U.S. Fish & Wildlife Service

Recovery Plan for the Santa Barbara County Distinct Population Segment of the California Tiger Salamander (*Ambystoma californiense*)

Ambystoma californiense (California tiger salamander). Photograph by Alice Abela. Used with permission.

Recovery Plan for the Santa Barbara County Distinct Population Segment of the California Tiger Salamander (*Ambystoma californiense*)

2016

Region 8

U.S. Fish and Wildlife Service

Ventura, California

Approved: acting

Regional Director, Pacific Southwest Region, Region 8,
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An electronic copy of this recovery plan will be made available at:

http://www.fws.gov/endangered/species/recovery-plans.html

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Executive Summary

Current Species Status

The Santa Barbara County Distinct Population Segment (DPS) of the California tiger salamander (*Ambystoma californiense*), was listed as endangered throughout its entire range in 2000 under the Endangered Species Act of 1973, as amended. The DPS is endemic to the northern portion of Santa Barbara County, California, and currently consists of six distinct metapopulations. The recovery priority number for the Santa Barbara County California tiger salamander is 3C, indicating a high potential for recovery and a high degree of threat in conflict with development.

Habitat Requirements and Threats

The California tiger salamander requires a combination of pond habitat for breeding and upland (underground) habitat for the rest of its life cycle. The species depends on a series of interconnected breeding and upland habitats as a metapopulation, making it particularly sensitive to changes in the amount, configuration, and quality of these habitats. A metapopulation is a set of local populations or breeding sites among which dispersal is possible, but not routine. The loss and destruction of habitat represent the primary threat to the species. Within the range of the Santa Barbara County California tiger salamander, significant portions of its habitat have been altered or destroyed. Additional threats to the species include hybridization with non-native tiger salamanders, predation by and competition with non-native species, and vehicle-strike mortality. Other potential threats include contaminants, disease, and climate change. A majority of the known California tiger salamander occurrences in Santa Barbara County currently occur on private lands, requiring continual coordination with multiple private and local government entities for management.

Recovery Strategy

The strategy to recover the Santa Barbara County California tiger salamander focuses on alleviating the threat of habitat loss and fragmentation in order to increase population resiliency (ensure a large enough metapopulation to withstand stochastic events) and redundancy (a sufficient number of metapopulations to ensure the species can withstand catastrophic events). Recovery of this species can be achieved by addressing the conservation of remaining aquatic and upland habitat that provides essential connectivity, reduces fragmentation, and sufficiently buffers against encroaching development. Appropriate management of these areas would also reduce mortality by addressing non-habitat related threats. Research and monitoring should be undertaken to determine the extent of other threats and reduce them to the extent possible, including those from non-native and hybrid tiger salamanders, other non-native species, and vehicle-strike mortality.

Recovery Goal and Objectives

The goal of this recovery plan is to reduce the threats to the Santa Barbara County California tiger salamander to ensure its long-term viability in the wild, and allow for its removal from the list of threatened and endangered species. The interim goal is to recover the population to the point that it can be downlisted from endangered to threatened status. The recovery objectives of the plan are:

1. Protect and manage sufficient habitat within the metapopulation areas to support long-term viability of the Santa Barbara County California tiger salamander.
2. Reduce or remove other threats to the Santa Barbara County California tiger salamander.

Recovery Criteria

Downlisting may be warranted when the recovery criteria below have been met in a sufficient number of metapopulation areas such that the Santa Barbara County California tiger salamander exhibits increased resiliency and redundancy to prevent endangerment in the foreseeable future.

Delisting may be warranted when the following recovery criteria have been met in a sufficient number of metapopulation areas to support long-term viability of the Santa Barbara County California tiger salamander:

1. At least four functional breeding ponds are in fully preserved status per metapopulation area.
2. A minimum of 623 acres (252 hectares) of functional upland habitat around each preserved pond is in fully preserved status.
3. Adjacent to the fully preserved ponds and fully preserved upland habitat, a minimum of 1,628 acres (659 hectares) of additional contiguous, functional upland habitat is present, which is at least 50 percent unfragmented and partially preserved.
4. Effective population size (N_e) in the metapopulation shows an overall positive trend across 10 years.
5. Management is implemented to maintain the preserved ponds free of non-native predators and competitors (e.g., bullfrogs and fish).
6. Risk of introduction and spread of non-native genotypes is reduced to a level that does not inhibit normal recruitment and protects genetic diversity within and among metapopulations.

Actions Needed

The actions identified below are those that we believe are necessary to bring about the recovery of the Santa Barbara County California tiger salamander.

1. Protect and manage habitat.
2. Restore and maintain habitat, reduce vehicle-strike mortalities, and reduce barriers to dispersal.
3. Reduce and remove threats from non-native species.
4. Prevent and reduce the potential for the transmission of disease.
5. Conduct research on threats.
6. Undertake activities in support of developing and implementing management and monitoring plans.
7. Foster collaboration and cooperation through education, outreach, and regular meetings.

Estimated Date and Cost of Recovery

Date of recovery: If recovery actions are implemented promptly and are effective, recovery criteria could be met by approximately 2045.

Cost of recovery: $181,340,000

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I. Background

A. Overview

All California tiger salamanders (*Ambystoma californiense*) are federally listed; however, they are listed as three unique entities, or Distinct Population Segments (DPSs): the Sonoma County DPS of California tiger salamander, the Santa Barbara County DPS of California tiger salamander, and Central DPS of California tiger salamander. When listing a population as a DPS under the Endangered Species Act of 1973 (USFWS 1973), as amended (Act), three elements are considered: (1) the discreteness of the population segment in relation to the remainder of the species to which it belongs, (2) the significance of the population segment to the species to which it belongs, and (3) the population segment's conservation status in relation to the Act's standards for listing (USFWS and National Marine Fisheries Service 1996).

We, the U.S. Fish and Wildlife Service (USFWS), emergency listed the Santa Barbara County DPS of the California tiger salamander as endangered under the Act on January 19, 2000 (USFWS 2000a). The final listing rule for the DPS was subsequently published on September 21, 2000 (USFWS 2000b). On May 23, 2003, we published a proposed rule in the Federal Register to list the Central California DPS as threatened and reclassify the Santa Barbara and Sonoma County DPSs from endangered to threatened, as well as a proposed rule pursuant to section 4(d) of the Act to exempt routine ranching activities from the Act's prohibitions (USFWS 2003). On August 4, 2004, we published the final rule that listed the California tiger salamander as a single threatened species rangewide rather than three separate DPSs (USFWS 2004a). This rule was subsequently vacated by a judicial decision on August 19, 2005, and the Santa Barbara County DPS was reinstated and returned to endangered status. As a result, the listed entity for this recovery plan is the endangered Santa Barbara County DPS, as determined by the September 21, 2000 listing rule (USFWS 2000b). In 2004, we designated critical habitat for the Santa Barbara County DPS of the California tiger salamander, consisting of six units totaling 7,491 acres (USFWS 2004b). The California tiger salamander is listed as a single entity by the State of California throughout its range as a threatened species (California Code of Regulations, 2010).

We finalized a 5-year review for the Santa Barbara County California tiger salamander on November 13, 2009 (USFWS 2009), and the DPS was re-assigned a recovery priority number of 3C (from 5C), indicating that the DPS has a high potential for recovery, a high degree of threat, and is in conflict with construction or development (USFWS 1983).

The following discussion summarizes characteristics of California tiger salamander biology, distribution, habitat requirements, population status, and threats that are most relevant to Santa Barbara County California tiger salamander recovery. Additional information is available in USFWS (2000a, b, 2003, 2009), Trenham (2000, 2001), Trenham et al. (2001), Shaffer et al. (2004), Trenham and Shaffer (2005), Wang et al. (2009), Searcy and Shaffer (2011), Searcy et al. (2013), and associated literature.

B. Species Description and Taxonomy

The California tiger salamander is a member of the group of mole salamanders (Family Ambystomatidae). It is a large, stocky, terrestrial salamander with a broad, rounded snout; adult

total lengths can range from 6 to 10.5 inches (15 to 22 centimeters) (Storer 1925, Searcy and Shaffer *in litt*. 2015). Adult coloration generally consists of random white or yellowish markings against a black body, and larval coloration is variable, but usually pale (Stebbins 2003).

The California tiger salamander was described as *Ambystoma californiense* by Gray (1853) from specimens collected in Monterey County (Grinnell and Camp 1917), and the species was recognized as distinct by Storer (1925) and Bishop (1943), which was later confirmed with genetic data (Shaffer and McKnight 1996, Irschick and Shaffer 1997). Recent genetic studies also show that there has been little, if any, gene flow between the Santa Barbara County California tiger salamander and other populations for a substantial period of time (Shaffer et al. 2004, 2013).

C. Distribution

The Santa Barbara County DPS of the California tiger salamander is restricted to Santa Barbara County in southern California. All known occurrences of the salamander are within the Santa Maria Basin Geomorphic Province, which occurs between the interface of the westernmost extent of the east-west trending Transverse Ranges (i.e., the Santa Ynez Mountains) and the southernmost extent of the north-south trending Coast Ranges (i.e., the San Luis Range and San Rafael Mountains). This population constitutes the southernmost range of the species (USFWS 2000b). At the time of publication of the emergency listing rule in January 2000, the Santa Barbara County California tiger salamander was known from 14 ponds. The emergency and final listing rules acknowledged that other potential breeding ponds or pond complexes may exist, but could not be surveyed at that time because access was restricted.

The Santa Barbara County California tiger salamander is found in six metapopulation areas: (1) West Santa Maria/Orcutt, (2) East Santa Maria, (3) West Los Alamos, (4) East Los Alamos, (5) Purisima Hills, and (6) Santa Rita Valley (Figure 1) (USFWS 2009). For the purposes of this recovery plan, a "metapopulation" is defined as a set of local populations or breeding sites among which dispersal is possible, but not routine. The "metapopulation areas" displayed on the maps in this plan (Figure 1; see Appendix D for maps of individual metapopulations) encompass both currently occupied, and potentially occupied suitable habitat for each metapopulation for regional conservation planning purposes. Critical habitat for the Santa Barbara County California tiger salamander has been designated within portions of each of the six metapopulations (USFWS 2004b). Each of the six metapopulation areas for the Santa Barbara County California tiger salamander contain breeding ponds for the species and are described in detail in USFWS (2009) and summarized in Figure 1 and Table 1.

Currently, there are approximately 60 known extant California tiger salamander breeding ponds in Santa Barbara County (USFWS 2009) distributed across the six metapopulations (Table 1). Since listing, USFWS and the California Department of Fish and Wildlife (CDFW) developed guidance for protocol survey efforts (USFWS and CDFG 2003), and this guidance aided in the detection of additional breeding ponds discovered post-listing. Several of the additional ponds were discovered as a result of surveys conducted as a part of proposed development or land conversion projects.

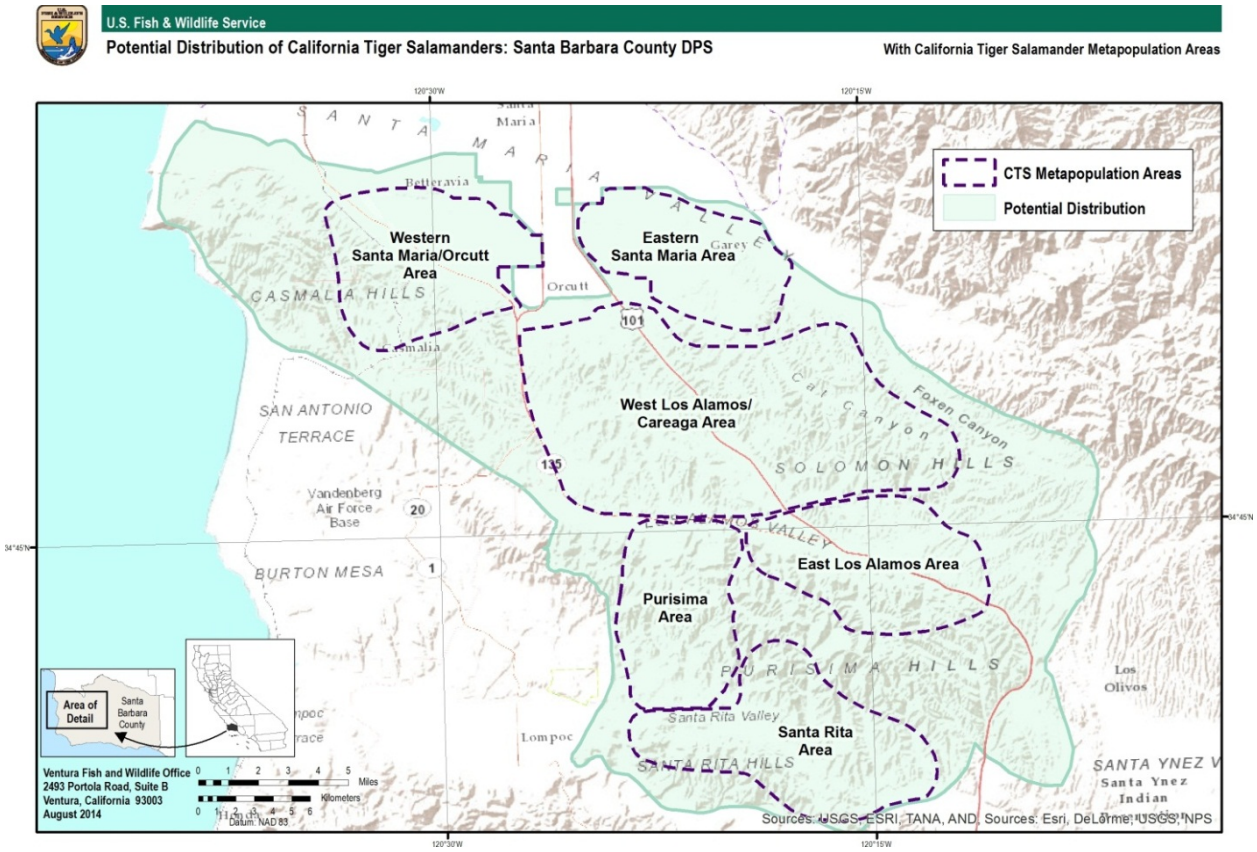

Figure 1. Distribution of Santa Barbara County California Tiger Salamanders. Metapopulation areas encompass the general area of current occurrences and associated habitat and outline the general areas where recovery actions will be focused. Potential Distribution includes the general area of suitable habitat within the range of the species that is currently occupied or has the potential to become occupied.

