declining population. Institute for Bird Populations, Point Reyes Station, California.

DeSante, D.F., E.D. Ruhlen, S.L. Adamany, K.M. Burton, and S. Amin. 1997. A census of burrowing owls in central California in 1991. Pages 38-48 *in* J.L. Lincer and K. Steenhof (Editors). The burrowing owl, its biology and management: including the Proceedings of the First International Symposium. Raptor Research Report No. 9.

DeSante, D.F., E.D. Ruhlen, D.K. Rosenberg, and R. Scalf. 2003. The distribution and relative abundance of burrowing owls in California in the early 1990s. Abstract. California Burrowing Owl Symposium Program and Abstracts.

DeSante, D.F., E.D. Ruhlen, and D.K. Rosenberg. 2004. Density and abundance of burrowing owls in the agricultural matrix of the imperial valley, California. *Studies in Avian Biology* 27:116-119.

DeSante, D.F., E.D. Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of burrowing owls in California during 1991–1993: Evidence for a declining population and thoughts on its conservation. Pages 1–41 *in* Barclay, J.H., K.W. Hunting, J.L. Lincer, J. Linthicum, and T.A. Roberts (Eds.) Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations Point Reyes Station, California, and Albion Environmental, Inc. 197 pp.

Dimmitt, M.A., and R. Ruibal. 1980. Environmental correlates of emergence in spadefoot toads (*Scaphiopus*). *Journal of Herpetology* 14(1):21-29.

Dixon, J.B., R.E. Dixon, and J. E. Dixon. 1957. Natural history of the White-tailed Kite in San Diego County, California. *Condor* 59: 156-165.

Dodd, C.K., Jr., W.J. Barichivich, and L.L. Smith. 2004. "Effectiveness of a Barrier Wall and Culverts in Reducing Wildlife Mortality on a Heavily Traveled Highway in Florida." *Biological Conservation* 118:619–631.

Donaldson, J. I. Nanni, C. Zachariades, and J. Kemper. 2002. Effects of habitat fragmentation on pollinator diversity and plant reproductive success in renosterveld shrublands of South Africa. *Conservation Biology* 16(5) 1267-1276.

Drewien, R. 1973. Ecology of Rocky Mountain greater sandhill cranes. Dissertation. Univ. of Idaho, Moscow. 82 pp.

Dumont, H.J., and S. Negrea. 2002. Introduction to the Class Branchiopoda. Guides to the Microinvertebrates of the Continental Waters of the World. Backhuys, Leiden.

Dudek. 2014. Preliminary stakeholder draft South Sacramento Habitat Conservation Plan. Unpublished manuscript. September 29, 2014. Dudek, 980 9th Street, Sacramento California.

Dunk, J.R. 1995. White-tailed Kite (*Elanus leucurus*). *In* The Birds of North America, No. 178 (A. Poole and F. Gill, Eds.). The Academy of Natural Sciences, Philadelphia, and the American Ornithologists Union, Washington, D.C.

Dunk, J.R. and R.J. Cooper. 1994. Territory size regulation in Black-shouldered Kites. *Auk*. 111: 588-595.

Dunn, E.R. 1940. The races of *Ambystoma tigrinum*. *Copeia,* 1940(3): 154-162.

Dunne, T. and L. Leopold. 1978. Water in Environmental Planning. W. H. Freeman and Company. New York. pp. 225.

Ebird.org. 2005-2010. Ebird - Bird Observations Mapping Tool Website. Audubon and Cornell Lab of Ornithology. Ithaca, New York. Accessed online: http://ebird.org/content/ebird

Ebird.org. 2005-2010. Records of occurrence locations of greater sandhill cranes as self- reported by local birders on Ebird.org.

Edwards, A.L., and R.R. Sharitz. 2000. Population genetics of two rare perennials in isolated wetlands: *Sagittaria isoetiformis* and *Sagittaria teres* (Alismataceae). *American Journal of Botany*. 87(8):1147-1158.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The birder's handbook, a field guide to the natural history of North American birds. Simon and Schuster, New York. 785pp.

Eisenmann, E. 1971. Range expansions and population increase in North and Middle America of the White-tailed Kite (*Elanus leucurus*). *American Birds* 25:529-536.

Elam, D.R. 1998. Population genetics of vernal pool plants: theory, data, and conservation implications. Pp. 180-189 *in:* C. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Eds.). Ecology, Conservation, and Management of Vernal Pool Ecosystems. Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, California.

Elwell, A.S. 1962. Blue jay preys on young bats. *Journal of Mammalogy* 43(3):434.

Emlen, J.M., and E.K. Pilkitch. 1989. Animal population dynamics: identification of critical components. *Ecological Modeling*. 44: 253-273.

Emlen, J.T. 1941. An experimental analysis of the breeding cycle of the tricolored red-wing. *Condor,* 43:209-219.

Eng, L.L. 1984. Rare, threatened and endangered invertebrates in California riparian systems. *In:* R.E. Warnter and K.M. Hendrix (Eds) California riparian systems ecology, conservation, and productive management. University of California Press, Berkeley California

Eng, L., D. Belk, and C. Eriksen. 1990 Californian Anostraca: distribution, habitat, and status. *Journal of Crustacean Biology* 10(2):247-277.

England, A. Sidney, J. Estep, W. Holt. 1995. Nest-site and reproductive performance of urban- nesting Swainson's hawks in the Central Valley of California. *Journal of Raptor Research*, 29: 179–186.

England, A. Sidney, M.J. Bechard, and C.S. Houston. 1997. Swainson's hawk (*Buteo swainsoni*). *In* A. Poole and F. Gill (Eds.) Birds of North America, No. 265. The Birds of North America, Inc., Philadelphia, Pennsylvania.

Erichsen, A.L. 1995. The white-tailed kite (*Elanus leucurus*): nesting success and seasonal habitat selection in an agricultural landscape. Thesis. University of California, Davis. Davis, California.

Eriksen, C. and D. Belk. 1999. Fairy shrimps of California's pools, puddles, and playas. Mad River Press, Eureka, California.

Erichsen, A.L., K.S. Smallwod, N.D. Ottum, and D.M. Fry. 1994. The white-tailed kite: GIS analysis of habitat selection in the Sacramento Valley, California with implication for conservation of wildlife in agricultural landscapes. Abstract. *Journal of Raptor Research* 28(1):46.

Erichsen, A.L., K.S. Smallwood, A.C. Commandatore, B.W. Wilson, and D.M. Fry. 1996. White-tailed Kite movement and nesting patterns in an agricultural landscape. Pages 165-175 *in*. D. Bird and J.J. Negro (Editors). Raptors in Human Landscapes. Academic Press, London.

Ernst, C.H., J.E. Lovich, and R.W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, DC.

Estep, J. 1989. Biology, movements, and habitat relationships of the Swainson's Hawk in the Central Valley of California, 1986-87. Calif. Dept. Fish and Game, Nongame Bird and Mammal Sec. Rep.

Estep, J. 2006. The distribution, abundance, and habitat associations of the Swainson's Hawk (*Buteo swainsoni*) in the City of Elk Grove Planning Area. Estep Environmental Consulting, Sacramento, California.

Estep, J. 2007. The distribution, abundance, and habitat associations of the Swainson's Hawk (*Buteo swainsoni*) in the City of Rancho Cordova Planning Area. Estep Environmental Consulting, Sacramento, California.

Estes, W.A., and R.W. Mannan. 2003. Feeding behavior of Cooper's Hawks at urban and rural nests in southeastern Arizona. *Condor* 105:107-116.

Evermann, B.W. 1919. A colony of Tricolored Blackbirds. *The Gull,* 1:2-3.

Evers, D.E., C.E. Sasser, J.G. Gosselink, D.A. Fuller, and J.M. Visser. 1998. The impact of vertebrate herbivores on wetland vegetation in Atchafalaya Bay, Louisiana. *Estuaries*. 21(1):1-13.

Evenden, F.G., Jr. 1948. Distribution of the turtles of western Oregon. *Herpetologica* 4:201-204.

Ewing, R.A., N. Tosta, R. Tuazon, L. Huntsinger, R. Marose, K., Nielson, R. Motroni, and S. Turan. 1988. California's forest and rangelands: growing conflict over changing uses. California Department of Forestry and Fire Protection. 348 pp. with appendices.

Eya, B. K. 1976. Distribution and status of a longhorn beetle, *Desmocerus californicus dimorphus* Fisher (Coleoptera: Cerambycidae). Unpublished report, Department of Zoology, University of California, Davis, California. 6 pp.

Fahrig, L. 1997. Relative effects of habitat loss and fragmentation on population extinction. *Journal of Wildlife Management* 61(3):603-610.

Falk D.A., C.I. Millar, and R.F. Noss (Eds). 1996. Restoring diversity; strategies for reintroduction of endangered plants. Center for Plant Conservation, Missouri Botanical Garden. Island Press, Washington, D.C. and Covelo, California

Feaver, P.E. 1971. Breeding pool selection and larval mortality of three California amphibians: *Ambystoma tigrinum californiense* Gray, *Hyla regilla* Baird and Girard, and *Scaphiopus hammondii* Girard. Master of Arts Thesis, Fresno State College, Fresno, California. 58pp.

Feldman, C.R., and J.F. Parham. 2001. Molecular systematics of Emydine turtles, a Linnaeus Fund Research Report. *Chelonian Conservation and Biology*. 4(1):224-228.

Feldman, C.R. and J.F. Parham. 2002. Molecular phylogenetics of Emydine turtles: taxonomic revision and the evolution of shell kinesis. *Molecular Phylogenetics and Evolution*. 22(3):388-398.

Feldman, M. 1982. Notes on reproduction in *Clemmys marmorata*. *Herpetological Review* 13(1):10-11.

Fisher, W. S. 1921. A new Cerambycid beetle from California. *Proceedings of the Entomological Society of Washington,* 23 (9):206-208.

Fisher, R.N., and H.B. Shaffer. 1996. The Decline of Amphibians in California's Great Central Valley. *Conservation Biology*. 10(5): 1387-1397.

Fitch, H.S. 1940. A biogeographical study of the *ordinoides* Artenkreis of garter snakes (genus *Thamnophis*. *University of California Publications in Zoology*. 44:1-150.

Fitch, H.S. 1941. The feeding habits of California garter snakes. California Department of Fish and Game 27:2-32.

Fitzgerald, S.D., J.S. Patterson, M. Kiupel, H.A. Simmons, S.D. Grimes, C.F. Sarver, R.M Fulton, B.A. Steficek, T.M. Cooley, J.P. Massey, and J.G. Sikarskie. 2002. Clinical and pathologic features of West Nile Virus infection in Native North American Owls (Family Strigidae). *Avian Diseases*, 47 (3):602-610.

Fitzpatrick, B.M., and H.B. Shaffer. 2004. Environment-dependent admixture dynamics in a tiger salamander hybrid zone. *Evolution,* 58(6):1282-1293.

Fitzner, R.E. 1980. Behavioral ecology of the Swainson's Hawk (*Buteo swainsoni*) in Washington. Pac. NW Lab. PLN-2754.

Fleckenstein, J., M. Anderson, G. Fogg, and J. Mount. 2004. Managing Surface Water- Groundwater to Restore Fall Flows in the Cosumnes River. J. of Water Resources Planning and Management. 130(4):301-310.

Forman, R. T. T., D. Sperling, J. A. Bissonette, A. P. Clevenger, C. D. Cutshall, V. H. Dale, L Fahrig, R. France, C. R. Goldman, K. Heanue, J. A. Jones, F. J. Swanson, T. Turrentine, T. C. Winter. 2003. Road ecology: science and solutions. Island Press, Washington, Covelo, and London. 482 pp.

Fox, W. 1951. Relationships among the garter snakes of the T*hamnophis elegans rassenkreis*. *University of California Publications in Zoology.* 50:485-530.

Frankham, R. 1995. Effective population size/adult population ratios in wildlife: a review. *Genetical Research.* 66(2):95-107.

Franson J.C., L. Sileo, and N.J. Thomas. 1995. Causes of eagle deaths. *In* Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. E.T. LaRoe, G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac, editors. U.S. Department of the Interior, National Biological Survey. Washington, D.C.:

Franklin A.B, B.R. Noon, and T.L. George. 2002. What is Habitat Fragmentation? *Studies in Avian Biology*. No. 25:20-29.

