United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2009-F-0857-7

April 16, 2012

Ms. Moujan Mostaghimi
California Department Transportation
Environmental Division, MS 8E
111 Grand Avenue
Oakland, California 94612

Subject: Biological Opinion on the Effects of the Proposed Interstate 80/Interstate 680/State Route 12 Interchange Phase 1 Project, Solano County, California (EA 0A5300)

Dear Ms. Mostaghimi:

This is in response to your April 20, 2011, request for consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Interstate 80 (I-80)/Interstate 680 (I-680) /State Route 12 (SR 12) Interchange Phase 1 Project in Solano County, California. At issue are the effects of the proposed action on the endangered showy Indian clover (*Trifolium amoenum*), endangered Contra Costa goldfields (*Lasthenia conjugans*) and its critical habitat, endangered vernal pool tadpole shrimp (*Lepidurus packardii*), threatened vernal pool fairy shrimp (*Branchinecta lynchi*), endangered callippe silverspot butterfly (*Speyeria callippe callippe*), threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), threatened Central California Distinct Population Segment of the California tiger salamander (*Ambystoma californiense*), the threatened California red-legged frog (*Rana draytonii*) and its critical habitat, and the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*).

The Service concurs with the California Department of Transportation's (Caltrans) determination that the proposed project may affect, but is not likely to adversely affect the showy Indian clover, Contra Costa goldfields, and the Central California Distinct Population Segment of the California tiger salamander.

Caltrans has not completed protocol-level surveys for showy Indian clover in the entire action area due to access problems. Due to its extreme rarity we concur that the proposed project may affect, but is not likely to adversely affect this listed plant. Caltrans has committed to conducting Service protocol-level plant surveys of the previously inaccessible parcels on the Mangels' property north of SR 12 West (SR 12W) for showy Indian clover prior to the initial groundbreaking for Construction Package 3. Caltrans will reinitiate consultation pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)(Act) if

the listed plant is found, with the understanding that the presence of any additional listed species could lead to additional conservation measures that will be determined in conjunction with the Service. In the case of reinitiation, Caltrans' course of action with this species could lead to project delays, project redesign, or other significant effects on the project.

Caltrans has minimized potential effects such that it will not adversely affect the Contra Costa goldfields, Central California Distinct Population Segment of the California tiger salamander, and salt marsh harvest mouse. This determination was based upon: (1) the proposed retaining wall along the south shoulder of SR 12 East (SR 12E) between Ledgewood Creek and approximately 300 feet east of Pennsylvania Avenue and (2) information provided in the April 2011 Biological Assessment (BA) stating that the proposed construction activities and project design would not adversely affect the hydrology of the Gentry Suisun wetlands. The adjacent Gentry Suisun wetlands are occupied by Contra Costa goldfields and this lowland area is designated critical habitat for the species. The area provides potential habitat for the Central California Distinct Population Segment of the California tiger salamander and sufficient surveys have not been conducted to discount species presence. There are records of the salt marsh harvest mouse from within the pickleweed habitat in the Gentry Suisun wetlands (CDFG 2011a, 2011b). Along with *Proposed Conservation Measure 23*, the proposed retaining wall will avoid intrusion of proposed road widening into the low-lying wetland and will be of sufficient height to prevent salamanders that may inhabit the area from entering the SR 12E roadway.

In their April 20, 2011, letter, Caltrans requested formal consultation on the valley elderberry longhorn beetle and the California red-legged frog. Caltrans determined the project may affect, but is unlikely to adversely affect the Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, and callippe silverspot butterfly. Pursuant to 50 CFR 402.13(d), we do not concur with the determination by Caltrans on the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. During the technical assistance phase, the Service informed Caltrans and Solano Transit Authority (STA) that it is our biological opinion that the project may affect and is likely to adversely affect the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. This adverse effects determination was reflected in the DEIR/EIR and was not challenged by Caltrans or STA during the technical assistance phase, prior to issuance of the April 2011 BA. The Service repeated the biological reasoning for our determinations in our June 30, 2011 30-Day Letter and subsequent meetings with Caltrans and STA after Caltrans issued contrary effects determinations in their April 2011 BA. The Service disagreed with the biological rationale provided by Caltrans to support their not likely to adversely affect determinations for the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly in their April 2011 BA, their August 17, 2011 response to the 30-day letter, and in meetings with the Service subsequent to the issuance of the April 2011 BA. Therefore, we are issuing this biological opinion on the adverse effects of your project.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users legislation (23 U.S.C. § 327) allows the Secretary of the U.S. Department of Transportation acting through the Federal Highway Administration (FHWA) to establish a Surface Transportation Project Delivery Pilot Program, whereby a State may assume the FHWA responsibilities under the National Environmental Policy Act (NEPA) for environmental review,

responsibilities under the National Environmental Policy Act (NEPA) for environmental review, agency consultation and other actions pertaining to the review or approval of a specific project. Caltrans assumed these responsibilities for the FHWA on July 1, 2007 through a Memorandum of Understanding within the State of California (http://www.dot.ca.gov/ser/downloads/MOUs/nepa_delegation /sec6005mou.pdf) and are exercising this authority as the Federal nexus for section 7 consultation on this project.

This biological opinion is based on: (1) the April 2011 BA, (2) the September 15, 2011 meeting with Caltrans and STA, (3) site visits and meetings during the technical assistance phase of the consultation; (4) discussions with Sue Wickham of the Solano Land Trust (SLT) regarding listed species in nearby SLT holdings; (5) miscellaneous correspondence and electronic mail (e-mail) messages between the Service and Caltrans; (6) results from the joint resolution process; and (7) other information available to the Service.

Consultation History

March 26, 2007	The Service received meeting notes from a March 15, 2007, NEPA/404 Integration Memorandum of Understanding checkpoint meeting. The Service did not attend the meeting.
March 10, 2009	The Service received a California red-legged frog habitat assessment for the project from STA's consultant.
May 29, 2009	The Service received meeting notes for a February 10, 2009, presentation of the alternatives for inclusion in the Draft Environmental Impact Statement (EIS) for the project and the criteria for the selection of alternatives from Caltrans. The Service did not attend this meeting.
November 19, 2009	The Service met with Caltrans and STA's consultant to discuss future consultation on the project. The expectations for the BA and the need to incorporate wildlife passage into the project design were discussed. The Service was informed that the first project phase was expected to begin in 2012 and later phases may not start for 30 years or more. Caltrans and STA stated that each project phase had independent utility and Caltrans planned to initiate separate consultation on Phase 1 Their current EIS was limited to Phase 1 but the Environmental Impact Report (EIR) included Phase 1 and 2.
June 28, 2010	The Service attended a meeting with Caltrans and STA to discuss the consultation process and a revised project description.
July 15, 2010	The Service provided technical assistance via an e-mail message to STA's consultant in response to the March 2009 California red-legged frog habitat assessment.

July 19, 2010 The Service visited Solano Land Trust land holdings with STA's consultant to discuss needed funding to complete and perform California red-legged frog-associated restoration and habitat management projects. STA was exploring compensation opportunities to minimize the effects of the proposed project on the listed frog. The Service emphasized that preservation and management of red-legged frog breeding and upland habitat adjacent to the proposed Business Center Drive Extension is the preferred option for minimizing the projects' adverse effects on the frog. A conservation easement on this land would preserve the proposed road undercrossing connections between a primary breeding pond and the remainder of the SOL-2 California red-legged frog critical habitat unit.

July 20, 2010 The Service received Wildlife and Fish addendums for the DEIR/EIS from Caltrans for review.

August 13, 2010 The Service received Volumes 1 and 2 of the DEIR/EIS from Caltrans. Although a final alternative has not been selected, Caltrans decided to pursue section 7 consultation on what is identified as Alternative C Phase 1 in the DEIR/EIS. Caltrans included the Solano County Draft Habitat Conservation Plan (HCP) (SCWA 2009) in the *Consistency with State, Regional, and Local Plans and Programs*, Section 3.1.1.2. The DEIR/EIS acknowledged the draft Solano HCP as establishing a framework for complying with State and Federal endangered species regulations. According to the DEIR/EIS, all the proposed project alternatives would result in impacts to callippe silverspot butterfly, vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, California red-legged frog and their habitat. The document stated that Alternative C, Phase 1 had the potential to destroy or disturb callippe silverspot butterfly or its habitat. The DEIR/EIS also stated that Alternative C Phase 1 would result in impacts to 1.71 acres (1.45 acres direct impacts + 0.26 acre indirect impacts) of vernal pool fairy shrimp/vernal pool tadpole shrimp habitat. In the DEIR/EIS, Caltrans committed to compensating for direct effects to vernal pool fairy shrimp and vernal pool tadpole shrimp at 3:1 and at a minimum of 1.1:1 for indirect effects. The DEIR/EIS stated that the actual ratios would be determined through consultation with the Service and that credits would be purchased through a Service-approved conservation bank. Although the analysis was not included in the April 2011 BA, the DEIR/EIS acknowledged that the proposed Business Center Drive Extension would reduce dispersal opportunities within the California red-legged frog SOL-2 critical habitat unit. The DEIR/EIS concluded that this reduction in dispersal could result in substantial frog mortality. The DEIR/EIS stated that the effects to the California red-legged frog would be compensated by habitat enhancement or contribution to a California red-legged frog conservation bank. In the *Growth-Inducing Impacts* section of the DEIR/EIS, Caltrans concluded that the proposed project would accommodate growth and that it would indirectly

	lead to development and intensification of land uses by improving access and roadway capacity.
October 18, 2010	The Service issued a DEIR comment letter (Service File #81420-2009-TA-0857-1) to Caltrans.
November 4, 2010	The Service met with STA and their consultant to discuss our DEIR/EIS comments relevant to the consultation. We explained the need for adequate passage to allow listed species and wildlife to safely cross roads, wildlife passage structures and directional fencing designs, construction scheduling, conservation measures, effects determinations on Contra Costa goldfields critical habitat, and the California tiger salamander habitat assessment.
November 10, 2010	The Service sent STA's consultant comments regarding their draft of the November 4, 2010, meeting notes. The Service recommended that the two large crossings on the Business Center Drive Extension be spanned structures rather than culverts and that the western crossing (the third undercrossing on the Business Center Drive Extension) be at least 78 inches wide with a natural bottom. The Service clarified that the use of vegetation would not be an effective alternative to fencing to direct California red-legged frogs to safe undercrossings or exclude them from the road.
November 18, 2010	The Service visited the proposed project site with Caltrans and STA's consultant to discuss the Business Center Drive Extension and the Contra Costa goldfields critical habitat, potential branchiopod habitat, and potential California tiger salamander habitat in the Gentry Suisun wetland area.
November 29, 2010	The Service attended a NEPA/Section 404 Integration Process checkpoint meeting. The Service recommended that the planned relocation of businesses displaced by the project should be covered in the section 7 consultation because the relocations would not occur if not for the proposed project. Caltrans and STA informed the Service that a BA would be provided for the project within a week of the meeting.
April 21, 2011	The Service received a digital and hard copy of an April 2011 BA from Caltrans with a letter requesting formal consultation for the California red-legged frog and valley elderberry longhorn beetle, and informal consultation on Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, and the Central California Distinct Population Segment of the California tiger salamander.
May 24, 2011	The Service received a letter from Caltrans stating that the Service was beyond the 30-day review period for the BA. However, the BA that had been provided to us by Caltrans was incomplete and it did not contain all

	of the information necessary to initiate formal consultation pursuant to 50 CFR 402.14(c).
June 30, 2011	The Service issued a 30-day letter (Service File #81420-2009-0857-2) to Caltrans in response to the April 2011 BA.
August 19, 2011	The Service received Caltrans' August 17, 2011 response to the Service's June 30, 2011 30-day letter. In the letter, Caltrans requested the issuance of a draft biological opinion.
August 26, 2011	Caltrans notified the Service via an e-mail message that they were entering the formal elevation process to resolve consultation conflicts. This is a procedure both agencies have to agree to in order to resolve impasses on projects.
September 15, 2011	The Service met with Caltrans and STA to discuss Caltrans' August 19, 2011, response to the June 30, 2011, 30-day letter. The issues and requests for adequate project and species information were not resolved during the meeting. Caltrans asserts that under section 7 they do not recognize in-perpetuity preservation of habitat as a means to minimize the project's effects on listed species. The Service explained the biological reasons why the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly are likely to be affected by the proposed project. Caltrans and STA stated they were reluctant to seek take coverage for these species because of their concerns of the costs associated with conservation measures for these species. Caltrans and STA requested a list of conservation measures that would be appropriate to minimize the adverse effects on these listed animals. Caltrans requested that the Service issue a biological opinion for the project without authorization for incidental take for these three species with the acknowledgement they would accept the risk of violating the prohibitions of section 9.
October 7, 2011	The Service Caltrans Liaison preparing the draft biological opinion was instructed to stop work on the project while Caltrans considered approval to provide additional funding to complete consultation.
November 3, 2011	In response to a request made during the September 15, 2011 meeting, the Service sent a written list of recommended conservation measures to minimize the proposed project's effects on listed species to Caltrans and STA (Service File #81420-2009-F-0857-3).
November 17, 2011	The Service received Caltrans' November 15, 2011 letter response to the Service's November 3, 2011 letter via e-mail. Caltrans declined to change their determination and request formal consultation for the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. However, they provided no biological explanation for their determination.

	Caltrans also declined adoption of the appropriate conservation measures listed in the Service's November 3, 2011 letter to minimize effects to the vernal pool fairy shrimp, vernal pool tadpole shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog.
November 30, 2011	The Service Caltrans Liaison received approval from Caltrans to resume work on the consultation.
December 1, 2011	The Service attended a NEPA/Section 404 checkpoint meeting. Caltrans and STA discussed the project alternatives and avoidance and minimization measures with a collection of State and Federal regulatory agencies. A final project alternative had not been selected. Caltrans is still in the process of finalizing a Least Environmentally Damaging Practicable Alternative determination and approval of a Conceptual Mitigation Plan.
December 15, 2011-April 11, 2012	Caltrans and the Service entered into and completed the joint dispute resolution elevation process to resolve outstanding issues on the consultation

BIOLOGICAL OPINION

Description of the Proposed Action

The following project description was provided by Caltrans with minor modifications for reasons of clarity and accuracy provided by the Service.

Caltrans' full-build project involves comprehensive transportation improvements to the I- 80/ I-680 /SR 12 interchange complex intended to meet the future traffic demand over a 20-year planning horizon. The full-build includes the widening of I-680 and I-80 and the relocation, upgrade, and expansion of the I-80 westbound truck scales. The full scope of these improvements is not currently funded under the Metropolitan Transportation Commission's Regional Transportation Plan, 2035. Consequently, a fundable first phase of the full-build project has been developed (referred to as Phase 1). Phase 1 is the subject of evaluation under NEPA and the action for which a record of decision will be issued. STA has provided rationale for why Phase 1 has independent utility and therefore is the proposed action for this section 7 consultation.

General Scope of Work

The proposed Phase 1 project is comprised of the following components:

1. Improvements to the I-80/I-680/SR 12W) interchange;

2. Realignment of I-680;

3. A new interchange at I-680 and Red Top Road;

4. A new road connecting the I-80/Red Top Road interchange to Business Center Drive (Business Center Drive Extension);

5. A new interchange at SR 12W and the new Red Top Road alignment;

6. A modified interchange at I-80 and Green Valley Road;

7 New I-80 bridges over Green Valley Creek;

8. Widening I-80;

9. A new lane on eastbound SR 12E; and

10. Widening of the SR 12E bridge over Ledgewood Creek.

Construction Schedule and Funding

The proposed project will be constructed in a series of seven discrete Construction Packages over an eight-year period, as funding becomes available. A summary of the anticipated construction packages, associated activities, and their sequencing is shown in Table 1.

Table 1. Construction Packages and Scheduling

Construction Package Number	Main Construction Elements	Scheduling
1	1. Construct the westbound I-80 to westbound SR 12W (Jameson Canyon) Connector. 2. Widen westbound I-80 between the existing I-80/I-680 separation and SR 12W. 3. Reconstruct the west half of the I-80 Green Valley Road interchange.	Start in 2013 with approximate two-year duration.
2	1. Construct the I-680/Red Top Road interchange. 2. Realign Lopes Road and Fermi Road. 3. Realign Ramsey Road around the proposed I-680/Red Top Road interchange.	Start in 2014 with approximate 1.5-year duration.
3	1. Construct the westbound I-80 to southbound I-680 connector. 2. Widen westbound I-80 between the I-80/Suisun Valley Road and the I-80/ Green Valley Road interchanges. 3. Reconstruct the westbound I-80 bridge over Green Valley Creek. 4. Construct a new westbound on-ramp from I-80 at Suisun Valley Road. 5. Construct a new westbound off-ramp from I-80 to Green Valley Road. 6. Construct new bridge over Green Valley Creek carrying westbound off-ramp to Green Valley Road. 7. Remove the existing I-80/I-680 connector bridges over I-80 and Green Valley Creek. 8. Remove Neitzel Road. 9. Remove eastbound I-80 to SB I-680 connector. 10. Excavation and grading of the Business Center Drive Extension.	Start in 2014 with approximate two-year duration.

4	1. Construct the northbound I-680 to eastbound I-80 connector. 2. Reconstruct the eastbound SR 12W connector to eastbound I-80. 3. Reconstruct the eastbound I-80 off-ramp to Green Valley Road. 4. Reconstruct Green Valley Road on-ramp to eastbound I-80. 5. Realign both Lopes Road and Green Valley Road to connect to the original I-680 alignment. 6. Widen SR 12E one lane to the south, including widening the culvert for Ledgewood Creek.	Start in 2014 with approximate two-year duration. FHWA and Caltrans will adopt the full new alignment of I-680 and transfer the original alignment to local control.
5	1. Construct the northbound I-680 to westbound SR 12W connector. 2. Reconstruct the I-80/Red Top interchange. 3. Construct a new SR 12W/Red Top Road interchange. 4. Construct the Red Top Road/Business Center Drive extension.	Start in 2018 with approximate two-year duration.
6	1. Construct the I-80/I-680 HOV connectors.	Start in 2018 with approximate two-year duration.
7	1. Construct the northbound I-680/WB I-80 loop on-ramp. 2. Construct the eastbound I-80 connector to southbound I-680. 3. Reconstruct the Union Pacific Railroad underpass.	Start in 2018 with approximate 1.5-year duration.

NOTE: This schedule is approximate and subject to change.

Work in drainages and wetlands will be restricted to the dry season (April 15–October 15, or as otherwise specified in regulatory permits). Work in drainages that support habitat for anadromous fish, such as Green Valley Creek and Ledgewood Creek, will be restricted to the time when fish are not as likely to be present. To the extent possible, vegetation removal will be limited to between September 1 and January 31 to minimize adverse effects to migratory birds. Nighttime construction will be minimized.

Construction Activities

Highway and Road Construction

Highway construction for Phase 1 will consist of widening I-80 to the north for approximately 1 mile between a point west of Suisun Valley Road and SR 12W, realignment of I-680 and realignment of the connector between westbound I-80 and SR 12W Caltrans will acquire additional ROWs to accommodate the widening. Some highway construction will take place in all seven Construction Packages.

Highway construction will generally consist of cutting and filling to create a roadbed, grading to a maximum depth of 3.3 feet, paving or repaving, and striping or restriping. Highway sections will be constructed or altered to encourage drainage to the sides of the highway.

Roadway excavation will be conducted using equipment such as scrapers, front-end loaders, and motor graders to excavate the area and haul material to construct the embankments necessary to support the proposed roadways. Surplus excavated material will be hauled offsite to an approved commercial disposal site using dump trucks when necessary. The location(s) of material borrow and location and type of material disposal will be determined by the contractor. Caltrans will require the contractor to obtain any necessary environmental clearances associated with obtaining a material borrow site, or with the disposal or reuse of surplus materials. Once the roadbed has been excavated, the soil will be rolled and vibrated with a sheepsfoot or drum roller to 95 percent relative compaction.