Table 1. Metapopulations of the Santa Barbara County California tiger salamander

Metapopulation	Designated Critical Habitat Unit & Acreage of Designated Critical Habitat	Known Extant Breeding Ponds within Metapopulations[1]	Figure of Metapopulation
West Santa Maria/Orcutt	Unit 1 (W. Santa Maria/Orcutt) 4,135 ac (acres) (1,673 ha (hectares))	15	Figure 2 (Appendix D)
East Santa Maria	Unit 2 (Eastern Santa Maria)/ 2,909 ac (1,177 ha)	5	Figure 3 (Appendix D)
West Los Alamos	Unit 3 (West Los Alamos/Careaga) / 1,451 ac (587 ha)	11	Figure 4 (Appendix D)
East Los Alamos	Unit 4 (Eastern Los Alamos) / 90 ac (36 ha)	4	Figure 5 (Appendix D)
Purisima Hills	Unit 5 (Purisima Hills) / 1,957 ac (792 ha)	19 (8 of which are permanently protected)	Figure 6 (Appendix D)
Santa Rita Valley	Unit 6 (Santa Rita Valley) / 638 ac (258 ha)	5	Figure 7 (Appendix D)

D. Abundance and Population Trends

The population size and trends of the Santa Barbara County California tiger salamander are unknown due to its cryptic life history strategy and restricted access to ponds for surveys. However, recent advances in molecular techniques have allowed researchers to measure the effective population size (N_e) of California tiger salamander populations (Wang et al. 2011). The effective population size is defined as the size of an ideal population (i.e., one that meets all the Hardy-Weinberg assumptions) that would lose heterozygosity at a rate equal to that of the observed population (Wright 1969). Effective population size measurements can be used to estimate size of the population and trends over time. Recent research on the Central DPS of the California tiger salamander shows that N_e is positively related to the area of individual vernal pools; however, no relationship was found with the area of stock ponds (Wang et al. 2011, Shaffer et al. 2013). This suggests that larger vernal pools are more valuable for the conservation of the species than smaller ones.

California tiger salamander breeding populations can fluctuate substantially due to random, natural processes. At one study site monitored for seven years in Monterey County (Central DPS of the California tiger salamander), the number of breeding adults visiting a site ranged from 57 to 244 individuals (Trenham et al. 2000). Similar work also conducted in Monterey County showed a comparable pattern of variation, suggesting that such fluctuations are typical (Loredo

[1] Number of known breeding ponds is based on USFWS 2010 known SB CTS breeding pond GIS data.

and Van Vuren 1996). Further complicating the estimation of population size is that California tiger salamanders move between ponds (Trenham et al. 2001) or even forego breeding for 2 to 8 years (Loredo and Van Vuren 1996; Trenham et al. 2000). For example, in years where rainfall is insufficient for creating suitable breeding habitat, both males and females will forego breeding for that year and each year thereafter for which breeding ponds do not fill with water (Jennings 2000). These tendencies can result in negative aquatic surveys despite the presence of the species in adjacent uplands (Trenham et al. 2000, Alvarez et al. 2013).

E. Habitat Characteristics

Historically, the Santa Barbara County California tiger salamander inhabited low-elevation (generally under 1,500 feet (475 meters)) seasonal ponds and associated grassland, oak savannah, and coastal scrub plant communities of the Santa Maria, Los Alamos, and Santa Rita Valleys in the northwestern area of Santa Barbara County (Shaffer et al. 1993, Sweet 1993). Seasonal ponds, such as vernal pools (seasonal, shallow wetlands that alternate between dry and wet periods) and sag ponds (ponds located in depressions formed at a strike-slip fault), are typically used by California tiger salamanders for breeding. California tiger salamanders are rarely found in streams or rivers. Natural breeding ponds inundate for variable periods from winter to spring, but may be completely dry for most of the summer and fall. Bedrock or hard clay layers, which help retain water, typically lie beneath these ponds. These ponds range in size from small pools to shallow lakes; preferred ponds have depths ranging between approximately 15.75 to 31.5 inches (40 to 80 centimeters) (Cook et al. 2005).

Variation in seasonal and annual rainfall can cause dramatic changes in the size and period of inundation of seasonal ponds. Breeding ponds typically collect water during winter and spring rains, changing in volume in response to varying weather patterns. During a single season, they may fill and dry several times, and in years of drought, some ponds may not fill at all. Changes in climate can alter the amount of water and the length of time that ponds are inundated, potentially resulting in long-term loss of ponds that are important breeding habitat (Pyke and Marty 2005).

The area occupied by the Santa Barbara County California tiger salamander has several unique soil formations, including dune fields (e.g., Orcutt Terrace Dune Sheet), folded and faulted ridges (e.g., Casmalia, Purisima, and Santa Rita Hills), and adjacent valleys (e.g., Los Alamos and Santa Rita Valleys) (Hunt 1993, Ferren and Hecht 2003). The complex, geologically active landscape of the area provides the seasonal ponds required by California tiger salamanders for breeding.

The introduction of livestock and the associated man-made watering or stock ponds have created various types of artificial aquatic habitat in which Santa Barbara County California tiger salamanders breed (Sweet, pers. comm. 2009). Often these ponds are located in foothill and upland terrain, and are created when a berm is placed in a natural drainage corridor, forming a pond behind it. The availability of these created aquatic habitats, along with the loss of natural vernal and seasonal pools and sag ponds, has caused California tiger salamanders to extensively shift to using these manmade or modified ephemeral and permanent ponds in the foothills. Whether or not this has affected patterns of upland habitat use is unknown (Sweet, pers. comm. 2009), but these ponds now constitute an important component of Santa Barbara County California tiger salamander habitat.

Terrestrial habitat for California tiger salamander is characterized by several important features. Small mammal burrows, primarily those of the California ground squirrel (*Spermophilus beecheyi*) and Botta's pocket gopher (*Thommomys bottae*) (Loredo et al. 1996, Trenham and Shaffer 2005), provide important habitat for California tiger salamanders during the terrestrial part of their life cycle (Trenham et al. 2000), although the density of adult California tiger salamanders appears independent of burrow density (Searcy et al. 2013). Vegetation type and microhabitat within upland areas also play a role. The species may prefer drier microhabitats to more mesic (moist) areas (Searcy et al. 2013), and less vegetation may facilitate the movement of California tiger salamanders from upland areas to breeding ponds (USFWS 2003). For example, studies have shown that radio-tracked adults favored grasslands with scattered oaks over more densely wooded areas (Trenham 2001), and that movement through grassland was twice as costly to the species (in terms of gene flow) as movement through chaparral, while oak woodlands are the most costly for the species to traverse (Wang et al. 2009).

F. Life History and Ecology

Life Cycle

Like other members of the family Ambystomatidae, California tiger salamanders spend the majority of their lives underground in small mammal burrows. California tiger salamanders may also use landscape features such as leaf litter or desiccation cracks in the soil for upland refugia. Such refugia provide protection from the sun and wind associated with a dry California climate, which can otherwise desiccate (dry out) and kill amphibians in upland terrain.

Little is known about the fossorial (i.e., underground) behavior of California tiger salamanders as they are difficult to observe while underground, though most evidence suggests that California tiger salamanders remain active. Trenham (2001) recorded underground movements within burrow systems, and other researchers have used fiber optic or infrared scopes to observe active California tiger salamanders underground (Semonsen 1998).

Winter rain events trigger California tiger salamanders to emerge from refugia and seek breeding ponds (Storer 1925). After mating, females attach their eggs to submerged twigs, grass stems, vegetation, or debris (Storer 1925; Twitty 1941). California tiger salamander eggs hatch into larvae within 10 to 28 days, (Petranka 1998; Hansen and Tremper 1993), with observed differences likely related to water temperatures. Requiring a relatively short period to complete development of the aquatic larvae as compared to other salamanders, California tiger salamanders require ponds with continuous inundation periods for 70-90 days (Shaffer and Trenham 2004). The larval developmental period can be prolonged in colder weather, commonly in excess of 4 months (Trenham et al. 2000). After the larval developmental period, they emerge as terrestrial metamorphic salamanders, between approximately May and August (Trenham et al. 2000).

Lifetime reproductive success of California tiger salamanders is typically low because they require an extended amount of time before they reach sexual maturity (4 to 5 years) (Trenham et al. 2000). Less than 50 percent of first-time breeding California tiger salamanders typically survive to breed more than once (Trenham et al. 2000). Metamorphs also have low survivorship—in some populations, less than 5 percent survive to breed (Trenham 1998). Thus, isolated metapopulations can decline substantially from unusual, randomly occurring, natural

events (e.g., disease, drought) as well as from human-caused factors that reduce breeding success and individual survival.

Metapopulation Structure and Dynamics

The California tiger salamander has a metapopulation structure. A metapopulation is a set of local populations or breeding sites among which dispersal is possible, but not routine. California tiger salamanders appear to have high site-fidelity, returning to their natal pond as adults and commonly returning to the same terrestrial habitat areas after breeding (Orloff 2007, 2011; Trenham 2001). Wang et al. (2009) studied genetic distinctness across 16 Central DPS California tiger salamander breeding sites (Fort Ord, Monterey County), and confirmed genetic differences at almost every site. More work is needed to determine the genetic distinctness across metapopulations in Santa Barbara County; however, the metapopulation structure of the DPS suggests that there would be similar genetic differences.

Migration and Dispersal

Migration is defined as movements, primarily by resident adults, toward and away from aquatic breeding sites (Semlitsch 2008). For the adult residents using a breeding pond, migrations are reoccurring events (often, but not always annually), round-trip, and intrapopulational (within local populations). Dispersal is defined as unidirectional movements that are interpopulational (between different local populations) in scale, are ultimately greater in distance than for migrating adults, and may occur only once in a lifetime (Semlitsch 2008). A local population can be either one pond or clusters of ponds in close proximity.

Juvenile dispersal is more common than adult dispersal (Trenham et al. 2001). Dispersing juveniles move from natal sites to future breeding sites that are not the pond of birth and not part of the local population. A dispersing adult moves out of the local population and/or between metapopulations.

California tiger salamanders can undertake long-distance migrations, and can disperse long distances as well. They have been recorded traveling the second-longest distance among salamanders, which is also the longest of any salamander in the family Ambystomatidae (reviewed in Searcy et al. 2013). California tiger salamanders move more readily among breeding ponds than other members of the family, a characteristic found consistently among different study sites (Trenham et al. 2001, Wang et al. 2011).

Many studies have recorded migration and dispersal distances by adult and juvenile California tiger salamanders, both through radio-tracking (Loredo et al. 1996, Trenham 2001) and upland drift fence capture (Trenham and Shaffer 2005, Orloff 2007, 2011). None of these studies were conducted within the range of the Santa Barbara County California tiger salamander, but are considered to be the best available scientific information on the species. Movement of California tiger salamanders is reviewed in USFWS (2009) and Searcy et al. (2013). In general, studies show that adults can move 1.2 miles (6,336 feet; 2 kilometers) to more than 1.4 miles (7,392 feet; 2.2 kilometers) from breeding ponds (USFWS 2000a, Trenham et al. 2001, Orloff 2011). Estimates differ on the proportion of a population likely to move large distances, with studies finding that 95 percent of a population occurs within 2,034 feet (620 meters) (Trenham and Shaffer 2005) or 1.1 miles (5,587 feet; 1.7 kilometers) (Search and Shaffer 2008, 2011, Searcy et al. 2013, C. Searcy *in litt,* 2014) of a breeding pond.

Diet

California tiger salamander larvae typically feed on invertebrate prey. This includes zooplankton, small crustaceans, and aquatic insects until the salamanders grow large enough to switch to larger prey (Anderson 1968, Fisher and Shaffer 1996). Larger larvae consume aquatic invertebrates, as well as the tadpoles of other amphibians such as Pacific chorus frogs (*Pseudacris regilla*), western spadefoot toads (*Spea hammondii*), California red-legged frogs (*Rana draytonii*), bullfrogs (*Lithobates catesbeianus*), and even juvenile mice (Anderson 1968; Trenham et al. 2000, Bobzien and DiDonato 2007). Adult California tiger salamanders can act as lie-in-wait predators at the mouths of burrows and may eat ground-dwelling invertebrates and small vertebrates that are attracted to burrows (Stebbins and McGinnis 2012). Little is known about the dietary habits of subterranean life stages of the Santa Barbara County California tiger salamander. Stomach contents of several California tiger salamander sub-adults from the Santa Barbara County included spiders, earthworms, and aquatic insects (Hansen and Tremper 1993). Van Hattem (2004) anecdotally reported a Central DPS California tiger salamander eating a moth while being observed underground. Both larval and adult California tiger salamanders can cannibalize smaller California tiger salamanders (Stebbins and McGinnis 2012).

G. Reasons for Listing and Continued Threats

In determining whether to list, delist, or reclassify (change from endangered to threatened status, or vice versa) a species under section 4(a) of the Act, we evaluate five major categories of threats to the species: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. The following is a summary and update of factors that supported the listing of the Santa Barbara County DPS of the California tiger salamander (USFWS 2000a, b) and were addressed in the 5-year status review (USFWS 2009) for the species.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

At the time of listing, we determined that loss, destruction, degradation, and fragmentation of habitat was the primary threat to the Santa Barbara County DPS of the California tiger salamander, and it remains the current primary threat (USFWS 2000a, b; 2009). The ponds available to Santa Barbara County California tiger salamanders for breeding, and the associated upland habitats inhabited by salamanders for most of their life cycle, have been degraded and reduced in area due to agricultural conversion, urbanization, and the building of roads and highways. Maintaining inter-pond dispersal potential (connectivity between ponds) is important for the long-term viability of California tiger salamanders; however, the inter-pond linkages between populations of California tiger salamanders in Santa Barbara County are considerably degraded (Pyke 2005).

Habitat Loss and Fragmentation

Habitat loss reduces the available feeding, breeding, and sheltering opportunities required for California tiger salamander survival and reproduction and thus lowers the carrying capacity of the landscape and threatens the continued existence of the species. Habitat fragmentation reduces

population connectivity needed for dispersal and migration, resulting in isolation of the metapopulations within Santa Barbara County, making them more vulnerable to small population and stochastic effects.

Conversion of California tiger salamander habitat to intensive agricultural uses results in habitat loss and fragmentation that threatens the Santa Barbara County California tiger salamander. Agriculture is the foremost industry in northern Santa Barbara County, and some of the largest agricultural operations of over 1,000 acres (405 hectares) are located in the Santa Maria Valley (Santa Barbara County Association of Governments 2007), where two of the six Santa Barbara County California tiger salamander metapopulation areas occur. Grading and leveling or deep-ripping operations associated with agricultural conversion of uplands have destroyed ponds and pools (Coe 1988), reducing breeding habitat and causing direct injury and mortality to larvae and juveniles occupying the pools. Also, conversion to intensive agriculture can create permanent barriers that can isolate California tiger salamanders and prevent them from moving to new breeding habitat, or prevent them from returning to their breeding ponds or upland habitat.