Frayer, W.E., D.D. Peters, and H.R. Pywell. 1989. Wetlands of the California Central Valley: status and trends; 1939 to mid-1980s. U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

Fry, D.R., Jr. 1966. Recovery of the White-tailed Kite. *Pacific Discovery* 19: 27-30.

Fugate, M.L. 1992. Speciation in the Fairy Shrimp Genus *Branchinecta* (Crustacea: Anostraca) from North America; a dissertation submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Biology; University of California, Riverside.

Fugate, M.L. 1998. Branchinecta of North America: population structure and its implications for conservation practice. Pages 140-146 *in:* C.W. Witham, E. Bauder, D. Belk, W. Ferren, and R. Ornduff (Eds). Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, CA. 1998.

Gaines, D. 1974. A new look at the nesting riparian avifauna of the Sacramento Valley, California. *Western Birds* 5:61-80.

Gaines, D. 1977. Birds of the Yosemite Sierra. Cal-Syl Press, Oakland, California.

Grinnell, J., and A.H. Miller. 1944. Distribution of the birds of California. Pacific Coast Avifauna, No. 27. Berkeley, California.

Garmendia, A.E., H.J. Van Kruningern, R.A. French, J.F. Anderson, T.G. Andreadis, A. Kumar, and A.B. West. 2000. Recovery and identification of West Nile virus from a hawk in winter: *Journal of Clinical Microbiology* 38:3110-3111.

Garrison, B.A. 1990. Trends in winter abundance and distribution of Ferruginous hawks in California. *Trans. West. Sect. Wildl. Soc.* 26: 51-56.

Gawlik, D.E., and K.L. Bildstein. 1993. Seasonal habitat use and abundance of loggerhead shrikes in South Carolina. *Journal of Wildlife Management*, 57:352-357.

Gehlbach, F.R. 1967. *Ambystoma tigrinum*. T*he Catalogue of American Amphibians and Reptiles* 1:52.1-52.4.

Gervais, J. A., and D.K. Rosenberg. 1999. Burrowing Owls in California produce second broods of chicks. *Wilson Bulletin* 111:569-571.

Gervais, J. A., D. K. Rosenberg, D. M. Fry, and L. A. Trulio. 1997. Evaluation of contaminant residues in burrowing owls populations from central and southern California. The Institute for Bird Populations, Point Reyes Station, California. Publication No. 79.

Gervais, J.A., D.K. Rosenberg, D.M. Fry, L.A. Trulio, and K.K. Sturm. 2000. Burrowing owls and agricultural pesticides: Evaluation of residues and risks for three populations in California. *Environmental Toxicology and Chemistry* 19:337-343.

Gervais, J.A., D.K. Rosenberg, and R.G. Anthony. 2003. Burrowing Owl space use and pesticide exposure risk. *Journal of Wildlife Management* 67:155-64.

Gervais, J.A., D.K. Rosenberg, and L.A. Comrack. 2008. Burrowing owl (*Athene cunicularia*). Pages 218–226 in Shuford, W.D. and Gardali, T. (Eds). 2008. California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Getz, G.L., R.C. Frederick, and D.L. Gates. 1978. Interstate roadsides as dispersal routes for *Microtus pennsylvanicus*. *Journal of Mammalogy,* 59: 208 – 212.

Gifford, D.L., P.S. Hofmann, A.A. Truex, and D.H. Wright. 2012. Monitoring distribution and abundance of nesting Swainson's hawks in the Sacramento Valley and Sacramento River Delta, California. *California Fish and Game* 98(1): 7–18.

Gill, D.E. 1978. The metapopulation ecology of the red-spotted newt, *Notophthalmus viridescens* (Rafinesque). *Ecological Monographs* 48:145-166.

Gilmer, D.S., and R.E. Stewart. 1984. Swainson's Hawk nesting ecology in North Dakota. *Condor,* 86: 12-18.

Gilmer, D.S., D.L. Evans, P.M. Konrad, and R.E. Stewart. 1985. Recoveries of Ferruginous hawks banded in south central North Dakota. *Journal of Field Ornithology*, 56: 184-187.

Gist, D. H. and J.M. Jones. 1989. Storage of sperm in the oviducts of turtles. *Journal of Morphology* 199:379-384.

Gleason, R.S., and D.R. Johnson. 1985. Factors influencing nesting success of burrowing owls in southeastern Idaho. *Great Basin Naturalist* 45: 81-84.

Goldstein, M.I., B. Woodbridge, M.E. Zaccagnini, and S.B. Canavelli. 1996. An assessment of mortality of Swainson's Hawks on wintering grounds in Argentina. *Journal of Raptor Research*, 30:106-107.

Gonzalez, R.J., J. Drazen, S. Hathaway, B. Bauer, and M. Simovich. 1996. Physiological correlates of water chemistry requirements in fairy shrimps (Anostraca) from southern California. *Journal of Crustacean Biology* 16(2) 315-322.

Goodman, D. 1987. The demography of chance extinction. Pages 11–34 *in* M.E. Soule (Ed.). Viable populations for conservation. Cambridge University Press, Cambridge, UK.

Gordon, E. 1996. Dispersal type, germination and seedling growth of Sagittaria latifolia (Alismataceae). *Fragmenta Floristica et Geobotanica* 41(2):657-688.

Gorman, L.R., D.K. Rosenberg, N.A. Ronan, K.L. Haley, J.A. Gervais, and V. Franke. 2003. Estimation of reproductive rates of burrowing owls. *Journal of Wildlife Management* 67:493-500.

Gossett, D.N. 1993. Studies of Ferruginous hawk biology: I. Rediscoveries of banded Ferruginous hawks from presumed eastern and western subpopulations, II. Morphological and genetic differences of presumed subpopulations of Ferruginous hawks. Master's thesis, Boise State Univ, Boise, Idaho.

Gough, L., and J.B. Grace. 1998. Herbivore effects on plant species density at various productivity levels. *Ecology*. 79(5):1586-1594.

Graf, M. and Allen-Diaz. 1993. Evaluation of mosquito abatement district's use of mosquitofish as biological mosquito control: case study - Sindicich Lagoon in Briones Regional Park. Unpublished manuscript. 22 pp.

Grant, C.V., B.B. Steele, and R.L. Bayn, Jr. 1991. Raptor population dynamics in Utah's Uinta Basin: the importance of food resource. *Southwest Naturalist*, 36:265-280.

Gray, E. 1995. DNA fingerprinting reveals lack of genetic variation in northern populations of the western pond turtle (*Clemmys marmorata*). *Conservation Biology* 9:1244-1255.

Green, G.A. 1983. Ecology of breeding burrowing owls in the Columbia Basin, Oregon. M.S. Thesis, Oregon State University. Corvallis, OR.

Green, G.A., and R.G. Anthony. 1989. Nesting success and habitat relationships of burrowing owls in the Columbia Basin, Oregon. *Condor* 91:347-354.

Griggs, F.T. 1974. Systematics and ecology of the genus *Orcuttia* (Gramineae). M.S. Thesis, California State University, Chico, California. 70pp.

Griggs, F.T. 1976. Life history strategies of the genus *Orcuttia*. *In* Jain, S. (ed.) Vernal pools: their ecology and conservation. Institute of Ecology Publication No. 9, University of California, Davis, California. 93pp.

Griggs, F.T. 1980. Population studies in the genus *Orcuttia* (Poaceae). Ph.D. Dissertation, University of California, Davis, California.

Griggs, F.T. 1981. 1981. Life histories of vernal pool annual grasses. *Fremontia* 9:1 pp. 14-17.

Griggs, F.T. 1984. A strategy for the conservation of the genus *Orcuttia*. Pp. 255-262 *in:* S. Jain and P. Moyle, (editors) Vernal pools and intermittent streams. Institute of Ecology No. 28, University of California, Davis, California.

Griggs, F.T., and S. K. Jain. 1983. Conservation of vernal pool plants in California. II. Population biology of a rare and unique grass genus *Orcuttia*. *Biological Conservatio*n 27: 171-193.

Grinnell, J., and C.L. Camp. 1917. A distributional list of the amphibians and reptiles of California. *University of California Publications in Zoology,* 17(10): 131, 138.

Grinnell, J., and A.H. Miller. 1944. The distribution of the birds of California. *Pacific Coast Avifauna*, No. 27. Cooper Ornithological Club, Berkeley, California. Reprinted 1986.

Grosberg, R. 2002. Conservation planning for vernal pool crustaceans of eastern Merced County. Appendix C *in* Noss R.F.; R. Amundson, M. Barbour, R. Bugg, B. Cypher, R. Grosberg, T. Hanes, R. Hansen, B. Pavlik, K. Rice. 2002. Report of science advisors for the Eastern Merced County Natural Community Conservation Plan and Habitat Conservation Plan. Unpublished Report.

Gutzwiller K.J, R.T. Wiedenmann, K.L. Clements, and S.H. Anderson. 1994. Effects of human intrusion on song occurrence and singing consistency in subalpine birds. *The Auk,* vol. 111, 28-37.

Hall, R.E. 1959. The development of eggs of *Chirocephalus diaphanus* Prévost at a low temperature. *Hydrobiologia*, 13: 156-159.

Hall, E.R. 1981. The mammals of North America. Vol. 1. John Wiley and Sons, New York. 600 pp.

Hall R.J. and P.F.P. Henry. 1992. Assessing effects of pesticides on amphibians and reptiles: status and needs. *Herpetological Journal,* 2:65-71.

Halstead, J. A., and J. A. Oldham. 2000. New distribution records for the elderberry longhorn beetle *Desmocerus californicus* Horn (Coleoptera: Cerambycidae). *Pan-Pacific Entomologist* 76:74-76.

Hamann, B., H. Johnston, P. McClelland, S. Johnson, L. Kelly, and J. Gobielle. 1999. Birds. Pages 3.1-3.34 *in* G. Joslin and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society. 307 pp.

Hamerstrom, F. 1969. A harrier population study. Pp. 367-383 I*n* J. J. Hickey (Ed) Peregrine falcon populations, their biology, and decline. University of Wisconsin Press, Madison.

Hamerstrom, F. 1986. Harrier, hawk of the marsh: the hawk that is ruled by a mouse. Smithsonian Institution Press, Washington, D.C.

Hamerstrom, F., F. N. Hamerstrom, and C. J. Burke. 1985. Effect of voles on mating systems in a central Wisconsin population of harriers. *Wilson Bulletin*, 97:332-346.

Hamilton, W.J. III. 1998. Tricolored Blackbird itinerant breeding in California. *Condor,* 100:218-226.

Hamilton, W.J. 2000. Tricolored blackbird 2000 Breeding Season Census and Survey – Observations and Recommendations. Unpublished report. Available on the Tricolored Blackbird Portal: http://tricolor.ice.ucdavis.edu/reports

Hamilton, W.J. III, L. Cook, and R. Grey. 1995. Tricolored Blackbird project 1994. Unpublished report prepared for U.S. Fish and Wildlife Service Region 1, Portland, Oregon.

Hanes, T. and L. Stromberg. 1998. Hydrology of vernal pools on non-volcanic soils in the Sacramento Valley. Pages 38-49 *in*: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren, Jr., and R. Ornduff (Eds). *Ecology, conservation, and management of vernal pool ecosystems.* Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, California.

Hanes, W.T., B. Hecht, and L.P. Stromberg. 1990. Water relationships of vernal pools in the Sacramento region, California. Pages 49-60 *in*: D.H. Ikeda and R.A. Schlising, editors. Vernal pool plants, their habitats and biology. Studies from the Herbarium Number 8, California State University. Chico, California.

Hansen, E.C. 2001. Year 2001 Investigations of the Giant Garter Snake (*Thamnophis gigas*) at Badger Creek, Cosumnes River Preserve. Prepared for The Nature Conservancy. December 20. 14 pp.

Hansen E.C. 2008. Results of year 2008 giant garter snake (*Thamnophis gigas*) surveys, Yolo County, California. Letter to David Kelley, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, California. February 12.

Hansen, G.E. 1982. Status of the giant garter snake (*Thamnophis couchii gigas*) along portions of Laguna and Elk Grove Creeks, Sacramento County, California. Report to Sacramento County Planning Dept. 15 pp.

Hansen, G.E. 1988. Review of the status of the GGS (*Thamnophis couchi gigas*) and its supporting habitat during 1986-1987. Final report for CDFG, Contract C-2060. Unpublished. 31 pp.