SR 12E Widening
In Construction Package 4, a third eastbound lane and standard shoulder will be constructed along SR 12E from I-80 east to the existing Webster Street off-ramp immediately east of the SR 12E/Pennsylvania Avenue intersection. Construction of the lane and shoulder will include retaining walls to minimize temporary and permanent disturbance south of SR 12E, and the existing ROW fence would remain in its current location. Drainage improvements along SR 12E would maintain existing hydrological conditions and patterns.

Business Center Drive Extension
Construction of the extension of Red Top Road to Business Center Drive will include excavation to a maximum depth of 95 feet in some areas prior to grading and paving. Excavation and grading will occur during Construction Package 3 and roadway construction will occur during Construction Package 5. Three undercrossings will be included in the Business Center Drive Extension between the existing terminus of Business Center Drive and the proposed intersection with Jameson Canyon Road (SR 12W). The undercrossings will include two approximately 15 by 14 feet span style undercrossings corresponding with two existing dirt access roads. The easternmost large undercrossing will allow continued vehicle access to an existing residence and the second undercrossing will enable access for vehicles and cattle to the Mangels' Pond. The third culvert will be located between the pond access and Jameson Canyon Road. This 60-inch diameter round culvert will convey an ephemeral drainage and will be designed to have a natural bottom (dirt or gravel). The extension from the Jameson Canyon Road intersection to I-80 will include a span bridge over Jameson Canyon Creek.

Approximately 2.5 miles of directional fencing will be attached to the ROW fencing paralleling the Business Center Drive Extension. The ROW fencing is intended to define the ROW, deter access to adjacent private land, and keep livestock from entering the ROW The attached directional fencing is intended to exclude California red-legged frogs from the ROW and guide them to the three undercrossings and Jameson Canyon Creek Bridge described in the previous paragraph. The fencing will consist of hard plastic or a combination of permanent hardware cloth and flashing with a lip sufficient to deflect frogs on the top, or similar material and design. Directional fencing will be attached to the newly installed ROW fence on both sides of the new roadway constructed between Business Center Drive and I-80. The fence will be constructed along Business Center Drive, which is a local road off the State highway system, and its long-term maintenance will be the responsibility of STA.

Culverts and Bridge/Box Culvert Construction
The project would require the extension/widening of 12 existing culverts and bridges.

Bridge Replacement Construction Activities. The existing I-80 bridges over Green Valley Creek will be replaced with single-span structures. In Construction Package 3, the existing westbound I-80 bridge will be removed and replaced with a single-span structure approximately 103 feet long and 133 feet wide. A new single-span Green Valley Creek bridge for the I-80 Green Valley Road off-ramp will be approximately 180 feet long and 39 feet wide.

Bridge replacement will occur in two segments to maintain traffic on I-80. The work within Green Valley Creek bed and bank for each segment is expected to take approximately four

months and will be scheduled between June 15 and October 15. Bridge demolition will occur when Central Valley fall-run/late-fall-run Chinook salmon and central California coast steelhead are less likely to be present. Any work occurring before June 15 or after October 15 will be restricted to the road or bridge surface, and all work in or adjacent to a creek will be done with the implementation of water quality best management practices (BMPs).

Construction equipment would access the site from the north side of I-80. A staging area will be located within the curve of the I-680 entrance to westbound I-80. Bridge construction will involve the following activities.

1. Bridge abutment locations will be scarified and then excavated to the bottom of the abutment or pile cap using backhoes or bobcats. In some cases, the area adjacent to the abutment will be over-excavated by several feet to ensure that low-expansion material is adjacent to the abutment and wing walls.

2. Temporary cofferdams will be constructed both upstream and downstream of the bridge, and a piped water diversion system will be installed. The cofferdams will be at least 20 feet from the limit of the existing bridge.

3. Pile driving will be necessary to construct new bridge abutments for both bridges over Green Valley Creek. Piles will be located at the top of the creek bank and are anticipated to be 12-inch-square piles driven to a depth of approximately 70 feet. A vibratory hammer will be used when feasible. The number of strikes will depend on the loading and soil characteristics. Pile driving equipment will be operated from beyond the top bank.

4. Concrete abutments or pile caps will be constructed above the piles.

5. Wooden or steel falsework will be placed within the creek (banks and channel) once the abutments and columns have been constructed as necessary to support the construction of the cast-in-place concrete box girder structures.

6. When the reinforcement is set, the concrete will be placed for the superstructure. Once the concrete for the superstructure has hardened the tendons will be tensioned.

7. The last elements of major construction for the bridges will be bridge railings, approach slabs (placed on the embankment approaches to the bridge), and slope paving.

8. To the extent practicable, disturbed portions of Green Valley Creek (bed and bank) will be restored to pre-project conditions upon completion of construction. This may include grading and contouring the site, and seeding or planting with native plants as appropriate.

Culvert Construction Activities. Culvert construction will take place at Ledgewood Creek in Construction Package 3 and at Jameson Canyon Creek in Construction Packages 3 and 4. Construction associated with the culverts is expected to take approximately four months and will be scheduled during the driest time of the year (June 15–October 15).

Culvert construction will involve the following activities:

1. Temporary cofferdams (made of gravel, fabric, and pipe) will be constructed upstream and downstream from the culvert; a water diversion system using pipes will be installed to facilitate dewatering of the channel within the cofferdam during construction while bypassing creek flow. The cofferdams will be approximately 20 feet from the limit of the existing culvert.

2. Temporary cofferdams will be constructed to facilitate excavation of existing footings. The cofferdams will consist of gravel wrapped in fabric and would be slightly larger than the footing plan dimensions.

3. Vibratory equipment will be used to compact soil if feasible.

4. Falsework will be placed within the creek (banks and channel) as necessary to support construction of the cast-in-place (poured) concrete box culvert.

5. Falsework will be removed after concrete has set.

6. The concrete invert slab (i.e., invert of the culvert) will be extended to the edge of the widened culvert.

7. To the extent practicable, disturbed portions of Ledgwood Creek and Jameson Canyon Creek (bed and bank) will be restored to pre-project conditions when construction is complete. This may include grading and contouring the site, and seeding or planting with native plants as appropriate.

Ledgewood Creek Culvert. The Ledgewood Creek culvert will be extended 15 feet to the south to accommodate an additional lane for SR 12E (Construction Package 4). The existing crossing consists of a series of five culverts, each measuring 16.5 feet wide and supported by wall piers.

Construction associated with the culvert is expected to take approximately four months and will be scheduled during the driest time of the year (June 15–October 15) for ease of operation and to avoid potential effects to anadromous fish.

Jameson Canyon Creek Culvert. The Jameson Canyon Creek culvert will be constructed under the new I-680 alignment. It will be a two-box culvert, with each box approximately 12 feet wide and 8 feet high. Construction associated with the culvert is expected to last approximately four months and will be scheduled during the driest time of the year (June 15–October 15).

Utilities

As part of the proposed project, utilities within the project footprint will be relocated, realigned, or extended as necessary to accommodate project construction and operation. The maximum extent of disturbance from utilities falls within the project footprint. Utilities that will be affected are water, electrical, gas, cable/fiber, and telephone lines. Actions affecting these utilities will be coordinated with the respective operators. Caltrans will submit detailed

descriptions of utility relocations should the area of disturbance exceed the limits of the current proposed project footprint.

Staging Locations

Caltrans has identified potential construction staging areas within the proposed action area. Should construction contractors determine that other staging areas within or outside the state ROW and proposed action area are necessary to complete work, the contractor will be required by Caltrans or STA to obtain all necessary environmental clearances associated with the alternative staging areas prior to their use for staging purposes. Staging locations will be used for temporary placement of heavy construction equipment and vehicles; construction materials such as shotcrete (a mixture of concrete, fine aggregate, and water blown pneumatically through a hose), gravel, road base, and rebar; equipment maintenance shops; field offices; and rest rooms.

Access roads linking staging areas to the various work areas will be cleared and graded using equipment such as excavators, bobcats, and bulldozers. Upon project completion, and to the extent practicable, staging location and access roads will be returned to their pre-project conditions.

Construction Site Restoration

Caltrans plans to restore areas of temporary ground disturbances, including storage and staging areas, and temporary roads. These areas will be re-contoured, if appropriate, and revegetated with seeds and/or cuttings of appropriate native plant species to promote restoration of the area. Caltrans has developed a restoration plan that will be submitted to the Service for approval prior to initial ground breaking. This plan includes immediate application of permanent erosion control measures for all areas disturbed by construction activities. The permanent erosion control measures will include native (here referring to species naturally occurring in Solano County) grass and forb seed, fertilizer, compost and mulch for soil protection. The restoration plan also includes planting at each creek crossing using a combination of wetland, riparian and upland/transitional species appropriate for the conditions at the specific creek crossings and is informed by local reference sites. To the maximum extent practicable (i.e., presence of natural lands), topsoil will be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion will be prevented with straw bales, straw wattles, or similar means provided they do not entangle or block California red-legged frog escape or dispersal routes.

Equipment

Construction is expected to require heavy equipment such as cranes, pile drivers, vibratory and hydraulic hammers, excavators, bobcats, bulldozers, roadheaders, hydraulic excavators or backhoes, scrapers, rubber-tired dump trucks, front-end loaders, load-haul-dumps, drill jumbos, front-end loaders and motor graders, sheepsfoot or drum rollers, and asphalt-paving machines.

Temporary construction areas will be cleared, graded, and reestablished using equipment such as excavators, bulldozers, and/or bobcats.

Routine Maintenance

Routine maintenance activities are anticipated within the R-O-Ws. Within R-O-Ws determined to be temporarily impacted, routine maintenance may have restrictions.

Proposed Conservation Measures

Caltrans proposes to avoid and minimize effects to the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, Central California Distinct Population Segment of the California tiger salamander, and California red-legged frog by implementing the following measures:

1 All construction personnel will attend a mandatory Worker Environmental Awareness Training Program delivered by a Service-approved biologist prior to working on the project site. The program will focus on the conservation measures that are relevant to employee's personal responsibility and will include an explanation as how to best avoid take of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog. The program will include an explanation of Federal laws protecting these listed species as well as the importance of compliance with this biological opinion. Documentation of the training, including sign-in sheets, will be kept on file and will be available on request.

2. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

3. A Service-approved biologist(s) will be on-site during any ground-disturbing activities that have the potential to adversely affect the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, California tiger salamander, and California red-legged frog.

4. A Service-approved biologist will be present during all construction-related activities in sensitive habitats. If special-status species are discovered during these activities, the Service-approved biologist, through the Resident Engineer, will halt all work within 50 feet of the species and contact the Service to determine how to proceed.

5. Prior to construction, Environmentally Sensitive Areas will be delineated using high-visibility orange construction fencing installed along the perimeter of the work areas to clearly delineate the extent of the construction area. The project plans will show the locations where fencing will be installed. The plans will also define the fencing installation procedure. The project's special provisions package will provide clear language regarding acceptable fencing material and prohibited construction-related activities, vehicle operation, material and equipment storage, and other surface-disturbing activities within sensitive areas.

6. No more than 20 calendar days prior to any ground disturbance in a given location, pre-construction surveys will be conducted by a Service-approved biologist for the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, elderberry plants, and California red-legged frog where habitat was identified for each respective species. These surveys will consist of walking surveys of the project limits and accessible adjacent areas within at least 50 feet of the project limits. The biologist(s) will investigate all potential California red-legged frog cover sites. This includes thorough investigation of mammal burrows, appropriately sized soil cracks, and debris. Native vertebrates found in the cover sites will be documented and relocated to an adequate cover site in the action area vicinity. The entrances and other refuge features within the project limits will be collapsed or removed following investigation and clearance.

7 Vegetation clearing will be limited throughout the proposed project area to the non-nesting season (September 1–January 31) to the extent possible. Vegetation removal work outside this window will be preceded by preconstruction nest clearance surveys.

8. Vegetation will be cleared only where necessary and will be cut approximately 4 inches above soil level except in areas that will be excavated for roadway construction. This will allow plants that reproduce vegetatively to resprout after construction. All clearing and grubbing of woody vegetation will be done using hand tools, small mechanical tools, or backhoes and excavators. All cleared vegetation will be removed from the project footprint to prevent attracting animals to the project site.

9. All slopes or unpaved areas temporarily disturbed by construction activities will be stabilized to prevent erosion at least three days prior to a forecasted rain event. After construction activities, the temporarily disturbed areas will be restored to pre-project conditions to the maximum extent practicable. Where disturbance includes the removal of trees, native species will be replanted.

10. To reduce the spread of invasive, nonnative plant species and minimize the potential decrease of palatable vegetation for wildlife species, Caltrans will comply with Executive Order 13112. This order is intended to prevent the introduction of invasive species and provide for their control to minimize adverse economic, ecological, and human health effects. In the event that noxious weeds are disturbed or removed during construction-related activities, the contractor will be required to contain the plant material associated with these noxious weeds and dispose of them in a manner that will not promote the spread of the species. The contractor will be responsible for obtaining all permits, licenses, and environmental clearances for properly disposing of materials. Areas subject to noxious weed removal or disturbance will be replanted with fast-growing native grasses or a native erosion control seed mixture. If seeding is not possible, the area of disturbance will be covered to the extent practicable with heavy black plastic solarization material until the end of project construction.

11. Construction access, staging, storage, and parking areas will be located within the project ROW or temporary easements and outside of designated Environmentally Sensitive

Areas. Access routes and the number and size of staging and work areas will be limited to the minimum necessary to construct the proposed project. Routes and boundaries of roadwork will be clearly marked prior to initiating construction or grading.

12. All food and food-related trash items will be enclosed in sealed trash containers and removed completely from the site at the end of each day.

13. No firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

14. Caltrans and STA will install bio-swales and bio-filtration in the area adjacent to roadways to avoid and minimize sediment loading and point source pollutants.

15. Stormwater pollution prevention plans (SWPPPs) and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion and will be in compliance with the requirements of the Regional Water Quality Control Board. The design staff will include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and nonstormwater discharges. Protective measures will include, at a minimum, those listed below.

    a. No discharge of pollutants from vehicle or equipment cleaning will be allowed into any storm drains or water courses.

    b. Vehicle and equipment fueling and maintenance operations will be at least 50 feet away from water courses, except at established commercial gas stations or established vehicle maintenance facilities.

    c. Concrete waste and water from curing operations will be collected in washouts and will be disposed of and not allowed into water courses.

    d. Spill containment kits will be maintained onsite at all times during construction operations and/or staging or fueling of equipment.

    e. Dust control measures will include use of water trucks and organic tackifiers to control dust in excavation-and-fill areas, covering temporary access road entrances and exits with rock (rocking), and covering of temporary stockpiles when weather conditions require.

    f. Silt fences, coir rolls, or straw wattles will be installed along or at the base of slopes during construction to capture sediment.

16. All equipment will be maintained such that there will be no leaks of automotive fluids such as gasoline, oils, or solvents, and a Spill Response Plan will be prepared.

17 To prevent inadvertent entrapment of animals during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each

working day with plywood or other suitable material, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled they must be thoroughly inspected for trapped animals. All replacement pipes, culverts, or similar structures stored in the action area overnight will be inspected before they are subsequently moved, capped, or buried. If at any time a listed species is discovered, the Resident Engineer and Service-approved biologist will be immediately informed. The animal will be allowed to move out of the area on its own volition.

18. If requested through the Resident Engineer or Construction Inspector before, during, or upon completion of groundbreaking and construction activities, Caltrans will ensure that the Service and/or its designated agents can, immediately and without delay, access and inspect the project site for compliance with the proposed project description, conservation measures, and terms and conditions of the biological opinion, and to evaluate project effects on listed species and their habitat.

19. The following measures are intended to avoid and minimize effects to the showy Indian clover.

    a. Prior to groundbreaking for Construction Package 3, protocol-level surveys of the inaccessible parcels on the Mangels' property north of SR 12W will be conducted for showy Indian clover in accordance with the Service protocol.

    b. If protocol-level surveys identify showy Indian clover plants within 250 feet of the project footprint, the project footprint will be fenced and flagged to ensure that construction equipment and construction activities are confined and completely avoid any potential direct or indirect effects on individual showy Indian clover plants during construction. In the event of a positive survey finding, Caltrans will implement the following specific measures.

        i. Orange Environmentally Sensitive Area construction barrier fencing at least 4 feet in height will be installed to protect Environmentally Sensitive Areas. A Service-approved biologist will identify sensitive biological resources adjacent to the construction area; the Environmentally Sensitive Areas to be fenced will be included in the contract plans and specifications.

        ii. A Service-approved biologist will identify potential showy Indian clover habitat, and a protective silt fence, described in the Caltrans Standard BMPs, will be installed to protect down-gradient habitat for showy Indian clover from being affected by sediment loading.

        iii. Construction activities conducted within the area of potential showy Indian clover habitat will be confined to the driest season (June 1–October 15) to protect down-gradient, showy Indian clover habitat and minimize potential indirect dust effects on identified flowering showy Indian clover plants.

iv. A Service-approved biologist will be present during all ground-disturbing activities occurring within 250 feet of occupied showy Indian clover habitat to ensure that showy Indian clover habitat is avoided.

v. Vegetation removal within 250 feet of occupied showy Indian clover habitat will be limited to the maximum extent practicable.

vi. A Service-approved biologist will develop and conduct environmental education training for construction employees working on ground-disturbing activities. The program will include the following: a description of showy Indian clover and its habitat needs, photographs of the plant species, an explanation of its legal status and protection under the Act, and a list of the measures that will be implemented to minimize and avoid potential effects on showy Indian clover.

vii. The Service-approved monitor will coordinate with the Resident Engineer to ensure that the contractor maintains the staked, fenced, and flagged perimeters of the construction area and staging areas adjacent to sensitive biological resources, including occupied or potential showy Indian clover habitat.

20. The following measures are intended to minimize direct and indirect effects to callippe silverspot butterfly.

a. Caltrans will minimize harm to the callippe silverspot butterfly resulting from the adverse effects to 58.14 acres of habitat. Compensation implemented within Service-approved areas that are both California red-legged frog habitat and Callippe silverspot butterfly may be overlaid on common acreage as long as it is appropriate habitat for each species. The area will receive conservation credit from the Service for both species. The compensation will be phased to coincide with project construction packages as presented in Table 1and implemented 60 calendar days prior to the date of initial ground disturbance.

Compensation will be based on the amount of permanent and temporary loss of callippe silverspot butterfly habitat. Temporary habitat loss will be compensated at rates based on the amount of time it takes to restore the habitat to baseline conditions following the date of initial habitat disturbance and whether the restored habitat will be subjected to ongoing roadway maintenance activities that would not be entirely beneficial to the species. Off-site conservation will offset routine maintenance activities that are short in duration, e.g. mowing. Habitat value in these R-O-W areas is diminished but not permanently destroyed. Should the determination of permanent versus temporary habitat loss change after Caltrans has provided this compensation, Caltrans will provide additional compensation, if necessary, or apply excess compensation towards future projects that adversely affect the callippe silverspot butterfly.

The maintained ROW is defined as the ROW between the edge of pavement or denuded road shoulder and the Caltrans ROW fence. Permanent effects will

occur within the bounds of the maintained ROW (road surface and area between edge of pavement and ROW fence).

Callippe Silverspot Butterfly Habitat Compensation

Level of Effect	Duration [1]	Compensation Ratio	Acres of Effects[2]	Acres of Compensation[3]
Permanent	Permanent	3:1	38.82	116.46
Temporary	Within 1 year	1:1on-site 0.5 off-site	19.32	9.66
	Within 2 years	1:1 on-site 1.5:1 off-site	0	0
	Greater than 2 years	3:1 off-site **OR** 2:1 off-site **AND** 1:1 on-site	0	
TOTAL			**58.14**	**126.12**

[1]period of time from the date of initial ground disturbance until the success criteria described in the restoration/revegetation plan are met.
[2] as per GIS map dated March 2012, potential to be adjusted at final project design, with subsequent reinitiation.
[3] Acres of compensation = off-site areas.