In addition to agricultural conversion, habitat loss and fragmentation resulting from urban development also threatens aquatic and upland habitat in the range of the Santa Barbara County California tiger salamander. Urban growth causes habitat loss and fragmentation as build-out converts habitat to pavement and creates structures that inhibit normal California tiger salamander movements. The City of Santa Maria and surrounding land is the fastest-growing area in the County, and the population within the City of Santa Maria is forecasted to grow 35 percent by 2040 (City of Santa Maria 2006). To meet the needs of the increasing population, several thousand acres of residentially zoned land will be needed for residences, and several thousand more acres of commercial and industrial development (e.g., schools, parks, and other urban infrastructure) will be needed to support the new residents. The West Santa Maria and East Santa Maria metapopulation areas (Appendix D: Figures 2 and 3) are isolated from one another by the cities of Orcutt and Santa Maria and U.S. Highway 101, and these metapopulations are further threatened by continued urban growth in the area. A detailed description of the threats of agricultural and urban development to each metapopulation of the Santa Barbara County California tiger salamander can be found in USFWS (2009).

Roads and highways also create permanent physical obstacles and increase habitat fragmentation. Road construction can reduce or completely eliminate the viability of a breeding site, and in some cases, large portions of a metapopulation. Large roads and highways represent physical obstacles to California tiger salamanders and can prevent them from returning to their breeding ponds or upland habitat, hinder their ability to move to new breeding habitat, and prevent recolonization of breeding sites, significantly reducing the local breeding population (Trombulak and Frissell 2000). A majority of Santa Barbara County California tiger salamander breeding ponds are less than 1 mile (1.6 km) from highways or major roads (USFWS 2009). The East Santa Maria and West Santa Maria metapopulation areas were likely one large metapopulation in pre-settlement times, but have become isolated from one another by U.S. Highway 101 (Appendix D: Figures 2 and 3). The Santa Rita metapopulation area is bisected by Highway 246, and the highway is immediately adjacent to a California tiger salamander breeding pond (Appendix D: Figure 7).

Two California tiger salamander breeding ponds in Santa Barbara County are within 0.2 mile (0.4 km) of a railroad that runs between them, possibly reducing migration, dispersal, and genetic

interchange between the ponds. Along with the barriers created by fill that allows railroads to cross small canyons and watercourses, the railroad tracks themselves can act as barriers to migrating salamanders (Jones 1993) because they cannot cross over the rails and may have difficulty moving under the tracks unless adequate burrows are present that provide for passage underneath.

Habitat Alteration

Santa Barbara County California tiger salamanders are also negatively affected by factors that alter the quality of their habitat, including: measures to control burrowing rodents; dense vegetation, often comprised of non-native invasive species, that overtakes vernal pool habitats in the absence of grazing; alteration of hydrology; and reduced pond water quality due to agricultural runoff.

California tiger salamanders are strongly associated with California ground squirrel and pocket gopher populations, as the burrows created by active colonies of ground squirrels are necessary for the salamanders to survive (Shaffer et al. 1993, Loredo et al. 1996). Because ground squirrels and pocket gophers are critical for burrow construction and maintenance, and therefore critical to the California tiger salamander, rodent population control efforts are a threat to California tiger salamander habitat quality (Shaffer et al. 1993, Loredo-Prendeville et al. 1994). Recovery of ground squirrel populations can be very rapid through immigration from nearby populations with high levels of reproductive success (Gilson and Salmon 1990). Once control efforts are halted, California tiger salamander habitat can recover relatively quickly.

Although poor grazing practices can have negative impacts on California tiger salamanders, grazing generally is compatible with the continued use of rangelands by the California tiger salamander as long as best management practices are followed, intensive burrowing animal control programs are not implemented, and grazing is not excessive (Jones 1993, Shaffer et al. 1993). Cattle ranching can be compatible with or beneficial to California tiger salamander conservation (USFWS 2003) because cattle also need open grasslands and ponds. Cattle grazing may mediate the effects of increased drying rates on vernal pools due to climate change, by reducing vegetation and allowing for longer periods of inundation that are adequate enough for California tiger salamanders to successfully breed (Pyke and Marty 2005). By keeping vegetation cover low, grazing can make areas more suitable for ground squirrels (whose burrows are used by California tiger salamanders), can facilitate the movement of California tiger salamanders from upland areas to breeding ponds (USFWS 2003), and can allow more surface runoff into the pool basin thereby helping to maintain water available for California tiger salamander breeding. Exclusion of livestock grazing may also allow invasion of aquatic habitat by non-native annual grasses and forbs within and around the bed and shoreline of the pond (Barry 1998). In Santa Barbara County, much of the remaining vernal pool complexes and isolated ponds with large amounts of suitable California tiger salamander habitat are currently being grazed.

Some seasonal ponds have been converted to irrigation ponds, which are often modified or managed in ways that reduce the quality of these pools as California tiger salamander breeding habitat. Such modifications and management include: lining of ponds that cause changes in substrate and water quality; pumping methods that can result in mortality of California tiger salamander larvae; and frequent (often daily) changes in water levels that can result in desiccation of eggs (Collins 2000). Ponds and California tiger salamander larvae inhabiting the

ponds are also subject to indirect effects of conversion to row crops such as increased siltation and eutrophication (the process of increased nutrient input) from runoff containing fertilizers, which reduces water quality and introduces toxins that can interfere with normal larval development.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization was not known to be a factor at the time of listing and is not considered a threat at this time.

FACTOR C: Disease or Predation

Disease

Disease is an important causative factor in the global amphibian decline crisis (Daszak et al. 2003). Because the Santa Barbara County California tiger salamander has limited genetic variation, it is likely to be more vulnerable to unpredictable factors, including disease (Shaffer et al. 2013). Although the exact cause of death is unknown, a possible disease outbreak was reported by a landowner in the Los Alamos Valley who saw large numbers of dead and dying Santa Barbara County California tiger salamanders in a pond (Sweet, pers. comm. 1998).

A pathogenic (disease-causing) chytrid fungus (*Batrachochytrium dedrobatidis*) (Bd), the causative agent of the amphibian disease chytridiomycosis, has been linked to amphibian declines worldwide (Berger et al. 1998, Bosch et al. 2001, Fellers et al. 2001, Lips et al. 2006, Skerratt et al. 2007, Kilpatrick et al. 2010). Bd was first documented in California tiger salamanders in Santa Clara County, California (Central DPS) (Padgett-Flohr and Longcore 2005). In a short-term laboratory study of the effects of Bd on California tiger salamanders, the species was found to be susceptible to Bd, but did not die from chytridiomycosis infection (Padgett-Flohr 2008). Longer-term studies are needed to determine the effects of Bd infection in California tiger salamanders in the wild. Bd has been documented in a population of California red-legged frogs in southern Santa Barbara County (AECOM 2009), and from Vandenberg Air Force Base in northern Santa Barbara County (J. La Bonte et al., unpublished data). Although chytrid fungus has not been found responsible for California tiger salamander mortality in the laboratory conditions or the field, its potential to cause mortality or reduced fitness cannot be ruled out (CDFG 2010). A recently discovered, salamander-specific species of pathogenic chytrid fungus, *Batrachochytrium salamandrivorans* (Bsal), has been associated with a mass die-off of salamanders in the Netherlands (Martel et al. 2013); however, the pathogenicity of Bsal to California tiger salamanders is unknown, and it has not yet been detected in North America.

Although their impact on the Santa Barbara California tiger salamander is unknown, several disease-causing agents have been associated with die-offs of closely related tiger salamanders and other amphibian species, including: the bacterium *Acinetobacter* (Worthylake and Hovingh 1989); *Ambystoma tigrinum* virus (ATV), an iridovirus that has caused amphibian die-offs and is lethal to California tiger salamanders (Picco et al. 2007, Picco and Collins 2008); and the water mold *Saprolegnia parasitica* (Lefcort et al. 1997).

Predation

California tiger salamanders in Santa Barbara County are susceptible to predation by several non-native species (Morey and Guinn 1992) such as bullfrogs, non-native tiger salamanders

(*Ambystoma tigrinum mavortium*), mosquitofish, other introduced fish, and non-native crustaceans. Bullfrogs prey on California tiger salamander larvae (Anderson 1968) and have been found in at least four California tiger salamander breeding ponds in Santa Barbara County (USFWS 2009). Introduced predators can be indicators of ponds that are so highly disturbed that California tiger salamanders cannot survive to reproduce successfully (Shaffer et al. 1993).

Non-native tiger salamanders from the central United States, which are known to prey on many native amphibians, were introduced to California for fishing bait over 60 years ago (Ryan et al. 2009). Until recently, it was not known whether *A. tigrinum mavortium* co-occurred with native California tiger salamanders within Santa Barbara County. Two co-occurrence sites have been documented within the Purisima Hills metapopulation, making the Santa Barbara County California tiger salamander susceptible to predation (and hybridization, see Factor E, below) by non-native tiger salamanders.

Mosquitofish, which prey on mosquito larvae, have been widely introduced in California by vector control agencies to control mosquitoes. Mosquitofish are also known to prey on the eggs and larvae of many amphibian species, including the California newt (*Taricha torosa*) (Graf and Allen-Diaz 1993, Gamradt and Kats 1996), California red-legged frog (Schmieder and Nauman 1993), and Pacific tree frog (Goodsell and Kats 1999). Significantly reduced survival of California tiger salamanders has been observed in permanent ponds with high densities of adult mosquitofish (Leyse and Lawler 2000, Loredo-Prendeville et al. 1994), suggesting that mosquitofish also prey on eggs and larvae of California tiger salamanders. California tiger salamanders may be especially vulnerable to mosquitofish predation due to the salamander's fluttering external gills, which may attract these visual predators (Graf and Allen-Diaz 1993). Although we do not have specific presence/absence data, mosquitofish may become a more serious threat to California tiger salamander breeding ponds within Santa Barbara County as they are increasingly used for mosquito control. As urban areas continue to expand, the introduction of mosquitofish into previously untreated ponds, in combination with other threats, may result in the elimination of California tiger salamanders from these breeding sites.

In addition to mosquitofish, predation from other introduced, non-native fish threatens the California tiger salamander. Bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and fathead minnow (*Pimephales promelas*) are some of the fish species that have been found in California tiger salamander breeding ponds in Santa Barbara County (Collins 2000). A number of ponds in or near occupied California tiger salamander habitat in the west Orcutt area have been occupied by introduced fish for more than 20 years (B. Daniels, pers. comm. 2000), likely extirpating any California tiger salamanders that may have bred there. The distribution of the California tiger salamander in the West Los Alamos metapopulation area may be limited by catfish (order Siluriformes) that were introduced several years ago (Sweet 2000). California tiger salamanders are absent from a pond with introduced catfish that appears to have suitable breeding habitat, although a pond less than 250 feet (76 meters) away that appears less suitable for breeding, but is free of catfish, is occupied by California tiger salamanders (Sweet 2000).

Louisiana red swamp crayfish (*Procambarus clarkii*) may have eliminated some California tiger salamander populations in the Central DPS (Shaffer et al. 1993, Jennings and Hayes 1994), and have been documented in California tiger salamander ponds in Santa Barbara County (Sweet, pers. comm. 1999).

Additionally, California tiger salamander eggs, larvae, and adults are also prey for a variety of native species. Native predators include great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), western pond turtle (*Clemmys marmorata*), various garter snakes (*Thamnophis* spp.), larger California tiger salamanders, larger western spadefoot (*Spea hammondii*) larvae, California red-legged frogs, and raccoons (*Procyon lotor*) (Baldwin and Stanford 1987, Hansen and Tremper 1993, Petranka 1998, Stebbins and McGinnis 2012). Predation by native species is not considered a threat to the Santa Barbara County California tiger salamander; however, when combined with other impacts, such as predation by non-native species and habitat alteration, the collective result may be a substantial decrease in population abundance and viability and constitute a significant threat to the DPS.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

In the final rule to list the Santa Barbara County DPS of the California tiger salamander in 2000 (USFWS 2000b), we concluded that Federal, State, and local laws have not been sufficient to prevent past and ongoing losses of the California tiger salamander and its habitat. At the time, these included Federal protections such as the Clean Water Act, State laws such as the California Endangered Species Act (CESA) and California Environmental Quality Act (CEQA), and local protections.

The primary cause of the decline of the Santa Barbara County California tiger salamander is the loss, destruction, degradation, and fragmentation of habitat that results from human activities. Many Federal, State, and local regulations exist that have the potential to directly or indirectly benefit the California tiger salamander. In the past, they have had limited ability to prevent ongoing threats to the species and its habitat (USFWS 2009). The State listing of the California tiger salamander throughout its range in 2010 has increased regulatory consideration during project review at the local and State levels. Applicable laws are discussed further below.

Federal Regulations

Federal Endangered Species Act

The Act, as amended, is the primary Federal law providing protection for the Santa Barbara County DPS of the California tiger salamander. The listing of the DPS as endangered provided the full protection of Act. Sections 7, 9, and 10 of the Act have been the most relevant sections that have provided a conservation benefit to the species. Section 9 of the Act prohibits unauthorized taking of any federally listed endangered or threatened species. Section 3(19) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[2] Since the USFWS listed the Santa Barbara

[2]USFWS regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. We define harassment as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the "take" of federally endangered and threatened wildlife.

County DPS of the California tiger salamander in 2000, its Division of Law Enforcement has investigated several potential violations of section 9. These incidents were primarily related to habitat disturbance that may have resulted in the take of salamanders; however, none of the investigations resulted in prosecution. Two resulted in settlements which included a fine and the purchase of an easement and restoration of a breeding pond in the Purisima Hills metapopulation area. The Act has incorporated the methods discussed below for individuals or entities to obtain exemptions from the prohibitions of section 9 for activities that are otherwise legal.

Section 7 of the Act provides for consultation between the USFWS and other Federal agencies for actions they fund, authorize, or implement that may affect listed species. If, as a result of formal consultation, USFWS determines that the proposed action is not likely to jeopardize the continued existence of the species, USFWS will issue an incidental take statement in its biological opinion that provides an exemption to the section 9 prohibitions against take. Since listing, we have conducted consultations primarily with the Army Corps of Engineers for flood control and water supply-related projects; with the California Department of Transportation for highway projects; with the Federal Communications Commission for construction of cell towers; and with the Federal Aviation Administration for airport expansion and other development projects. In general, consultations have resulted in the minimization of impacts through such strategies as timing of projects and using best management practices; in a few cases, habitat or conservation easements have been acquired.