Hansen, G.E. 1996. Status of the Giant Garter Snake (*Thamnophis gigas*) in the San Joaquin Valley in 1995. Final report for CDFG, Standard Agreement No. FG4052IF. Unpublished. 31 pp.

Hansen G.E., and J.M. Brode. 1980. Status of the giant garter snake, *Thamnophis couchi gigas* (Fitch). California Department of Fish and Game. Inland Fisheries Endangered Species Program Special Publication Report No. 80-5. 14 pp.

Hansen G.E., and J.M. Brode. 1993. Results of relocating canal habitat of the GGS (*Thamnophis gigas*) during widening of State Route 99/70 in Sacramento and Sutter counties, California. Final report for Caltrans Interagency Agreement 03E325 (FG7550) (FY 87/88-91-92). Unpublished. 36 pp.

Hansen, R.W. 1980. Western aquatic garter snakes in central California: an ecological and evolutionary perspective. Master's thesis, Department of Biology, California State University, Fresno. 78 pp.

Hansen, R.W., and G.E. Hansen. 1990. *Thamnophis gigas*. Reproduction. *Herpetological Review* 21(4):93-94. Hansen, R.W., and R.L. Tremper. 1993. Amphibians and reptiles of Central California. California Natural History Guides. University of California Press, Berkeley. 11 pp.

Harlow, D.L., and P.H. Bloom. 1989. Buteos and the golden eagle. Pages 102-110 *in* B.G. Pendleton, ed. Proceedings of the western raptor management symposium and workshop. National Wildlife Federation Scientific and Technical Series No. 12. Washington, D.C.

Harvey, M.J., J.S. Altenbach, and T.L. Best. 1999. *Bats of the United States*. Arkansas Game and Fish Commission in cooperation with the U.S. Fish and Wildlife Service.

Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. The Burrowing Owl (*Speotyto cunicularia*). (A.P. Gill, Ed.) Washington, D.C.: The American Ornithologists' Union.

Haug, E.A. and L.W. Oliphant. 1990. Movements, Activity Patterns, and Habitat Use of Burrowing Owls in Saskatchewan. J*ournal of Wildlife Management*, 54, 27–35.

Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. The Burrowing Owl (*Speotyto cunicularia*). In Poole, A. and F. Gill (editors). The birds of North America, No. 61. Philadelphia: The Academy of Natural Sciences; Washington, D.C. and The American Ornithologists' Union. Washington, D.C.

Hawbecker, A.C. 1942. A life history study of the White-tailed Kite. *Condor* 44: 267-276.

Henry, M.E. 1983. Home range and territoriality in breeding White-tailed Kites. Master's thesis, San Diego State Univ., San Diego, California.

Hayes, M.P., and M.R. Jennings. 1986. Decline of ranid frog species in western North America: are bullfrogs (*Rana catesbeiana*) responsible? *Journal of Herpetology* 20:490-509.

Hays, D.W., K.R. McAllister, S.A. Richardson, and D.W. Stinson. 1999. Washington State Recovery Plan for Western Pond Turtle. Washington Department of Fish and Wildlife, Olympia, Washington.

Heady, H.F. 1977. Valley Grassland. Pp. 491-514 *In*: M. G. Barbour and J. Major (Editors). Terrestrial vegetation of California. California Native Plant Society, Special Publication No. 9.

Helm, B. 1998. Biogeography of eight large branchiopods endemic to California. Pp. 124-139 *In*: Witham, C. W., E. T. Bauder, D. Belk, W. R. Ferrin Jr., and R. Orduff (eds.) Ecology, conservation, and management of vernal pool ecosystems − proceedings from a 1996 conference. California Native Plant Society, Sacramento, California. 285 pp.

Herzog, S.K. 1996. Wintering Swainson's Hawks in California's Sacramento-San Joaquin River Delta. *Condor,* 98: 876-879.

Hickman, J.C. (ed.) 1993. The Jepson Manual. Higher Plants of California. University of California Press, Berkeley, California.

Hoffmeister, D., and W.L. Downes. 1964. Blue jays as predators of red bats. *Southwestern Naturalist* 9(2):102-109.

Holland, D. 1985. An ecological and quantitative study of the western pond turtle (*Clemmys marmorata*) in San Luis Obispo County, California. Master's Thesis, California State University Fresno, Fresno, California. 181 pp.

Holland, D. 1991a. A synopsis of the ecology and status of the western pond turtle (*Clemmys marmorata)* in 1991. Unpublished report for the US Fish and Wildlife Service, National Ecology Research Center., San Simeon, California. 146 pp.

Holland, D. 1991b. Status and reproductive dynamics of a populations of western pond turtles (*Clemmys marmorata*) in Klickitat County, Washington in 1991. Report prepared for Washington Department of Wildlife. 40 pp.

Holland, D. 1992. A synopsis of the distribution and current status of the western pond turtle (*Clemmys marmorata*) in Oregon. Report prepared for Oregon Department of Fish and Wildlife. 41 pp.

Holland, D. 1994. The western pond turtle: habitat and history. Prepared for U.S. Department of Energy Bonneville Power Administration, DOE/BP-62137-1. Wildlife Diversity Program, Oregon Department of Fish and Wildlife, Portland, Oregon.

Holland, R.F. 1978. The geographic and edaphic distribution of vernal pools in the Great Central Valley, California. California Native Plant Society Special Publication No. 3; or Special Publication No. 4 pages 1-12. California Native Plant Society. Berkeley, California.

Holland, R.F. 1983. Endangerment status of *Legenere limosa* (Greene) McVaugh in California. Submitted to the California Natural Diversity Database, Department of Fish and Game. Sacramento, California.

Holland, R.F. 1987. What constitutes a good year for an annual plant? Two examples from the Orcuttieae. *In:* T.S. Elias, (Ed.) Conservation and Management of Rare and Endangered Plants, California Native Plant Society, Sacramento.

Holland, R. F. 1998. Great Valley vernal pool distribution, photorevised in 1996. Pages 71-75 I*n*: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Editors). Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, CA. 1998.

Holland, R.F. 1998b. No net loss? Changes in Great Valley vernal pool distribution from 1989 to 1997. Prepared for the California Department of Fish and Game, Natural Heritage Division, Sacramento, California.

Holland, R.F. 2008. Great Valley Vernal Pool Distribution, RePhotorevised in 2005. A PowerPoint presentation to the Sacramento Fish and Wildlife Office on 10-15-2008.

Holland, R. F. 2009. Great Valley Vernal Pool Distribution RePhotorevised in 2005. Prepared for Placer Land Trust, Auburn, California. December 2009. 20 pages.

Holland, R.F., and V.I. Dains. 1990. The edaphic factor in vernal pool vegetation. Pp. 31-48 *in:* Ikeda, D.H., and R.A. Schlising (Eds.). Vernal pool plants: their habitat and biology. Studies from the Herbarium, CSU Chico, California. Number 8.

Holland, R.F., and S. Jain. 1981. Insular biogeography of vernal pools in the Central Valley of California. *The American Naturalist* 117(1): 24-37.

Holland, R. F., and S. Jain. 1988. Vernal Pools. Pages 515–553 *in:* M.G. Barbour and J. Major (eds.), Terrestrial vegetation of California, 2nd edition, California Native Plant Society, Special Publication No. 9. California Native Plant Society, Sacramento, California.

Holt R.D. and T.H. Keitt. 2000. Alternative causes for range limits: a metapopulation perspective. *Ecology Letters* 3:41-42.

Hosea, R.C. 1986. A population census of the Tricolored Blackbird, Agelaius tricolor (Audubon), in four counties in northern Central Valley of California. M.S. thesis. California State University, Sacramento, California.

Hunt, G.L. 1972. Influence of food distribution and human disturbance on the reproductive success of herring gulls. *Ecology*, Vol. 53, No. 6, 1051-1061.

Hunting, K. 2001. Ferruginous hawk (*Buteo regalis*). Species account for the CalPIF Grassland Bird Conservation Plan. http://www.prbo.org/calpif/htmldocs/species/grassland/ fehaacct.html.

Huxel, G. 2000. The effect of the Argentine ant on the threatened valley elderberry longhorn beetle. *Biological Invasions,* 2:81-85.

Ikeda, D.H., and R.A. Schlising (Eds.). Vernal pool plants: their habitat and biology. Studies from the Herbarium, CSU Chico, California. Number 8.

Ivey, G.L., C.P. Herziger. 2003. Sandhill crane monitoring at Staten Island, San Joaquin County, California, 2002-03. A survey for The Nature Conservancy, Galt, California.

Jackson, S.D., and C.R. Griffin. 2000. A Strategy for mitigating highway impacts on wildlife. Pages 143–159 *In* Messmer, T.A., and B. West, (eds) Wildlife and highways: seeking solutions to an ecological and socio-economic dilemma. The Wildlife Society.

Jennings, M.R. 1988. Natural history and decline of native ranids in California. Pages 61-72 *in*: H. F. DeLisle, P. R. Brown, B. Kaufman, and B. M. McGurty (Eds). Proceedings of the conference on California Herpetology, Southwestern Herpetologists Society.

Jennings, M.R., and M.P. Hayes. 1994. Amphibian and reptile species of concern in California. Final report to California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

Johnson, B.S. 1997a. Characterization of population and family genetics of the burrowing owl by DNA fingerprinting with pV47-2. Pages 58–63 *in* J.L Lincer and K. Steenhof (Eds.). The burrowing owl, its biology and management. Raptor Research Report No. 9.

Johnson, B.S. 1997b. Reproductive success, relatedness, and mating patterns of colonial burrowing owls. Pages 64-67 in J.L Lincer and K. Steenhof (Eds.). The burrowing owl, its biology and management. Raptor Research Report No. 9.

Johnson, B.S. 1997c. Demography and population dynamics of the burrowing owl. Pages 28–33 *in* J.L. Lincer and K. Steenhof (eds.). The burrowing owl, its biology and management. Raptor Research Report No. 9.

Johnson, B.S. 1997. Demography and population dynamics of the burrowing owl. Pages 28-33 *in* J.L and K. Steenhof (Eds). The Burrowing owl, its biology and management: including the Proceedings of the First International Symposium. Raptor Research Report Number 9.

Johnson, C.G., L.A. Nickerson, and M.J. Bechard. 1987. Grasshopper consumption and summer flocks of non-breeding Swainson's Hawks. *Condor,* 89: 676-678.

Johnson, J.R., M.E. Ryan, S. J. Micheletti, and H.B. Shaffer. 2013. Short pond hydroperiods decreases fitness of nonnative hybrid salamanders in California. *Animal Conservation* 13: 1-10.

Johnson, S., G. Haslam, and R. Dawson. 1993. The Great Central Valley, California's Heartland. University of California Press, Berkeley.

Jones and Stokes. 1990. Sacramento vernal pools, their distribution, classification, ecology, and management. Prepared for Sacramento Planning and Community Development Department. Sacramento, California.

Katibah, E. E., K. J. Dummer, and N. E. Nedeff. 1984. Current condition of riparian resources in the Central Valley of California. Pages 314-321 *in* R. E. Warner and K. M. Hendrix, editors. California Riparian Systems: Ecology, Conservation, and Productive Management. University of California Press, Berkeley, California.

Katibah, E.F. 1981. A brief history of riparian forests in the Central Valley of California. Paper presented at the California Riparian Systems Conference. (UC Davis Sep. 1981). Davis, California.

Kauffman, J.B., and W.C. Krueger. 1984. Livestock impacts on riparian ecosystems and streamside management implications; A review. *Journal of Range Management* 37(5):430-438.

Kaye, T., W. Messinger, S. Massey, and R Meinke. 1990. *Gratiola heterosepala*: inventory and breeding system evaluation. Unpublished report to the U.S. Bureau of Land Management, Lakeview, Oregon.

Keeler-Wolf, T., D.R. Elam, K. Lewis and S.A. Flint. 1998. California vernal pool assessment preliminary report. California Department of Fish and Game, Sacramento, California. 159 pages.

Keeley, J.E. 1981. Photosynthetic characteristics of certain vernal pool species. Pp. 218-222 *in:* S. Jain and P. Moyle, (Eds). Vernal pools and intermittent streams. Institute of Ecology No. 28, University of California, Davis.

Keeley, J.E. 1988. Anaerobiosis and fungi in the germination of two vernal pools grasses. *American Journal of Botany,* 75:1086-1089.