Caltrans will compensate for adverse effects to callippe silverspot butterfly habitat by implementing one of the following two options:

i. Caltrans will establish in-perpetuity callippe silverspot butterfly habitat preservation by purchasing habitat or purchasing callippe silverspot butterfly habitat credits from a Service-approved conservation bank.

Compensation will be implemented with in-perpetuity preservation of callippe silverspot butterfly habitat with high conservation values and (1) include ridge line topographical features associated with callippe silverspot butterfly breeding behavior and adult and/or larval nectar plants, and (2) preference given to areas located within the Callippe Silverspot Butterfly Conservation Area defined in the Draft Solano HCP (SCWA 2009). Location of the proposed conservation areas will be submitted to the Service for review and approval.

The habitat will include a Service-approved conservation easement, held by a third party. An approved ecologically-based conservation easement will include managed public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a PAR-like property analysis. The management plan will include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities will be implemented, how often and to what level monitoring of the site will occur, and an action/contingency plan to address potential management issues.

ii. Caltrans will implement or fund restoration and enhancement actions within occupied callippe silverspot butterfly habitat that will have beneficial effects on the species. Such measures shall be implemented on lands with in-perpetuity conservation beneficial to the callippe silverspot butterfly.

Implementation includes identification of land to be restored or enhanced, associated agreements to fund restoration or enhancement activities, and a restoration plan and schedule approved by the Service.

b. Caltrans will survey for the presence of adult nectar and larval host plants and adult nectar sources within areas that will be subject to temporary effects within callippe silverspot habitat. The surveys will be conducted during the blooming season (March to May) no more than one year prior to the excavation and grading of the Business Center Drive Extension proposed to occur during Construction Packages within Callippe silverspot butterfly habitat. SLT will be contacted in order to synchronize the surveys with peak *Viola* blooming on the Swett Ranch. Observed adult nectar plants and *Viola* will be mapped and flagged. Caltrans will modify the boundaries of temporary work areas to avoid the nectar and host plants when feasible.

c. To the maximum extent possible, Caltrans will avoid areas of *Viola* delineated prior to construction and during preconstruction surveys within temporary affected areas.

d. The project footprint will be clearly delineated with Environmentally Sensitive Area fencing and signage to limit construction activities to the described footprint and to maintain awareness. All Environmentally Sensitive Areas will be shown on the final construction drawings.

e. Grading activities within callippe silverspot butterfly habitat will be conducted between August 1 and April 1, to the extent practicable as determined during constructability review. When grading activities must take place after April 1 and before August 1, daily biological monitoring will occur for the callippe silverspot butterfly.

f. Insecticides or herbicides in the Business Center Drive Extension ROW will not be applied during road construction or long-term operational maintenance within 300 feet of the host plant occurrences mapped by Monk & Associates in 2004 or otherwise identified or adult nectar plants or from other locations where the chemical treatments can be carried in by wind or surface flow.

g. Standard erosion and dust control measures will be implemented to minimize the deposition of dust, soil, and silt on callippe silverspot butterfly habitat.

h. Caltrans and STA will ensure there is no drift of sprayable dust control formulations used for dust and erosion control towards callippe silverspot butterfly habitat during construction. Appropriate spray devices and application methods, such as spray pressures, nozzle opening size, and additives such as spray retardants, will be used to prevent drift. Applications will be made on calm days or when the wind speed is low and blowing away from callippe silverspot butterfly habitat. Spray applications will not be made within 200 yards by air or 40 yards by ground upwind from callippe silverspot butterfly habitat. Applications will not occur during rain events.

i. No equipment will be driven or parking or laydown areas established within 20 feet of larval host plants located outside the defined construction footprint and, to the extent feasible, within 20 feet of adult nectar plants located outside the defined construction footprint.

j. If any other life history phases of the callippe silverspot butterfly are found such as adults, pupae, larvae, or eggs, the Service shall be immediately contacted for further guidance.

21 The following measures are intended to avoid and minimize direct and indirect effects to vernal pool fairy shrimp and vernal pool tadpole shrimp.

a. The potential vernal pool fair shrimp and vernal pool tadpole shrimp habitat within the action area is within what is described in the draft Solano HCP as having a low conservation value. Caltrans will compensate for the effects to 1 71 acres (1.45 acres direct effects + 0.26 acre indirect effects) of vernal pool habitat based on the conservation strategy in the draft Solano HCP as follows:

Listed Vernal Pool Crustacean Compensation

Type of Effect	Compensation Ratio	Acres of Effects	Acres of Compensation	Type of Compensation
Direct	1:1	1.45	1.45	Preservation of vernal pool and swale habitat
Direct	1:1	1.45	1.45	Restoration of vernal pool and swale habitat
Indirect	1:1	0.26	0.26	Preservation of vernal pool and swale habitat

i. The above compensation of 1.71 acres of preservation and 1.45 acres of restoration will be implemented no later than sixty (60) calendar days prior to the date of initial ground disturbance of the specific construction packages. The compensation will be phased to coincide with the initiation of the individual project construction packages as presented in Table 1.

ii. Preservation and restoration for adverse effects to Low Value Conservation Areas shall occur within Medium to High Value Conservation Areas identified in the draft Solano HCP The location of the compensation will be submitted for Service approval. Preservation and restoration ratios reflected

above are based on the premise that effects to low value conservation areas will be compensated in medium to high value areas.

b. To the extent practicable, Caltrans and its contractors will initiate all work in or within 250 feet of potential habitat for vernal pool crustaceans between May 1 and November 1. When construction activities must take place after November 1 and before May 1, daily biological monitoring will occur for the vernal pool crustaceans.

c. To the extent practicable, Caltrans will incorporate design modifications to avoid direct permanent effects on potential habitat for federally listed branchiopods.

d. Caltrans will avoid potential vernal pool fairy shrimp and vernal pool tadpole shrimp habitat, to the maximum extent practicable, during construction activities in temporary work areas. All potential vernal pool fairy shrimp and vernal pool tadpole shrimp habitat not directly affected will be designated as an Environmentally Sensitive Area and protected with appropriate fencing and signage. All Environmentally Sensitive Areas will be shown on the final construction drawings.

e. Caltrans will perform all work in accordance with a SWPPP BMPs will be implemented and may include the use of silt fences, sandbags, detention basins, and other means as appropriate to prevent erosion into any potential habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp.

22. The following measures are intended to avoid direct and indirect effects to Contra Costa goldfields, and effects to potential listed branchiopods and California tiger salamander habitat immediately south of SR 12E, between Ledgewood Creek and Suisun City.

a. Caltrans will construct a retaining wall along SR 12E, between Ledgewood Creek and Suisun City. This design feature will limit the roadway expansion to the existing raised roadbed and avoid permanent intrusion into the immediately adjacent seasonal wetland habitat (Gentry Suisun wetland).

b. The boundaries of this habitat along SR 12E will be identified as inaccessible by an orange construction barrier fence and depicted on final design plans. The fence will be at least 4 feet high, it will include signage as the boundary of an Environmentally Sensitive Area, and the installation will be guided and monitored by a Service-approved biologist.

c. A Service-approved biologist will identify potential Contra Costa goldfields habitat prior to ground-disturbing activities, and a protective silt fence, described in the Caltrans Standard BMPs, will be installed to protect down-gradient areas from being affected by sediment loading. This fencing will prevent direct impacts on wetlands south of SR 12E between Ledgewood Creek and the eastern end of the construction area.

d. A Service-approved biologist will conduct construction monitoring in and adjacent to all sensitive special-status plant populations. Construction monitoring frequency will range from daily to weekly depending on the biological resource and the construction activities.

e. A Service-approved biologist will coordinate with the Resident Engineer to ensure that the contractor maintains the staked, fenced, and flagged perimeters of the construction area and staging areas adjacent to sensitive biological resources, including potential Contra Costa goldfields habitat.

f. Vegetation removal on the south side of the existing SR 12E will be limited to the minimum necessary.

g. The Service-approved biologist will be present during all ground-disturbing activities occurring within 250 feet of vernal pool habitat.

h. Construction activities conducted within the area between Ledgewood Creek and Suisun City will be confined to the driest season (April 15–October 15, or as otherwise specified in regulatory permits) to protect down-gradient habitat.

i. Caltrans or STA will survey the seasonal wetland / pools south of their Biological Study Area located between SR 12E, Pennsylvania Avenue, Ledgewood Creek, and the SPRR rail line for California tiger salamander prior to construction. Should these surveys find occurrences of California tiger salamander within the action area, Caltrans and STA will reinitiate formal Section 7 consultation with the Service.

23. The following measures are intended to avoid and minimize direct and indirect effects to valley elderberry longhorn beetle.

a. Caltrans will install Environmentally Sensitive Area fencing and flag all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer has been approved by the Service, the fencing will provide a minimum 2-foot setback from the drip line of each elderberry plant.

b. Caltrans will provide contractors with training educating them on the status of the valley elderberry longhorn beetle and its host plant and emphasize the need to avoid damaging elderberry plants.

c. Caltrans will erect signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs will be clearly readable from a distance of 20 feet, and will be maintained for the duration of construction.

d. Caltrans will restore, to the maximum extent practicable, any damage or disturbance to the buffer area (areas within 100 feet of elderberry plants) during construction. Caltrans will provide erosion control and revegetate the areas with appropriate native plants.

e. Caltrans will prohibit the use of insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant in the buffer areas or within 100 feet of any elderberry plant with one or more stems measuring 1.0 inch or more in diameter at ground level.

f. Caltrans and STA will work with the Solano County Resource Conservation District or a Service-approved bank to facilitate the plant removal and transplanting effort. Transplantation of ten elderberry shrubs that are within the construction footprint will be done prior to ground-disturbing activities within 100 feet of the shrubs and will be conducted according to the Service's 1999 *Conservation Guidelines for the Valley Elderberry Longhorn Beetle*. A Service-approved biologist will be on-site to monitor the transplanting of the elderberry plants.

g. Caltrans will implement one or a combination of the following:

i. Provide replacement plantings and associated native plantings as described in Table 1 at a Service-approved location.

Table 1. Minimization ratios based on location, stem diameter of affected elderberry plants at ground level, and presence or absence of exit holes.

Location	Stem Diameter (inches)	Exit Holes Present (No/Yes)	Number of Stems	Elderberry Seedling Ratio	Elderberry Seedling Plantings	Associated Native Plant Ratio	Associated Native Plantings
Non-riparian	1-3	N	8	1:1	8	1:1	8
		Y	2	2:1	4	2:1	8
	3-5	N	7	2:1	14	1:1	14
		Y	1	4:1	4	2:1	8
	> 5	N	5	3:1	15	1:1	15
		Y	2	6:1	12	2:1	24
Riparian	1-3	N	20	2:1	40	1:1	40
		Y	0	4:1	0	2:1	0
	3-5	N	8	3:1	24	1:1	24
		Y	0	6:1	0	2:1	0
	> 5	N	9	4:1	36	1:1	36
		Y	0	8:1	0	2:1	0
Total			**62**		**157**		**177**

ii. Purchase valley elderberry longhorn beetle credits from a Service-approved conservation bank.

h. Two elderberry shrubs are located within 100 feet of the limit of disturbance. These shrubs will be protected by:

i. Fencing and flagging all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer has been approved by the Service, Caltrans will provide a minimum setback of at least 20 feet from the dripline of each elderberry plant.

ii. Erecting signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs should be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.

24. The following measures are intended to avoid and minimize direct and indirect effects to California red-legged frog.

a. Caltrans will compensate for harm resulting from adverse effects to the California red-legged frog and 97.80 acres of its habitat, and the adverse effects critical habitat for the California red-legged frog by providing appropriate habitat compensation.

The compensation will be based on the amount of permanent and temporary loss of red-legged frog habitat. Temporary habitat loss will be compensated at rates based on the amount of time it takes to restore the habitat to baseline conditions following the date of initial habitat disturbance and whether the restored habitat will be subjected to ongoing Caltrans routine maintenance activities, e.g. mowing, that may affect the species.

The maintained ROW is defined as the ROW between the edge of pavement or denuded road shoulder and the Caltrans ROW fence. Permanent effects will occur in areas of maintained ROW that include barriers to frog movement. Areas of ROW within and adjacent to retaining walls will be permanently affected by the project. Caltrans commits to installing a Service-approved frog exclusion fence along the proposed Business Center Drive Extension from the existing Business Center Drive to Jameson Canyon Road in order to direct California red-legged frogs to the three proposed undercrossings. Since the exclusion fence will likely prevent individuals of this threatened species from entering the maintained ROW, the entirety of the ROW within this area will be permanently affected by the proposed project. However, less compensation is necessary as the directional fence also results in a beneficial effect to California red-legged frogs by directing them to safe undercrossings. Off-site compensation is proposed to offset temporary impacts within the maintained R-O-W since habitat will continue to be impacted by on-going routine maintenance activities, e.g. mowing. Lastly, additional off-site compensation is necessary for temporal loss of habitat.

Caltrans will compensate for the loss of habitat of the California red-legged frog by implementing the following:

California Red-Legged Frog Habitat Compensation

Level of Effect	Location of disturbance	Duration[1]	Compensation Ratio	Acres of Effects[2]	Acres of Compensation[3]
Permanent	Within or beyond maintained ROW	Permanent	3:1	78.48	235.44
	Within maintained ROW and excluded by directional fence	Permanent	2:1	0	0
Temporary	Within the maintained ROW	Within 1 year	1:1 on-site 1:1 off-site	0	0
	Beyond the maintained ROW	Within 1 year	1:1on-site 0.5:1 off-site	19.32	9.66
	Within the maintained ROW	Within 2 years	1:1 on-site 1.5:1 off-site	0	0
	Beyond the maintained ROW	Within 2 years	1:1 on-site 1:1 off-site	0	0
	Within or beyond maintained ROW	Greater than 2 years	3:1 off-site **OR:** 2:1 off-site **AND** 1:1 on-site	0	0
TOTAL				**97.80**	**245.1**

[1]period of time from the date of initial ground disturbance until the success criteria described in the restoration/revegetation plan are met.
[2] as per GIS map dated March 2012, potential to be adjusted at final project design, with subsequent reinitiation.
[3] Acres of compensation = off-site lands.

Compensation implemented within areas that are both California red-legged frog habitat and Callippe silverspot butterfly habitat may be overlaid on common acreage as long as the area is appropriate habitat for each species. With Service approval, the conservation lands would receive compensation credit from the Service for both species.

Compensation will be implemented with in-perpetuity preservation of California red-legged frog habitat with high conservation values, consistent with the parameters described in the Draft Solano HCP (SCWA 2009) within sixty (60) calendar days prior to the date of initial ground disturbance at the project.

California red-legged frog habitat used for conservation will be: (1) preferably located within the California Red-Legged Frog Conservation Area defined in the Draft Solano HCP (SCWA 2009), (2) within 0.7 mile of unobstructed California red-legged frog breeding habitat and non-breeding aquatic habitats, (3) within a California red-legged frog critical habitat unit or within the vicinity of frog critical habitat, and (4) approval by the Service.

b. The Resident Engineer will stop work at the request of the Service-approved biologist(s) if activities are identified that may result in take of a California red-legged frog. Should the biologist(s) or Resident Engineer exercise this authority, the Service will be notified by telephone and email within one working day. The Service contact will be the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600.

c. The Resident Engineer will halt work immediately and contact the Service-approved project biologist and the Service in the event that a California red-legged frog is found within the construction zone. The Resident Engineer will suspend all construction activities in the immediate construction zone until the animal leaves the site voluntarily or is removed by the biologist to a release site using Service-approved transportation techniques.

d. To the extent practicable, initial ground-disturbing activities will be avoided between November 1 and March 31 to avoid the period when California red-legged frogs are most likely to be moving through upland areas. When ground-disturbing activities must take place between November 1 and March 31, daily monitoring will occur for California red-legged frogs.

e. Exclusionary fencing will be placed at the edge of active construction areas (cleared by biological surveys) in areas identified as California red-legged frog habitat. The fencing is intended to restrict frog access from the adjacent upland and riparian habitat. The fence will consist of taut silt fabric: 24 inches high, stacked at 10-foot intervals, with the bottom buried 6 inches below grade. The bid solicitation package Special Provisions will clearly describe acceptable fencing material and proper fence installation and maintenance. The wildlife exclusion fence will remain in place throughout the duration of construction activities and will be regularly inspected and fully maintained. The fence will be completely removed upon completion of project-related activities within these areas and the areas returned to preconstruction condition or better

f. California red-legged frogs that need to be relocated outside the construction area will be released beyond the exclusion fence within the same riparian area or watershed by the Service-approved biologist. If relocation of the frog outside the fence is not feasible (i.e., there are too many frogs observed per day), the biologist will relocate frogs to a preapproved location determined by Caltrans and the Service. Prior to construction, Caltrans will obtain approval of the relocation protocol from the Service in the event that a California red-legged frog is encountered and needs to be relocated away from the immediate project area.

g. To prevent inadvertent entrapment of a California red-legged frog during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each working day with plywood or similar material, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the onsite biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and email within one working day.

h. Within and adjacent to California red-legged frog habitat, all construction equipment or construction debris left overnight within the action area will be inspected for

California red-legged frogs by the Service-approved biologist prior to the beginning of each day's activities and prior to being moved.

i. Injured California red-legged frogs will be cared for by a licensed veterinarian or other qualified person such as the onsite biologist; dead individuals of any listed species will be preserved according to standard museum techniques and held in a secure location. The Service will be notified within one working day of the discovery of death or injury to a listed species that results from project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a U.S. Geological Survey (USGS) 7.5-minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. Dead frogs will be placed in a sealed plastic bag with a piece of paper containing information on where and when the animal was found along with the name of the person who found it, the bag will be placed in a freezer located in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600 and the Resident Agent-in-Charge of Service's Law Enforcement Division at (916) 414-6660.

j. To the extent practicable, nighttime construction will be minimized, especially for those areas adjacent to California red-legged frog habitat. When nighttime work is to be conducted in areas adjacent to potential habitat, all lighting will face away from potential habitat.

k. Plastic monofilament netting (erosion control matting) or similar material will not be used in the action area because California red-legged frogs can become entangled and trapped in it. Instead, Caltrans will use alternative materials such as coconut coir matting or pacified hydroseeding compounds.

l. Vehicle and equipment speed will be limited to 20 miles per hour in unpaved portions of the action area.

m. No pets will be permitted in the action area.

n. For onsite storage of pipes and conduits and other materials that could provide shelter for California red-legged frogs, an open-top trailer will be used to elevate the materials above ground. This is intended to reduce the potential for animals to climb into the conduits and other materials.

25. Caltrans will provide a Funding Assurance Letter stating that sufficient funds for habitat compensation have been budgeted in the Interstate I-80/I-680/SR 12 Interchange Phase 1 Project Expenditure Authorization. The Funding Assurance Letter will be signed by the District Deputy Director of Project Management and the District Deputy Director of Environmental Planning and Engineering. The Funding Assurance Letter provides

evidence that Caltrans has allocated sufficient funding to implement the proposed compensation.

26. Land used for habitat compensation will include a Service-approved conservation easement. An approved ecologically-based conservation easement will include managed public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a PAR-like property analysis. The management plan will include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities will be implemented, how often and to what level monitoring of the site will occur, and a action/contingency plan to address potential management issues.

27 Caltrans will provide a restoration and revegetation plan for each construction package to be reviewed and approved by the Service no later than sixty (60) calendar days prior to date of its initial groundbreaking of each construction package. The plan will include, but will not be limited to: schedule, methodology, a list of the seed mixes and container plants, plant material source, irrigation, maintenance schedule, monitoring program, success criteria, control of invasive, noxious weeds, and remediation and adaptive management. In addition, annual monitoring reports on the success of the plantings shall be provided to the Service following the completion for each construction package. The reports will be submitted on or before December 31 of each year monitoring is conducted.