Section 10 of the Act provides for the permitting of activities that are otherwise prohibited under section 9, either through recovery permits (for example, for research that would benefit the species) under section 10(a)(1)(A), or through an incidental take permit if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity under section 10(a)(1)(B). Project proponents develop habitat conservation plans (HCPs) to support their application for an incidental take permit; the USFWS reviews the HCP to ensure that the proposed action is not likely to jeopardize the continued existence of the species and that the project proponent minimizes and mitigates the effect of any permitted taking to the maximum degree practicable.

Clean Water Act

Under section 404 of the Clean Water Act, the U.S. Army Corps of Engineers (Corps) regulates the discharge of dredged or fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). However, recent Supreme Court rulings have called this definition into question. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving “isolated” wetlands. Currently, Corps regulatory oversight of such wetlands (e.g., vernal pools) is in doubt because of their “isolated” nature. In response to the Supreme Court decision, the Corps and the U.S. Environmental Protection Agency have released a memorandum providing guidelines for determining jurisdiction under the Clean Water Act. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, isolated wetland habitat (USEPA and USACE 2007). Although the overall effect of the new permit guidelines on loss of isolated wetlands is not known at this time, it is likely that the Corps has less authority to regulate the placement of dredged or fill material in isolated waters than previously.

California State Regulations

California Endangered Species Act

The California tiger salamander is listed by the State of California as threatened throughout its range and is protected under CESA (California Fish and Game Code, section 2080 et seq.). CESA prohibits the unauthorized "take" (as defined in Fish and Game Code) of State-listed threatened or endangered species and requires individuals and public agencies to obtain permits for incidental take and fully mitigate for any adverse impacts to the species or its habitat that result from the taking. The California tiger salamander was listed by the State in 2010; since then, local agencies have included consideration of California tiger salamanders as a State-listed species during review of projects they permit.

California Environmental Quality Act

Section 15065(a)(1) of CEQA requires a finding of significance if a project has the potential to ''substantially reduce the number or restrict the range" of a rare or endangered plant or animal. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). In the latter case, projects may be approved that cause significant environmental damage, such as destruction of habitat that supports listed or rare species.

The County of Santa Barbara is often the lead agency responsible for implementing CEQA process for projects within unincorporated portions of the County. The conservation benefit that is achieved for listed or rare species through the CEQA process is dependent upon the discretion of the agency involved, and has not been consistent. For instance, although the County is required to consider listed species when permitting development actions under CEQA, they often defer the responsibility of CESA and Act compliance to the landowners. At times, landowners have not contacted the USFWS, which results in many such projects being carried out without USFWS input or awareness. Thus, these projects miss the opportunity to engage the USFWS for recommendations in the early stages of project planning to meet project objectives as well as the requirements of the Act.

Title 14 of the California Code of Regulations

Since the listing under the Act in 2000, the USFWS has worked with CDFW to prohibit the sale of "waterdogs" (non-native tiger salamanders of the genus *Ambystoma*) as bait and pets. In October of 2014, the California Fish and Game Commission passed an amendment to Title 14 of the California Code of Regulations (§ 200.31) making it clear that any possession of non-native tiger salamanders is illegal, and removing a previous loophole that had allowed their use as fish bait (State of California Office of Administrative Law 2014). With this recent amendment, this regulation is no longer considered inadequate.

Local Regulations

County of Santa Barbara

The County is most often the lead agency responsible for implementing the CEQA process for projects within unincorporated portions of the County (see CEQA discussion above). In addition, land use planning is guided by the County's comprehensive plan (Santa Barbara County Planning Department 2014), along with a series of more specific Area Plans. Together, the comprehensive plan and area plans prescribe guidelines for land use, including those for specific

elements such as conservation, environmental resources management, and open space. Depending on how parcels are zoned for land use and how much area is affected by an individual action, certain agricultural land conversions do not require discretionary permits from the County of Santa Barbara (B. Gillette, County of Santa Barbara, pers. comm. 2007) and may not be required to consider impacts to California tiger salamanders or their habitat under CEQA.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

As identified in the listing rule, several other factors, including hybridization with, and competition from, introduced species; vehicle-strike mortality; and contaminants are threats to the Santa Barbara County California tiger salamander and its aquatic and upland habitats. In addition, we now recognize that other factors, including climate change and drought, are also threats.

Hybridization

Larval and adult individuals of the non-native tiger salamander (*A. tigrinum mavortium*) were widely sold as fish bait (waterdogs) in California during the past century, and a number of populations of the non-native species have become established in the State, some within the range of the California tiger salamander. Non-native tiger salamanders can have negative effects on California tiger salamander populations through hybridization, resulting in loss of genetically pure native salamanders (Shaffer et al. 1993, Riley et al. 2003). Non-native tiger salamanders are present at the Lompoc Federal Penitentiary grounds in Santa Barbara County (outside of but near the Santa Barbara County California tiger salamander's range), and a hybrid was discovered at a site in the Purisima Hills metapopulation area in 2009, which is the closest metapopulation to the penitentiary. The potential loss of any metapopulations of the Santa Barbara County California tiger salamander to hybridization is a serious threat.

Several studies of the Central DPS of the California tiger salamander have shown the extent of the threat of hybridization to the species. The extent of genetic mixing between native and non-native tiger salamanders can depend on the type of breeding habitat, as significantly more pure native genotypes were found in one study in vernal pools as compared to artificial ponds (Riley et al. 2003). Non-native alleles (alternate forms of a gene) typically predominate in perennial ponds, suggesting that the life history traits of non-native tiger salamanders give them an advantage in perennial ponds (Fitzpatrick and Shaffer 2004, 2007a). Once California tiger salamanders and hybrids co-occur in the same environment, however, time to metamorphosis is delayed in California tiger salamanders, eliminating their natural ability to compete based on early metamorphosis alone (Ryan et al. 2009, 2013). Further information regarding California tiger salamanders and hybridization with non-native tiger salamanders elsewhere in California is available in Johnson et al. (2010 a, b, 2011), Fitzpatrick et al. (2009, 2010), and Fitzpatrick and Shaffer (2007b).

Competition

Introduced species also can have negative effects on California tiger salamander populations through competition (Shaffer et al. 1993). Competition with non-native tiger salamanders can reduce metamorphic size and lengthen time to metamorphosis in California tiger salamanders (Ryan et al. 2009), which can increase desiccation and predation risk as well as competitive ability (Trenham et al. 2000). Therefore, when competing with non-native tiger salamanders and hybrids in ponds, California tiger salamanders are at a distinct disadvantage (Ryan et al. 2009).

Competition from fish that prey on mosquito larvae and other invertebrates can reduce the survival of salamanders. Both California tiger salamanders and mosquitofish feed on aquatic invertebrates (Anderson 1968, Holomuzki 1986, Stebbins and McGinnis 2012). Large numbers of mosquitofish may out-compete California tiger salamander larvae for food (Graf and Allen-Diaz 1993). The introduction of other fish inadvertently (e.g., fathead minnow; P. Collins, Santa Barbara Museum of Natural History, pers. comm. 1999), for recreational fishing (e.g., largemouth bass, green sunfish; Sweet, pers. comm. 1999), or other purposes may also affect prey base, reducing survival and growth rates of California tiger salamanders.

Vehicle-strike Mortality

Vehicles on roads contribute to direct mortality of Santa Barbara County California tiger salamanders. Salamanders are at risk of being run over by vehicles on their first dispersal as juveniles away the pond, and on future migrations to and from the ponds for breeding, contributing to metapopulation fragmentation through increased mortality and preventing recolonization of sites that would otherwise be only temporarily extirpated (Trombulak and Frissell 2000).

In the East Santa Maria metapopulation, California tiger salamanders are frequently seen crossing Dominion, Foxen Canyon, and Orcutt-Garey Roads on rainy nights during breeding migrations. More than 50 percent of these observations include California tiger salamanders that are dead or dying from vehicle strikes (A. Abela et al., unpublished data). California tiger salamanders most often impacted by vehicle strikes are migrating adults in breeding condition. Thus, particularly in metapopulations that are already compromised by other factors, road morality likely contributes to a decrease in population abundance and viability of the Santa Barbara County California tiger salamander.

Contaminants

Amphibians are extremely sensitive to pollutants, such as pesticides and other chemicals, due to their highly permeable skin, which can rapidly absorb pollutant substances (Blaustein and Wake 1990). Toxins at lower than lethal levels may cause abnormalities in larvae and behavioral anomalies in adults, both of which could eventually lead to mortality (Hall and Henry 1992, Blaustein and Johnson 2003). Pesticides may reduce or eliminate the prey base, increasing the risk of starvation to California tiger salamanders. Sources of chemical pollution that may threaten California tiger salamanders include hydrocarbon and other contaminants from the application of chemicals for agricultural production, burrowing animal control, oil production, and road runoff (USFWS 2009). Although there is some evidence that some amphibians may be affected when they come into secondary contact with chemicals (such as pesticides on crops applied to the habitat during the migration and dispersal seasons) (Sparling et al. 2001), Davidson et al. (2001, 2002) found no significant overall relationship between upwind agriculture and the California tiger salamander's decline. While this indicates that long-distance spread of agricultural pesticides may not be a significant threat to California tiger salamanders, there is evidence that commonly used pesticides do have negative, measurable effects on amphibians in direct contact with them (USFWS 2009).

Rodenticides, widely used in Santa Barbara County (PAN Pesticides Database – California Pesticide Use 2005), can be absorbed through the skin and are considered toxic to fish, birds, and other wildlife (Tasheva 1995, Salmon and Schmidt 1984). Given the permeable nature of

amphibian skin, California tiger salamanders that come into contact with rodenticides are likely harmed.

New technologies for extracting oil from shale that underlies most of Santa Barbara County have significantly increased the number of oil extraction operations in the county in recent years (Santa Barbara County Planning and Development 2013). Oil and other contaminants in runoff from roads have been detected in adjacent ponds and have been linked to die-offs of, and deformities in, California tiger salamanders and spadefoot toads, and die-offs of invertebrates that form most of both species' prey base (Sweet 1993). Several known breeding ponds occur along secondary roads and highways in northern Santa Barbara County and may be threatened by oil and other contaminants from road runoff.

A commonly used method to control mosquitoes, including in Santa Barbara County (California Department of Pesticide Regulation 2007), is the application of methoprene, which increases the level of juvenile hormone in insect larvae and disrupts the molting process, causing death. Because the success of many aquatic vertebrates (including California tiger salamanders) relies on an abundance of invertebrates in temporary wetlands, any delay in insect growth could reduce the numbers and density of available prey for California tiger salamanders (Lawrenz 1984-1985). Although in one study, methoprene did not cause increased mortality of gray treefrog (*Hyla versicolor*) tadpoles (Sparling and Lowe 1998), it did cause reduced survival rates and increased malformations in northern leopard frogs (*Rana pipiens*) (Ankley et al. 1998) and increased malformations in southern leopard frogs (*R. utricularia*) (Sparling 1998). Exposure to methoprene has also been correlated with delayed metamorphosis and high mortality rates in northern leopard frogs and mink frogs (*R. septentrionalis*) (Blumberg et al. 1998). Specific studies have not been conducted on the effects of methoprene on the Santa Barbara County California tiger salamander; however, the effects documented on other amphibian species and its application in Santa Barbara County do not allow us to rule it out as a potential threat to the species.

A bacterium, *Bacillus thuringiensis israeli* (Bti), is also used in Santa Barbara County for mosquito control (City of Santa Barbara 2007). Bti reportedly does not affect insects other than larvae of mosquitoes and blackflies, but research does not indicate which insects have been tested (Federation of BC Naturalists 2003). Its effects on California tiger salamander prey base have not been quantified. Because of a lack of information regarding which mosquito control methods are used and where, and about the bacterium's effects on salamanders, the degree to which the practices pose a threat to the Santa Barbara County California tiger salamander cannot be determined at this time.

Drought and Climate Change

Climate variability, such as fluctuations between wet and dry periods, is part of natural processes; however, climatic models suggest that much of the recent trends in climate are driven by anthropogenic causes, and models indicate that these trends are likely to continue into the future (Barnett et al. 2008).

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, Intergovernmental Panel on Climate Change 2014). Climate simulations have shown that, by 2100, California temperatures are likely to increase by

2.7 degrees Fahrenheit (1.5 degrees Celsius) under a lower emissions scenario, and by up to 8.1 degrees Fahrenheit (4.5 degrees Celsius) under a higher emissions scenario (Cayan et al. 2008). Because of the diversity of California's landscape, however, it is unknown at this time what effect (e.g., changes in precipitation, number and severity of storm events) increasing temperatures will have at the local level.

Global amphibian declines have been increasingly attributed to factors resulting from global climate change over the last decade (Corn 2005, Wake 2007, Reaser and Blaustein 2005). Factors such as epidemic disease (Pounds et al. 2006), changes in breeding phenology (Terhivuo 1988; Gibbs and Breisch 2001; Beebee 1995), changes in environmental conditions such as leaf litter (Whitfield et al. 2007), increased evaporation rate (Corn 2005, but see Pyke and Marty 2005), increased frequency of storm events and drought (Kagarise-Sherman, and Morton 1993) and ultraviolet radiation (Blaustein et al. 1998) have been identified to affect amphibian persistence. Diseases, such as the amphibian chytrid fungus, may become more virulent in changing climatic conditions (Pounds et al. 2006). Warmer temperatures have been linked to earlier breeding in some amphibians (Blaustein et al. 2001, Beebee 1995). Changes to the hydroperiod of ephemeral ponds due to changing weather patterns have significant implications for the diversity of amphibians that rely on those ponds for breeding (Corn 2005). Ultraviolet radiation has been shown to have negative effects on amphibian eggs and embryos around the world (Blaustein et al. 1998).

While it appears reasonable to assume that California tiger salamanders may be affected by factors resulting from climate change, it is difficult to predict how such climatic changes will affect the Santa Barbara County California tiger salamander. Because California experiences highly variable annual rainfall events and droughts, environmental conditions for California tiger salamander breeding and metamorphosis are not consistent. In years of drought, some pools/ponds may not fill at all. Breeding migrations and breeding events are dependent on weather. A lack of rain results in the temporal loss of vernal pools and can result in the degradation of complexes of long-lasting pools that provide important breeding habitat. Droughts may occasionally preclude reproductive success at a given pond; therefore, maintaining connectivity between ponds is important for the long-term viability of the Santa Barbara County California tiger salamander. In addition to direct climatic effects on habitat, warmer temperatures are associated with increased locomotor performance of hybrids, suggesting that increased temperatures may translate to increased movement of the "hybrid swarm" (hybrid population with interbreeding between hybrid individuals and its parent types) of non-native tiger salamander alleles through the landscape (Johnson et al. 2010a).