Keeley, J.E., 1990. Photosynthesis in vernal pool macrophytes: relation of structure and function. *In*: Vernal Pool Plants-Their Habitat and Biology. Studies from the Herbarium, California State University, Chico. Number 8.

Keeley, J.E. 1990. Photosynthesis in vernal pool macrophytes: relations of structure and function. Pp. 31-48 *in:* Ikeda, D.H., and R.A. Schlising (Eds.). Vernal pool plants: their habitat and biology. Studies from the Herbarium, CSU Chico, California. Number 8.

Keeley, J.E. 1998. C4 photosynthetic modifications in the evolutionary transition from land to water in aquatic grasses. *Oecologia* 116(1-2): 85-97.

Keeley, J.E., and P.H. Zedler. 1998. Characterization and Global Distribution of Vernal Pools. Pages 1-14 *in*: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Eds). Ecology, conservation, and management of vernal pool ecosystems – proceedings from a 1996 conference. California Native Plant Society, Sacramento, CCA. 1998.

Kelly, P.A., and J. T. Rotenberry. 1993. Buffer zones for ecological reserves in California: replacing guesswork with science. Pages 85–92 *In* Interface between ecology and land development in California. J. E. Keeley, ed. Southern California Academy of Sciences, Los Angeles, California:

Kelsey, R. 2008. Results of the Tricolored Blackbird 2008 Census. Audubon California, Winters, CA.

Keran, D. 1981. The incidence of man-caused and natural mortalities to raptors. *Journal of Raptor Research,* 15:108-112.

Keymer, J.E., P.A. Marquet, J.X. Velasco-Hernandez, and S.A. Levin. 2000. Extinction thresholds and metapopulation persistence n dynamic landscapes. *The American Naturalist* 156(5): 479-494.

King, J.L. 1996. The evolution of diversity in ephemeral pools crustaceans: from genes to communities. PhD Dissertation, Department of Zoology, University of California, Davis, California. 207 pp.

King, J.L. and Hanner, R. 1998. Cryptic species in a "living fossil" lineage: taxonomic and phylogenetic relationships within the genus *Lepidurus* (Crustacea: Notostraca) in North America. *Molecular Phylogenetics and Evolution*. 10(1). 23-36.

Klein, M.L. 1993. Waterbird Behavioral Responses to Human Disturbance. Wildlife Society Bulletin, Vol. 21, Number. 1, 31-39.

Kleinschmidt Associates. 2008. Cosumnes River Management Plan. Prepared for Cosumnes River Preserve. Cosumnes River Preserve, Galt, Ca.

Kneitel JM, Lessin CL. 2010. Ecosystem-phase interactions: aquatic eutrophication decreases terrestrial plant diversity in California vernal pools. *Oecologia*. 163(2): 461-9.

Kreissman, B. 1991. California: An Environmental atlas and guide. Bear Klaw Press, Davis, California. 255 pages.

Kyle, C.J., R.D. Weir, N.J. Newhouse, H. Davis, and C. Strobeck. 2004. Genetic Structure of Sensitive and Endangered Northwestern Badger Populations (*Taxidea taxus taxus* and *T. t. jeffersonii*). *Journal of Mammalogy*, Vol. 85, No. 4 (Aug., 2004), pp. 633-639.

Kyle, K., and R. Kelsey. 2011. Results of the 2011 Tricolored Blackbird Statewide Survey. Sacramento, CA: Audubon California.

Larry Walker Associates. 2015. Sacramento Valley Water Quality Coalition Monitoring and Reporting Program, 2014 Annual Monitoring Report. Davis, California: Larry Walker Associates. May 2015.

Larsen, C. J. 1987. Badger distribution study. California Department of Fish and Game, Nongame Wildlife Investigations Report, Proj. W-65-R-4, Job I-11.

Laudenslayer, Jr., W.F. and M.D. Parisi. 2007. Species Notes for American Badger (*Taxidea taxus*): California Wildlife Habitat Relationships (CWHR) System Level II Model Prototype. California Department of Fish and Game, California Interagency Wildlife Task Group, October, 2007. Accessed April 27, 2010 online at http://www.dfg.ca.gov/ biogeodata/cwhr/downloads/Level_II/Notes/II_American_Badger.pdf.

Le Corre M., A. Ollivier, S. Ribes, P. Jouventin. 2002. light-induced mortality of petrels: a 4-year study from Reunion Island (Indian Ocean). *Biological Conservation*, Vol 105, 93- 102.

Lefranc, N. 1997. Shrikes: a guide to the shrikes of the world. Yale University Press. New Haven and London. 192 pp.

Lehman, R.N., P.L. Kennedy, and J.A. Savidge. 2007. "The state of the art in raptor electrocution research: a global review." *Biological Conservation* 136:159–174.

Leibowitz, S.G. and Brooks, R.T. 2008. Hydrology and landscape connectivity of vernal pools. Pages 31-53 *in* A.J.K. Calhoun and P.G. de Maynadier (Eds.) Science and conservation of vernal pools in Northeastern North America. CRC Press, New York:

Lesica, P., and F.W. Allendorf. 1995. When are peripheral populations valuable for conservation? *Conservation Biology.* 9(4):753-760.

Lewis, J.C. 1974. Ecology of the sandhill crane in the southeastern central flyway. Dissertation. Oklahoma State University, Stillwater. 214 pp.

Lima, S.L, and L.M. Dill. 1990. Behavioral decisions made under the risk of predation: a review and prospectus. *Canadian Journal of Zoology*, 68, 619-640.

Lindzey, F. G. 1982. Badger, *Taxidea taxus*. Pp. 653–663 in J.A. Chapman and G.A. Feldhamer, eds.). Wild mammals of North America: biology, management, and economics. The Johns Hopkins University Press, Baltimore, Maryland.

Linsley, E.G. and J. A. Chemsak. 1972. Cerambycidae of North America, Part VI, No.1: The taxonomy and classification of the subfamily Lepturinae. *University of California Publications in Entomology*, 69:1-138.

Linsley, E.G. and J. A. Chemsak. 1997. Cerambycidae of North America, Part VIII. Bibliography, Index and Host Plant Index. *University of California Publications in Entomology*, 117:1-534.

Linzey, F. G. 1978. Movement patterns of badgers in northwestern Utah. *Journal of Wildlife Management*. 42:418-422.

Lindzey, F. G. (1982). "Badger: *Taxidea taxus*", pp. 653–663 in J.A. Chapman and G.A. Feldhamer (Eds). Wild mammals of North America: biology, management, and economics. The Johns Hopkins University Press. Baltimore, MD:

Littlefield, C. D. 1989. Status of sandhill crane breeding populations in California, 1988. California Department of Fish and Game Nongame Bird and Mammal Section Rept. Sacramento, California.

Littlefield, C.D. 1993. Annual assessment and monitoring report for grater sandhill cranes and other threatened and endangered species on the Little Dry Creek, California. California Dept. of Fish and Game, Rancho Cordova, California.

Littlefield, C.D., and G.L. Ivey. 2000. Conservation assessment for greater sandhill cranes wintering on the Cosumnes River Floodplain and Delta Region of California. The Nature Conservancy.

Littlefield, C.D., S.P. Thompson, and B.D. Ehlers. 1984. History and present status of Swainson's Hawks in southeast Oregon. *Journal of Raptor Research*, 18: 1-5.

Lloyd, H. 1937. Twenty-year-old Ferruginous Rough-legged Hawk. *Can. Field-Nat.* 51: 137.

Long, C. A. 1972. Taxonomic revision of the North American badger, *Taxidea taxus*. *Journal of Mammalogy*, 53:725-759.

Long, C. A. 1973. *Taxidea taxus*. Mammal Species 26: 1-4. *American Society of Mammologists*. June 13.1973

Longcore, T., and C. Rich. 2004. "Ecological Light Pollution." *Frontiers in Ecology and the Environment* 2:191–198.

Loredo, I., and D. Van Vuren. 1996. Reproductive ecology of a population of the California tiger salamander. *Copeia,* 1996(4): 895-901.

MacWhirter, R.B. 1985. Breeding ecology, prey selection, and provisioning strategies of northern harriers *Circus cyaneus* (L.). Honor's thesis, Mount Allison University, Sackville, NB.

MacWhirter, R.B. 1994. Offspring sex ratios, mortality, and relative provisioning of daughters and sons in the northern harrier (*Circus cyaneus*). Ph.D. Dissertation, Ohio State University, Columbus.

MacWhirter, R.B., and K.L. Bildstein. 1996. Northern harrier (*Circus cyaneus*) in A. Poole and F. Gill (eds.), the birds of North America. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Mannan, R.W., W.A. Estes, and W.J. Matter. 2004. Movements and survival of fledgling Cooper's Hawks in an urban environment. *Journal of Raptor Research* 38:26-34.

Marlow, C.B., and T.M. Pogacnik. 1985. Time of grazing and cattle-induced damage to streambanks. Pages 279-284, *In*: R.R. Johnson, C.D. Ziebell, Patton, D. R., P.F. Folliott, and R.H. Hamre (technical coordinators) Riparian Ecosystems and Their Management: Reconciling Conflicting Uses. First North American Riparian Conference. United States Department of Agriculture, National Forest Service, General Technical Report RM-120.

Marsh, D.M. and P.C. Trenham. 2001. Metapopulation dynamics and amphibian conservation. *Conservation Biology,* 15(1): 40-49.

Martin, J.W. 1987. Behavior and habitat use of breeding Northern Harriers in southwestern Idaho. *Journal of Raptor Research,* 21:57-66.

Martin, J.W. 1989. Harriers and kites. Pages 83-91 *In* Proceedings of the western raptor management symposium and workshop. National Wildlife Federation, Washington, D.C.

Marty, J. 2004. Managing for diversity in California vernal pool grasslands. Presentation Abstracts. Ecology and Management of California Grasslands. April 2–3, 2004, University of California at Berkeley.

Mason, H.L. 1957. Flora of the marshes of California. University of California Press, Berkeley and Los Angeles, California.

McCabe, T.T. 1932. Wholesale poison for the red-wings. *Condor,* 34:49-50.

McDonald, Phillip M. 1985. (revised 1998). Distributional data on *Quercus douglasii* Hook & Arn. Fagaceae – Beech family. U.S. Department of Agriculture, Forest Service- Northeastern Area. St Paul. MN. http://www.na.fs.fed.us/spfo/pubs/silvics_manual/ volume_2/quercus/douglasii.htm.

Meese, R.J. 2013. Chronic low reproductive success of the colonial Tricolored Blackbird from 2006 to 2011. *Western Birds* 44: 98-113.

Meese, R,J. 2014. Results of the 2014 tricolored blackbird statewide survey. University of California Davis, Department of Environmental Science & Policy. Davis, CA. July 31, 2014. 17pages.

Meese, R,J. 2017. Results of the 2017 tricolored blackbird statewide survey. University of California Davis, Department of Environmental Science & Policy. Davis, CA. November 8, 2017. 39 pages.

Messick, J. P. 1987. North American badger. Pages 584-597 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch (Eds). Wild furbearer management and conservation in North America. Ontario Ministry of Nat. Resources.

Messick, J. P., and M. G. Hornocker. 1981. Ecology of the badger in southwestern Idaho. *Wildlife Monographs* 76:1-53.

Miller, A.H., and R.C. Stebbins. 1964. The lives of desert animals in Joshua Tree National Monument. University of California Press, Berkeley. 452 pp.

Minta, S. C. 1993. Sexual differences in spatio-temporal interaction among badgers. *Oecologia* 96:402-409.

Moore, K.R., and C.J. Henny. 1984. Age-specific productivity and nest site characteristics of Cooper's Hawks (*Accipiter cooperii*). *Northwest Sci.* 58:290-299.

Morey, S.R. 1988. Western spadefoot *Scaphiopus hammondi*. Pages 56-57 *in*: D. C. Zeiner, W. F. Laudenslayer, Jr., and K. E. Mayer, editors. California's wildlife. Volume 1: Amphibians and reptiles, California Statewide wildlife habitat relationships system, California Department of Fish and Game, Sacramento, California.

Morey, S.R. 1998. Pool duration influences age and body mass at metamorphosis in the western spadefoot toad: implications for vernal pool conservation. Pages 86-91 *In* Witham, C.W., E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Editors). Ecology, Conservation, and management of vernal pool ecosystems proceedings from a 1996 conference. California Native Plant Society, Sacramento, California. 1998.