The revegetation plan will include a photo monitoring plan. The plan will include, but is not limited, to the following:

a. An adequate number of photo monitoring stations will be established to provide representative views of project restoration and construction activities. Stations will be located in areas that allow for unobstructed views and a field of vision of approximately 2000 feet, to the extent allowed by surrounding vegetative cover and topography. Each station will provide a representative panoramic view of the restoration footprint. Caltrans will ensure that photo monitoring stations numbers and locations are sufficient to document restoration success.

b. Baseline photographs will be taken during the spring growing season prior to construction. Following the completion of ground disturbance, photo documentation will be conducted quarterly to document restoration relative to four seasons. Photo documentation will conclude when the Service has agreed that success criteria have been met.

c. Photo monitoring station locations will be provided to the Service in an acceptable geographic format with the coordinate system identified.

d. If the Service or the biological monitor(s) determines that additional monitoring stations are necessary, the locations will be added to the inventory of photo monitoring stations prior to the date of the next photo documentation.

e. During each photo monitoring cycle all stations will be visited within a two day period.

f. At the conclusion of restoration, the acreage of restored areas will be tabulated and provided to the Service. The extent of restoration will be delineated with a handheld GPS device and a trackfile provided to the Service Representative.

28. Routine maintenance activities will be identified in the Restoration/Revegetation Plan. Maintained R-O-Ws may include routine maintenance activities that are short in duration, such as spraying and mowing. Specific restrictions may apply for the valley elderberry longhorn beetle, callippe silverspot butterfly , California red-legged frog, and the showy Indian clover.

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." For the proposed action, the action area includes: (1) all lands associated with the approximately 258.14-acre construction footprint (of which 136.72 acres is existing hardscape) including roads (except for County roads, and State and Federal highways) and other areas accessed by project vehicles, and (2) lands within 1,000 feet of the construction footprint subjected to project-related lighting, noise, vibration, runoff, and fugitive dust.

Analytical Framework for the Jeopardy and Adverse Modification Analysis

Jeopardy Determination

The following analysis relies on four components to support the jeopardy determination for the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog: (1) the *Status of the Species*, which evaluates the species' range wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the species.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the species' current status and, for non-Federal activities in the action area, those actions likely to affect the species in the future, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the species and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR §402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Biological Opinion relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range wide condition of designated critical habitat for Contra Costa goldfields and California red-legged frog in terms of PCEs, the factors responsible for that condition, and the intended recovery function of the critical habitat at the provincial and range-wide scale; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects* which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units. For purposes of the adverse modification determination, the effects of the proposed Federal action on Contra Costa goldfields and California red-legged frog critical habitats are evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for Contra Costa goldfields and the California red-legged frog.

The analysis in this Biological Opinion places an emphasis on using the intended range-wide recovery function of Contra Costa goldfields and California red-legged frog critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Status of the Species

Vernal Pool Fairy Shrimp

Refer to the *Vernal Pool Fairy Shrimp 5- Year Review* for status and life history information (Service 2007a). This document can be downloaded from the world wide web at: http://www.fws.gov/cno/es/images/Graphics/VPFS_5-yr%20review%20CNO%20FINAL%2027Sept07.pdf

Vernal Pool Tadpole Shrimp

Refer to the *Vernal Pool Tadpole Shrimp 5- Year Review* for status and life history information (Service 2007b). This document can be downloaded from the world wide web at: http://www.fws.gov/cno/es/images/Graphics/VP%20Tadpole%20Shrimp_5%20yr%20review%20FINAL%20CNO%2027Sept07.pdf

Callipe Silverspot Butterfly

Refer to the *Callippe Silverspot Butterfly 5- Year Review* for status and life history information (Service 2009). This document can be downloaded from the world wide web at: http://ecos.fws.gov/docs/five_year_review/doc2518.pdf.

Valley Elderberry Longhorn Beetle

Refer to *Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus) 5-Year Review: Summary and Evaluation* (Service 2006b) for status and life history information. This document can be downloaded from the world wide web at: http://ecos.fws.gov/docs/five_year_review/doc779.pdf.

California Red-Legged Frog

The California red-legged frog was listed as a threatened species on May 23, 1996 (61 FR 25813). A recovery plan was published for the California red-legged frog on September 12, 2002 (Service 2002). A revised critical habitat was designated for this species on March 17, 2010 (75 FR 12816). At this time, the Service recognized the taxonomic change from *Rana aurora draytonii* to *Rana draytonii* (Shaffer *et al.* 2010).

The California red-legged frog is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have light centers (Stebbins 2003), and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

The historic range of the California red-legged frog extended from the vicinity of Elk Creek in Mendocino County, California, along the coast inland to the vicinity of Redding in Shasta County, California, and southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). The species was historically documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (Service 2002). California red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the Central California Coast. Isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. The species is believed to be extirpated from the

southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (CDFG 2011a).

California red-legged frogs predominately inhabit permanent water sources such as streams, lakes, marshes, natural and manmade ponds, and ephemeral drainages in valley bottoms and foothills up to 4,921 feet in elevation (Jennings and Hayes 1994, Bulger *et al.* 2003, Stebbins 2003). However, California red-legged frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. California red-legged frogs also can be found in disturbed areas such as channelized creeks and drainage ditches in urban and agricultural areas. For example, an adult California red-legged frog was observed in a shallow isolated pool on North Slough Creek in the American Canyon area of Napa County (Christine Gaber/PG&E personal communication with Chris Nagano/Service on October 22, 2008). This frog location was surrounded by vineyard development. Another adult California red-legged frog was observed under debris in an unpaved parking lot in a heavily industrialized area of Burlingame (Patrick Kobernus/Coast Ridge Ecology communication with Michelle Havens/Service on October 16, 2008). This Burlingame frog was likely utilizing a nearby drainage ditch. Caltrans also has discovered California red-legged frog adults, tadpoles, and egg masses within a storm drainage system within a major cloverleaf intersection of Millbrae Avenue and State Route 101 in a heavily developed area of San Mateo County (Caltrans 2007). The California red-legged frog has the potential to persist in disturbed areas as long as those locations provide at least one or more of their life history requirements.

California red-legged frogs typically breed between November and April, although earlier breeding records have been reported in southern localities. Breeding generally occurs in still or slow-moving water often associated with emergent vegetation, such as cattails, tules or overhanging willows (Storer 1925, Hayes and Jennings 1988). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on or near the surface of the water (Hayes and Miyamoto 1984).

Habitat includes nearly any area within 1 to 2 miles of a breeding site that stays moist and cool through the summer including vegetated areas with coyote brush, California blackberry thickets, and root masses associated with willow and California bay trees (Fellers 2005). Sheltering habitat for California red-legged frogs potentially includes all aquatic, riparian, and upland areas within the range of the species and includes any landscape feature that provides cover, such as animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

California red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adults are often associated with permanent bodies of water. Some individuals remain at breeding sites year-round, while others disperse to neighboring water features. Dispersal distances are typically less than 0.5-mile, with a few individuals moving up to 1 to 2 miles (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move

directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005).

In a study of California red-legged frog terrestrial activity in a mesic area of the Santa Cruz Mountains, Bulger *et al.* (2003) categorized terrestrial use as migratory and non-migratory. The latter occurred from one to several days and was associated with precipitation events. Migratory movements were characterized as the movement between aquatic sites and were most often associated with breeding activities. Bulger *et al.* (2003) reported that non-migrating frogs typically stayed within 200 feet of aquatic habitat 90 percent of the time and were most often associated with dense vegetative cover, i.e., California blackberry, poison oak and coyote brush. Dispersing frogs in northern Santa Cruz County traveled distances from 0.25-mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003).

In a study of California red-legged frog terrestrial activity in a xeric environment in eastern Contra Costa County, Tatarian (2008) noted that the majority of frogs (57 percent) fitted with radio transmitters in the Round Valley study area stayed at their breeding pools, whereas 43 percent moved into adjacent upland habitat or to other aquatic sites. Her study reported a peak seasonal terrestrial movement occurring in the fall months associated with the first 0.2-inch of precipitation and tapering off into spring. Upland movement activities ranged from 3 to 233 feet, averaging 80 feet, and were associated with a variety of refugia including grass thatch, crevices, cow hoof prints, ground squirrel burrows at the base of trees or rocks, logs, and under man-made structures; others were associated with upland sites lacking refugia (Tatarian 2008). The majority of terrestrial movements lasted from one to four days; however, one adult female was reported to remain in upland habitat for 50 days (Tatarian 2008). Upland refugia closer to aquatic sites were used more often and were more commonly associated with areas exhibiting higher object cover, e.g., woody debris, rocks, and vegetative cover. Subterranean cover was not significantly different between occupied upland habitat and non-occupied upland habitat.

California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Egg masses containing 2,000 to 5,000 eggs are attached to vegetation below the surface and hatch after six to 14 days (Storer 1925, Jennings and Hayes 1994). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992). Eggs exposed to salinity levels greater than 4.5 parts per thousand resulted in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3½ to seven months following hatching and reach sexual maturity two to three years of age (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1985, 1990, 1994). Of the various life stages, larvae probably experience the highest mortality rates, with less than one percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Under favorable conditions, California red-legged frogs may live eight to ten years (Jennings *et al.* 1992). Populations can fluctuate from year to year; favorable conditions allow the species to have extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, the animal may temporarily disappear from an area when conditions are stressful (e.g., during periods of drought, disease, etc.).

The diet of California red-legged frogs is highly variable and changes with the life history stage. The diet of the larvae is not well studied, but is likely similar to that of other ranid frogs, which feed on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005: Kupferberg 1996a, 1996b, 1997). Hayes and Tennant (1985) analyzed the diets of California red-legged frogs from Cañada de la Gaviota in Santa Barbara County during the winter of 1981 and found invertebrates (comprising 42 taxa) to be the most common prey item consumed; however, they speculated that this was opportunistic and varied based on prey availability. They ascertained that larger frogs consumed larger prey and were recorded to have preyed on Pacific chorus frog, three-spined stickleback and, to a limited extent, California mice, which were abundant at the study site (Hayes and Tennant 1985, Fellers 2005). Although larger vertebrate prey was consumed less frequently, it represented over half of the prey mass eaten by larger frogs suggesting that such prey may play an energetically important role in their diets (Hayes and Tennant 1985). Juvenile and subadult/adult frogs varied in their feeding activity periods; juveniles fed for longer periods throughout the day and night, while subadult/adults fed nocturnally (Hayes and Tennant 1985). Juveniles were significantly less successful at capturing prey and all life history stages exhibited poor prey discrimination, feeding on several inanimate objects that moved through their field of view (Hayes and Tennant 1985).

The direction and type of habitat used by dispersing animals is especially important in fragmented environments (Forys and Humphrey 1996). Models of habitat patch geometry predict that individual animals will exit patches at more "permeable" areas (Buechner 1987; Stamps *et al.* 1987). A landscape corridor may increase the patch-edge permeability by extending patch habitat (La Polla and Barrett 1993), and allow individuals to move from one patch to another. The geometric and habitat features that constitute a "corridor" must be determined from the perspective of the animal (Forys and Humphrey 1996).

Because their habitats have been fragmented, many endangered and threatened species exist as metapopulations (Verboom and Apeldom 1990; Verboom *et al.* 1991). A metapopulation is a collection of spatially discrete subpopulations that are connected by the dispersal movements of the individuals (Levins 1970; Hanski 1991). For metapopulations of listed species, a prerequisite to recovery is determining if unoccupied habitat patches are vacant due to the attributes of the habitat patch (food, cover, and patch area) or due to patch context (distance of the patch to other patches and distance of the patch to other features). Subpopulations on patches with higher quality food and cover are more likely to persist because they can support more individuals. Large populations have less of a chance of extinction due to stochastic events (Gilpin and Soule 1986). Similarly, small patches will support fewer individuals, increasing the rate of extinction. Patches that are near occupied patches are more likely to be recolonized when local extinction occurs and may benefit from emigration of individuals via the "rescue" effect (Hanski 1982; Gotelli 1991, Holt 1993; Fahrig and Merriam 1985). For the metapopulation to persist, the rate of patches being colonized must exceed the rate of patches going extinct (Levins 1970). If some subpopulations go extinct regardless of patch context, recovery actions should be placed on patch attributes. Patches could be managed to increase the availability of food and/or cover

Movements and dispersal corridors likely are critical to California red-legged frog population dynamics, particularly because the animals likely currently persist as metapopulations with

disjunct population centers. Movement and dispersal corridors are important for alleviating over-crowding and intraspecific competition, and also they are important for facilitating the recolonization of areas where the animal has been extirpated. Movement between population centers maintains gene flow and reduced genetic isolation. Genetically isolated populations are at greater risk of deleterious genetic effects such as inbreeding, genetic drift, and founder effects. The survival of wildlife species in fragmented habitats may ultimately depend on their ability to move among patches to access necessary resources, retain genetic diversity, and maintain reproductive capacity within populations (Hilty and Merenlender 2004; Petit *et al.* 1995; Buza *et al.* 2000).

Most metapopulation or meta-population-like models of patchy populations do not directly include the effects of dispersal mortality on population dynamics (Hanski 1994; With and Crist 1995; Lindenmayer and Possingham 1996). Based on these models, it has become a widely held notion that more vagile species have a higher tolerance to habitat loss and fragmentation than less vagile species. But models that include dispersal mortality predict exactly the opposite: more vagile species should be more vulnerable to habitat loss and fragmentation because they are more susceptible to dispersal mortality (Fahrig 1998; Casagrandi and Gatto 1999). This prediction is supported by Gibbs (1998), who examined the presence-absence of five amphibian species across a gradient of habitat loss. He found that species with low dispersal rates are better able than more vagile species to persist in landscapes with low habitat cover. Gibbs (1998) postulated that the land between habitats serves as a demographic "drain" for many amphibians. Furthermore, Bonnet *et al.* (1999) found that snake species that frequently make long-distance movements have higher mortality rates than do sedentary species.

Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the California red-legged frog throughout its range. Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish, signal crayfish, and several species of warm water fish including sunfish, goldfish, common carp, and mosquitofish (Moyle 1976; Barry 1992; Hunt 1993; Fisher and Schaffer 1996). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs (*Rana aurora*), and suggested that bullfrogs could prey on subadult California red-legged frogs as well. Bullfrogs may also have a competitive advantage over California red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Furthermore, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with California red-legged frog reproduction by eating adult male California red-legged frogs. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; Jennings 1993). Thus bullfrogs are able to prey upon and out-compete California red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to California red-legged frog habitat has also affected the threatened amphibian. These declines are attributed to channelization of riparian

areas, enclosure of the channels by urban development that blocks dispersal, and the introduction of predatory fishes and bullfrogs. Diseases may also pose a significant threat, although the specific effects of disease on the California red-legged frog are not known. Pathogens are suspected of causing global amphibian declines (Davidson *et al.* 2003). Chytridiomycosis and ranaviruses are a potential threat because these diseases have been found to adversely affect other amphibians, including the listed species (Davidson *et al.* 2003; Lips *et al.* 2006). Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric threespine sticklebacks in northwestern California. Non-native species, such as bullfrogs and non-native tiger salamanders that live within the range of the California red-legged frog have been identified as potential carriers of these diseases (Garner *et al.* 2006). Humans can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (i.e., contaminated boots, waders or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in the listed species being more susceptible to the effects of disease.

Negative effects to wildlife populations from roads and pavement may extend some distance from the actual road. The phenomenon can result from vehicle-related mortality, habitat degradation, noise and light pollution, and invasive exotic species. Forman and Deblinger (1998) described the area affected as the "road effect" zone. One study along a four-lane road in Massachusetts determined that this zone extended for an average of 980 feet to either side of the road for an average total zone width of approximately 1,970 feet. However, in some areas they detected an effect greater than 0.6-mile from the road. The road effect zone can also be subtle. Van der Zandt *et al.* (1980) reported that lapwings and black-tailed godwits feeding at 1,575 to 6,560 feet from roads were disturbed by passing vehicles. The heart rate, metabolic rate and energy expenditure of female bighorn sheep increases near roads (MacArthur *et al.* 1979). Trombulak and Frissell (2000) described another type of "road-zone" effect due to contaminants. Heavy metal concentrations from vehicle exhaust were greatest within 66 feet of roads and elevated levels of metals in soil and plants were detected at 660 feet of roads. The "road-zone" varies with habitat type and traffic volume. Based on responses by birds, Forman (2000) estimated the road-zone along primary roads of 1,000 feet in woodlands, 1,197 feet in grasslands, and 2,657 feet in natural lands near urban areas. Along secondary roads with lower traffic volumes, the effect zone was 656 feet. The road-zone with regard to California red-legged frogs has not been adequately investigated.

The necessity of moving between multiple habitats and breeding ponds means that many amphibian species, such as the California red-legged frog are especially vulnerable to roads and well-used large paved areas in the landscape. Amphibians appear especially vulnerable to traffic mortality because they readily attempt to cross roads, are small and slow-moving, and thus are not easily avoided by drivers (Carr and Fahrig 2001). Van Gelder (1973) and Cooke (1995) have examined the effect of roads on amphibians and found that because of their activity patterns, population structure, and preferred habitats, aquatic breeding amphibians are more vulnerable to traffic mortality than some other species. High-volume highways pose a nearly impenetrable barrier to amphibians and result in mortality to individual animals as well as significantly fragmenting habitat. Hels and Buchwald (2001) found that mortality rates for anurans on high traffic roads are higher than on low traffic roads. Vos and Chardon (1998) found a significant negative effect of road density on the occupation probability of ponds by the moor frog (*Rana*

arvalis) in the Netherlands. In addition, incidences of very large numbers of road-killed frogs are well documented (Ashley and Robinson 1996), and studies have shown strong population level effects of traffic density (Carr and Fahrig 2001) and high traffic roads on these amphibians (Van Gelder 1973; Vos and Chardon 1998). Most studies regularly count road mortalities from slow moving vehicles (Hansen 1982; Rosen and Lowe 1994; Drews 1995; Mallick *et al.* 1998) or by foot (Munguira and Thomas 1992). These studies assume that every victim is observed, which may be true for large conspicuous mammals, but may be an incorrect assumption for small animals, such as the California red-legged frog. The carcasses of small soft-bodied amphibians like frogs are quickly decimated under passing tires and are less likely to be detected by researchers and are unlikely to persist for more than a day (Santos *et al.* 2011).

The recovery plan for the California red-legged frog identifies eight recovery units (Service 2002). The establishment of these recovery units is based on the determination that various regional areas of the species' range are essential to its survival and recovery. These recovery units are delineated by major watershed boundaries as defined by USGS hydrologic units and the limits of its range. The goal of the recovery plan is to protect the long-term viability of all extant populations within each recovery unit. Within each recovery unit, core areas have been delineated and represent contiguous areas of moderate to high California red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations. Thus when combined with suitable dispersal habitat, will allow for the long term viability within existing populations. This management strategy will allow for the recolonization of habitats within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of California red-legged frogs.

Environmental Baseline

Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp

The majority of the action area, including the eastern end of the Business Center Drive Extension is located within the Solano-Colusa vernal pool region, which was designated based largely on presence of endemic vernal pool species identified in the Service's *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Recovery Plan) (Service 2005a). The vernal pool fairy shrimp and vernal pool tadpole shrimp have been adversely affected by development and modification of vernal pool and grassland habitat within the Solano-Colusa vernal pool region and are present in much of the undeveloped areas within the region.

Most of the seasonal wetland habitat in Solano County has not been surveyed for listed branchiopods. Of the 23 vernal pool fairy shrimp records in Solano County, the CNDDB includes at least three occurrences within 5 miles of the action area (CDFG 2011a, 2011b). Three of the 30 records for vernal pool tadpole shrimp occur within 5 miles of the action area (CDFG 2011a, 2011b).