H. Past Conservation Efforts

Species-specific Research and/or Grant-supported Activities

Most of the known and potential California tiger salamander breeding ponds and surrounding upland habitats in Santa Barbara County occur on private lands, necessitating compatible land stewardship from private property owners, rather than public entities that can preserve and manage the habitat as a public resource. Through cooperative agreements, USFWS has allocated grant money for at least two projects that have improved California tiger salamander habitat in Santa Barbara County. One project received $4,000 for berm repair in 2006 to prevent the sedimentation of a vernal pond, which at the time was a potential California tiger salamander

breeding pond (USFWS 2006). Since the project was implemented, California tiger salamander breeding has been discovered at the pond. Another project was provided approximately $2,500 for the restoration of an eroding hillside, protecting a California tiger salamander breeding pond from the threat of sedimentation (USFWS 2001).

The County of Santa Barbara led an effort to create a regional conservation strategy from March 2006 through March 2008. The USFWS participated in monthly meetings with a steering committee to develop the plan, and the County committed staff and funding to the effort. The USFWS allocated approximately $267,000 in habitat conservation planning funds via section 6 of the Act for this project (USFWS 2007a). The USFWS allocated an additional $10,000 for a facilitator to build consensus among the diverse group of stakeholders working on the plan and maintain focus on the project. The County chose to discontinue the regional plan process in March 2008, and funds for both grants were returned to the USFWS unused (Becky Miller, pers. comm., 2009).

In 2007, the USFWS provided $491,000, through section 6 of the Act via the Cooperative Endangered Species Conservation Fund, to purchase conservation easements over California tiger salamander breeding ponds and their uplands at San Lorenzo Ranch, held by The California Rangeland Trust, in the Purisima Hills metapopulation. Approximately $215,275 of this grant was used to purchase the development rights on 539 acres (218 hectares) of potential upland and aquatic California tiger salamander habitat within the Purisima Hills metapopulation; 60 of these acres (24 hectares) fall within Unit 5 of the designated critical habitat for the Santa Barbara County California tiger salamander (USFWS 2007b).

In 2001, a University of California Santa Barbara student was awarded $18,146 from the USFWS to study California tiger salamander upland habitat use at the Santa Maria Airport. This study provided information about the dispersal habits, abundance, and upland habitat use of California tiger salamanders in this portion of the West Santa Maria metapopulation (critical habitat Unit 1) (Sykes 2006).

In 2009, the USFWS funded $39,000 for non-native tiger salamander eradication in Santa Barbara County. Property access restrictions limited the number of new ponds that could be sampled. Additionally, previously collected samples were re-analyzed with novel molecular techniques and the regions of known and potential occurrence of hybrids and non-native tiger salamanders were mapped (Hunt 2012).

In 2014, the USFWS awarded $137,333 to CDFW through section 6 of the Act, to conduct a non-native tiger salamander research and control study for the region where hybridization has been documented in Santa Barbara County. In coordination with local nonprofit organizations, biologists will work with local landowners on properties that may be occupied by non-native tiger salamanders and develop cooperative agreements to access the properties for hybrid and non-native tiger salamander control.

In 2015, the USFWS awarded Washington State University $23,285 to develop an environmental DNA (eDNA) assay for Santa Barbara County California tiger salamanders.

In 2015, the USFWS awarded University of California Los Angeles $71,675 to conduct a landscape genetics analysis to estimate historical and current effective population size and habitat connectivity throughout the range of the Santa Barbara County California tiger salamander. In 2016, University of California Los Angeles was awarded an additional $78,150 to

determine the extent of terrestrial habitat movement by Santa Barbara County California tiger salamanders, and to use those data to determine whether the extensive data available for two independent, ecologically diverse sites at Jepson Prairie and Hastings Reservation serve as reasonable models for Santa Barbara County.

Conservation Banking

The La Purisima Conservation Bank, located in the Purisima Hills metapopulation, was approved by USFWS and CDFW in March 2014. This bank sells credits to offset impacts from projects that result in the loss of California tiger salamander habitat. The habitat in the bank is protected by a perpetual conservation easement on over 853 acres of California tiger salamander habitat and has a funding mechanism for the perpetual management of the habitat and California tiger salamander population within the bank (Adams 2014).

Habitat Conservation

There are three areas fully dedicated and set aside for the Santa Barbara County California tiger salamander. These three properties are under formal conservation easements: 1) La Purisima Conservation Bank (853 acres) held by The Land Trust for Santa Barbara County, as mentioned above; 2) Anderson easement (160 acres) held by The Land Trust for Santa Barbara County/County of Santa Barbara; and 3) San Lorenzo Ranch (594 acres) held by The California Rangeland Trust. These properties are considered to be fully preserved as defined by this recovery plan (i.e., either: (a) owned in fee title by an agency or conservation organization; or, (b) privately-owned lands protected in perpetuity with conservation easements). All three properties are within the Purisima metapopulation area.

There are also three areas that entered into Memorandum of Understandings (MOUs) with the USFWS in 2004. These properties voluntarily agreed to implement adequate management plans to benefit the salamander, but are not under formal conservation easements. They are: 1) Los Robles Ranch (East Los Alamos metapopulation area); 2) Sainz Ranch (West Los Alamos/Careaga metapopulation area); and 3) property owned by The Scheller Living Trust (Purisima metapopulation area). These properties are considered to be partially preserved as defined by this recovery plan (i.e., areas with land uses committed to being compatible with successful growth and survival of salamanders, but not necessarily fully preserved). These MOUs may be terminated by any party following 60 days written notification to other parties.

Other Cooperative Conservation Efforts

Rangeland experts, academia, and the Alameda Resource Conservation District recently collaborated to produce the publication *Managing Rangelands to Benefit the California Red-Legged Frog and California Tiger Salamander* (Ford et al. 2013), which was partially funded by the USFWS. This document uses the best available science to provide guidelines for managing rangelands that support or have the potential to support California red-legged frogs and California tiger salamanders rangewide. The document also provides suggestions for integrative grazing management to benefit these two species while aligning with other goals for conservation and production on rangelands.

In 2012, the USFWS issued a programmatic biological opinion to the Natural Resources Conservation Service (NRCS) for activities conducted in Santa Barbara County. The biological opinion exempts “take” of California tiger salamanders and California red-legged frogs for

agricultural improvement projects funded by NRCS that also benefit these species. Permit programs such as these aim to encourage private landowners to implement voluntary conservation by streamlining the permitting process when listed species could be impacted during the construction of a project with a net benefit to listed species.

II. Recovery Program

A. Recovery Priority Number

The most recent 5-year status review of the Santa Barbara County DPS of the California tiger salamander changed the recovery priority number to 3C (USFWS 2009), indicating that the DPS has a high potential for recovery and a high degree of threat. The "C" in the recovery priority number indicates that conflict exists with "construction or other development projects or other forms of economic activity" (USFWS 1983).

B. Recovery Strategy

The range of the Santa Barbara DPS of the California tiger salamander is naturally restricted to Santa Barbara County in southern California. The species is further constrained by inhabiting seasonal wetlands (such as vernal pools) that have suffered extensive destruction and fragmentation, resulting in loss of habitat and isolation of metapopulations. The most significant threat to the Santa Barbara County California tiger salamander continues to be destruction, alteration, and fragmentation of habitat for agricultural and urban uses. Additional threats include hybridization with non-native tiger salamanders that have been introduced to the native species' range, predation and competition from non-native species, and vehicle-strike mortality. Finally, other potential threats to the species include contaminants, disease, and drought and climate change.

The strategy to recover the Santa Barbara County California tiger salamander focuses on alleviating the threat of habitat loss and fragmentation in order to increase population resiliency (i.e., ensure a large enough metapopulation to withstand stochastic events) and redundancy (i.e., a sufficient number of metapopulations to ensure the species can withstand catastrophic events) while maintaining current representation (genetic and ecological diversity). We think that recovery of this species could be achieved through the conservation of remaining aquatic and upland habitat that provides essential connectivity, reduces fragmentation, and sufficiently buffers against encroaching development. Appropriate management of these conserved areas would also reduce mortality by addressing non-habitat related threats. Habitat restoration and creation to achieve proper functioning of some of these wetland complexes may be necessary to ensure stable and well-distributed populations. Research and monitoring should be undertaken to determine the extent of other threats and reduce them to the extent possible, including those from non-native and hybrid tiger salamanders and other non-native species, vehicle-strike mortality, contaminants, disease and climate change.

Because the majority of the habitat for Santa Barbara County California tiger salamanders is on privately-owned lands, habitat-based conservation efforts will require the cooperative efforts of many entities, including both local agencies and private partners, and will play an important role in achieving suitable and sustainable habitat necessary for the recovery of the species. This effort will require extensive outreach and education programs to ensure public and private support. This recovery strategy is intended to support and produce self-sustaining metapopulations of the Santa Barbara County California tiger salamander that would maintain its geographic distribution through habitat-based conservation efforts and the reduction of threats.

C. Recovery Goal

The goal of this recovery plan is to sufficiently reduce the threats to the Santa Barbara County California tiger salamander to ensure its long-term viability in the wild and allow for its removal from the list of threatened and endangered species. The interim goal is to recover the DPS to the point that it can be downlisted from endangered to threatened status.

D. Recovery Objectives and Criteria

RECOVERY OBJECTIVES

1. Protect and manage sufficient habitat within the metapopulation areas to support long-term viability of the Santa Barbara County California tiger salamander.
2. Reduce or remove other threats to the Santa Barbara County California tiger salamander.

RECOVERY CRITERIA

Downlisting may be warranted when the recovery criteria below have been met in a sufficient number of metapopulation areas such that the Santa Barbara County DPS of the California tiger salamander exhibits increased resiliency and redundancy and maintained or increased current representation to prevent endangerment in the foreseeable future.[3]

Delisting may be warranted when the recovery criteria have been met in a sufficient number of metapopulation areas to support long-term viability of the Santa Barbara County DPS of the California tiger salamander. [4]

In developing the recovery criteria, we used information and analyses obtained from California tiger salamander researchers. Dr. Chris Searcy, University of Miami, provided an analysis and explanation on the necessary number of ponds and upland habitat area to support minimum viable population sizes (Appendix A). Dr. H. Bradley Shaffer, University of California, Los Angeles, provided an analysis and explanation on the monitoring of effective population size (N_e) (Appendix B). We have adopted these appendices as bases for our recovery criteria.

Criteria:

1. At least four functional breeding ponds[5] per metapopulation area are in fully preserved status[6] and managed for the benefit of the Santa Barbara County California tiger

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[3] We presently believe that the recovery criteria must be met in three metapopulation areas for downlisting to be warranted; further research and monitoring should clarify the exact number of metapopulations necessary.
[4] We presently believe that the recovery criteria must be met in all six metapopulation areas for delisting to be warranted; further research and monitoring should clarify the exact number of metapopulations necessary.
[5] The average size of known breeding ponds in Santa Barbara County is 1.47 acres, so four ponds with this size are required to preserve a minimum viable population for each metapopulation based on calculations in Appendix A. In metapopulation areas where ponds are smaller than 1.47 acres, more than 4 ponds may be needed to support the minimum viable population size since effective population size is related to pond area.
[6] Fully preserved status is either: (1) owned in fee title by an agency or conservation organization; or, (2) privately-owned lands protected in perpetuity with conservation easements. These lands must have funding secured for long-term management and monitoring.

salamander. The first priority is preservation of existing ponds, followed by restored or created ponds (addresses Factor A threats).

2. A minimum of 623 acres (252 hectares) of functional upland habitat around each preserved pond (see criteria 1) is in fully preserved status[7]. This functional upland habitat area may overlap with the functional upland habitat around adjacent ponds (addresses Factor A threats).
3. Adjacent to the fully preserved ponds (see criteria 1) and fully preserved upland habitat (see criteria 2), a minimum of 1,628 acres (659 hectares) of additional contiguous, functional upland habitat is present,[8] which is at least 50 percent unfragmented[9] and partially preserved.[10] This additional contiguous habitat area may overlap with the functional upland habitat around adjacent ponds (addresses Factor A threats).
4. Effective population size (N_e) in the metapopulation (see Appendix B) shows an overall positive trend across 10 years [11] (addresses Factor A, C, and E threats).
5. Management is implemented to maintain the preserved ponds (see criteria 1) free of non-native predators and competitors (e.g., bullfrogs and fish) (addresses Factor C and E threats).
6. Risk of introduction and spread of non-native genotypes is reduced to a level that does not inhibit normal recruitment and protects genetic diversity within and among metapopulations (addresses Factor E threats). [12]

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[7] The area of functional upland habitat (623 acres) is derived from recent estimates of area to support approximately 75% of a California tiger salamander population (Central DPS) (see Appendix A). Ideally, the 623 acres would include all habitat within 896 meters of the breeding pond because placement of the pond in the protected area will affect how many of the salamanders are protected.

[8] The area of this additional functional upland habitat (1628 acres) supporting the 25% of the population most distant from the pond, combined with the fully protected habitat (623 acres) supporting 75% of the population, is estimated to support approximately 95% of tiger salamander population (see Appendix A).

[9] If California tiger salamanders can select specific functional habitat, then this level of fragmentation can still support the 25% of the population most distant from the pond. Further research and monitoring are needed to determine the efficacy of this model (and adjust it up or down, accordingly).

[10] Partially preserved lands refer to areas with land uses that are compatible with successful growth and survival of juveniles and adults, but may not necessarily be fully protected.

[11] Ten years of monitoring is required to encompass two full generational cycles (California tiger salamanders reach sexual maturity at approximately 4-5 years) and to encompass a range of climatic and other unpredictable factors.

[12] This requires early detection of non-native phenotypes (i.e., paedomorphic, breeding individuals that remain aquatic, or hybrid-appearance individuals) and subsequent genetic assessment. Further research and monitoring are needed to determine the level of risk from hybridization which does not threaten long-term population viability.

III. Recovery Action Narrative

The actions identified below are those that, in our opinion, are necessary to bring about the recovery of the Santa Barbara County California tiger salamander, and ensure the long-term conservation of the species. However, these actions are subject to modification as dictated by new findings, changes in species status, and the completion of other recovery actions. Each action has been assigned a priority according to our determination of what is most important for the recovery of the species based on the life history, ecology, distribution, abundance, and threats (see the Background section of this document) and the following definitions of the priorities:

Priority 1: An action to prevent extinction or to prevent a species from declining irreversibly.

Priority 2: An action to prevent a significant decline of the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the species.