Morey, S.R. and D.A. Guinn. 1992. Activity patterns, food habits, and changing abundance in a community of vernal pool amphibians. Pp. 149-157 *In* Williams, D.F., S. Byrne, T.A. Rado (Eds). Endangered and Sensitive Species of the San Joaquin Valley, California. California Energy Commission, Sacramento, California. 1992.

Morreale, S.J., J.W. Gibbons, and J.D. Congdon. 1984. Significance of activity and movement in the yellow-bellied slider turtle (*Pseudemys scripta*). *Canadian Journal of Zoology* 62:1038-1042.

Moyle, P.B. 1973. Effects of introduced bullfrogs, *Rana catesbeiana*, on the native frogs of the San Joaquin Valley, California. *Copeia* 1973 (1):18-22.

Murphy, R.K., M.W. Gratson, and R.N. Rosenfield. 1988. Activity and habitat use by a breeding male Cooper's hawk in a suburban area. *Journal of Raptor Research* 22: 97-100.

Naiman, R. J., and H. Décamps. 1997. The ecology of interfaces: riparian zones. *Annual Review of Ecology and Systematics,* 28:621-658.

Naiman, R. J., H. Décamps, and M. Pollock. 1993. The role of riparian corridors in maintaining regional biodiversity. *Ecological Applications,* 3:209-212.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1 NatureServe, Arlington, Virginia, USA: Nature Serve. Available: http://www.natureserve.org/explorer. Accessed: March 22, 2013.

Neff, J.A. 1937. Nesting distribution of the tricolored red-wing. *Condor,* 39:61-81.

Nesbitt, S.A. and D.T. Gilbert. 1976. Powerlines and fences: hazards to birds. *Florida Naturalist,* 49(2):23.

Newhouse, N.J. and T.A. Kinley. 2000. Update COSEWIC status report on the American badger *Taxidea taxus* in Canada. Pages 1-26 in COSEWIC assessment and status report on the American badger *Taxidea taxus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario, Canada.

Noss, R.F., M.A. O'Connell, and D.D. Murphy. 1997. The Science of conservation planning: habitat conservation planning under the Endangered Species Act. Covelo, CA: Island Press.

Noss, R.F., E. Dinerstein, B. Gilbert, M. Gilpin, B. J. Miller, J. Terborgh, and S. Trombulak. 1999. Core areas: where nature reigns. Pages 99-128 *in* M. E. Soulê and J. Terborgh (Eds) Continental conservation: scientific foundations of regional reserve networks. Island Press. Washington, D.C., USA.

Noss R.F.; R. Amundson, M. Barbour, R. Bugg, B. Cypher, R. Grosberg, T. Hanes, R. Hansen, B. Pavlik, and K. Rice. 2002. Report of science advisors for the eastern Merced County Natural Community Conservation Plan and Habitat Conservation Plan. Unpublished Report.

Nyhof, P.E. 2013. Basking western pond turtle response to trail use in Mountain View, California. Thesis. San Jose State University, San Jose, California. 85 pages. Accessed online, May 1, 2018, at: http://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=7849&context= etd_theses .

O'Shea, T.J., M.A. Bogan, and L. E. Ellison. 2003. Monitoring trends in bat populations of the United States and territories: status of the science and recommendations for the future. *Wildlife Society Bulletin* 31(1):16-29.

Orians, G.H. 1961. Social stimulation within blackbird colonies. *Condor,* 63:330-337.

Orians, G.H. 1980. Some adaptations of marsh-nesting blackbirds. Monographs in Population Biology. Princeton University Press, Princeton, New Jersey.

Orloff, S.G. 2007. Migratory movements of California tiger salamander in upland habitat – A five-year study, Pittsburg, California. Prepared for Bailey Estates LLC. 47pp.

Orloff, S.G. 2011. Movement patterns and migration distances in an upland population of California tiger salamander (*Ambystoma californiense*). *Herpetological Conservation and Biology* 6(2): 266-276.

Orr, R.T. 1950. Notes on the seasonal occurrence of red bats in San Francisco. *Journal of Mammalogy* 31(4):457-458.

Palmer, R. S. 1988. Handbook of North American birds; volume 5. Yale University Press, New Haven, Connecticut. 465 pp.

Pandolfino, E.R. 2008. "Population trends of the loggerhead shrike in California: Possible Impact of West Nile Virus in the Central Valley." *CVBC Bulletin* 11(2):37–44. Accessed July 15, 2014.

Payne, R. 1969. Breeding seasons and reproductive physiology of tricolored blackbirds and red-winged blackbirds. A University of California Publication. *Zoology*, 90:1-115.

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press.

Petrovic, A.M. 1990. The fate of nitrogenous fertilizers applied to turfgrass. *Journal of Environmental Quality* 19: 1-14.

Pfennig, D.W. 1992. Polyphenism in spadefoot toad tadpoles as a local evolutionary stable strategy. *Evolution* 46(5): 1408-1420.

Pierson, E.D., W.E. Rainey, and C. Corben. 1999. [Abs.]. The western red bat, *Lasiurus blossevillii* – implications of distribution for conservation. *Bat Research News* 40(4):187.

Pierson, E.D., P.W. Collins, W.E. Rainey, P.A. Heady, and C. J. Corben. 2002. Distribution, status, and habitat associations of bat species on Vandenberg Air Force Base, Santa Barbara County, California. Santa Barbara Museum of Natural History Technical Reports – No. 1

Pierson, E.D., W.E. Rainey, and C. Corben. 2004. Distribution and status of red bats, *Lasiurus blossevillii* in California. Report to Species Conservation and Recovery Program, Habitat Conservation Planning Branch, California Department of Fish and Game, Sacramento, California. 40 pp.

Plantenkamp, G.A.J. 1998. Patterns of vernal pool biodiversity at Beale Air Force Base. Pp 38- 49 *in:* C. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Eds.) Ecology, Conservation, and Management of Vernal Pool Ecosystems. Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, California.

Platts, W.S. 1981. Influence of forest and rangeland management on anadromous fish habitat in western North America - effects of livestock grazing. General Technical Report PNW-124. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 25 pp.

Plumpton, D.L., and D.E. Andersen. 1997. Habitat use and time budgeting by wintering Ferruginous hawks. Condor 99:888-893.

Pogson, T.H. 1990. Distribution, abundance, and behavior of greater sandhill cranes, *Grus Canadensis tabida,* wintering in California's Central Valley. M.S. Thesis, University of Alaska, Fairbanks, Alaska.

Pogson, T.H., and S.M. Lindstedt. 1988. Abundance, distribution, and habitat of Central Valley population greater sandhill cranes during winter. Unpublished report. Biology and Wildlife, University of Alaska, Fairbanks.

Polite, C. 2005. Life history account for white-tailed kite. California Wildlife Habitat Relationships Program, California Department of Fish and Wildlife, Sacramento, California. Accessed online, March 28, 2018 at: https://nrm.dfg.ca.gov/taxaquery/SpeciesDocumentList.aspx?AssociatedItemID=856&STitle=Elanus+leucurus&PTitle=white-tailed%2bkite

Pollack, O. and T. Kan. 1998. The use of prescribed fire to control invasive exotic weeds at Jepson Prairie Preserve. Pages 241-249 in: CW Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr. and R. Ornduff (Eds) Ecology, conservation, and management of vernal pool ecosystems - proceedings from a 1996 conference. California Native Plant Society, Sacramento. CA.

Pough, F.H., R.M. Andrews, J.E. Cadle, M.L. Crump, A.H. Savitzky, and K.D. Wells. 2001. Herpetology. Prentice Hall, Upper Saddle River, NJ. 612 pp.

PRBO (Point Reyes Bird Observatory. 2002. Tricolored blackbird survey report 2001. Prepared for U.S. Fish and Wildlife Service, Portland, Oregon.

Primack, R.B. 1993 Essentials of Conservation Biology. Sinauer Associates, Inc. Sunderland, Massachusetts.

Prugh L.R., C.J Stoner, C.W. Epps, W.T. Bean, W.J. Ripple, A.S. LaLiberte, and J.S. Brashares. 2009. The rise of the mesopredator. *BioScience*. 59(9):779-791.

Pulliam, H. R. 1988. Sources, sinks, and population regulation. *The American Naturalist* 132:652-661.

Quinn, J.H. Y.A. Girard, K. Gilardi, Y. Hernandez, R. Poppenga, B.B. Chomel, J.E. Foley, and C.K. Johnson. 2012. Pathogen and rodenticide exposure in American badgers (*Taxidea taxus*) in California. *Journal of Wildlife Diseases*: April 2012, Vol. 48, No. 2, pp. 467–472.

Rahmea, A.H., A.S. Harestad, and F.L. Bunnell. 1995. Status of the badger in British Columbia. British Columbia Ministry of Environment, Lands and Parks, Wildlife Working Report WR-72:1-51.

Rains, M.C., G.E. Fogg, T. Harter, R.A. Dahlgreen, and R.J. Williamson. 2006. The role of perched aquifers in hydrological connectivity and biogeochemical processes in vernal pool landscapes, Central Valley, California. *Hydrobiological Processes* 20(5):1157-1175.

Rains, M.C., G.E. Fogg, T. Harter, R.A. Dahlgreen, and R.J. Williamson. 2008. Geological control of physical and chemical hydrology in California vernal pools. Wetlands 28(2):347-362.

Rathbun, G.B., N. Siepel, and D. Holland. 1992. Nesting behavior and movements of western pond turtles, *Clemmys marmorata*. *The Southwestern Naturalist* 37(3)319-324.

Rathbun, G.B., N.J. Scott, and T.G. Murphey. 2002. Terrestrial habitat use by pacific pond turtles in a Mediterranean climate. The Southwestern Naturalist, 47, 225-235.

Redford, K.H., and B.D. Richter. 1999. Conservation of biodiversity in a world of use. *Conservation Biology* 13(6) 1246-1256.

Reese, D.A., and H.H. Welsh. 1997. Use of terrestrial habitat by western pond turtles, *Clemmys marmorata*: implications for management. Pp. 352-357 *in* J. Van Abbema (Ed) Proceedings: conservation, restoration, and management of tortoises—an international conference. State University of New York, Purchase, New York.

Reese, D.A., and H.H. Welsh. 1998. Habitat use by western pond turtles in the Trinity River, California. *Journal of Wildlife Management* 62:842-853.

Reiner, R. & F. T. Griggs. 1989. TNC undertakes riparian forest restoration projects in California. *Restoration Management Notes* **7**:3 8.

Reiner, R., and R. Swenson. 2000. Saving Vernal Pools on the Cosumnes River Watershed. *Fremontia* 28(1):33-37.

Remsen, J.V. 1978. Bird Species of Special Concern in California. California Department of Fish and Game, Wildlife Management Branch Admin. Report, No. 78-1. 54pp.

Reynolds, R. T., and H. M. Wight. 1978. Distribution, density, and productivity of accipiter hawks breeding in Oregon. *Wilson Bulletin,* 90:182-96.

Riley, S.P.D., H.B. Shaffer, S.R. Voss, and B.M. Fitzpatrick. 2003. Hybridization between rare, native tiger salamanders (*Ambytoma californiense*) and its introduced cogener. *Ecological Applications,* 13(5):1263-1275.

Robins, J.D. and J.E. Vollmar, 2002 Livestock Grazing and Vernal Pools *In* Wildlife and Rare Plant Ecology of Eastern Merced County's Vernal Pool Grassland. Vollmar Consulting. Berkeley, California.

Rogers, D.C. 1998. Aquatic macroinvertebrate occurrences and population trends in constructed and natural vernal pools in Folsom, California. Pages 224-235 *In*: Witham, C. W., E. T. Bauder, D. Belk, W. R. Ferrin Jr., and R. Orduff (Eds.). Ecology, conservation, and management of vernal pool ecosystems − proceedings from a 1996 conference. California Native Plant Society, Sacramento, California.

Rogers, D.C. 2001. Revision of the nearctic *Lepidurus* (Notostraca). *Journal of Crustacean Biology* 21: 991–1006.

Rogers, D.C. 2002. Distribution and habitat parameter surveys B*ranchinecta mesovallensis* (Crustacea: Branchiopoda: Anostraca). Report to US Fish and Wildlife Service. Unpublished. Jones and Stokes Associates, Sacramento, CA.

Rogers, D.C. *In review*. Distribution and habitat parameter surveys for the fairy shrimp *Branchinecta mesovallensis* (Crustacea: Branchiopoda: Anostraca). Submitted to *Zootaxa*.