Although Caltrans did not perform protocol-level surveys for listed branchiopods, they identified at least 14 seasonal wetland features within 250 feet of the construction footprint that provide habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp. According to Caltrans, half

of these habitat features would be directly affected by the proposed project.

The Service has determined that the vernal pool fairy shrimp and vernal pool tadpole shrimp are likely to occur within the action area due to the presence of appropriate seasonal wetland habitat within the action area such as impervious soils, the seasonal hydroperiod, and topographical features that provide the necessary habitat attributes to support one or all of these species' life history stages. Caltrans identified 14 seasonal wetland features within the action area. Furthermore, wading birds, that visit this and other nearby occupied wetlands, ponds and swales to forage or drink water, act as vectors to transport cysts or adults from one pond to another through their feces or on their feathers or legs. For these reasons, the Service has determined that it is reasonable to conclude that vernal pool fairy shrimp and vernal pool tadpole shrimp to inhabit the identified seasonal wetlands within 250 feet of the construction footprint.

Callippe Silverspot Butterfly

Much of the undeveloped land in Solano County is privately owned and knowledge of the current distribution of callippe silverspot butterfly in the county's remaining areas of potential habitat is limited.

Reported records of the callippe silverspot butterfly in Solano County are located in the hills between Vallejo and Cordelia and northward into Jameson Canyon (SCWA 2009; CDFG 2011a, 2011b). Most of the current knowledge in Solano County is derived from SLT's Swett and King Ranch properties south of I-80 where management activities are being proposed and implemented to enhance callippe silverspot butterfly habitat (SCWA 2009; Service personal communication with SLT 2011).

As defined by the Solano Draft HCP's *Callippe Silverspot Butterfly Conservation Area* the likely distribution of the callippe silverspot butterfly in Solano County extends from Vallejo to at least 4 to 5 miles north of I-80 towards Green Valley and includes the rolling hills south and north of Jameson Canyon Road (SCWA 2009). This conservation area encompasses the proposed project footprint for the Business Center Drive Extension. The 3,300-acre conservation area includes core silverspot habitat and connectivity between these core areas. Approximately 7,870 acres of the conservation area is currently managed as open space by SLT and the Greater Vallejo Recreation District and an additional 660 acres has been preserved as "mitigation lands" (SCWA 2009). These open space lands are subject to varying degrees of public access for the purpose of recreation. Funding for additional surveys, monitoring, management, and enhancement of callippe silverspot butterfly habitat within the conservation area has been limited and inconsistent.

The draft Solano HCP acknowledges that steep slopes are important to the life history of the callippe silverspot butterfly (SCWA 2009). Of the approximately 1,560 acres of callippe silverspot butterfly habitat identified within the urban growth zone in the draft HCP, it was estimated that at least 350 acres of those would be conserved for the species because the slopes were too steep to develop. According to the Solano draft HCP, the cities of Vallejo and Fairfield have adopted restrictions in their general plans that limit development on slopes greater than

30 percent. The analysis in the draft HCP assumes that development would be avoided on all slopes greater than 30 percent and approximately half of those greater than 20 percent.
A key element to callippe silverspot butterfly occupation is the distribution of their larval host plant, Johnny jump-up. This perennial violet is found throughout much of the grassland and oak woodlands of coastal California but little is known about its distribution within Solano County. Silverspot butterflies may rely on Johnny jump-up stands of a few to several acres. The annual densities of this rhizomous herb on the King and Swett Ranches is highly variable (Service personal communication with SLT 2011) which is likely true throughout the *Callippe Silverspot Conservation Area*. In 2004, Monk & Associates (Caltrans 2011) found two previously unrecorded Johnny jump-up stands immediately adjacent to the construction footprint for the proposed Business Center Drive Extension. Caltrans was still able to observe a violet flower in 2011 when they attempted to follow-up on the Monk & Associates 2004 observations. However, the investigation was conducted after the plant's prime blooming period at the King/Swett Ranches reference stands (May 17, 2011 Memo from ICF International to Caltrans). Monk & Associates' 2004 observation confirmed that the larval host plant occurs within the conservation area north of I-80 and there are at least two stands adjacent to the proposed action area. Much of the proposed construction footprint for the Business Center Drive Extension is located on eastern-facing slopes. Johnny jump-ups appear to remain in bloom longer on eastern-facing slopes which likely increase the potential for larvae to mature into adulthood (SCWA 2009).

Adult callippe silverspot butterflies are less limited in their use of nectar plants. They are known to utilize native and exotic flowers depending upon availability. The butterflies show particular preference for California buckeye, coyote wildmint, and various thistles within the King and Swett Ranches (personal communication with SLT, 2011). California buckeye occurs within the various riparian areas north of I-80 and along Jameson Canyon Creek. ICF International reported numerous thistle and other adult silverspot butterfly nectar plants in the proposed Business Center Drive Extension area in May 2011 (May 17, 2011 Memo from ICF International to Caltrans).

The *Callippe Silverspot Butterfly Conservation Area* is characterized by rolling hills associated with silverspot butterfly "hill-topping" breeding behavior. Adult butterflies congregate on ridgelines and hilltops for breeding purposes and adult males will defend territories along these topographical features. The majority of the proposed construction footprint for the Business Center Drive Extension includes these associated topographical features.

Caltrans did not conduct surveys for callippe silverspot butterfly but Monk & Associates identified two *Viola* populations during general biological surveys for a former Business Center Drive Extension alignment. Monk & Associates mapped *Viola* stands approximately 20 feet south and 300 feet north of the construction footprint. Monk & Associates did not indicate how many violets they observed in each population. Caltrans was unable to successfully monitor the *Viola* populations following the 2004 observations. In addition to finding the larval host plant, Caltrans also identified numerous adult nectar plants throughout the area.

The Service believes that the callippe silverspot butterfly is reasonably certain to occur within the action area because: (1) it is located within the species' range; and (2) larval host plants, adult nectar plants, and topographical breeding habitat features are located within and/or adjacent

to the proposed construction footprint.

Valley Elderberry Longhorn Beetle

The action area is located within the current range of the valley elderberry longhorn beetle. There are at least five known occurrences of valley elderberry longhorn beetle within 5 miles of the action area (CDFG 2011a, 2011b). The draft Solano HCP states that any elderberry shrub in Solano County has the potential to support the valley elderberry longhorn beetle even though a specific plant may not show evidence of beetle use (SCWA 2009). Caltrans identified the listed beetle's host plant, the elderberry shrub, in the action area as potential habitat (Caltrans 2011). According to the BA, ten elderberry shrubs will be directly affected by the project and will be removed and transplanted. Caltrans found a potential valley elderberry longhorn beetle exit hole in two of the shrubs with stems 1 inch or greater in diameter at ground level. Therefore, the Service has determined that the valley elderberry longhorn beetle is reasonably certain to occur within the action area because of the biology and ecology of the animal, and the presence of suitable habitat.

California Red-Legged Frog

The entirety of the proposed project is located within the species' range and current distribution. The proposed project cuts through a mosaic of industrial, residential, agricultural, fallow, and open space land uses, representing a range of highly modified and degraded to high quality California red-legged frog habitat. The alignment crosses and is adjacent to several creeks (Jameson Canyon Creek, Dan Wilson Creek, Suisun Creek, Ledgewood Creek, and Green Valley Creek), numerous constructed drainage features, and perennial and seasonal ponds and marshes that provide breeding and non-breeding aquatic habitat for the California red-legged frog. Riparian vegetation along creeks and drainages and landscape vegetation in the action area provide valuable refuge, forage, and dispersal habitat for red-legged frogs. Upland grassland areas with rodent burrows and other cover sites along constructed drainage features, in fallow, and grazed fields also provide refuge, forage, and dispersal habitat for the species.

The western portion of the action area, including the Business Center Drive Extension, is within and bisects Core Area #15 (Jameson Canyon-Lower Napa River) of the California red-legged frog Recovery Unit 3 (North Coast and North San Francisco Bay) (Service 2002). The conservation needs for the Jameson Canyon-Lower Napa River core area are: (1) protecting existing populations from current and future urbanization; (2) create and manage alternative breeding habitats; and (3) protecting dispersal corridors. The Jameson Canyon-Lower Napa River Core Area is described in the recovery plan as an important source population for the species.

The Business Center Drive Extension bisects the southeastern quarter of the SOL-2 California red-legged frog designated critical habitat unit (Jameson Canyon Unit). SOL-2 is considered essential for the California red-legged frog because it provides connectivity from Napa County south to unit SOL-3 (American Canyon Unit) which occupies a wedge of habitat located between Jameson Canyon Road and Interstate 80. Critical habitat unit SOL-1 (the Sky Valley Unit) is the southernmost unit in Solano County and extends south to Suisun Bay. The connectivity function

of the three Solano County units is dependent upon maintaining red-legged frog passage across I-80 and Jameson Canyon Road (SR 12W). The construction footprint also enters the eastern corner of SOL-3 at the proposed intersection of the Business Center Drive/Redtop Road and I-80.

The *California Red-Legged Frog Conservation Strategy* in the draft Solano HCP represents the most complete regional scientific data and analysis for the California red-legged frog in Solano County (SCWA 2009). The western portion of the construction footprint, beginning at the SR 12W/I-80 intersection, is located within the *California Red-Legged Frog Conservation Area* defined in the draft HCP According to the draft HCP analysis, the existing Jameson Canyon Road and Interstate 80 create barriers between the SOL-1, -2, and -3 critical habitat units and "severely restrict or eliminate the natural dispersal and migratory movements of individuals between these three blocks of habitat, reducing the resiliency of populations and limiting genetic diversity." One of the objectives of the draft HCP is to conserve 20 percent of the historic range of the California red-legged frog within Solano County which amounts to approximately 99 percent of the Jameson Canyon-Lower Napa River core recovery area.

Relatively little is known about the California red-legged frog population in Solano County. Much of the red-leg frog habitat in Solano County occurs on private land and has not been subject to protocol-level or other surveys. As directed by the draft Solano HCP, regional surveys will be conducted for California red-legged frogs within the Jameson Canyon-Lower Napa River Core Recovery Area within two years of adopting the final HCP and will continue every five years for the life of the HCP (SCWA 2009). The first California red-legged frog CNDDB record for Solano County was not recorded until 1993 (SCWA 2009). There are only two reported observations of the species in the SOL-2 critical habitat unit and both records are the result of surveys conducted by Monk & Associates for the former alignment of the Business Center Drive Extension (Caltrans 2011). The records are located between the proposed Business Center Drive Extension and I-80. One record includes adult and juvenile red-legged frogs found approximately 400 feet from the construction footprint in a plunge pool of an ephemeral drainage. The second record includes adult frogs and tadpoles in Mangle's Pond, approximately 300 feet north of the construction footprint and south of the Business Center Drive Extension. The CNDDB record identified red-legged frog breeding on the Mangels' Property. The Mangels' pond is likely the primary breeding pond within the SOL-2 California red-legged frog critical habitat unit. There are at least 13 other California red-legged frog occurrences reported to the CNDDB within 1 to 5 miles from the construction footprint (CDFG 2011a, 2011b).

Caltrans did not conduct standardized or protocol-level frog or other wildlife surveys in the action area or a wildlife movement analysis to support their baseline analysis for the project. Due to limited access, Caltrans and the Service used aerial photography and field observations from available access locations to independently assess habitat throughout the action area vicinity.

In addition to the Mangels' Pond, Caltrans determined that the marsh immediately south of the Mangels' Pond is potential red-legged frog breeding habitat. The southern edge of this marsh is within the construction footprint for work occurring at the SR 12W/I-80 interchange. Caltrans also identified a marsh immediately north of Green Valley Creek and I-80 as potential breeding

habitat.

There are numerous barriers and impediments to California red-legged frog movement in the action area vicinity. Existing roads, business, and other development fragments the landscape and prevent or encumber access between aquatic and upland habitat for foraging, movement, dispersal, refuge, and breeding. SR 12, I-80, I-680, and surrounding surface streets do not include barriers to exclude red-legged frogs from the roadway or direct them towards safe undercrossings. Frogs that attempt to cross these roads risk mortality due to vehicle collision and exposure.

The land west of I-80, north and south of SR 12W is primarily open grassland for grazing, with interspersed ranches and vineyards. This area is characterized by large expanses of rolling hills with ephemeral drainages, riparian corridors, stock ponds, and agricultural basins. Critical habitat units SOL-2 and SOL-3 are found within these contiguous blocks of habitat.

The Service believes that the California red-legged frog is reasonably certain to occur within the action area because: (1) it is located within the species' range and current distribution; (2) suitable aquatic, riparian, and upland California red-legged frog habitat intersect the action area in multiple locations; (3) the construction footprint is immediately adjacent to recent California red-legged frog observations; (4) the project is within the California Red-Legged Frog Conservation Area identified in the draft Solano HCP (SCWA 2009); (5) the project will construct a linear barrier between a recorded breeding pond and adjacent upland habitat; (6) all the elements needed to support the species' life history are located within the construction footprint; and (6) the biology and ecology of the animal, especially the ability of adults to move considerable distances.

Critical Habitat Status and Baseline

Critical habitat is defined in Section 3 of the Act as: (1) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b)). The Service is required to list the known Primary Constituent Elements (PCE's) together with the critical habitat description. Such physical and biological features include, but are not limited to, the following:

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, or dispersal; and

5. Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Contra Costa Goldfields Critical Habitat

The Service designated 14,730 acres of critical habitat for Contra Costa goldfields in 2005 (Service 2005b). In determining which areas to designate as critical habitat, the Service considers those physical and biological features (PCEs) that are essential to the conservation of the species, and that may require special management considerations and protections (50 CFR §424.14).

Critical habitat PCEs for goldfields are the habitat components that provide:

1. 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 pools, providing for dispersal and promoting hydroperiods of adequate length in the pools; and

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 wetland species and typically exclude both native and non-native 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 proposed project includes direct effects to 3.83 acres of Contra Costa goldfields critical habitat Unit 5B. This unit encompasses 736.72 acres and is essential to the conservation of the species because it is needed to maintain the current geographic and ecological distribution of the species. The project area lies along the northern boundary of Unit 5B whose boundary is defined by SR 12E. The action area parallels the existing SR 12E and the intrusion into Unit 5B is primarily limited to the existing SR 12E road embankment sloping down to the Gentry Suisun wetland.

California Red-Legged Frog Critical Habitat

The Service designated critical habitat for the California red-legged frog on April 13, 2006 (71 FR 19244) (Service 2006a) and a revised designation to the critical habitat was published on March 17, 2010 (75 FR 12816) (Service 2010).

The PCE's defined for the California red-legged frog provide aquatic habitat for breeding and non-breeding activities and upland habitat for shelter, foraging, predator avoidance, and dispersal across its range. The PCE's and, therefore, the resulting physical and biological features essential for the conservation of the species were determined from studies of California red-

legged frog ecology. Based on the above needs and our current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, the Service determined that the PCE's essential to the conservation of the California red-legged frog are:

1. Aquatic Breeding Habitat. Standing bodies of fresh water (with salinities less than 7.0 parts per thousand), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.

2. Non-Breeding Aquatic Habitat. Freshwater and wetted riparian habitats, as described above, that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs. Other wetland habitats that would be considered to meet these elements include, but are not limited to: plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period.

3. Upland Habitat. Upland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile in most cases and comprised of various vegetational series such as grasslands, woodlands, wetland, or riparian plant species that provide the frog shelter, forage, and predator avoidance. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the wetland or riparian habitat. These upland features contribute to the filling and drying of the wetland or riparian habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), as well as small mammal burrows and moist leaf litter.

4. Dispersal Habitat. Accessible upland or riparian dispersal habitat within designated units and between occupied locations within a minimum of 1 mile of each other that allow for movement between such sites. Dispersal habitat includes various natural habitats and altered habitats such as agricultural fields, which do not contain barriers (e.g., heavily traveled road without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large reservoirs over 50 acres in size, or other areas that do not contain those features identified by PCE's 1, 2, or 3 as essential to the conservation of the subspecies.

With the revised designation of critical habitat, the Service intends to conserve the geographic areas containing the physical and biological features that are essential to the conservation of the species, through the identification of the appropriate quantity and spatial arrangement of the

PCE's sufficient to support the life-history functions of the species. Because not all life-history functions require all the PCE's, not all areas designated as critical habitat will contain all the PCE's. Refer to the final designation of critical habitat for California red-legged frog for additional information (75 FR 12816).

The action area is within critical habitat units SOL-2 and SOL-3. The proposed action will directly affect 12.75 acres of SOL-2 and 0.46 acre of SOL-3.

SOL-2 comprises approximately 3,360 acres in southwestern Solano County and a portion of extreme southeastern Napa County, south of I-80 and west of I-680. SOL-2 is essential for the conservation of the species because it provides connectivity to adjacent units to the south in the interior Coast Range north of the Suisun Bay and is expected to prevent further fragmentation of habitat in this portion of the species' range. The unit contains high-quality permanent and ephemeral aquatic habitats (PCE 1 and PCE 2) consisting of stream and plunge pools as well as large freshwater marsh surrounded by open grassland, willow, and oak that provide for breeding, and upland areas (PCE 3 and PCE 4) for dispersal, shelter, and foraging. The unit consists entirely of private land.

The physical and biological features essential to the conservation of California red-legged frog in the SOL-2 unit may require special management considerations or protection due to nonnative animal species, over grazing of habitat, urbanization, habitat alteration from invasive plant species, and recreational use which may alter aquatic or upland habitats and thereby result in the direct or indirect loss of egg masses or adults due to habitat modification and predation.

SOL-3 comprises approximately 4,597 acres in southwestern Solano County and a portion of extreme southeastern Napa County, north of I-80 and south of SR 12W The unit contains high-quality permanent and ephemeral aquatic habitats (PCE 1 and PCE 2), consisting of pools, stream, and spring habitat surrounded by riparian tree species and annual grasslands that provide for breeding, and upland areas for dispersal, shelter, and foraging (PCE 3 and PCE 4). The designation of this unit was expected to prevent further fragmentation of habitat in this portion of the species' range and provides connectivity to other units farther north and south in the interior Coast Range north of the Suisun Bay. The unit consists of 1,087 acres of local nonprofit ownership and 3,510 acres of private land.

The physical and biological features essential to the conservation of California red-legged frog in the SOL-3 unit may require special management considerations or protection due to overgrazing of aquatic and riparian habitats, and loss and alteration of habitat due to urbanization, which may alter or eliminate aquatic or upland habitats and thereby result in the direct or indirect loss of egg masses or adults.

Effects of the Proposed Action

The DEIR/EIS (Caltrans 2010) notes that a HCP has been prepared for Solano County. The draft Solano HCP is based on a conservation strategy that has been developed for a number of species, including the vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, callippe silverspot butterfly, the Central Valley Distinct Population Segment of the

California tiger salamander, and California red-legged frog (SCWA 2009). The participants in this strategy include the cities of Vallejo, Fairfield, Suisun City, and the County of Solano. The goal of the conservation strategy is to establish a framework for complying with the Federal and State endangered species acts while accommodating future urban growth, development of infrastructure, and on-going operations and maintenance activities associated with flood control, irrigation facilities, and other public infrastructure undertaken under the permitting authority of the strategy participants within Solano County over the next 30 years. The amount and type of loss and destruction of habitat and the concomitant effects on the covered species is based on a comprehensive analysis of the biology and ecology of the taxa, amount and location of habitat types, and mitigation measures that are necessary to mitigate the adverse effects. The implementation of large scale projects that are not consistent with the strategy, specifically the type, amount, location and in-perpetuity management of appropriate habitat, likely will compromise the ability of the strategy to meet the conservation requirements of the species.