The following Recovery Action Narrative provides details of the actions recommended to achieve full recovery. Actions are laid out in an outline format that starts with an overarching recovery action, and "steps down" to more specific recovery actions. The "stepped down" actions are discrete actions that can be funded, permitted, or carried out independently.

1. Protect and manage habitat for the Santa Barbara County California tiger salamander.

Nearly all populations of the Santa Barbara County California tiger salamander occur on private lands. Suitable habitat for each of the Santa Barbara County California tiger salamander metapopulations should be secured and protected (as specified in the Recovery Objectives and Criteria) through mechanisms such as land acquisition, acquisition of property rights or fee title purchase (i.e. development rights), open space and conservation easements, and conservation agreements. The presence of aquatic breeding habitat is essential to the species, and preservation of natural vernal pools and seasonal ponds is the highest priority, followed by preservation of man-made ponds. This protection is necessary to prevent further declines in distribution and abundance of the Santa Barbara County California tiger salamander.

Open space and conservation easements provide a method to acquire specific property rights needed to conserve biological resources and physical or scenic characteristics of the land. These easements offer the landowner an economic incentive of reduced property taxes while, in many circumstances, the landowner can continue to use the land in the same ways as prior to the easement. Easements may be accepted by the State, cities, counties, or nonprofit organizations whose primary purpose is to preserve and protect land in its natural condition.

When prioritizing parcels of California tiger salamander habitat for protection, we consider not only prior use of the habitat by the species, but also current and likely future threats to the species. Sites where major threats cannot be abated, even after placed under protection, are of limited value for recovery of this species. Upland and aquatic habitat,

once protected, may require further management efforts, such as the retirement of a current intensive agricultural practice, to retain habitat characteristics important for California tiger salamander survival.

USFWS should consult with the Planning Departments for the County of Santa Barbara and Cities of Santa Maria and Los Alamos regarding opportunities for conservation easements and acquisition.

The following Recovery Actions will assist in the recovery of the Santa Barbara County California tiger salamander by protecting habitat and restoring or enhancing habitat, reducing threats, and facilitating informed management where necessary. This will ensure that viable metapopulations of the Santa Barbara County California tiger salamander are protected throughout the species' range.

1.1 **Permanently protect Santa Barbara County California tiger salamander breeding ponds and their adjacent uplands (see Recovery Criteria 1, 2, 3) through acquisition and conservation easements.[13] (Priority 1)**

Maintain a sufficient extent of current upland and aquatic breeding habitat through conservation easements or other land protection. In all instances, secure funding for long-term management and monitoring through an endowment or other funding mechanism, and protect the species from incompatible uses through long-term conservation agreements with landowners. Preserve metapopulation dynamics within and between metapopulation areas through adequate protection of aquatic and upland habitat. The USFWS and CDFW should solicit private landowner participation and support for recovery, establish open space or conservation easements by the property owner, establish permanent resource management easements, or acquire lands through fee acquisition from willing sellers.

Land purchase could be made through an existing land trust. Fee title ownership includes obtaining all property rights. This acquisition can be accomplished by fee, simple purchase, dedication, complete donation, exchange, or transfer from one agency to another. The fee title method of land preservation provides control over land use and avoids potential problems associated with partial ownership or rights to access, water, or minerals.

1.2 Develop management plans for protected Santa Barbara County California tiger salamander habitats. (Priority 1)

Develop management plans at each protected area of Santa Barbara County California tiger salamander aquatic and upland habitat. Include descriptions of on-the-ground activities necessary to maintain and/or restore Santa Barbara County California tiger salamander aquatic and upland habitat.

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[13] Areas will be owned in fee title by a government agency or other organization and managed in a manner that promotes Santa Barbara County California tiger salamander conservation. All sizes of conservation easements and other acquisitions pursuant to action 1.1 will be derived from the recovery criteria.

These plans should include strategies to abate threats such as non-native tiger salamanders, other non-native predators, small mammal eradication programs, pesticides, and sedimentation. If new threats are identified or other new information becomes available affecting Santa Barbara County California tiger salamander recovery, management plans should be re-evaluated and revised so that abatement of those threats can be addressed. USFWS should review management plans as they are being developed and approve final management plans.

1.3 Develop a Regional Habitat Conservation Plan or Conservation Strategy for the County of Santa Barbara and the City of Santa Maria. (Priority 1)

The County of Santa Barbara initiated a regional conservation strategy for the Santa Barbara County California tiger salamander, but they discontinued their efforts in 2008, citing insufficient resources. To ensure that lands in northern Santa Barbara County are appropriately managed for recovery of the Santa Barbara County California tiger salamander, a regional HCP or Conservation Strategy should be developed that will take into account future effects of agricultural and urban development within the range of the Santa Barbara County California tiger salamander. This would provide landowners with an opportunity to obtain incidental "take" (as defined in the section 3(19) of the Act) coverage for ground-disturbing activities in areas covered by the HCP through the County or City permitting processes, while ensuring that impacts to California tiger salamanders are appropriately mitigated. This will also ensure that conservation areas and mitigation for impacts are planned on a landscape scale to achieve the most recovery benefit for the species. Such a plan must provide for adequate conservation of upland and breeding habitat to mitigate the effects of County-permitted development on the Santa Barbara County California tiger salamander and its habitat.

1.4 Develop a Safe Harbor Agreement(s) or obtain financial incentives for landowners to maintain vernal pools/stock ponds and associated uplands in Santa Barbara County California tiger salamander habitat. (Priority 1)

USFWS should: work with local jurisdictions such as resource conservation districts (RCDs) and city and county governments to inform landowners of conservation measures that are available to them, such as Safe Harbor Agreements for stock pond maintenance in California tiger salamander habitat; work with landowners to develop Safe Harbor Agreements and/or programmatic Safe Harbor Agreements, as appropriate; and assist private landowners in their efforts to obtain economic incentives for maintaining vernal pools and/or stock ponds and associated uplands and working towards the recovery of the Santa Barbara County California tiger salamander.

1.5 Reduce burrowing animal control in Santa Barbara County California tiger salamander habitat. (Priority 2)

Reduce California ground squirrel and Botta's pocket gopher eradication efforts deemed to threaten the Santa Barbara County California tiger salamander on protected lands, and other areas as feasible. Limited, localized, small mammal eradication efforts may occur if deemed necessary for livestock safety (such as around watering troughs or other areas determined to have high livestock use) or flood risk management (such as along levees), provided the eradication efforts do not decrease California tiger salamander populations.

In coordination with the NRCS, RCDs, and Regional Water Quality Control Board (RWQCB), develop a plan to reduce the use of rodenticides in areas within migration and dispersal distances of Santa Barbara County California tiger salamander habitat and successfully implement for a minimum of 10 years.

1.6 Manage sedimentation to protect Santa Barbara County California tiger salamander breeding ponds. (Priority 2)

Manage sediment to ensure that grading near Santa Barbara County California tiger salamander breeding ponds does not create runoff that results in sedimentation of ponds. This should be done through the development and implementation of sedimentation control strategies in coordination with local jurisdictions, including the Santa Barbara County Agricultural Commissioner, NRCS, RWQCB, and local landowners. If necessary, install berms to halt or prevent sedimentation of ponds or other appropriate sediment control measures.

2. Restore and maintain habitat for the Santa Barbara County California tiger salamander, and reduce vehicle-strike mortalities and barriers to dispersal from roads.

2.1 Restore and enhance Santa Barbara County California tiger salamander habitats.

Lands managed for the benefit of the Santa Barbara County California tiger salamander should undertake activities to restore upland habitat of the Santa Barbara County California tiger salamander, as applicable. Such activities include, but are not limited to, voluntary replacement of crops with native grassland or scrub (see Wang et al. 2009) and instituting low-intensity grazing or mowing in lieu of ground-disturbing activities such as tilling, deep ripping, or grading.

If a breeding pond was historically ephemeral but converted through human-caused activities to become perennial, the breeding pond should be restored back to ephemeral to the extent feasible.

USFWS should work with private landowners, providing them with technical assistance in the development of restoration strategies on their lands.

Although there are many opportunities for habitat restoration throughout the range of the Santa Barbara County California tiger salamander, we recommend the following areas for restoration:

2.1.1 East Santa Maria Metapopulation Area (Priority 1): Restore ponds SISQ-9E and SISQ-9W; maintain connectivity between pond SAMA-1 (Appendix D: Figure 3) and the known Santa Barbara County California tiger salamander breeding ponds to the east, including the creation of a minimum of three additional functioning breeding ponds. (Priority 1)

2.1.2 Santa Rita Metapopulation Area (Priority 1): Restore upland habitat on the south side of Highway 246 opposite of LOAL-2W and LOAL-2E (Appendix D: Figure 7). (Priority 1)

2.1.3 Restore aquatic habitat. (Priority 1)

Restore aquatic habitat, which may involve excavation of vernal wetlands to their former (pre-modern) size and shape, and the planting of native grassland and vernal wetland plants.

Within protected habitat areas, the USFWS and CDFW's decision of whether or not sites should be restored to natural vernal wetland habitat should be based primarily on the following criteria: (1) the historical natural condition of the site (if possible to ascertain), and (2) the habitat and hydrology needs of the Santa Barbara County California tiger salamanders in that recovery area.

2.1.4 Restore upland habitat. (Priority 1)

Many upland areas have been heavily impacted by agricultural land conversion. Some upland areas can be restored to improve both dispersal and upland habitat for the Santa Barbara County California tiger salamander. This will usually involve reverting land back to grazing and other non-ground disturbing land uses, such as passive recreation.

2.1.5 Work with private landowners in habitat restoration efforts. (Priority 1)

Provide technical assistance and funding to private landowners for the restoration and/or enhancement of Santa Barbara County California tiger salamander habitat. Develop cooperative agreements with willing landowners to protect California tiger salamander habitat on private lands. Work with USFWS Partners for Fish and Wildlife Program and NRCS EQIP, WHIP, and other programs to provide funding for restoration and enhancement projects to benefit Santa Barbara County California tiger salamanders.

2.2 Manage and maintain habitat to benefit each Santa Barbara County California tiger salamander metapopulation.

2.2.1 Develop and implement habitat maintenance and land use guidelines for Santa Barbara County California tiger salamander breeding ponds in each metapopulation area. (Priority 2)

2.2.2 Follow grazing best management practices to prevent degradation of Santa Barbara County California tiger salamander habitats. (Priority 3)

Cattle grazing is the agricultural land use most compatible with Santa Barbara County California tiger salamander conservation. However, significant disturbance can occur to vernal pool landscapes and Santa Barbara County California tiger salamanders under poor grazing management. Grazing species, livestock density, and time of grazing are important items for consideration in managing for California tiger salamander conservation[14].

2.2.3 Evaluate the use of pesticides and other environmental contaminants that may be harmful to Santa Barbara County California tiger salamanders. (Priority 2)

Work with agencies and scientists to evaluate the effects of pesticides and other chemicals frequently used in the outdoor environment that could be harmful to Santa Barbara County California tiger salamanders.

2.2.4 Work with local landowners and agencies in Santa Barbara County California tiger salamander habitats where agricultural chemicals are used. (Priority 2)

Develop best-use practices for use of agricultural chemicals near California tiger salamander habitat in coordination with USFWS, CDFW, RWQCB, and the County of Santa Barbara. USFWS and partners should inform private landowners and highway and road maintenance agencies of the threat posed to the Santa Barbara County California tiger salamander by the use of herbicides and pesticides near sensitive habitats. USFWS should work with these entities to develop guidelines to ensure protection of Santa Barbara County California tiger salamanders and their habitat.

2.3 Reduce vehicle-strike mortality and remove or retrofit barriers to California tiger salamander dispersal created by roads.

2.3.1. Develop and implement a plan to minimize the effects of vehicle-strike mortality on California tiger salamanders. (Priority 1)

California tiger salamanders most often impacted by vehicle strikes are those making breeding migrations; that is, those in breeding

[14] See "Managing Rangelands to Benefit California Red-legged Frogs and California Tiger Salamanders" (Ford et al. 2013) for specific guidelines regarding livestock grazing compatible with California tiger salamander habitat.

condition. Develop and implement a plan to minimize and reduce vehicle-strike mortality and include specific provisions for: Highway 246 (within the Santa Rita metapopulation; Appendix D: Figure 7), Black Road (West Santa Maria metapopulation; Appendix D: Figure 2), Highway 101 in Los Alamos (West Los Alamos and East Los Alamos metapopulations; Appendix D: Figures 4 and 5), and Dominion and Orcutt-Garey Roads (East Santa Maria metapopulation; Appendix D: Figure 3).

2.3.2 Install under crossings at strategic locations to reduce California tiger salamander vehicle-strike mortality and monitor effectiveness. (Priority 1)

Strategic locations to develop under-crossings include sites where California tiger salamanders are frequently found crossing the road and are killed by vehicle strikes. These localities include, but are not limited to: Highway 246 between Buellton and Lompoc adjacent to ponds LOAL-2W and LOAL-2E (Appendix D: Figure 7), Dominion Road in Orcutt between Clark Avenue and Orcutt-Garey Road (adjacent to pond TWDA-10 (Appendix D: Figure 3)), Orcutt-Garey Road between Dominion Road and Foxen Canyon Road; Foxen Canyon Road south from Orcutt-Garey Road to 2 miles south (adjacent to pond TWDA-15 (Appendix D: Figure 3)), Highway 101 in Los Alamos (between ponds SISQ-3 and SISQ-2 (Appendix D: Figure 4) and adjacent to LOAL-19 (Appendix D: Figure 5)), and Black Road between Highway 1 and Betteravia Road. Effectiveness of under crossings should be monitored. USFWS and CDFW should work closely with the California Department of Transportation to coordinate the installation and monitoring of these under crossings.

2.3.3 Restore habitat in key migration/dispersal corridors. (Priority 1)

Barriers to migration and dispersal include habitat entirely lost to development, as well as suboptimal habitat that does not provide adequate refuge in the form of small mammal burrows or other cover. Such barriers could include agricultural fields. Prioritize restoration of dispersal corridors within 5,587 feet (1,703 meters) of breeding ponds and between breeding ponds.

3. Reduce and remove threats from non-native species.

Non-native salamanders threaten the Santa Barbara County California tiger salamander with hybridization. The presence of non-native predators, particularly fish, bullfrogs, and crayfish, also pose a threat to the California tiger salamander. USFWS should work with its partners to eliminate or reduce populations of these non-native species as much as possible in areas occupied by California tiger salamanders in Santa Barbara County. As a short-term method, physical removal of these non-native species may be most beneficial. However, proactive means of

reducing the conditions in which these non-native species thrive is a long-term priority.