Rogers, D.C. *In prep*. Dispersal agents and speciation in the Branchiopoda (Crustacea).

Rogers D.C. 2014. Larger hatching fractions in avian dispersed anostracan eggs (Branchiopoda). *Journal of Crustacean Biology* 34: 135–143.

Ronan, N.A. 2002. Habitat selection, reproductive success, and site fidelity of burrowing owls in a grassland ecosystem

Rosen, P., and C. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of Southern Arizona. *Biological Conservation* 68(1994): 143-148.

Rosenberg, D.K., and K.L. Haley. 2004. The ecology of burrowing owls in the agroecosystem of the Imperial Valley, California. Studies in Avian Biology 27:120-135.

Rosenberg, D.K., J. Gervais, H. Ober, and D. DeSante. 1998. An adaptive management plan for the burrowing owl population at Naval Air Station Lemoore, Lemoore, California. The Institute for Bird Populations. Point Reyes Station, California. Publication No. 95.

Rosenfield, R.N., J. Bielefeldt, L.J. Rosenfield, S.J. Taft, R.K. Murphy, A.C. Stewart. 2002. Prevalence of *Trichomonas gallinae* in nestling Cooper's hawks among three North American populations. *The Wilson Bulletin*, 114(1):145-147.

Rosenfield, R.N., and J. Bielefeldt. 1993. Cooper's hawk (*Accipiter cooperii*). *In* The birds of North America, No. 75 (A. Poole and F. Gill, Editors). Philadelphia: The Academy of Natural Sciences, Washington, DC. The American Ornithologists' Union.

Rosenfield, R.N., C.M. Morasky, J. Bielefeldt, and W.L. Loope. 1992. Forest fragmentation and island biogeography, a summary and bibliography. USDI, National Park Service Technical Report 92/08.

Rosenfield, R.N., J. Bielefeldt, R.K. Anderson, and J.M. Papp. 1991. Status reports: Accipiters. Pages 42-49 *in* Proc. Midwest Raptor Management Symposium and Workshop. Natl. Wildl. Fed., Washington, D.C.

Roth, T. C., and S. L. Lima. 2003. Hunting behavior and diet of Cooper's Hawks: an urban view of the small-bird-in-winter paradigm. *Condor* 105:474–483.

Ruibal, R., L. Tevis, Jr., and V. Roig. 1969. The terrestrial ecology of the spadefoot toad *Scaphiopus hammondii*. *Copeia* 1969:571-584.

Safina C. and J. Burger. 1983. Effects of human disturbance on reproductive success in the black skimmer. *The Condor.* 85 (2), Number 2, 164-171.

Sauer, J.R., J.E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Sauer, J.R., D.K. Niven, J.E. Hines, D.J. Ziolkowski, Jr, K.L. Pardieck, J.E. Fallon, and W.A. Link. 2017. The North American breeding bird survey, results, and analysis 1966 - 2015. Version 2.07.2017 U.S. Geological Survey Patuxent Wildlife Research Center, Laurel, Maryland. Accessed online March 28, 2018, at: https://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento, California.

Sawyer, J. O, T. Keeler-Wolf, and J. Evens. 2009. A manual of California vegetation. California Native Plant Society, Sacramento, California.

Schmutz, J.K., S.H. Bretchel, K.D. De Smet, G.L. Hjertaas, G.L. Holroyd, C.S. Houston, and R.W. Nero. 1992. Recovery plan for the ferruginous hawk in Canada. Prepared for Recovery of Nationally Endangered Wildlife (RENEW), Ottawa.

Schmutz, J.K., and D.J. Hungle. 1989. Population of ferruginous and Swainson's hawks increase in synchrony with ground squirrels. *Can. J. Zool.* 67:2598-2601.

Schmutz, J.K., and R.W. Fyfe. 1987. Migration and mortality of Alberta ferruginous hawks. *Condor* 89:169-174.

Scobie, D. 2002. Status of the American badger (*Taxidea taxus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report 43:1-17.

SCS (Soil Conservation Service). 1993. Soil survey of Sacramento County, California; April 1993. United States Department of Agriculture Soil Conservation Service, Sacramento, California.

Searcy, C.A. and H.B. Shaffer. 2008. Calculating biologically accurate mitigation credits: insights from the California tiger salamander. *Conservation Biology* 22(4): 997-1005.

Searcy, C.A. and H.B. Shaffer. 2011. Determining the migration distance of a vagile vernal pool specialist: How much land is required for conservation of California tiger salamanders? Pages 73-87 *In:* D.G. Alexander and R.A. Schlising (Eds), Research and recovery in vernal pool landscapes. Studies from the Herbarium, Number 16. California State University, Chico, California.

Searcy, C.A., H.B. Rollins, and H.B. Shaffer. 2016. Ecological equivalency as a tool for endangered species management. *Ecological Applications* 26(1): 94-103

Seburn, C.N.L., D.C. Seburn, and C.A. Paskowski. 1997. Northern leopard frog (*Rana pipiens*) dispersal in relation of habitat. Pages 64-72 *in* D. M. Green (Ed). Amphibians in decline: Canadian studies of a global problem. Society for the Study of Amphibians and Reptiles, St. Louis, Missouri.

Selleck, D.M., and B. Glading. 1943. Food habits of nesting barn owls and marsh hawks at Dune Lakes, California, as determined by the "cage nest" method. *California Fish and Game* 20:122-131.

Semlitsch, R.D. 1998. Biological delineation of terrestrial buffer zones for pond-breeding salamanders. *Conservation Biology,* 12(5): 1113-1119.

Semlitsch, R.D., and J.R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. *Conservation Biology* 17(5):1219-1228.

Serrentino, P. 1987. The breeding ecology and behavior of northern harriers in Coos County, New Hampshire. Master's thesis, University of Rhode Island, Kingston.

Seymour, R.S. 1973. Energy metabolism of dormant spadefoot toads (*Scaphiopus*). *Copeia* 1973:435-445.

Seymour, R., and M. Westphal. 1994. Final Report - Status and habitat correlates of California tiger salamanders in the eastern San Joaquin Valley: results of the 1994 survey. Report prepared by the Coyote Creek Riparian Station for the U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office. 33 pp.

Shaffer, H.B., and P.C. Trenham. 2004. Family Ambystomatidae: *Ambystoma californiense* Gray, 1853, California Tiger Salamander.

Shaffer, H.B., R.N. Fisher, and S.E. Stanley. 1993. Status report: the California tiger salamander (*Ambystoma californiense*). Final report for the California Department of Fish and Game. 36 pp.

Shaffer, H.B., G.B. Pauly, J.C. Oliver, and P.C. Trenham. 2004. The molecular phylogenetics of endangerment: Cryptic variation and historical phylogeography of the California tiger salamander, *Ambystoma californiense*. Molecular Ecology (2004)13: 3033-3049.

Shump, K.A., and A.U. Shump. 1982. *Lasiurus borealis*. Mammalian Species No. 183, 1-6 pp.

Simmons, R.E., P.C. Smith, and R.B. MacWhirter. 1986. Hierarchies among northern harrier (*Circus cyaneus*) harems and the cost of polygyny. *Journal of Animal Ecology*, 55:755-771.

Small, A. 1994. California birds: their status and distribution. Ibis Publ. Company, Vista, California.

Smith, D.G., and J.R. Murphy. 1973. Breeding ecology of raptors in the eastern Great Basin of Utah. Brigham Young University Scientific Bulletin Bio. Ser. 28:1-76.

Smith, D.G., and J.R. Murphy. 1978. Biology of the ferruginous hawk in central Utah. *Sociobiology* 3:79-98.

Smith, D.W. and Verrill, W.L., 1998. "Vernal pool-soil-landform relationships in the Central Valley, California." *In* C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Eds). Ecology, conservation, and management of vernal pool ecosystems–proceedings from a 1996 Conference. Sacramento, California: California Native Plant Society.

Smith, F.E. 1977. A short review of the status of riparian forests in California. *In:* A. Sands (Ed.). Riparian forests in California: their ecology and conservation. Inst. of Eco. Pub. 15. UC Davis. Davis, California.

Smith, F. 1980. A short review of the status of riparian forests in California. *In*: A. Sands (Ed.), Riparian forests in California: their ecology and conservation. University of California Regents, Berkeley, California.

Solomeshch, A.I., M.G. Barbour, and R.F. Holland. 2007. Vernal pools. Pages 394–424 *In* Barbour M.G, T. Keeler-Wolf, and A.A. Schoenherr (Eds) Terrestrial vegetation of California, 3rd edition. University of California Press, Berkeley, California. .

Soulé, M.E., D.T. Bolger, A.C. Alberts, J. Wright, M. Sorice, S. Hill. 1988. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. *Conservation Biology*. 2(1): 75-92.

Sperry, C.E. 1933. Opossum and skunk eat bats. *Journal of Mammalogy* 14:152-153.

Stabler, M. 1941. The morphology of *Trichomonas gallinae* (= *columbae*). *Journal of Morphology* 69: 501–515. November 1941.

Stacey P.B., M. Taper. 1992. Environmental variation and the persistence of small populations. *Ecological Applications*. 2(1):18-29

Stains, H.J. 1965. Female red bat carrying four young. *Journal of Mammalogy*. 46(2):333.

Stebbins, G.L. 1976. Ecological islands and vernal pools. *Fremontia*. 4(3):12-18.

Stebbins, R.C. 1985. A field guide to western reptiles and amphibians; Second Edition. Houghton Mifflin Company, Boston, Massachusetts. 336 pp.

Stebbins, R.C. 2003. Western reptiles and amphibians. Third Edition, Revised. Houghton Mifflin Company, Boston, Massachusetts .530 pp.

Steenhof, K., and M.N. Kochert. 1985. Dietary shifts of sympatric buteos during a prey decline. *Oecologia* 66: 6-16.

Stendell, R.C. 1972. The occurrence, food habits, and nesting strategy of white-tailed kites in relation to a fluctuating vole population. Ph.D. diss., Univ. of California, Berkeley.

Stone, R.D., W.B. Davilla, D.W. Taylor, G.L. Clifton, and J.C. Stebbins. 1988. Status survey of the grass tribe Orcuttieae and *Chamaesyce hooveri* (Euphorbiaceae) in the Central Valley of California. U.S. Fish and Wildlife Service Stone Technical Report. Prepared by Biosystems Analysis for USFWS Office of Endangered Species, Sacramento, California.

Storer, T.I. 1930. Notes on the range and life-history of the Pacific fresh-water turtle, *Clemmys marmorata*. University of California Publications in Zoology. 32(5):429-441.

Sugnet and Associates, Inc. 1993. Wetland preservation and compensation plan for Sammis Sunrise-Douglas. June 18, 1993. Sacramento, California.

Swainson's Hawk Technical Advisory Committee. 2000. Recommended timing and methodology for Swainson's hawk nesting surveys in California's Central Valley. Unpublished manuscript. TAC. Sacramento, California.

Swolgaard, C., 2004. Nesting density and habitat use of Swainson's hawk in a vineyard landscape in northern San Joaquin County, California. Master's Thesis, CSUS, Sacramento, California.

Tacha, T.D., D.C. Martin, and C.G. Endicott. 1978. Mortality of sandhill cranes associated with utility highlines. Pages 175-176 in: J.C. Lewis (Ed). Proceedings of 2nd crane workshop, Rockport, Texas. National Audubon Society. Colorado State University Printing Service, Ft. Collins, Colorado.

Tacha, T.D., S.A. Nesbitt, and P.A. Vohs. 1992. Sandhill crane. *In* The birds of North America, No. 31 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

Talley, T.S. 2003. Data obtained from surveys conducted in March 21, 2003; April 7, 2003; April 17, 2003. The data has been modified to show only new exit holes.

Talley T.S, E. Fleishman, M. Holyoak, D.D. Murphy, and A. Ballard. 2007. Rethinking a rare- species conservation strategy in an urban landscape: The case of the Valley elderberry longhorn beetle. *Biological Conservation*. 135:21–32.

TNC (The Nature Conservancy). 2000. Effects of prescribed fire and grazing on a vernal pool grassland landscape: recommendations for monitoring. Environmental Protection Agency, San Francisco, California. pp. 91

Temeles, E.J. 1987. The relative importance of prey availability and intruder pressure in feeding territory size regulation by harriers, *Circus cyaneus*. *Oecologia* 74:286-297.