Vernal Pool Fairy Shrimp/ Vernal Pool Tadpole Shrimp

According to Caltrans, construction of the proposed project will result in the loss of 1.45 acres - acre of seasonal wetland habitat suitable for vernal pool fairy shrimp and vernal pool tadpole shrimp (Caltrans 2010). All vernal pool crustaceans occupying the 1.45 acres will be killed due to earth-moving activities and permanent filling of seasonal wetland habitat.

Indirect effects to 0.26 acre of vernal pool crustacean habitat will likely result from changes in hydrology or degradation of water quality resulting from upstream construction activities. The biota of vernal pools and swales can change when the hydrologic regime is altered and small changes can have deleterious effects on entire populations of vernal pool crustaceans (Bauder 1986, 1987). Survival of aquatic organisms like vernal pool fairy shrimp and vernal pool tadpole shrimp is directly linked to the water regime of their habitat (Zedler 1987). Although vernal pool hydrology is driven by the input of precipitation, water input to vernal pool basins also occurs from surface and subsurface flow from the swale and upland portions of the complex (Zedler 1987, Hanes *et al.* 1990, Hanes and Stromberg 1998). Surface flow through the swale portion of the complex allows vernal pool species to move directly from one vernal pool to another. Upland areas are a critical component of vernal pool hydrology because they directly influence the rate of vernal pool filling, the length of the inundation period, and the rate of vernal pool drying (Zedler 1987; Hanes and Stromberg 1998).

The timing, frequency, and duration of inundation are critical to the survival of vernal pool species. Alterations of the hydrology can be particularly harmful to vernal pool crustaceans due to premature pool dry-down before the life cycles of the species are completed, preventing reproduction and disrupting gene flow. Also longer periods of inundation and/or changes in water depth could effectively change seasonal wetland functions (*e.g.*, change from vernal pool to perennial/permanent wetlands). Therefore, construction activities within vernal pool areas will result in the decline of vernal pool crustaceans, including these two listed species.

Caltrans proposes to install and properly maintain erosion control (including dust control) and water quality protection measures that will minimize downstream effects on seasonal wetlands and listed branchiopods that occupy them.

The proposed landscape and habitat restoration is important in minimizing the indirect effects to seasonal wetland habitat and the surrounding uplands. However, restoration of hydrological conditions linked to vernal pools may be difficult if not impossible to achieve in areas such as the proposed Business Center Drive Extension where a dramatic cut will be made through the rolling topography in order to achieve an acceptable road grade. Removal of topographical features will also remove watershed and other functions that influence the inundation and character of the seasonal wetlands within at least 250 feet of the construction footprint.

Caltrans proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation of 1 71 acres and restoration of 1.45 acres of vernal pool fairy shrimp and vernal pool tadpole shrimp habitat in Solano County will likely offset the adverse effects of the project and provide a benefit for the species.

Conservation measures proposed along SR 12E, including the work window, retaining wall, erosion control and stormwater protection, off-limits fencing, and biological monitoring are likely to be effective in minimizing adverse effects to listed branchiopod habitat in the Gentry Suisun wetlands.

Callippe Silverspot Butterfly

The proposed project will result in the permanent loss of 38.82 acres of callippe silverspot butterfly habitat due to construction of the Business Center Drive Extension from approximately 500 feet west of the existing western terminus of Business Center Drive to the existing Red Top Road/1-80 Intersection as callippe silverspot habitat. Establishment of this new road will require extensive grading and recontouring of rolling grasslands that provide topographical features important for callippe silverspot butterfly hill-topping breeding behavior, foraging, and possible larval development. Construction of the road will result in replacement of butterfly habitat with hardscape and maintained ROW that will likely be inhospitable for the listed butterfly. In addition to the harm and harassment associated with the destruction of callippe silverspot butterfly habitat, the project is also likely to result in effects associated with habitat fragmentation.

Construction of the Business Center Drive Extension will also result in the temporary loss of 19.32 acres of callippe silverspot butterfly habitat. This habitat will be temporarily lost due to construction access, staging, and recontouring for borrow material. Successful restoration of temporarily disturbed areas with a grassland seed mix that includes callippe silverspot butterfly nectar plants is likely to limit the habitat loss to less than one year following the initial ground disturbance.

The construction of Business Center Drive Extension will result in the loss of hilltops and ridgelines likely utilized by the callippe silverspot butterfly for reproduction. The adults of this animal frequently engage in hilltopping (Murphy and Weiss undated; Shields 1967; Thomas Reid Associates 1982), which is the behavior where adults congregate on hilltops for the purpose of locating mates. Males are more likely than females to spend time on hilltops. In a study at San Bruno Mountain in San Mateo County, 62 percent of male callippe silverspot butterflies were caught on hilltops, while only 48 percent of females were caught on hilltops (Thomas Reid

Associates 1982). After mating, females spend less time hilltopping, and more time searching for oviposition sites and nectar sources. Males tended to utilize hilltops throughout their lifespans (Thomas Reid Associates 1982). Males actively patrol hilltops and ridgelines searching for females. Females are mated almost immediately upon emergence from pupae, because males emerge first and doggedly pursue females (Mattoon et al. 1971).

Hilltops and ridgelines play an important role in callippe silverspot butterfly breeding behavior. The importance of hilltops may vary with population density; at high population levels, males may patrol below hilltops, and congregate on them during periods of low population levels (Shields 1967; Baughman et al. 1988). Hilltops and ridge lines should be considered integral components of callippe silverspot butterfly habitat. Losing hilltops from habitat areas likely decreases mate location and genetic mixing over the long-term.

The callippe silverspot butterfly conservation strategy in the draft Solano HCP did not consider the adverse impacts associated with activities such as the proposed 1.3-mile Business Center Drive Extension from the western terminus of Business Center Drive to I-80. Construction of this road extension will involve the removal of topographical features with slopes greater than 20 or 30 percent. These slopes were identified in the draft Solano HCP as important butterfly hilltop habitat that would be conserved for the species. Based on topographical maps it appears that the majority of the 58.14 acres of callippe silverspot habitat that will be directly affected by the project is characterized by slopes that could be used by the callippe silverspot butterfly for breeding purposes.

Clearing and grading may result in temporary adverse effects to some or all the life history stages through crushing or burial during larval diapauses as this process often occurs in leaf litter at the base of the plant. The caterpillars are small and difficult to find. This inability to detect caterpillars prevents any form of site survey or capture and hold of caterpillars during construction.

Use of heavy earthmoving equipment and other ground-disturbing activity resulting in habitat destruction, dust, and prolonged disturbance will likely cause adult butterflies both in and near the construction footprint to flee the area, especially during the approximate mid-May to mid-July flight season for adult butterflies. These disturbances could disrupt essential behaviors such as reproduction and foraging which could lead to adverse effects such as decreased reproductive success due to moving to less suitable areas or increased difficulty in locating a mate.

Adult callippe silverspot butterflies are strong fliers. After road construction is complete, butterflies would likely avoid collision with vehicles by flying over road cuts for the Business Center Drive Extension. However, they would be susceptible to harm and mortality when crossing in areas where habitat on either side of the new road is at or near grade with the road. Road mortality can result in significant reliable loss of adult butterflies over time.

Construction and grading activities may produce dust which can interfere with the respiration and foraging of active adults. Insects breathe via spiracles and inhalation of small particles, such as dust, could prevent their respiration and result in their asphyxiation. Ehrlich (1984) speculated that the decline of the common alpine butterfly in the upper East River drainage of

Gunnison County. Colorado, was the result of an increase in dust from increased vehicular traffic.
Viola populations have been recorded adjacent to the construction footprint but the extent of the populations is not well known. There have been no additional larval host plant surveys since the reconnaissance-level surveys conducted in 2003 and 2004. The food plants of the callippe silverspot butterfly adult nectar plants could be eliminated by construction. Destruction of larval host and larval and adult nectar plants would result in a decrease in the amount of habitat available for reproduction and development of immature butterflies.

Successful propagation and establishment of *Viola* has not been successful to date. Therefore loss of larval host plants cannot be minimized through restoration alone. Successful establishment of adult food plants is feasible and will be an integral part of Caltrans' restoration plan.

Another potential effect of the proposed project on the listed butterfly is the elimination of their habitat due to non-native vegetation invading areas where restoration has not been implemented or is inadequate. Soil disturbance, such as that associated with project associated activities, facilitates the invasion of areas by non-native species. Increased human activity introduces new non-native species. These plants could eventually displace or otherwise out-compete the plants which are depended upon by the callippe silverspot butterfly.

The Business Center Drive Extension construction footprint is immediately adjacent to two previously identified *Viola* populations. The proximity of construction activities may deter livestock grazing in these locations and temporary and permanent road ROW fencing will exclude livestock from accessing these areas. The removal of livestock grazing pressure from patches of vegetation supporting *Viola* could result in a reduction in the abundance and distribution of this plant. This in turn could result in a reduction in available habitat for the early stages of callippe silverspot butterfly.

Caltrans' proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation or restoration of 126.12 estimated acres of callippe silverspot butterfly habitat in Solano County. This will likely offset the adverse effects of the project and provide a benefit for the species. This habitat will be permanently protected and a management plan will be implemented which will aid the species.

Valley Elderberry Longhorn Beetle

The proposed project will directly affect ten elderberry shrubs that are suitable habitat for the valley elderberry longhorn beetle within the proposed project area. Transplantation of the elderberry shrubs may cause them to die, experience stress, or become unhealthy due to changes in soil, hydrology, microclimate, or associated vegetation. This may reduce their quality as habitat for the valley elderberry longhorn beetle, or impair their production of habitat-quality stems in the future. Branches containing larvae may be cut, broken, or crushed as a result of the transplantation process. The actions described in the *Conservation Measure 23* will reduce, but not eliminate, the potential for these effects. Additionally, the proposed project will ultimately increase the value of the valley elderberry longhorn beetle habitat in the area chosen for

transplantation.
California Red-Legged Frog

The proposed project will likely adversely affect the threatened California red-legged frog during the construction and operational phases of the project. According to Caltrans, the proposed project will result in the permanent loss of 78.48 acres and the temporary loss of 19.32 acres of California red-legged frog habitat that is used by all life stages for breeding, feeding, sheltering, and dispersal. In addition to the harm and harassment associated with the destruction of California red-legged habitat (described further below), the project is also likely to result in effects associated with habitat fragmentation.

Caltrans proposes to minimize construction related effects by implementing the *Conservation Measures* and design features (undercrossings and directional fencing along the proposed Business Center Drive Extension) included in the project description section of this biological opinion. However, in spite of these measures the project has the potential to result in a variety of adverse effects that would result in take of the California red-legged frog.

Construction could result in the killing, harming and/or harassment of juveniles and adults inhabiting areas of suitable aquatic and upland habitat. The project as proposed by Caltrans in the project description of this biological opinion would result in the loss of approximately 97.8 acres of California red-legged frog habitat. The Service has determined that the permanent and temporary loss and/or degradation of California red-legged frog habitat will result in the take of all frogs within these areas as a direct result of habitat loss.

During the construction phase, permanent and temporal loss of aquatic and upland habitat will result from the removal and/or disturbance of soil and vegetation. Construction noise, vibration, lighting used for possible night work, and increased human activity during construction may interfere with normal behaviors such as feeding, sheltering, movement between refugia and foraging grounds, and other frog essential behaviors. This can result in avoidance of areas that have suitable habitat but intolerable levels of disturbance.

Unless identified by the biological monitor or site personnel, and rescued by the biological monitor, individual California red-legged frogs exposed during excavations likely will be crushed and killed or injured by construction-related activities. Even with biological monitoring, overall awareness, and proper escape ramps, California red-legged frogs could fall into the trenches, pits, or other excavations, and then risk being directly killed or be unable to escape and be killed due to desiccation, entombment, or starvation.

Red-legged frogs can be expected to fall or willingly enter into excavations created as a result of the project. Juvenile and adult frogs may have difficulty escaping pits. Entrapment may cause frogs to be more susceptible to predation and desiccation due to exposure. Frogs may take refuge in excavations, increasing their likelihood of being crushed, entombed, or otherwise injured. Such excavations are not part of the baseline environmental conditions and therefore Caltrans would have created a feature that could lead to harm and possible frog mortality.

Proper trash disposal is often difficult to enforce on a large construction site and is a common

non-compliance issue. Improperly disposed edible trash could attract predators, such as raccoons, crows, and ravens, to the sites, which could subsequently prey on the listed amphibian. Caltrans commitment to not use erosion control devices with mono-filament should be effective in avoiding the associated risk of entanglement that can result in death by predation, starvation, or desiccation (Stuart *et al.* 2001).

Caltrans proposes to limit initial ground-disturbing activities in California red-legged frog habitat (Caltrans 2011) between April 1 and November 1, when feasible. This measure would primarily avoid the wettest time of year and the onset of the breeding season when frogs are more likely to be involved in upland dispersal. When the work window is not feasible, biological monitoring will be performed when activities occur between November 1 and March 31 Frogs are more likely to move at night and more likely to be taking cover during the day. California red-legged frogs are cryptic and can be difficult for even experienced biological monitors to find. Monitoring will be occurring during the day when most frogs will be taking cover, making them even more difficult to find. Frogs that have moved into work areas at night and taken cover are unlikely to be found by biological monitors and will most likely be killed or harmed by activities. Frogs that are found, captured, and moved will be subjected to displacement and harassment that may lead to death or injury. Therefore allowing ground-disturbing activities with the implementation of biological monitoring during the wet and cool season (November 1 to March 31) likely will result in increased take relative to limiting ground-disturbing activities to the dry season.

Caltrans states they will attempt to minimize adverse effects by locating construction staging, storage and parking areas outside of California red-legged frog habitat; clearly marking construction work boundaries with high-visibility fencing, conducting preconstruction surveys and biological monitoring, and revegetating temporarily disturbed areas. The effects of construction activities and the removal of habitat will be partially minimized by installing wildlife exclusion fencing to deter frogs from wandering onto construction sites; educating workers; and requiring a Service-approved biologist to be present to monitor construction activities.

If unrestricted, the proposed construction activities could result in the introduction of chemical contaminants to frog habitat. Exposure pathways could include inhalation, dermal contact, direct ingestion, or secondary ingestion of contaminated soil, plants or prey species. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. However, Caltrans proposes to minimize these risks by implementing erosion control, stormwater control, and spill prevention plans to minimize the potential degradation of aquatic and upland habitat that could lead to mortality and harm of California red-legged frogs. If unrestricted, biologists and construction workers traveling to the action area from other project sites may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytridiomycosis, caused by chytrid fungus, may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (e.g., water pH) that reduce normal immune response capabilities (Bosch *et al.* 2001, Weldon *et al.* 2004).

Preconstruction surveys and the relocation of individual California red-legged frogs may avoid injury or mortality; however, capturing and handling frogs may result in stress and/or inadvertent injury during handling, containment, and transport. Caltrans proposes to minimize these effects by using Service-approved biologists and relocating amphibians to suitable nearby habitat.

The Business Center Drive Extension will likely result in significant fragmentation of the landscape and ecosystem functions. Bridge work within the aquatic and riparian California red-legged frog habitat associated with Jameson Canyon Creek, Ledgewood Creek, and Green Valley Creek will include earth-moving, vegetation clearing, habitat loss, general disturbance, and temporary creek diversions. These activities have the potential to harm and harass frogs that use these areas for year-round refuge, dispersal, and foraging.

The majority of the approximately 1.3-mile road segment from Business Center Drive to SR 12W and then south to I-80 will be bordered by road cuts which limit the potential for wildlife movement or incorporating safe wildlife passage across the road. In conjunction with directional fencing, the three undercrossing will likely provide safe crossing for most wildlife, including the California red-legged frog; however, connectivity will be greatly reduced compared to existing conditions and we anticipate that fewer frogs will successfully find and successfully navigate the new undercrossings.

Of primary concern, the Business Center Drive Extension will limit movement to and from the Mangels' pond which is likely the primary population source for the western portion of the SOL-2 critical habitat unit. Isolation of this breeding pond from the remainder of the surrounding habitat will reduce the size and distribution of California red-legged frogs in the SOL-2 unit by severing or limiting connectivity of what is now largely contiguous habitat north and south of the proposed Business Center Drive Extension. With the addition of the three proposed undercrossings and directional fencing, frogs and other wildlife will be limited to 35 feet of crossing opportunities along the 0.79-mile Business Center Drive Extension from the western terminus of the existing Business Center Drive and Jameson Canyon Road (SR 12W). Construction of this barrier will reduce dispersal to 0.8 percent of the original topography that was available for movement. This adverse effect could be partially minimized if one or more breeding ponds would be constructed north of the Business Center Drive Extension.

The Business Center Drive Extension is within the City of Fairfield's urban growth boundary and establishment of the road will enable access for future industrial, residential, and recreational development within California red-legged frog habitat. This development is likely to result in additional habitat fragmentation, degradation, and loss. Caltrans has not proposed any measures to minimize this take from increased development due to this road extension.

The development associated with the proposed Business Center Drive Extension will further reduce available foraging and dispersal habitat for California red-legged frogs that breed in Mangels' pond and disperse widely to the north and west. This development, when combined with reduced connectivity of habitat caused by construction of the road extension itself, is likely to significantly reduce the size and distribution of frogs that occupy the area from Mangels' pond northward into Napa County as animals will become less successful at reaching Mangels' pond

to breed and disperse north as juveniles and lose the ability to live in the area south of the road extension as habitat is lost to development. The keys to minimizing these effects include:

1 Easements south of the proposed Business Center Drive Extension that connect Mangels' pond and the Business Center Drive Extension underpasses, and

2. Easements north of the Business Center Drive Extension.

The proposed project further precludes a key conservation need for the Jameson Canyon Lower Napa River Core Recovery Area, which is to protect the dispersal corridors between Jameson Canyon Creek and surrounding upland and breeding habitat. Planned infrastructure changes to SR 12W are likely to exacerbate the barrier effects as the roadway is widened and median barriers are installed.

Caltrans proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation of 245.1 acres of California red-legged frog habitat in Solano County will likely offset the adverse effects of the project and provide a benefit for the species. This habitat will be permanently protected and a management plan will be implemented which will aid the species.

Contra Costa Goldfields Critical Habitat

The proposed action is not expected to appreciably diminish the conservation and recovery value of critical habitat for Contra Costa goldfields. The proposed project will result in the loss of 3.83 acres (1.31 permanent + 2.52 temporary) of the 736.72-acre critical habitat unit 5B. The permanent loss is approximately 0.2 percent of the total unit. The effects will be limited to the northern edge of the unit and will occur on the existing raised SR 12E roadbed and parallel to the bottom of the slope. The completed project will not expand southward into Gentry Suisun wetland and has been designed to sustain existing hydrology. The project will avoid adverse effects to topographical features that influence the hydrology (PCE 1) and will not result in the modification of depressional features (PCE 2) within Contra Costa goldfields habitat

California Red-Legged Frog Critical Habitat

The proposed action is expected to diminish the value of the SOL-2 critical habitat in its intended function for the conservation and recovery of the California red-legged frog. The proposed project will result in the direct loss of 12.75 acres (8.30 permanent + 4.45 temporary) of the 3,360-acre unit.

The proposed project will result in the isolation of the only verified California red-legged frog breeding habitat (Mangels' Pond) in the SOL-2 unit. Mangels' Pond is also the largest pond in the unit. The Business Center Drive Extension will include three undercrossings and fencing intended to exclude frogs from the roadway and direct them towards the undercrossings. Movement, including juvenile dispersal from breeding habitat and adult movement to and from breeding habitat will be substantially limited due to a 99.2 percent reduction in the available north-south dispersal corridor.

Establishing the new road is also likely to be growth inducing, allowing access for development that will further constrict, degrade, and eliminate upland habitat adjacent to Mangels' Pond and the road undercrossings. Therefore, the proposed project has the potential to completely isolate what is likely a population source breeding pond from the remainder of SOL-2.