3.1 Develop and successfully implement a management plan to survey for and control non-native and hybrid tiger salamanders. (Priority 1)

Areas of highest priority for this action include the La Purisima Golf Course and Lompoc Federal Penitentiary. Develop a monitoring plan to ensure risk abatement for the introduction and containment of non-native genotypes within the range of the Santa Barbara County California tiger salamander including a management plan for reducing the degree of hybridization in areas where non-native genes have been introduced[15].

3.2 Prevent the introduction of non-native predators into California tiger salamander ponds. (Priority 1)

Work with landowners, State agencies, Cachuma RCD, and local agencies to prevent intentional or unintentional introduction of non-native fish, bullfrogs, or crawfish into Santa Barbara County California tiger salamander breeding ponds.

3.3. Develop and implement strategies to remove non-native fish, crayfish, and bullfrog populations from preserved California tiger salamander breeding ponds. (Priority 1)

Develop guidance for efforts to remove non-native fish, crayfish, and bullfrogs from California tiger salamander breeding ponds in coordination with USFWS and CDFW. This guidance should include predator removal to minimize California tiger salamander mortality and minimize effects on cattle and other animals that use ponds. One possible method is to drain ponds from August to October. If a pond is small, exhaustive sampling with a seine to remove predators may be feasible[16]. The agencies should develop mechanisms to streamline these efforts and reduce regulatory restrictions that constrain efficiency in such efforts.

4. Prevent and reduce the potential for the transmission of disease in California tiger salamander metapopulations.

4.1 Work with experts in the field of amphibian pathology/disease to develop disease prevention strategies for the Santa Barbara County California tiger salamander. (Priority 2)

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[15] Pending genetic analysis, the degree of genetic introgression of a given population will remain 'undetermined.' If the breeding habitat where hybrid or non-native individuals are found is adjacent to, or within, a region preserved to meet recovery criteria, then the breeding habitat must be maintained in a manner consistent with California tiger salamander life cycle (e.g., hydrology and absence of non-native predators left intact), except as a means of temporary control efforts. Control or management activities will be coordinated on a case-by-case basis in consultation with the USFWS.

[16] Methods for removing non-native fish and bullfrogs are discussed in Ford et al. (2013).

Include methodology on how to respond to a disease event if one were to occur in a California tiger salamander metapopulation and how to reduce the transmission of disease between metapopulations. Inform landowners and local and State agencies on strategies to employ to prevent disease transmission into California tiger salamander metapopulations.

4.2 Implement guidelines to prevent disease transmission into California tiger salamander breeding ponds. (Priority 2)

Incorporate methods to monitor populations of California tiger salamanders for pathogens and parasites into the California tiger salamander survey protocol.

4.3 Follow "The Declining Amphibian Populations Task Force Fieldwork Code of Practice" (See Appendix C) to limit the spread of disease between individuals and populations of California tiger salamander. (Priority 1)

5. Conduct research on threats to the Santa Barbara County California tiger salamander.

5.1 Conduct a population viability analysis for the Santa Barbara County California tiger salamander. (Priority 2)

Population viability analysis is a species-specific method of risk assessment frequently used in conservation biology to determine the probability that a population will go extinct within a specified timeframe. As monitoring data become available from implementation of Recovery Action 6.1, a population viability analysis for each metapopulation should be conducted.

5.2 Conduct research to develop assays for detecting California tiger salamanders and non-native tiger salamanders from water samples using environmental DNA (eDNA). (Priority 1)

Development of these assays and methods would enable workers to quickly and efficiently establish the status of ponds (e.g., whether a pond is a California tiger salamander or hybrid breeding pond); eDNA sampling would save large amounts of effort and funds that could then be put toward California tiger salamander conservation and recovery efforts. These assays could also be used elsewhere within the species' range.

5.3 Explicitly evaluate how California tiger salamanders use and respond to compatible versus incompatible land uses. (Priority 1)

This action will allow evaluation of recovery criteria 3 and whether or not California tiger salamanders can select specific functional habitat in a landscape with both presumed compatible and incompatible land uses.

5.4 Conduct research on the effects of ranaviruses, *B. dendrobatidi*s, and *B. salamandrivorans* within the range of the Santa Barbara County California tiger salamander. (Priority 2)

This action will allow agencies to determine the extent to which these diseases are a likely threat to the species and, if deemed appropriate, develop viable detection, prevention, and treatment strategies.

5.5 Conduct research to determine the level of threat that contaminants pose to Santa Barbara County California tiger salamanders. (Priority 2)

Determine the level of threat that contaminants pose to Santa Barbara County California tiger salamanders and develop site-specific plans, if necessary, to ensure that the contaminant threat is resolved.

5.6 Conduct research on alternatives to using mosquitofish for vector control. (Priority 2)

Alternatives include other biological control methods such as the application of several species of bacteria (*Bacillus*) that kill only mosquito larvae. Extensive research may be required to understand the implications of introducing these bacterial species or other methods as control agents.

5.7 Conduct research and monitoring to determine level of mortality from vehicle-strikes and evaluate connectivity within metapopulations. (Priority 2)

6. Undertake activities in support of developing and implementing management and monitoring plans.

6.1 Monitor effective population size (N_e, as per Recovery Criterion 4) in each metapopulation to track population status and determine whether measures need to be modified or additional measures need to be taken to protect and enhance habitat and/or reduce threats. (Priority 1)

Seek permission from private landowners or public land managers to monitor California tiger salamander populations on their property. Follow guidelines in Appendix B "Monitoring Effective Population Size (N_e) in the Santa Barbara County California Tiger Salamander."

6.2 Determine the most effective strategies to control non-native and hybrid tiger salamander populations. (Priority 1)

6.3 Identify potential California tiger salamander breeding ponds within its range in Santa Barbara County and survey these ponds. (Priority 2)

These efforts will involve coordination with private landowners for access and permission to survey these ponds. Cooperative agreements with landowners may be necessary to accomplish this action.

6.4 Conduct biennial aerial surveys or implement other appropriate methods to quantify the status of California tiger salamander habitat and identify areas that have high potential for habitat creation/restoration. (Priority 3)

7. Foster collaboration and cooperation through education, outreach, and regular meetings.

7.1 Organize and implement a 'Santa Barbara CTS Recovery Collaborative' including agencies and stakeholders to foster collaboration and cooperation in recovery implementation. (Priority 1)

Develop a collaborative working group with the goal of coordinating implementation of the recovery plan, particularly to get ponds and upland habitat into conservation status and to control the presence of hybrids and fish (e.g. restoration or removal) in existing ponds. Meet regularly to foster ongoing collaboration.

7.2 Implement USFWS Schoolyard Habitat Program at schools within the range of the Santa Barbara County California tiger salamander. (Priority 3)

A USFWS Schoolyard Habitat project is a naturalized habitat area that is created by students, for students. The area is designed to be ecologically sound and provide habitat for local native plant and wildlife species. The habitat area acts as an outdoor classroom for students, is integrated into the curriculum, and is designed to encourage long-term stewardship. Schoolyard Habitat Programs within the range of the California tiger salamander would aim to educate children about the species and its habitat.

7.3 Conduct public outreach to foster collaboration, including public awareness about the biology and threats to the Santa Barbara County California tiger salamander. (Priority 3)

IV. Implementation Schedule

The following implementation schedule outlines actions and estimated costs for this recovery plan. It is a guide for meeting the objectives discussed in Chapter II. This schedule prioritizes actions, provides an estimated timetable for performance of actions, indicates the responsible parties, and estimates costs of performing actions. Cost estimates are provided for the entire recovery period (estimated to be 30 years). These actions, when accomplished, should further the recovery and conservation of the listed species.

Key to Terms and Acronyms Used in the Implementation Schedule:

Priority numbers are defined per USFWS policy (USFWS 1983) as:

Priority 1: An action taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2: An action taken to prevent a significant decline in the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the species.

Definition of Action Durations:

Number: The predicted duration of the action in years.

Continual: An action that is not currently underway but will be implemented on a routine basis, once initiated.

Ongoing: An action that is currently being implemented and will continue until action is no longer necessary.

Unknown: Either action duration or associated costs are not known at this time.

Responsible Parties:

Responsible parties are those agencies and other partners who may voluntarily participate in implementation of particular actions listed within this recovery plan. Responsible parties may willingly participate in project planning, or may provide funding, technical assistance, staff time, or any other means of implementation; however, responsible parties are not obligated to implement any of these actions. Other parties are invited to participate in the recovery of the Santa Barbara County California tiger salamander, as well.

ALL	All responsible parties
CDFW	California Department of Fish and Wildlife
CRCD	Cachuma Resource Conservation District
CITY	City governments
CLTRNS	California Department of Transportation
CNTY	County of Santa Barbara

EPA	U.S. Environmental Protection Agency
FBP	Federal Bureau of Prisons
NGO	Non-governmental organizations (e.g., The Land Trust for Santa Barbara County, The Nature Conservancy)
NRCS	Natural Resources Conservation Service
PVT	Private parties
RWQCB	Regional Water Quality Control Board
TBD	To be determined
USFWS	U.S. Fish and Wildlife Service
UNIV	University

Action Number and Description		Priority	Responsible Parties	Duration (years)	Total Cost Estimate (in $1,000)			Comments
1.1	Permanently protect Santa Barbara County California tiger salamander breeding ponds and their adjacent uplands (see Recovery Criteria 1, 2, 3) through acquisition and conservation easements	1	CDFW, CNTY, CITY, PVT, TBD, USFWS	20	172,440			The amount in the table is the total cost for all six metapopulation areas. This figure is based on 5,748 acres[17] being placed into easements per metapopulation area, at an approximate easement cost of $5,000/acre[18] = $28,740,000 per metapopulation.
1.2	Develop management plans for protected California tiger salamander habitats	1	CDFW, CRCD, USFWS, TBD, PVT, NRCS	10	250			$25,000/year for 10 years

[17] Using the average Santa Barbara County California tiger salamander breeding pond size (1.47 acres), 4 ponds per metapopulation area would need be necessary to support a minimum viable population size (Searcy et al. 2014; Recovery Criterion 1). An estimated 95% of the salamander population will be encompassed in 2,251 acres around each pond: 623 acres in permanent protection and 1,628 acres sufficiently unfragmented constituting no less than 50% of the adjoining area (Recovery Criteria 2 and 3). Therefore, we estimate approximately 1,437 acres total would need to be preserved per pond. Assuming no overlap of protected area among the 4 protected ponds, each metapopulation will need 5,748 acres either: (1) owned in fee title by a government agency or conservation organization and managed for the benefit of the Santa Barbara County California tiger salamander; or (2) privately-owned lands that are protected in perpetuity with conservation easements and managed in a manner that promotes the conservation of the Santa Barbara County California tiger salamander.

[18] The $5,000/acre easement cost is based on an estimate of approximate easement value for a 1,000 acre parcel with development rights removed by the easement. If the 1,000 acre parcel were grazing land only (no development rights), the easement value would be closer to $2,000 an acre. Easement values in California tiger salamander habitats in Santa Barbara County are highly variable and depend upon individual property characteristics; price per acre values range broadly depending on development potential and extent of grazing-only lands, from $2,500 per acre to $20,000/acre (Jim Hammock, pers. comm., 2014). Estimates are for easement costs only; acquisition costs would be much higher. Necessary management of the protected habitat will incur additional costs per acre as identified in management-related actions in the implementation table.

Action Number and Description		Priority	Responsible Parties	Duration (years)	Total Cost Estimate (in $1,000)			Comments
1.3	Develop a Regional Habitat Conservation Plan or Conservation Strategy for the County of Santa Barbara and the City of Santa Maria.	1	CNTY, CITY, CRCD, CDFW, NGO, NRCS, PVT, USFWS	3	300			3 years of development at $100,000/year
1.4	Develop a Safe Harbor Agreement(s) or obtain financial incentives for landowners to maintain vernal pools/stock ponds and associated uplands in Santa Barbara County California tiger salamander habitat	1	USFWS, CDFW, CRCD, NGO	Continual	TBD			
1.5	Reduce burrowing animal control in Santa Barbara County California tiger salamander habitat	2	USFWS, CDFW, NRCS, CNTY, EPA, RWQCB, NGO,	Continual	TBD			
1.6	Manage sedimentation to protect Santa Barbara County California tiger salamander breeding ponds	2	NRCS, PVT, USFWS, CDFW	Continual	TBD			
2.1.1	Restore and enhance Santa Barbara County California tiger salamander habitats: East Santa Maria Metapopulation Area	1	CDFW, NRCS, USFWS PVT, CRCD	Ongoing	TBD			
2.1.2	Restore and enhance California tiger salamander habitats: Santa Rita Metapopulation Area	1	CDFW, NRCS, USFWS, PVT, CRCD	Ongoing	TBD			

Action Number and Description		Priority	Responsible Parties	Duration (years)	Total Cost Estimate (in $1,000)			Comments
2.1.3	Restore aquatic habitat	1	CDFW, NRCS, USFWS	Ongoing	TBD			
2.1.4	Restore upland habitat	1	CDFW, NRCS, USFWS, PVT, CRCD	Ongoing	TBD			
2.1.5	Work with private landowners in habitat restoration efforts	1	CRCD, CDFW, CNTY, NGO, NRCS, PVT, USFWS	Ongoing	300			
2.2.1	Develop and implement habitat maintenance guidelines for Santa Barbara County California tiger salamander breeding ponds in a metapopulation area	2	CDFW, CRCD, CNTY, EPA, NGO, NRCS, PVT, RWQCB, USFWS	3	TBD			
2.2.2	Follow grazing best management practices to prevent degradation of Santa Barbara County California tiger salamander habitats	3	CDFW, CRCD, CNTY, NRCS, USFWS	Ongoing	TBD			
2.2.3	Evaluate the use of pesticides and other environmental contaminants that may be harmful to Santa Barbara County California tiger salamanders	2	CDFW, CNTY, EPA, RWQCB, USFWS	Ongoing	TBD			

Action Number and Description		Priority	Responsible Parties	Duration (years)	Total Cost Estimate (in $1,000)			Comments
2.2.4	Work with local landowners and agencies in Santa Barbara County California tiger salamander habitats where agricultural chemicals are used	2	CDFW, CRCD, NGO, RWQCB, USFWS, PVT	Ongoing	TBD			
2.3.1	Develop and implement a plan to minimize the effects of vehicle-strike mortality on California tiger salamanders	1	CLTRNS, CDFW, USFWS, CNTY, CITY	5	TBD			
2.3.2	Install under crossings at strategic locations to reduce California tiger salamander vehicle related mortality and monitor effectiveness	1	CLTRNS, CDFW, USFWS, CNTY, CITY	3	200			50,000 per undercrossing, at 4 locations
2.3.3	Restore habitat in key migration/ dispersal corridors	1	CDFW, CITY, CNTY, NGO, NRCS, PVT, USFWS	Ongoing	6000			Two key dispersal corridors per metapopulation, $500,000 per corridor
3.1	Develop and successfully implement a plan to survey for and control non-native and hybrid tiger salamanders	1	CDFW, CRCD, CLTRNS, FBP, NGO, NRCS, PVT, USFWS	10	480			$60,000/year for 8 years
3.2	Prevent the introduction of non-native predators into California tiger salamander ponds	1	CDFW, CITY, CNTY, NRCS, USFWS	Ongoing	100			$10,000/year for 10 years until sufficiently protective