Thompson-Hanson, P.A. 1984. Nesting ecology of northern harriers on the Hanford site, south- central Washington. Master's thesis, Washington State University, Pullman.

Thompson, C.D., and S.H. Anderson. 1988. Foraging behavior and food habits of burrowing owls in Wyoming. *Prairie Naturalist* 20:23-28.

Thomsen, L. 1971. Behavior and ecology of burrowing owls on the Oakland Municipal Airport. *Condor* 73:177-192.

Thorp, R.W. 1990. Vernal pool flowers and host-specific bees *in* Ikeda, D.H., and R.A. Schlising (Eds.). Vernal pool plants: their habitat and biology. Studies from the Herbarium, CSU Chico, California. Number 8.

Toland, B. 1985. Northern harrier predation on greater prairie chickens in southwest Missouri. *Journal of Raptor Research,* 19:146-148.

Trenham, P.C. 2001. Terrestrial habitat use by adult California tiger salamanders. *Journal of Herpetology.* 35(2), 343-346.

Trenham, P.C., and H.B. Shaffer. 2005. Amphibian upland habitat use and its consequences for population viability. *Ecological Applications,* 15:1158–1168.

Trenham, P.C., H. B. Shaffer, W. D. Koening and M. R. Stromberg. 2000. Life history and demographic variation in the California tiger salamander (*Ambystoma californiense*). *Copeia,* 2000(2): 365-377.

Trenham, P.C., W. D. Koenig and H.B. Shaffer. 2001. Spatially autocorrelated demography and interpond dispersal in the salamander (*Ambystoma californiense). Ecology,* 82(12): 3519-3530.

Trombulak, S.C. and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology* 14(1): 18-30.

Trulio, L.A., and D.A. Chromczak. 2007. Burrowing Owl Nesting Success at Urban and Parkland Sites in Northern California. Pages 115–122 *in* Barclay, J.H., K.W. Hunting, J.L. Lincer, J. Linthicum, and T.A. Roberts (Eds.). Proceedings of the California burrowing owl symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc. Point Reyes Station, CA. 197 pp.

USACE (U.S. Army Corps of Engineers). 2014. Memorandum for Record: Cumulative impact analysis for the South Sacramento Habitat Conservation plan area (SPK-1995-00386). Sacramento, California: USACE Sacramento District, California South Branch. Signed September 9, 2014. 39 pages.

USDA (U.S. Department of Agriculture). 2014. Soil Survey Geographic (SSURGO) Database. U.S. Department of Agriculture, Natural Resources Conservation Service, National Soil Survey Center. Digital data obtained through the USDA web portal: http://soils.usda.gov/ survey/geography/ssurgo.

USDA (U.S. Department of Agriculture) NRCS (Natural Resources Conservation Service). 1993. Soil Survey of Sacramento County, California. USDA Natural Resources Conservation Service in cooperation with the Regents of the University of California. April 1993. http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA067/0/sacramento.pdf. Accessed June 24, 2015.

USFS (U.S. Forest Service). 2008. Species accounts: animals. Available online at: http://www.fs.fed.us/r5/scfpr/ projects/lmp/read.htm.

USFWS (U.S. Fish and Wildlife Service). 1980. Listing the Valley elderberry longhorn beetle as a threatened species with critical habitat; Final Rule. **Federal Register.** August 8, 1980.

USFWS (U.S. Fish and Wildlife Service). 1984. Valley Elderberry Longhorn Beetle Recovery Plan. U. S. Fish and Wildlife Service Region 1, Portland, Oregon. 62 pp.

USFWS (United States Fish and Wildlife Service). 1994. Endangered and threatened wildlife and plants; Final Rule; determination of endangered status for the Conservancy fairy shrimp, longhorn fairy shrimp, and the vernal pool tadpole shrimp; and threatened status for the vernal pool fairy shrimp; Final Rule. **Federal Register** 59: 48136-48153. September 19, 1994.

USFWS (United States Fish and Wildlife Service). 1997. Endangered and threatened wildlife and plants; determination of endangered status three plants and threatened status for five plants from vernal pools in the Central Valley of California; Final Rule. **Federal Register** 62 (58): 14338-14352.

USFWS (United States Fish and Wildlife Service). 1999a. Formal consultation on water service contracts with the Sacramento County Water Agency, the San Juan Water District, and the City of Folsom, in Sacramento County, California, 1-1-97-F-0161 (aka the Zone-40 Water Biological Opinion). U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento California. March 11, 1999.

USFWS (United States Fish and Wildlife Service). 1999b. Draft recovery plan for the giant garter snake (*Thamnophis gigas*). US Fish and Wildlife Service Region 1, Portland, Oregon. 192 pp.

USFWS (United States Fish and Wildlife Service). 1999c. Conservation guidelines for the valley elderberry longhorn beetle. US Fish and Wildlife Service Sacramento Field Office. 9 July 1999.

USFWS (U.S. Fish and Wildlife Service). 2002. Endangered and threatened wildlife and plants; Critical Habitat for four vernal pool crustaceans and eleven vernal pool plants in California and southern Oregon; Proposed Rule. **Federal Register** 67: 59884-59939. September 4, 2002.

USFWS (U.S. Fish and Wildlife Service). 2003a. Endangered and threatened wildlife and plants; final designation of Critical Habitat for four vernal pool crustaceans and eleven vernal pool plants in California and southern Oregon; Final Rule. **Federal Register** 68: 46684-46850. August 6, 2003.

USFWS (U.S. Fish and Wildlife Service). 2003b. Endangered and threatened wildlife and plants; 90-day finding for a petition to list the midvalley fairy shrimp as endangered; Notice of 90-day petition finding and initiation of status review. **Federal Register**. 68(82): 22724-22727. April 29, 2003.

USFWS (U.S. Fish and Wildlife Service). 2004a. Formal and early section 7 endangered species consultation of the Freeport Regional Water Project, California, 1-1-04-F-0224 (aka Freeport Water Project Biological Opinion). U.S. Fish and Wildlife Service Sacramento Field Office. December 10, 2004.

USFWS (U.S. Fish and Wildlife Service). 2004b. Endangered and threatened wildlife and plants; designation of Critical Habitat for the California tiger salamander, central population; Proposed Rule. **Federal Register.** 69(153): 48570-48649.

USFWS (U.S. Fish and Wildlife Service). 2004c. Endangered and threatened wildlife and plants; determination of threatened status for the California tiger salamander; and special rule exemption for existing routine ranching activities; Final Rule. **Federal Register** 69(149): 47212-47248. August 4, 2004.

USFWS (U.S. Fish and Wildlife Service). 2005a. Recovery plan for vernal pool ecosystems of California and southern Oregon. U.S Fish and Wildlife Service Region 1, Portland, Oregon. 574 pp. December 15, 2005.

USFWS (U.S. Fish and Wildlife Service). 2005b. Endangered and threatened wildlife and plants; designation of critical habitat for the California tiger salamander, central population; Final rule. **Federal Register** 70 (162): 49380-49458.

USFWS (U.S. Fish and Wildlife Service). 2006a. Endangered and threatened wildlife and plants; designation of critical habitat for four vernal pool crustaceans and eleven vernal pool plants; Final Designation. **Federal Register** 71: 7118-7316. February 10, 2006.

USFWS (U.S. Fish and Wildlife Service). 2006b. Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) five-year review: Summary and evaluation. September 2006. USFWS, Sacramento Fish and Wildlife Office, Sacramento, California.

USFWS (U.S. Fish and Wildlife Service). 2007a. Vernal pool fairy shrimp (*Branchinecta lynchi*) 5-year review: Summary and evaluation. Sacramento Fish and Wildlife Office, Sacramento California. September 2007.

USFWS (U.S. Fish and Wildlife Service). 2007b. Vernal pool tadpole shrimp (*Lepidurus packardi*) 5-year review: Summary and evaluation. Sacramento Fish and Wildlife Office, Sacramento California. September 2007.

USFWS (U.S. Fish and Wildlife Service). 2008a. Habitat conservation plan for South Sacramento, Sacramento County, CA, Notice of intent (NOI) to prepare an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) and notice of public scoping meetings. **Federal Register** 70(112):32729-32732. June 10, 2008.

USFWS (U.S. Fish and Wildlife Service). 2008b. *Orcuttia viscida* (Sacramento Orcutt grass) 5-year review: summary and evaluation. U.S. Fish and Wildlife Service Sacramento Fish and Wildlife Office, Sacramento California. June 2008.

USFWS (U.S. Fish and Wildlife Service). 2009. Slender Orcutt grass (*Orcuttia tenuis*) 5-year review: summary and evaluation. U.S. Fish and Wildlife Service Sacramento Fish and Wildlife Office, Sacramento California. November 2009.

USFWS (U.S. Fish and Wildlife Service). 2012. Giant garter snake *(Thamnophis gigas)* 5-year review: Summary and evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 62 pp.

USFWS (U.S. Fish and Wildlife Service). 2013. Habitat conservation plan for South Sacramento County, California; Notice of intent, request for comments, and notice of public scoping meetings. (Revised Notice of Intent). **Federal Register**. 78(213): 66058-66061. November 4, 2013.

USFWS (U.S. Fish and Wildlife Service). 2014a. California tiger salamander Central California Distinct Population Segment (*Ambystoma californiense*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service Sacramento Fish and Wildlife Office, Sacramento California. October 1, 2014.

USFWS (U.S. Fish and Wildlife Service). 2014b. Endangered and threatened wildlife and plants; withdrawal of the proposed rule to remove the Valley elderberry longhorn beetle from the federal list of endangered and threatened wildlife; Proposed rule. **Federal Register** 79(180): 55874-55917.

USFWS (U.S. Fish and Wildlife Service). 2016. Biological Opinion for the Cordova Hills Special Planning Area, Sacramento County; Corps File Number SPK-2004-00116. U.S. Fish and Wildlife Service Sacramento Field Office 08ESMF00-2016-F-2190. Sacramento, California.

USFWS (U.S. Fish and Wildlife Service). 2017a. Proposed habitat conservation plan for South Sacramento County, California; joint Draft Environmental Impact Statement/ Environmental Impact Report; Notice of availability; receipt of permit application; request for public comment. **Federal Register**. 82(105) 25612-25614. June 2, 2017.

USFWS (U.S. Fish and Wildlife Service). 2017b. Recovery plan for the Central California distinct population segment of the California tiger salamander (*Ambystoma californiense*). U.S. Fish and Wildlife Service Region 8. Sacramento, California. June 6, 2017.

USFWS (U.S. Fish and Wildlife Service). 2017c. Recovery plan for the giant garter snake (*Thamnophis gigas)*. U.S. Fish and Wildlife Service Region 8, Sacramento, California. September 9, 2017.

USFWS (U.S. Fish and Wildlife Service). 2017d. Framework for assessing impacts to the Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). U.S. Fish and Wildlife Service Sacramento Field Office. Sacramento, California. 28 pp.

USFWS (U.S. Fish and Wildlife Service). 2018. Habitat conservation plan for South Sacramento County, California; Final Joint Environmental Impact Statement/ Environmental Impact Report; Notice of availability. **Federal Register**. 83(94):22510-22512. May 15, 2018

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1998. Endangered Species Act consultation handbook; procedures for conducting section 7 consultations and conferences. March 1998. U.S. Government Printing Office, Washington, DC. ISBN 0-16-049596-2

USFWS (U.S. Fish and Wildlife Service) and NOAA (National Oceanic and Atmospheric Administration) Fisheries. 1996. Habitat conservation planning and incidental take permit processing handbook. U.S. Department of Interior and U.S. Department of Commerce. November 4, 1996.

USFWS (U.S. Fish and Wildlife Service) and NOAA (National Oceanic and Atmospheric Administration) Fisheries. 2016. Habitat conservation planning and incidental take permit processing handbook. U.S. Department of Interior and U.S. Department of Commerce. December 21, 2016.

USFWS (U.S. Fish and Wildlife Service) and Sacramento County. 2017. Draft environmental impact statement/environmental impact report for the South Sacramento Habitat Conservation Plan; State Clearinghouse Number: 2008062030. Available from: County of Sacramento Office of Planning and Environmental Review. Sacramento, California. March, 2017

USFWS (U.S. Fish and Wildlife Service) and Sacramento County. 2018. Final environmental impact statement/environmental impact report for the South Sacramento Habitat Conservation Plan. State Clearinghouse Number: 2008062030. Available from: County of Sacramento Office of Planning and Environmental Review. Sacramento, California. February, 2018.