The Business Center Drive Extension along with the road widening and vertical barrier construction on SR 12W will severely limit connectivity that now exists between SOL-2 and SOL-3.
Therefore, the proposed project is likely to negatively modify the function of the SOL-2 unit by limiting or eliminating access to a primary breeding pond (PCE 1) and by severely limiting dispersal within the SOL-2 unit and between SOL-2 and SOL-3 (PCE 4). Caltrans' *Proposed Conservation Measures* are unlikely to sufficiently avoid adverse modification of these PCEs because the project includes limited features and the project creates limited potential for maintaining connectivity.

For purposes of the adverse modification determination, the effects on California red-legged frog critical habitat is evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales. Although the proposed project is likely to significantly impair the habitat function and recovery value of the SOL-2 and SOL-3 units, it is unlikely to adversely modify the range-wide recovery role and functions of overall California red-legged frog critical habitat designation.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area. 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 Act.

Although not a covered activity, the proposed project area is included in the zone of covered activities for the draft Solano HCP. The Fairfield General Plan designates much of this area for planned development. Adverse effects to showy Indian clover, Contra Costa goldfields and its critical habitat, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, Central California Distinct Population Segment of the California tiger salamander, and California red-legged frog and its critical habitat including habitat loss and further fragmentation in this area due to non-Federal actions would result in cumulative effects to listed species and their critical habitat. Realignment of the interchanges, particularly extension of Business Center Drive is likely to enhance urban growth potential.

Conclusion

After reviewing the current status of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog, the environmental baseline for the action area; the effects of the proposed I-80/I-680/SR 12 Interchange Phase 1 Project and the cumulative effects; it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of these listed species.

However, the proposed project likely will result in significant negative effects to critical habitat unit SOL-2 of the California red-legged frog. We based these determinations on the following: (1) pre-construction surveys will be conducted for listed species; (2) a Service-approved biologist will monitor all activities for compliance with this biological opinion; (3) effects to the valley elderberry beetle will be addressed by implementing programmatic conservation measures, including transplantation of elderberry shrubs; (4) directional fencing along and undercrossings across Business Center Drive will avoid complete isolation of a California red-legged frog breeding pond; (5) California red-legged frogs found in the project work area will be relocated to nearby suitable habitat; (6) habitat loss will be compensated with in-perpetuity preservation of vernal pool tadpole shrimp, vernal pool fairy shrimp, and California red-legged frog habitat; (7) callippe silverspot butterfly habitat loss will be compensated with in-perpetuity preservation of callippe silverspot butterfly habitat and/or enhancement of occupied habitat; and (8) other conservation measures, as described in the *Proposed Conservation Measures* of this biological opinion, that will be fully implemented by Caltrans.

The Service has also determined that the proposed action is not likely to result in the destruction or adverse modification of critical habitat for the Contra Costa goldfields due to limiting permanent effects to the existing road embankment.

The proposed action is not likely to result in the destruction or adverse modification of critical habitat for the California red-legged frog because although it will significantly reduce access to the only known breeding pond in this critical habitat unit, the effects likely will diminish the recovery, but not the survival value, of critical habitat units SOL-2 and SOL-3.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, movement, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including movement, 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 Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of any grant or permit issued to Caltrans as appropriate, in order for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this Incidental Take Statement. If Caltrans: (1) fails to adhere to the

terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document; and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

Vernal Pool Fairy Shrimp/Vernal Pool Tadpole Shrimp

The Service expects that incidental take of vernal pool fairy shrimp and vernal pool tadpole shrimp may occur during this action. The extent of the take will be difficult to detect or quantify because of the ecology and biology of these species. Additionally, their size and cryptic nature makes the finding of a dead specimen unlikely. Seasonal population fluctuations also may mask the ability to determine the exact extent of take. Due to the difficulty in quantifying the number of vernal pool crustaceans that will be taken as a result of the proposed action, the Service is quantifying take incidental to the proposed project as the number of acres of seasonal wetlands (vernal pool crustacean habitat), that will become unsuitable for vernal pool crustaceans due to direct effects as a result of the action. Therefore, the Service estimates that the proposed action will result in the direct take of all vernal pool crustaceans inhabiting 1.45 acres of vernal pool habitat. Anticipated take is expected to be in the form of harm and mortality from habitat loss and modification, construction related disturbance, and reduced fitness.

Callippe Silverspot Butterfly

The Service anticipates incidental take of callippe silverspot butterfly will be difficult to detect or quantify because it is unlikely an injured or dead specimen will be found due to the elusive and cryptic nature of the early stages of this species (eggs, larvae, pupae), the difficulty of non-specialist to observe and identify the adults, and their small size. However, the level of incidental take of this animal can be anticipated by the effects to cover, foraging, and breeding habitat. Conservation measures in this biological opinion will reduce, but are unlikely to eliminate, the potential for incidental take of this listed species. The Service, therefore, anticipates incidental take of callippe silverspot butterfly will result from the proposed project. Upon implementation of the reasonable and prudent measures, all individuals of callippe silverspot butterfly inhabiting 58.14 acres of identified habitat will be subject to incidental take in the form of harm, harassment, injury, and mortality.

Valley Elderberry Longhorn Beetle

The Service expects that incidental take of the valley elderberry longhorn beetle will be difficult to detect or quantify because the life cycle of the beetle and its small body size make discovery of a dead specimen unlikely, losses may be masked by seasonal fluctuations in numbers or other causes, and the species occurs in habitat that makes them difficult to detect. It is not possible to make an accurate estimate of the number of valley elderberry longhorn beetles that will be harassed, harmed, injured, or killed as a result of construction activities. In instances when take is difficult to detect, the Service often estimates take relative to the number of elderberry stems, 1 inch or greater in diameter, that are lost or degraded as a result of the action. Therefore, the Service estimates that all valley elderberry longhorn beetles inhabiting the 62 stems of 1 inch or

greater in the ten identified elderberry shrubs in the action area may be harassed, harmed, injured, or killed, as a result of the proposed action.

California Red-Legged Frog

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect due to their small size, wariness, and cryptic nature. Finding an injured or dead California red-legged frog is unlikely due to their relatively small body size, rapid carcass deterioration, and likelihood that the remains will be removed by a scavenger. Losses of this species may also be difficult to quantify due to a lack of baseline survey data and seasonal/annual fluctuations in their numbers due to environmental or human-caused disturbances. There is a risk of harm, harassment, injury and mortality as a result of the proposed construction activities, the permanent and temporary loss/degradation of suitable habitat, and capture and relocation efforts; therefore, the Service is authorizing take incidental to the proposed action as: (1) the injury and mortality of two adult or juvenile California red-legged frogs; and (2) the capture, harm and harassment of all California red-legged frogs within the construction footprint.

Upon implementation of the following *Reasonable and Prudent Measures*, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterflies, valley elderberry longhorn beetles, and California red-legged frogs within the action area in proportion to the amount and type of take outlined above will become exempt from the prohibitions described under section 9 of the Act. No other forms of take are exempted under this opinion.

This biological opinion does not authorize take for Federal and non-Federal actions associated with the maintenance of roadways included in this action, and the associated Caltrans and STA ROWs. Routine Caltrans and STA maintenance activities such as the removal/displacement of sand, silt, sediment, debris, rubbish, vegetation, and other obstruction flow, the control of weeds, grasses and emergent vegetation, minor repair of existing facilities, rip-rap replacement, and culvert replacement may affect listed species. Such maintenance activities and their potential effects to listed species are not evaluated in this biological opinion.

Effect of the Take

The Service has determined that the level of anticipated take for the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog is not likely to jeopardize the continued existence of this species.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed action on the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog. Caltrans will be responsible for implementation of and compliance with these measures:

1 Caltrans will minimize the effect of take to the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the Act, Caltrans shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following *Terms and Conditions* implement *Reasonable and Prudent Measure* one (1):
   a. Caltrans shall minimize the potential for harm, harassment, or killing of vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog resulting from project related activities by implementing the conservation measures as described in the *Description of the Proposed Action* of this Biological Opinion.

   b. Caltrans shall require all contractors to comply with the Act in the performance of the action and shall perform the action as outlined in the *Description of the Proposed Action* of this Biological Opinion and all other supporting documentation submitted to the Service.

   c. Caltrans shall include language in their contracts that expressly requires contractors and subcontractors to work within the boundaries of the project footprints identified in this biological opinion, including vehicle parking, staging, laydown areas, and access roads.

   d. The Service, and/or their designated agents shall have direct access at any time or immediately upon verbal request to the action area and all Service-approved biologists to ensure compliance with this Biological Opinion. Access to areas outside of the Caltrans ROW or easements shall be coordinated by Caltrans with the respective property owners.

   e. Qualifications of proposed biological monitor(s) shall be submitted to the Service for approval at least 30 calendar days prior to initiating construction activities for the proposed project.

   f. Prior to approval, the biologist(s) shall submit a letter to the Service verifying that they possess a copy of this biological opinion and understand its Terms and Conditions. The biologist(s) shall keep a copy of this Biological Opinion in their possession when on-site.

   g. The Resident Engineer or their designee shall be responsible for implementing the conservation measures and Terms and Conditions of this Biological Opinion and shall be the point of contact for the project. The Resident Engineer or their designee shall maintain a copy of this Biological Opinion onsite whenever construction is taking place. Their name and telephone number shall be provided to the Service at least thirty (30) calendar days prior to groundbreaking for each of the construction packages. Prior to ground breaking, the Resident Engineer must submit a letter to the Service verifying that they possess a copy of this Biological Opinion and have read the Terms and Conditions.

   h. An outline of the Worker Environmental Awareness Training Program shall be submitted to the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife

Office within 30 days prior to the initial onset of construction activities. As needed, training will be conducted in Spanish for Spanish language speakers.

i. A Service-approved biologist(s) shall be onsite during all activities that may result in take of vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog as determined by the Service. A minimum of one Service-approved biologist shall be onsite throughout the project duration. The Service will consider the implementation of specific project activities without the oversight of a Service-approved biologist on a case-by-case basis.

j. During construction activities outside the existing hardscape, the Service-approved biologist shall conduct clearance surveys at the beginning of each day within or adjacent to suitable listed species habitat and regularly throughout the workday when construction is occurring within or adjacent to suitable habitat.

k. Vegetation clearing and construction operations shall be limited to the minimum necessary in areas of temporary access, work areas, and staging. Trees, snags, shrubs, other vegetation, woody debris, and uncompacted forest litter will be protected to the maximum extent practicable. Tree and shrub trimming shall be minimized to the extent possible. Trees shall be pruned, or shrubs that interfere with construction or project operation shall be pruned or topped. Shrubs shall be trimmed above ground and roots will be left intact. All vegetation trimmings shall either be hauled off-site and disposed of properly, or chipped and left on-site as determined by the Caltrans Resident Engineer. When possible, stockpiles of trimmed vegetation shall be kept at least 50 feet from the bed and bank.

l. In areas where valley elderberry longhorn beetle will affected, within sixty (60) calendar days prior to the initiation of ground disturbance, Caltrans shall provide a written description of how the valley elderberry longhorn beetle buffer areas will be restored, protected, and maintained after construction is completed.

m. The following measures are intended to minimize the effect of take in the form of harassment on the California red-legged frog.

i. Each California red-legged frog encounter shall be treated on a case-by-case basis in coordination with the Service but general guidance is as follows: (1) leave the non-injured frog if it is not in danger; or (2) move the frog to a nearby location if it is in danger.

These two options are further described below.

a) When a California red-legged frog is encountered in the action area the first priority is to stop all activities in the surrounding area that have the potential to result in the harm, harassment, injury, or death of the individual. Then the monitor needs to assess the situation in order to select a course of action that will minimize adverse effects to the individual. Contact the Service once the site is

secure. The contacts for this situation are Ryan Olah (ryan_olah@fws.gov) or John Cleckler (john_cleckler@fws.gov). They can be reached at (916) 414-6600. If you get voicemail message for these contacts then contact John Cleckler on his cell phone at (916) 712-6784. The issue of contacting people on the weekend or after office hours is addressed later.

The first priority is to avoid contact with the frog and allow it to move out of the action area and hazardous situation on its own to a safe location. The animal should not be picked up and moved based on it not moving fast enough or an inconvenience for construction activities. This guidance only applies to situations where a California red-legged frog is encountered on the move during conditions that make their upland travel feasible. This does not apply to California red-legged frogs that are uncovered or otherwise exposed or in areas where there is not sufficient adjacent habitat to support the life history of the California red-legged frog should the frogs move outside the immediate area.

Avoidance is the preferred option if a California red-legged frog is not moving and is using aquatic habitat or is within some sort of burrow or other refugia. The area should be well marked for avoidance by construction and a Service-approved biological monitor should be assigned to the area when work is taking place nearby.

b) The animal should be captured and moved when it is the only option to prevent harm.

If appropriate habitat is located immediately adjacent to the capture location then the preferred option is short-distance relocation to that habitat. This must be coordinated with the Service but the general guidance is the frog should not be moved outside of the radius it would have traveled on its own. Under no circumstances should a frog be relocated to another property without the owner's written permission. It is Caltrans' responsibility to arrange for that permission.

The release must be coordinated with the Service and will depend on where the individual was found and the opportunities for nearby release. In most situations the release location is likely to be into the mouth of a small burrow or other suitable refugia and in certain circumstances pools without non-native predators may be suitable.

Only Service-approved biologists for the project can capture California red-legged frogs. Nets or bare hands may be used to capture California red-legged frogs. Soaps, oils, creams, lotions, repellents, or solvents of any sort cannot be used on hands within two hours before and during periods when they are capturing and relocating California red-legged frogs. To avoid transferring disease or pathogens between sites during the course of surveys or handling of the frogs, Service-approved biologists must use the following guidance for disinfecting equipment and clothing. These recommendations are adapted from

the *Declining Amphibian Population Task Force's Code* which can be found in their entirety at: http://www.open.ac.uk/daptf/

1) All dirt and debris, including mud, snails, plant material (including fruits and seeds), and algae, must be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water and/or an amphibian. Cleaned items should be rinsed with clean water before leaving each site.

2) Boots, nets, traps, etc., must then be scrubbed with either a 70 percent ethanol solution, a bleach solution (0.5 to 1.0 cup of bleach to 1.0 gallon of water), QUAT 128 (quaternary ammonium, use 1:60 dilution), or a six percent sodium hypochlorite 3 solution and rinsed clean with water between sites. Avoid cleaning equipment in the immediate vicinity of a pond or wetland. All traces of the disinfectant must be removed before entering the next aquatic habitat.

3) Used cleaning materials (liquids, etc.) must be disposed of safely, and if necessary, taken back to the lab for proper disposal.

4) Service-approved biologists must limit the duration of handling and captivity. While in captivity, individual California red-legged frogs shall be kept in a cool, dark, moist, aerated environment, such as a clean and disinfected bucket or plastic container with a damp sponge. Containers used for holding or transporting should not contain any standing water.

ii. The Service-approved biologist(s) shall perform a California red-legged frog clearance survey immediately prior to the initial ground disturbance. Safety permitting, the Service-approved biologist(s) will investigate areas of disturbed soil for signs of the listed species within 30 minutes following the initial disturbance of that given area.

iii. Construction crews shall review the dewatering plan prior to any in-stream work within the bed and banks that requires the construction of coffer dams and/or dewatering.

iv. Removal of vegetation shall be accomplished by a progressive cutting of vegetation from the overstory level to the ground level to allow California red-legged frogs more opportunity move out of the work area under their own volition. Vegetation shall be cleared only where necessary and will be cut approximately 4 inches above soil level except in areas that will be excavated for roadway construction. This is intended to encourage plants that reproduce vegetatively to resprout after construction. All clearing and grubbing of woody vegetation shall be done using hand tools, small mechanical tools, or backhoes and excavators. All cleared vegetation shall be removed from the project footprint to prevent attracting animals to the project site.

v. If pumping is used for dewatering, intakes shall be completely screened with wire mesh no larger than 0.2 inch to prevent frogs from entering the pump.

vi. The Service-approved biologist(s) shall permanently remove, from the project site, any aquatic exotic wildlife species, such as bullfrogs and crayfish, to the extent possible.

n. Erosion control materials other than seeding only shall consist of hydraulically applied erosion control products, organic mulches free of non-native seeds, organic mulch control nettings with loose weave construction (the strands slide along cross strands) and openings over 4 centimeters, staked in straw bales or temporary erosion control fencing. Materials utilizing fixed weaves (strands cannot move), polypropylene, polymer or other synthetic materials shall not be used.

o. Through the Resident Engineer or their designee, the Service-approved biological monitor(s) will be given the authority to communicate either verbally, by telephone, e-mail message, or hardcopy with Caltrans personnel, construction personnel or any other person(s) at the project site or otherwise associated with the project to ensure that the terms and conditions of this biological opinion are being met. If situations arise where the terms and conditions may not be met or are not being met, the biological monitor will inform the Resident Engineer, who has the authority to stop work. If the Resident Engineer exercises this authority, the Service will be notified by telephone and e-mail message within one working day. The Service contact is the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600. Discussions with the Resident Engineer, biological monitor, Caltrans staff and Service staff, will take place to identify and inform actions to resolve the issue and to document decisions.

Reporting Requirements

Caltrans shall report to the Service any information about take or suspected take of listed wildlife species. Caltrans must notify the Service via an e-mail or telephone message within 24 hours of receiving such information. Notification must include the date, time, location of the incident or of the finding of a dead or injured animal, and photographs of the specific animal. The individual animal shall be preserved, as appropriate, and held in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600, and the Resident Agent-in-Charge of the Service's Law Enforcement Division at (916) 414-6660.

Caltrans shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of each Construction Package. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the vernal pool tadpole shrimp, vernal pool fairy

shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog, if any; (v) occurrences of incidental take to any listed species, if any; and (vii) other pertinent information. The final construction acreage of permanent and temporary habitat loss will be tabulated separately and provided to the Service. The extent of permanent and temporary habitat loss will be delineated with a handheld GPS device and a trackfile of each will be provided to the Service.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases. The Service requests notification of the implementation of any conservation recommendations in order to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats. We propose the following conservation recommendations:

1. Enhancing habitat connectivity and wildlife passage across roads as well as reducing road effects should be included in the *Purpose and Need* section of environmental documents. FHWA agreed to coordinate with the Service on wildlife movement issues in a June 2, 2010, letter addressed to Mr. Greg Costello of the Western Environmental Law Center. As their NEPA delegate, Caltrans District 4 is expected to adopt the commitments made by FHWA to consider wildlife movement in transportation planning and project development.

2. Caltrans District 4 should include a wildlife passage section in their BAs that includes an analysis of the existing passage and how the project will affect passage. The analysis should include identification of the species' resources on both sides of the project boundaries, an appropriately timed road mortality survey to identify "hot spots," and strategic locations where the species could benefit from the enhancement of an existing crossing or the installation of a new crossing. Caltrans District 4 should coordinate with their headquarters office and the University of California at Davis Road Ecology Center to develop a passage and road effects approach. Further guidance is provided by FHWA's *Wildlife Vehicle Collision Reduction Study* (available at: http://www.fhwa.dot.gov/environment/hconnect/wvc/index.htm) and Caltrans' *Wildlife Crossings Guidance Manual* (http://www.dot.ca.gov/hq/env/bio/wildlife_crossings/).

3. Efforts should be made to establish upland culverts designed specifically for wildlife movement as well as making accommodations for terrestrial wildlife movement through culverts that convey hydrology. Transportation agencies should also acknowledge the value of enhancing human safety by providing safe passage for wildlife in their early project design.

4. Caltrans should reference their internal system they have developed to keep track of road mortality records and the University of California at Davis, Road Ecology Center's

California Roadkill Observation System (http://www.wildlifecrossing.net/california/). Information from these databases should be referenced in road project assessments.

5. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog and other listed species. Such banking systems also may be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate. Efforts should be made to preserve habitat along roadways in association with established or planned wildlife crossings.