USGS (U.S. Geological Survey). 2013. "National Hydrography GIS Dataset." Accessed January 2018. http://nhd.usgs.gov/.

USGS (U.S. Geological Survey) and NRCS (Natural Resources Conservation Service). 2013. Federal standards and procedures for the National Watershed Boundary Dataset (WBD): Chapter 3 of Section A, Federal Standards, Book 11, collection and delineation of spatial data. 4th ed. Accessed January 2018. https://pubs.usgs.gov/ tm/11/a3/pdf/tm11-a3_4ed.pdf.

Vollmar, J.E. (Ed.). 2002. Wildlife and rare plant ecology of eastern Merced County's Vernal Pool Grasslands. Merced, California: Merced County UC Development Office. Vollmar Consulting, Berkeley, CA.

Vollmar, J.E., R. Holland, and C. Witham. 2013. Predictive habitat analysis and mapping of four rare vernal pool species in Merced, Sacramento, and Placer Counties, Great Valley, California. Prepared for CVPIA Habitat Restoration Program, Grant Agreement Number 80270-A-G509. USFWS Pacific Southwest Region, Sacramento, Ca.

Wacker, M., and N.M. Kelly. 2004. Changes in vernal pool edaphic setting through mitigation at the project and landscape scale. Wetlands Ecology and Management 12: 165-178.

Waian, L.B. 1973. The behavioral ecology of the North American White-tailed Kite (*Elanus leucurus majusculus*) of the Santa Barbara coastal plain. Ph.D. diss., Univ. of California, Santa Barbara.

Waian, L.B., and R.C. Stendell. 1970. The white-tailed kite in California with observations of the Santa Barbara population. *California Fish and Game* 56: 188-198.

Walkinshaw, L.H. 1949. The sandhill cranes. Cranbrook Institute of Science Bulletin 29, Bloomfield Hills, Michigan.

Warner, J.S., and R.L. Rudd. 1975. Hunting by the white-tailed kite. *Condor* 77: 226-230.

WBWG (Western Bat Working Group). 1998. Species accounts: ecology, conservation, and management of western bat species. Western Bat Working Group Workshop, February 9- 13, 1998, Reno, Nevada.

Weiler, J.H., Jr. 1962. A bio-systematic study of the genus *Downingia*. Ph.D. Thesis. University of California, Berkeley, California. 189 pp.

Wilkinson, C.W., and C.M. Levy. 1993. Sacramento urban area levee construction project: Sacramento River Swainson's hawk nesting population study, 1992. Prepared for U.S. Army Corps of Engineers, Sacramento, California.

Wilks, B.J., and H.E. Laughlin. 1961. Roadrunner preys on a bat. *Journal of Mammalogy* 42:98.

Williams, D. F. 1986. Mammalian species of special concern in California, American badger. California Department of Fish and Game, Sacramento. Admin. Rep. 86-1. 112 pp.

Williamson, R.J., G. E. Fogg, M. C. Rains, and T. H. Harter. 2005. Hydrology of vernal pools at three sites, Southern Sacramento Valley. Final report for project: F 2001 IR 20. Developing a floristic statewide vernal pool classification, and a functional model of pool hydrology and water quality. Prepared for California Department of Transportation. 89pp.

Willis, C.K.R., and R.M. Brigham. 2001. Daily torpor use by temperate insect-eating bats in natural roosts. *Bat Research News* 42(3):128-129.

Witham, C. (Ed.). 1998. Ecology, Conservation, and Management of Vernal Pool Ecosystems. Proceedings from a 1996 Conference. California Native Plant Society. 285 pages.

Witham, C.W. 2013. Status surveys for seven federally listed vernal pool grasses and *Chamaesyce hooveri* in the Sacramento and San Joaquin Valleys (Great Valley), California, USA. Carol W. Witham Consulting, Sacramento, CA. Report prepared for the U.S. Fish and Wildlife Service's and Bureau of Reclamation's CVPIA Habitat Restoration Program under grant agreement No. 80270-8-G137 with the USFWS. U.S. Fish and Wildlife Pacific Southwest Region (Region 8), Sacramento California.

Witham, C.W., R.F. Holland, and J.E. Vollmar. 2013. The 2005 Great Valley vernal pool map, plus Merced, Placer, and Sacramento County losses 2005-2010; USFWS grant agreement 80270-A-G509; Final Report January 31, 2013. Prepared for: CVPIA Habitat Restoration Program, U.S. Fish and Wildlife Service, Sacramento, California

Witham, C.W., R.F. Holland, and J.E. Vollmar. 2014. Changes in the distribution of Great Valley vernal pool habitats from 2005-2012. Sacramento, California. Report prepared for the U.S. Fish and Wildlife Service and Bureau of Reclamation CVPIA Habitat Restoration Program under grant agreement No.

F11AP00169 with the Service. U.S. Fish and Wildlife Service Pacific Southwest Region (Region 8), Sacramento, California.

Woffinden, N.D., and J.R. Murphy. 1989. Decline of a ferruginous hawk population: a 20-year summary. *Journal of Wildlife Management*, 53: 1127-1132.

Woodbridge, B., K.K. Finley, and P. H. Bloom. 1995a. Reproductive performance, age structure, and natal dispersal of Swainson's hawks in the Butte Valley, California. *Journal of Raptor Research*, 29: 187-192.

Woodbridge, B., K.K. Finley, S.T. Seager. 1995b. an investigation of the Swainson's Hawk in Argentina. *Journal of Raptor Research*, 29(3): 202-204.

Wylie, G. D., M. Cassaza, and J. K. Daugherty. 1997. 1996 Progress report for the GGS study; Preliminary report. US Geological Survey, Biological Resources Division. Dixon, California.

Wylie, G. D., M. L. Casazza, and L. L. Martin. 2003. Giant garter snake surveys in the Natomas Basin: 2000 - 2002. U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, California. September 2003.

Wylie, G. D., L. L. Martin, and M. Amarello. 2008. Results of monitoring for giant garter snakes (*Thamnophis gigas*) for the bank protection project on the left bank of the Colusa Basin Drainage Canal in Reclamation District 108, Sacramento River Bank Protection Project, Phase II; prepared for the U.S. Army Corps of Engineers. U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, Dixon, California.

Wylie, G.D., M.L. Casazza, B.J. Halstead, and C.J. Gregory. 2009. Sex, season, and time of day interact to affect body temperatures of the giant garter snake. *Journal of Thermal Biology* 34: 183-189.

Wylie, G.D., M.L. Casazza, C.J. Gregory, and B.J. Halstead. 2010. Abundance and sexual size dimorphism of the giant garter snake (*Thamnophis gigas*) in the Sacramento Valley of California. *Journal of Herpetology* 44(1): 94-103.

Yosef, R., 1996. Loggerhead Shrike (*Lanius ludovicianus*). *In* A. Poole and F. Gill (Eds.), the birds of North America, No. 231. The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.:

Yosef, R., and T.C. Grubb. 1993. Effect of vegetation height on hunting behavior and diet of loggerhead shrikes. *Condor* 95:127-131.

Yosef, R., and T.C. Grubb. 1994. Resource dependence and territory size in loggerhead shrikes. *Condor,* 95:127-131.

Zarn, M. 1974. Burrowing owl; Technical Note T-N-250. U.S. Department of Interior, Bureau of Land Management, Denver, Colorado, 25 pp.

Zedler, P.H. 1987. The ecology of southern California vernal pools: a community profile; Biological Report 85:7-11. U.S. Fish and Wildlife Service, Washington, D.C.

Zedler, P.H., 1990. Life histories of vernal pool vascular plants. Pp. 123-146 *in:* D.H. Ikeda and R.A. Schlising (Eds). Vernal pool plants: their habitats and biology. Studies from the Herbarium Number 8, California State University, Chico, California.

Zedler, P.H., and T.A. Ebert. 1979. A survey of vernal pool of Kearny Mesa, San Diego, CA; a progress report submitted to the California Department of Transportation in accordance with CALTRANS Grant 06309 to the San Diego State University Foundation. July 1979.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (Eds). 1990. California's wildlife: Volume I - amphibians and reptiles; Volume II - birds; and Vol. III - mammals. California Department of Fish and Game. Sacramento, California.

IN LITTERIS REFERENCES (CORRESPONDENCE)

Ahart, Lowell. 2003. Rancher and Botanist in Butte County, California. Thoughts on *Juncus leiospermus* var. *ahartii*, in an unpublished note given to John Dittes (Consulting Botanist), as cited in Chapter 3.6 of Appendix B in the Final SSHCP (County of Sacramento et al. 2018).

Bacchini, Emily. 2014, 2016, 2017. SMUD Environmental Management Specialist III, Sacramento California. Electronic mail messages sent in December 2014 and November 2016 to Kellie Berry (Sacramento Fish and Wildlife Office) regarding central California tiger salamanders near the Cosumnes Power Plant.

Henry, Mike. 2018. Dudek Senior Ecologist. E-mail messages send to Nina Bicknese (Senior Biologist, Sacramento Fish and Wildlife Office) between April 2018 and December 2018.

Henry, Mike. 2019. Dudek Senior Ecologist. E-mail messages send to Nina Bicknese (Senior Biologist, Sacramento Fish and Wildlife Office) between January 2019 and April 2019.

Martine, Andrea. 2014, 2015. California Energy Commission; Siting Transmission and Environmental Protection Division. E-mail messages sent in December 2014 and January 2015 to Kellie Berry and Nina Bicknese (Sacramento Fish and Wildlife Office) regarding California tiger salamanders near the Cosumnes Power Plant.

McKinley, Stacey. 2012. The McKinley Group for Strategic Planning and Advocacy, Folsom, California. January 2012 e-mail to the SSHCP Resource Agency Working Group members, and Susan Moore and Terry Adelsbach (Sacramento Fish and Wildlife Office).

USFWS (U.S. Fish and Wildlife Service). 2013. U.S. Fish and Wildlife Service Sacramento Field Office. Unpublished databases, files, and information on the current status of vernal pool tadpole shrimp and vernal pool fair shrimp. Accessed by Terry Adelsbach (USFWS Senior Biologist) in February, 2013.

PERSONAL COMMUNICATIONS

Adelsbach, Terry. 2010. U.S. Fish and Wildlife Service Senior Biologist. Personal comments made to Rich Radmacher (Senior Planner, County of Sacramento) regarding greater sandhill crane roosting habitat in the Plan Area.

Ahart, Lowell. 2003. Rancher/Botanist in Butte County, California. Personal comments made to John Dittes and Josephine Guardino regarding dwarf downingia, Bogg's lake hedge-hyssop, Ahart's dwarf rush, and legenere, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Calderaro, Angela. [date unknown]. Consulting Biologist. Personal comments made to John Dittes and Josephine Guardino regarding valley elderberry longhorn beetle, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Dittes, John. [dates unknown]. Consulting Botanist, Dittes and Guardino Consulting. Personal observations of vernal pool grasslands and vernal pool plant species, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Gause, Matt. Consulting Botanist. Personal comments made to John Dittes and Josephine Guardino regarding Sanford's arrowhead, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Gardner, Todd. 2010. California Department of Fish and Wildlife Environmental Scientist, Sacramento California. Personal comments made to Rich Radmacher (Senior Planner, County of Sacramento) regarding greater sandhill crane roosting habitat.

Henry, Mike. 2018. Dudek Senior Ecologist. Personal comments made to Nina Bicknese (Senior Biologist, Sacramento Fish and Wildlife Office) about SSHCP records for American badger occurrences south of the former Mather Air Force Base.

Holt, Waldo. [dates unknown]. Biologist. Unpublished notes and personal observations of Swainson's hawk, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Ivey, Gary. (2004, 2005). Personal comments made to Todd Sloat (Consulting Biologist) regarding greater sandhill cranes, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Stone, Douglas. [dates unknown]. Botanist. Personal comments made to John Dittes and Josephine Guardino (Consulting Botanists) regarding Sacramento Orcutt grass, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Witham, Carol. [dates unknown]. Consulting Botanist. Personal comments made to John Dittes, Josephine Guardino, Todd Sloat, and Christopher Rogers, as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).

Wylie, Glen. 2005. Researcher, US Geological Survey. Personal comments made to Jamison Watts (Consulting Biologist), as cited in Appendix B of the Final SSHCP (County of Sacramento et al. 2018).