6. Caltrans should continue to develop and implement their *Early Statewide Biological Mitigation Planning Project* that has been developed by the University of California at Davis, Road Ecology Center to offset the effects of Caltrans' projects on listed species.

REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the I-80/I-680/SR 12 Interchange Phase 1 Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (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, including work outside of the project footprint analyzed in this opinion and including vehicle parking, staging, lay down areas, and access roads; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion including use of rodenticides or herbicides; relocation of utilities; and use of vehicle parking, staging, lay down areas, and access roads; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

If you have any questions regarding this biological opinion for the I-80/I-680/SR 12 Interchange Phase 1 Project, please contact John Cleckler or Ryan Olah at the letterhead address or at (916) 414-6600.

Sincerely,

Susan K. Moore

Susan K. Moore
Field Supervisor

cc:
Scott Wilson and Brenda Blinn, California Department of Fish and Game, Yountville, California
Janet Adams, Solano Transportation Authority, Suisun City, California
Brendan Thompson, San Francisco Bay Regional Water Quality Control Board, Oakland, California
Carolyn Mulvihill, U.S. Environmental Protection Agency, San Francisco, California
Paula Gill, U.S. Army Corps of Engineers, San Francisco, California
Joe Heublein, National Marine Fisheries Service, Santa Rosa, California
Christopher States, Jeffrey Jenson, Frances Malamud-Roam, and Howell Chan, California Department of Transportation, Oakland, California
Shahira Ashkar, ICF International, Sacramento, California

Literature Cited

Adger, N., P Aggarwal, S. Agrawala, J. Alcamo, A. Allali, O. Anisimov, N. Arnell, M. Boko, O. Canziani, T Carter, G. Cassa, U. Confalonieri, R. Cruz, E. de Alba Alcaraz, W Eastreling, C. Field, A. Fischlin, B. Fitzharris, C G. Garcia, C. Hanson, H. Harasawa, K. Hennessy, S. Huq, R. Jones, L. K. Bogataj, D. Karoly, R. Kliein, Z. Kundzewicz, M. Lal, R. Lasco, G. Love, X. Lu, G. Magrin, I. J. Mata, R. McLean, B. Menne, G. Midgley, N. Mimura, M. Q. Mirza, J. Moreno, L. Mortsch, I. Niang-Diop, R. Nichols, B. Novaky, L. Nurse, A. Nyon, M. Oppenheimer, J. Palutikof, M. Parry, A. Patwardhan, P R. Lankao, C. Rosenzweig, S. Schneider, S. Semenov, J. Smith, J. Stone, J. van Ypersele, D. Vaughan, C. Vogel, T Wilbanks, P Wong, S. Wu, and G. Yohe. 2007 Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. Climate Change 2007· Climate change impacts, adaptation and vulnerability. Brussels, Belgium.

Ashley, E. P and J. E. Robinson. 1996. Road mortality of amphibians, reptiles and other wildlife on the Long Point Causeway, Lake Erie, Ontario. Canadian Field Naturalist 110: 403-412.

Barry, S. 1992. Letter to Marvin L. Plenert, Regional Director, U.S. Fish and Wildlife Service, Portland, Oregon, regarding proposed listing.

Bauder, E. T 1986. San Diego vernal pools: recent and projected losses, their condition, and threats to their existence. California Department of Fish and Game, Sacramento, California.

_____ 1987 Threats to San Diego vernal pools and a case study in altered pool hydrology. Pages 209-214 *in* T S. Elias (editor). Conservation and management of rear and endangered plants. California Native Plant Society. Sacramento, California.

Baughman, J.F., D.D. Murphy, and P.R. Ehrlich. 1988. Population structure of a hilltopping butterfly. Oecologia 75:593–600.

Bonnet, X., G. Naulleau, and R. Shine. 1999. The dangers of leaving home: dispersal and mortality in snakes. Biological Conservation 89: 39–50.

Bosch, J., I. Martinez-Solano, and M. Garciaparis. 2001. Evidence of a chytrid fungus infection involved in the decline of the common midwife toad (*Alytes obstetricans*) in protected areas of central Spain. Biological Conservation 97· 331–337

Buechner, M. 1987 Conservation in insular parks: simulation models of factors affecting the movement of animals across park boundaries. Biological Conservation 41:57-76.

Bulger, J. B., N. J. Scott Jr., and R. B. Seymour. 2003. Terrestrial activity and conservation of adult California red-legged frogs *Rana aurora draytonii* in coastal forests and grasslands. Biological Conservation 110:85-95.

Bury, R. B and J. A. Whelan. 1984. Ecology and management of the bullfrog. Fish and Wildlife Service/Resource Publication 155.

Buza, L. A. Young, and P Thrall. 2000. Genetic erosion, inbreeding and reduced fitness in fragmented populations of the endangered tetraploid pea *Swainsona recta*. Biological Conservation 93:177–186.

California Department of Fish and Game (CDFG). 2011a. California Natural Diversity Data Base (CNDDB) RAREFIND. Natural Heritage Division, Sacramento, California.

_____ 2011b. BIOSIS. Natural Heritage Division, Sacramento, California.

California Department of Transportation (Caltrans). 2007 Biological assessment for the restoration of the hydraulic capacity of the Cowan Storm Drain Canal within the U.S. Highway 101/Millbrae Avenue Interchange. EA 3A0400. December 2007 Caltrans District 4, Oakland, California.

_____ 2010. Interstate 80/Interstate 680/State Route 12 Interchange Project Draft Environmental Impact Report/Environmental Impact Statement. Volume 1 August 2010. Caltrans District 4, Oakland, California.

_____ 2011 Biological assessment for the Interstate 80/Interstate 680/State Route 12 Interchange Project. EA 0A5300. April 2011 Caltrans District 4, Oakland, California.

Carr, L. W., and L. Fahrig. 2001 Effect of road traffic on two amphibian species of differing vagility. Conservation Biology 15: 1071-1078.

Casagrandi, R., and M. Gatto. 1999. A mesoscale approach to extinction in fragmented habitats. Nature 400: 560-562.

Cooke, A. S. 1995. Road mortality of common toads (*Bufo bufo*) near a breeding site, 1974-1994. Amphibia-Reptilia 16: 87-90.

Davidson, E. W., M. Parris, J. Collins, J. Longcore, A. P Pessier, and J. Brunner. 2003. Pathogenicity and transmission of Chytridiomycosis in tiger salamanders (*Ambystoma tigrinum*). Copeia 2003(3): 601-607

Drews, C. 1995. Road kills of animals by public traffic in Mikumi National Park, Tanzania, with notes on baboon mortality. African Journal of Ecology 33: 89-100.

Emlen, S. T 1977 "Double clutching" and its possible significance in the bullfrog. Copeia 1977(4):749-751

Fahrig, L. 1998. When does fragmentation of breeding habitat affect population survival? Ecological Modeling 105: 273-292.

Fellers, G. 2005. *Rana draytonii* Baird and Girard, 1852b California red-legged frog. Pages 552-554 *in* M. Lannoo (editor). Amphibian declines the conservation status of United States species. University of California Press. Berkeley, California.

Fisher, R. N., and H. B. Schaffer. 1996. The decline of amphibians in California's Great Central Valley. Conservation Biology 10(5):1387-1397

Forman, R.T 2000. Estimate of the area affected ecologically by the road system in the United States. Conservation Biology 14(1): 31-35.

Forman, T T and R. D. Deblinger. 1998. The ecological road-effect zone for transportation planning. and a Massachusetts highway example. Pages 78-96 *in* G. L. Evink, P Garrett, D. Zeigler, and J. Berry (editors). Proceedings of the International Conference on Ecology and Transportation. Publication FL-ER-69-98. Florida Department of Transportation, Tallahassee.

Forys, E. A. and S. R. Humphrey. 1996. Home range and movements of the Lower Keys marsh rabbit in a highly fragmented environment. Journal of Mammalogy 77·1042-1048.

Garner, T W.J. S. Walker, J. Bosch, A. D. Hyatt, A. A. Cunningham, M. C. Fisher. 2005. Chytrid fungus in Europe. Emerging Infectious Diseases 11 1639–1641

Gibbs, J. P 1998. Amphibian movements in response to forest edges, roads, and streambeds in southern New England. Journal of Wildlife Management 62: 584-589.

Gilpin, M. E., and M. E Soule. 1986. Minimum viable populations: process of species extinctions. Pages 19-34 *in* M. E. Soule (editor). Conservation biology: the science of scarcity and diversity. Sinauer, Sunderland, Massachusetts.

Gotelli, N. J. 1991. Metapopulation models: the propagule rain, the rescue effect, and the core-satellite hypothesis. The American Naturalist 138: 768-776.

Hanes W T and L.P 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 and W.R. Ferren, Jr (editors). 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. D.H. Ikeda and R.A. Schlising (editors). Pages 49–60 in California Vernal Pool Plants: Their Habitat and Biology, Studies from the Herbarium, California State University, Chico, Number 8, Chico, CA.

Hansen, L. 1982. Trafikdræbte dyr i Danmark (Road kills in Denmark, in Danish). Dansk Ornitologisk Forenings Tidsskrift 76, pages 97–110.

Hanski, I. 1982. Dynamics of regional distribution: the core and satellite hypothesis. Oikos 38:210-221.

_____ 1991. Single species metapopulation systematics: concepts, models and observations. Biological Journal of the Linnean Society 42:3-16.

_____ 1994. A practical model of metapopulation dynamics. Journal of Animal Ecology 63: 151-162.

Hayes, M. P., and M. R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): implications for management. Pages 144-158 *in* R. Sarzo, K. E. Severson, and D. R. Patton (technical coordinators). Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. United States Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station, Fort Collins, Colorado. General Technical Report (RM-166): 1-458.

Hayes, M. P and D. M. Krempels. 1986. Vocal sac variation among frogs of the genus *Rana* from western North America. Copeia 1986(4):927-936.

Hayes, M. P and M. M. Miyamoto. 1984. Biochemical, behavioral and body size differences between *Rana aurora aurora* and *R. a. draytonii*. Copeia 1984(4):1018-1022.

Hayes, M. P., and M. R. Tennant. 1985. Diet and feeding behavior of the California red-legged frog, *Rana aurora draytonii* (Ranidae). Southwestern Naturalist 30(4): 601-605.

Hels, T and E. Buchwald. 2001. The effect of road kills on amphibian populations. Biological Conservation 99: 331-340.

Hilty, J. A. and A. M Merenlender. 2004. Use of riparian corridors and vineyards by mammalian predators in Northern California. Conservation Biology 18: 126-135.

Holt, R. D. 1993. Ecology at the mesoscale: the influence of regional processes on local communities. Pages 77–88 *in* Species Diversity in Ecological Communities. Ricklefs, R. & Schluter, D. (editors). University of Chicago Press. Chicago, Illinois,.

Hunt, L. 1993. Letter to Marvin L. Plenert, Regional Director, U.S. Fish and Wildlife Service, Portland, Oregon, regarding proposed listing.

Jennings, M. R. 1993. Letter to Peter C. Sorensen, U.S. Fish and Wildlife Service, Sacramento, California.

Jennings, M. R., and M. P Hayes. 1985. Pre-1900 overharvest of California red-legged frogs (*Rana aurora draytonii*): The inducement for bullfrog (*Rana catesbeiana*) introduction. Herpetological Review 31(1):94-103.

_____ 1990. Final report of the status of the California red-legged frog (*Rana aurora draytonii*) in the Pescadero Marsh Natural Preserve. Final report prepared for the California Department of Parks and Recreation, Sacramento, California, through Agreement (4-823-9018). Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California. 30 pages.

_____ 1994. Amphibian and reptile species of special concern in California. California Department of Fish and Game, Rancho Cordova, California. 255 pp.

Jennings, M. R., M. P Hayes, and D. C. Holland. 1992. A petition to the U.S. Fish and Wildlife Service to place the California red-legged frog (*Rana aurora draytonii*) and the western pond turtle (*Clemmys marmorata*) on the list of endangered and threatened wildlife and plants. 21 pages.

Kupferberg, S. J. 1996a. Hydrologic and Geomorphic Factors Affecting Conservation of a River-Breeding Frog (*Rana boylii*). Ecological applications 6:1322-1344.

_____ 1996b. The Ecology of Native Tadpoles (*Rana boylii* and *Hyla regilla*) and the Impacts of Invading Bullfrogs (*Rana catesbeiana*) in a Northern California River. PhD dissertation. University of California, Berkeley, California.

_____ 1997 Bullfrog (*Rana catesbeiana*) Invasion of a California River: The Role of Larval Competition. Ecology 78(6):1736-1751

Kruse, K. C and M. G. Francis. 1977 A predation deterrent in larvae of the bullfrog, *Rana catesbeiana*. Transactions of the American Fisheries Society 106(3):248-252.

La Polla, V N. and G. W Barrett. 1993. Effects of corridor width and presence on the population dynamics of the meadow vole (Microtis pennsylvanicus). Landscape Ecology 8:25-37

Levins, R. A. 1970. Extinction. American Mathematical Society 2: 77-107

Lindenmayer, D. B. and H. P Possingham. 1996. Modeling the interrelationships between habitat patchiness, dispersal capability and metapopulation persistence of the endangered species, Leadbeater's possum, in southeastern Australia. Landscape Ecology 11·79-105.

Lips K. R., D. E. Green. and R. Papendick. 2003. Chytridiomycosis in wild frogs from southern Costa Rica. Journal of Herpetology 37(1): 215-218.

MacArthur, R. A., R. H. Johnston, and V Geist. 1979. Factors in influencing heart rate in free-ranging bighorn sheep: a physiological approach to the study of wildlife harassment. Canadian Journal of Zoology 57· 2010-2021.

Mallick, S. A., G. J. Hocking, and M. M. Driessen. 1998. Road-kills of the eastern barred bandicoot (*Perameles gunnii*) in Tasmania: an index of abundance. Wildlife Research 25: 139-145.

Mao, J., D. E. Green, G. M. Fellers, and V G. Chincar. 1999. Molecular characterization of iridoviruses isolated from sympatric amphibians and fish. Virus Research 6: 45-52.

Mattoon, S.O., R.D. Davis, and O.D. Spencer. 1971 Rearing techniques for species of *Speyeria* (Nymphalidae). Journal of the Lepidopterists' Society 25:247–256.

Moyle, P B. 1976. Fish introductions in California: history and impact on native fishes. Biological Conservation 9(1):101-118.

Munguira, M. L. and J. A. Thomas. 1992. Use of road verges by butterfly and moth populations, and the effect of roads on adult dispersal and mortality. Journal of Applied Ecology 29: 316-329.

Murphy, D.D., and S.B. Weiss. undated. Report on surveys for the callippe silverspot butterfly, *Speyeria callippe callippe*, at the proposed Sky Valley development site. Department of Biological Sciences, Stanford University, Stanford, California.

Petit, R. J., N. Bahrman, and P Baradat. 1995. Comparison of genetic differentiation in maritime pine (*Pinus pinaster* Ait) estimated using isozymes, total proteins and terpenic loci. Heredity 75; 382–389.

Rosen, P C. and C. H. Lowe. 1994. Highway mortality of snakes in the Sonoran desert of southern Arizona. Biological Conservation 68: 143-148.

Santos SM, F. Carvalho, and A. Mira. 2011. How long do the dead survive on the road? Carcass persistence probability and implications for road-kill monitoring surveys. PLoS ONE 6(9): e25383. doi:10.1371/journal.pone.0025383

Shaffer, H. B., G.M. Fellers, S. R. Voss, C. Oliver, and G.B. Pauley. 2010. Species boundaries, phylogeography, and conservation genetics of the red-legged frog (*Rana aurora/draytonii*) complex. Molecular ecology 13: 2667-2677

Shields, O. 1968. Hilltopping. Journal Research on the Lepidoptera 6(2): 69-178.

Solano County Water Agency (SCWA). 2009. Solano Multispecies Habitat Conservation Plan Final Administrative Draft. Prepared by LSA. June 2009. Available at http://www.scwa2.com/Conservation_Habitat_FinalAdminDraft.aspx.

Stamps, J. A., M. Buechner and V V Krishnan. 1987 The effects of edge permeability and habitat geometry on emigration from patches of habitat. The American Naturalist 129 (4): 533-552

Stebbins, R. C. 2003. A field guide to western reptiles and amphibians. Houghton Mifflin Company, Boston, Massachusetts.

Storer, T I. 1925. A synopsis of the amphibia of California. University of California Publications in Zoology 27·1-1-342.

_____ 1933. Frogs and their commercial use. California Department of Fish and Game 19(3)203-213.

Stuart, J. M., M. L. Watson, T L. Brown, and C. Eustice. 2001 Plastic netting: an entanglement hazard to snakes and other wildlife. Herpetological Review 32(3): 162-164.

Tatarian, P J. 2008. Movement patterns of california red-legged frogs (*Rana Draytonii*) in an inland California environment. Herpetological Conservation and Biology 3(2):155-169. November.

Thomas Reid Associates. 1982. Final report to San Mateo County Steering Committee for San Bruno Mountain: endangered species survey (San Bruno Mountain), biological study - 1980–1981 Thomas Reid Associates, Palo Alto, California.

Trombulak, S. C. and C. A. Frissell. 2000. The ecological effects of roads on terrestrial and aquatic communities: a review. Conservation Biology 14:18-30.

Twedt, B. 1993. A comparative ecology of *Rana aurora* Baird and Girard and *Rana catesbeiana* Shaw at Freshwater Lagoon, Humboldt County, California. Unpublished. Master of Science thesis. Humboldt State University, Arcata, California. 53 pages plus appendix.

U.S. Fish and Wildlife Service (Service). 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). Portland, Oregon. 173 pages.

_____ 2005a. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, Oregon. xxvi + 606 pages.

_____ 2005b. 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; evaluation of economic exclusions from August 2003 Final Designation; Final Rule. **Federal Register** 70:46924-46999.

_____ 2006a. Endangered and threatened wildlife and plants; designation of critical habitat for the California red-legged frog (*Rana aurora draytonii*), and special rule exemption associated with final listing for existing routine ranching activities; final rule. **Federal Register** 71(71):19244-19346.

_____ 2006b. Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) 5-year review: summary and evaluation. Sacramento, California

_____ 2007a. Vernal pool fairy shrimp (*Branchinecta lynchi*) 5-year review: Summary and evaluation. Sacramento, California

_____ 2007b. Vernal pool tadpole shrimp (*Lepidurus packardi*) 5-year review: summary and evaluation. Sacramento, California

_____ 2010. Endangered and threatened wildlife and plants; revised designation of critical habitat for California red-legged frog; final rule. **Federal Register** 75: 12815-12959.

Van der Zande, A. N., W J. ter Keurs, and W J. Van der Weijden. 1980. The impact of roads on the densities of four bird species in an open field habitat - evidence of a long-distance effect. Biological Conservation 18: 299-321.

Van Gelder, J. J. 1973. A quantitative approach to the mortality resulting from traffic in a population of *Bufo bufo* L. Oecologia 13:93-95.

Verboom, B. and R. Apeldoorn. 1990. Effects of habitat fragmentation on the red squirrel *Sciurus vulgaris*. Landscape Ecology 4: 171–176.

Verboom, B. J., K. Lankester, and J. A. Metz. 1991 Linking local and regional dynamics in stochastic metapopulation models. Biological Journal Linnean Society 42:39-55.

Vos, C. C. and J. P Chardon. 1998. Effects of habitat fragmentation and road density on the distribution pattern of the moor frog, *Rana arvalis*. Journal of Applied Ecology 35: 44-56.

With, K. A. and T O. Crist. 1995. Critical thresholds in species' responses to landscape structure. Ecology 76: 2246-2459.

Wright, A. H. and A. A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. Comstock Publishing Company, Inc., Ithaca, New York. 640 pages.

Zedler, P H. 1987 The ecology of southern California vernal pools: a community profile. U.S. Fish and Wildlife Service Biological Report 85 (7.11).