Action Number and Description		Priority	Responsible Parties	Duration (years)	Total Cost Estimate (in $1,000)			Comments
3.3	Develop and implement strategies to remove non-native fish, crayfish, and bullfrog populations from preserved California tiger salamander breeding ponds	1	CDFW, CRCD, NGO, NRCS, PVT, USFWS	3	150			3 years for development of plan; implementation would be ongoing
4.1	Work with experts in the field of amphibian pathology/disease to develop disease prevention strategies for the Santa Barbara County California tiger salamander	2	CDFW, USFWS, UNIV, USFWS	Ongoing	TBD			
4.2	Implement guidelines to prevent disease transmission into California tiger salamander breeding ponds	2	ALL	Ongoing	TBD			
4.3	Follow "The Declining Amphibian Populations Task Force Fieldwork Code of Practice" (See Appendix C) to limit the spread of disease between individuals and populations of California tiger salamander	1	ALL	Ongoing	TBD			
5.1	Conduct a population viability analysis for the Santa Barbara County California tiger salamander	2	CDFW, UNIV, USFWS	10	100			
5.2	Conduct research to develop assays for detecting California tiger salamanders and non-native tiger salamanders from water samples using environmental DNA (eDNA)	1	UNIV, USFWS	3	30			3 years at $10,000/year

Action Number and Description		Priority	Responsible Parties	Duration (years)	Total Cost Estimate (in $1,000)			Comments
5.3	Explicitly evaluate how California tiger salamanders use and respond to compatible versus incompatible land uses	1	UNIV, USFWS	5	125			
5.4	Conduct research on the effects of ranaviruses, *B. dendrobatidis*, and *B. salamandrivorans* within the range of the Santa Barbara County California tiger salamander	2	CDFW, PVT, USFWS, UNIV	5	50			Three years of monitoring and two years to develop implementation strategies, $10,000/year
5.5	Conduct research to determine the level of threat that contaminants pose to Santa Barbara County California tiger salamanders	2	USFWS, CDFW, EPA, UNIV, NRCS	3	TBD			
5.6	Conduct research on alternatives to using mosquitofish for vector control	2	CDFW, CITY, CNTY, USFWS, UNIV	2	20			2 years at $10,000/year
5.7	Conduct research and monitoring to determine level of mortality from vehicle-strikes and evaluate connectivity within metapopulations	2	CLTRNS, CDFW, USFWS, CNTY, CITY	5	TBD			
6.1	Monitor effective population size (N_e, as per Recovery Criterion 4) in each metapopulation to track population status and determine whether measures need to be modified or additional measures need to be taken to protect and enhance habitat and/or reduce threats	1	CDFW, PVT, USFWS, UNIV	Ongoing	500			10 years at $50,000/year

Action Number and Description		Priority	Responsible Parties	Duration (years)	Total Cost Estimate (in $1,000)			Comments
6.2	Determine the most effective strategies to control non-native and hybrid tiger salamander populations	1	CDFW, CRCD, PVT, USFWS, UNIV, PVT	5	125			5 years at $25,000/year
6.3	Identify potential California tiger salamander breeding ponds within its range in Santa Barbara County and survey these ponds	2	CDFW, CRCD, PVT, USFWS, UNIV	5	50			Ongoing effort for 5 years at $10,000/year
6.4	Conduct biennial aerial surveys or other methods to quantify the status of California tiger salamander habitat and identify areas that have high potential for habitat creation/restoration	3	CDFW, USFWS	Ongoing	60			$5,000 twice annually, ongoing
7.1	Organize and implement a 'Santa Barbara CTS Recovery Collaborative' including agencies and stakeholders to foster collaboration and cooperation in recovery implementation	1	CDFW, CRCD, CITY, CNTY, NGO, USFWS	10	0			
7.2	Implement USFWS Schoolyard Habitat Program at schools within the range of the Santa Barbara County California tiger salamander	3	USFWS, CITY	5	40			$4,000 from USFWS and $4,000 matching from the school per habitat (assuming 1 habitat per year for 5 years)
7.3	Conduct public outreach to foster collaboration, including public awareness about the biology and threats to the Santa Barbara County California tiger salamander	3	USFWS	2	20			First two years are for development, requiring ongoing maintenance thereafter

Total cost to recovery: $181,340,000

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VI. Appendices

Appendix A. Pond buffer area and minimum viable population size estimates (Searcy *in litt.* 2014)

This is a description of my newest estimate for the distance from the shoreline of a breeding pond needed to include 95% of a California tiger salamander population.

My first step was to use the procedure described in Searcy and Shaffer (2011) to fit a repeated-measures ANOVA that models the density of California tiger salamanders as a function of distance from the edge of the breeding pond, while accounting for variation between the two monitored breeding ponds at Jepson Prairie and the variation observed over the eight years of the study (2005-2013). This entailed calculating the density of each age class of salamanders (metamorphs, juveniles, and adults) at each distance from the pond shoreline at which we have drift fences (10, 100, 200, 300, 400, 500, 600, 700, 850, and 1000 m). I then took a weighted sum of these densities, weighting each age class by its relative reproductive value (1 for adults, 0.38 for juveniles, and 0.14 for metamorphs). These weightings come from an integral projection model that I have created using recapture data from the Jepson Prairie study. These weightings replace the weightings used in Searcy and Shaffer (2011), which were based on demographic data from Hastings Natural History Reservation (Trenham et al. 2000). Now that demographic data is available from Jepson Prairie, where the density distribution data was also collected, it makes sense to use only data from this population. I fit the repeated-measures ANOVA to the weighted sum, which represents the density of reproductive value, which values salamanders by their probability of contributing to future population growth. The resulting function relating density of reproductive value to distance from pond edge is: density = 5.436*e-0.002516*distance. This function represents the density of salamanders emanating in all directions from the breeding pond, so in order to calculate the total number of salamanders across the two-dimensional landscape, you need to multiply by $2\pi r$ and integrate it. In this case, r = distance+250, since a pond with an area that is the average of Olcott Lake and Round Pond (the two breeding ponds used in the study) would have a radius of 250 meters. I then solved the equation $0.95*\text{Int}[2\pi*(\text{distance}+250)*5.436*e-0.002516*\text{distance},\{\text{distance},0,\infty\}] = \text{Int}[2\pi*(\text{distance}+250)*5.436*e-0.002516*\text{distance},\{\text{distance},0,x\}]$ for x. This yields the distance one would have to go from the breeding pond in order to include 95% of the salamander population, which turns out to be 1703 m. This is the same approach used in Searcy and Shaffer (2011), but the rate of exponential decay is slightly more negative (-0.002516 as opposed to -0.002317), which yields a slightly lower migration distance. A 1703 m buffer around a breeding pond would encompass 2251 acres, assuming that the pond was a point source. A very similar calculation yields 504 m as the distance needed to encompass 50% of the salamander population, which would require a 197 acre buffer area, and 896 m would encompass 75% of the salamander population, which would require a 623 acre buffer.

The following are a few notes on the total pond area needed to sustain a viable California tiger salamander metapopulation.

According to Traill et al. (2007), the average minimum viable population size for a population of herptiles is 5409 individuals. Since our equation relating pond area to population size is in terms of effective population size, we need a conversion factor between effective and census population size. I calculated the census number of metamorphs for Blomquist Pond, taking the average of the six years covered in Trenham et al. (2000). I chose to base the census population size on metamorphs, because all metamorphs should be captured each year, while a large fraction of the juveniles and adults remain underground each year. Using the census number of metamorphs, I then calculated the census number of juveniles and adults based on the growth, survivorship, and maturity functions in the integral projection model developed from the Jepson Prairie recapture data. My final calculations for the census population size at Blomquist Pond were: 190 adults, 362 juveniles, and 397 metamorphs. Wang and Shaffer (unpublished data) give two estimates for the effective population size of Blomquist Pond: 11 and 16. I averaged these two values (13.5) and then divided the census population size of Blomquist Pond by this value to get the conversion factors: adults (14.074x), juveniles (26.815x), and metamorphs (29.407x). When calculating the minimum viable population size, I only considered adults and juveniles, since metamorphs are not present for the majority of the year. Getting a census population size of 5409 individuals thus requires an effective population size of 5409/(14.074+26.815) = 132. The equation relating effective population size to pond area from Wang et al. (2011) is Ne = 7.721*ln(area) – 30.999. So, in order to get the sufficient pond area with a single pond, that pond would need to be 364,189 acres. In order to get it with two ponds, each would need to be 71 acres (slightly smaller than Olcott Lake). In order to get it with three ponds, each would need to be 4.1 acres, which is a typical size for the playa pools at Jepson Prairie. So, in almost any landscape, getting the sufficient pond area would require at least three ponds, which will provide at least some redundancy in breeding sites. The average pond size in Santa Barbara County is 1.47 acres, so it would require four ponds with this size in order to get a stable metapopulation. In order to get it with eight ponds, each would need to be 470 m^2, and in order to get it with nine ponds, each would need to be 370 m^2.

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Appendix B. Monitoring Effective Population Size (N_e) in the Santa Barbara County California Tiger Salamander

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For any pond-breeding amphibian, there are at least three ways to estimate population size, and therefore population increases or decreases over time. One is to use drift fences to estimate the number of adults or metamorphs at a site. A second is to count the number of larvae in a breeding site at some time in the larval period. The third is to use molecular genetic techniques to estimate the size of the population. The first two approaches return point samples of the census population size—that is, how many individuals are actually at a breeding site at one or more points in the life cycle. Such estimates are often expensive and time-consuming to collect and difficult to interpret, given that only some individuals in the population breed in any year. In particular for California tiger salamanders (CTS), we have strong evidence that in low rain years, most individuals do not breed, whereas in high rain years, more come out to breed. This makes the interpretation of counts within and across years difficult, since the count reflects the rain year, the time of year when the count is done relative to breeding and metamorphosis, and the actual census size of the population. For larval counts, it may also reflect the density of predators (including predatory insects, introduced bullfrogs and fishes, and native birds, snakes, and other taxa) as well as an indirect indication of breeding activity for that year.

Alternatively, one can use genetic approaches to estimate the *effective population size*, or N_e. This approach is based on sampling a reasonable number of individuals (larvae, adults or metamorphs), estimating variation at a large number of genetic markers, and using that to estimate the number of individuals that would have to breed at random to produce the variation seen in that random collection of offspring. N_e is usually smaller than the census size—in CTS our estimates are that it is often about 10 fold less, but N_e estimates are also very reproducible and are correlated with the census size. In addition, N_e is often a more accurate indication of the total population size, rather than just the number of individuals that happened to breed in a particular year. In that sense, changes in N_e are a more accurate representation of population trends than any given estimate of the census size for a given year. In addition, N_e can be based on non-destructive larval sampling—we need only to capture ~30-50 larvae, snip off the end of the tail, and within a few minutes, return the larva to the point of capture. Recent experimental work from our lab (Polich et al. 2013) suggests that under semi-naturalistic conditions there is no decrease in survival or fitness associated with this tissue sampling, and that at least in replicated mesocosms, larvae regrow the missing portion of their tail and metamorphose as normal-size individuals.

To track the population increases or decreases in the Santa Barbara DPS of CTS using N_e, we propose using at least two different methods. The sibship assignment method as implemented in the program COLONY (Jones and Wang 2010) uses genetic data to determine the probabilities

of all possible pairs of samples from a population being full-sibs or half-sibs. These probabilities are then used to determine N_e based on an equation that relates the probability of drawing these assignments from a randomly sampled, single cohort of larvae to the number of effective breeding adults. The method also returns 95% confidence intervals on each estimate of N_e. We have applied this method to CTS in the past (Wang et al. 2011, Wang and Shaffer unpublished data), and it returns biologically reasonable, reproducible estimates. The LDNe method (Waples and Do, 2008) implements a linkage disequilibrium method that has been shown to be an accurate estimate of the population size as long as a reasonable (30-60) number of individuals and loci are used (Tallmon et al. 2010). Together the two approaches provide reasonable estimates of the number of individuals breeding that year and the population size from which they were drawn.

Given that individual breeding ponds have a relatively high level of random variation in breeding success in any given year, we recommend that for each Santa Barbara metapopulation, molecular estimates of N_e be collected from three to five ponds per metapopulation and doing so each year for 10 consecutive years. Simulations indicate that yearly sampling may not be necessary (Tallmon et al. 2010), but the actual breeding of CTS is so variable and idiocynratic with respect to rainfall and weather that it is best to obtain yearly estimates when trying to determine if populations are increasing, decreasing, or remaining constant. This sampling will span different climate and rainfall years, allowing one to account for environmental variation when estimating population trends. Ideally, the sampled ponds would be ecologically variable and span the range of sites used with respect to natural vs. manmade, size/depth, and the amount of open space around each. Sampling each year will yield the most accurate estimate of yearly variation (and trends) in N_e, but it is also the most expensive and time-consuming approach. Our recommendation is to avoid a strategy that explicitly ignores drought years, since they are a component of the biology of CTS populations, and they should be incorporated into time series of population trends. Sample sizes of 30-50 larval tail tips for each pond should provide adequate information on N_e (Tallmon et al. 2010), and ideally those samples should be collected during the late-larval period, probably in April in most years. Tissue samples should be sufficiently large to ensure that there is plenty of tissue for multiple DNA extractions and sequencing experiments, since the technology will almost certainly evolve and change every few years.

In the past, microsatellites were the technology of choice for this kind of work, and they still could be used. However, simulation work indicates that the most important increases in accuracy of Ne estimates derive from increasing the number of loci (especially if 30-60 individuals are sampled), and microsatellites are both expensive and difficult to increase beyond a few dozen loci at most. Recent advances in using single nucleotide polymorphisms (SNPs) have led to the widespread use of these variable, stable, informative markers, and we recommend using them for this work. 100-300 variable SNPs should suffice for these analyses, depending on the level of variation that exists in each population. In the past, the very large genome size (~32 billion base pairs, or roughly 10X human) of CTS has made the collection of such SNP data technically very difficult. However, our lab has now developed a panel of 5200 SNPs for an analysis of CTS hybridization in central California (McCartney-Melstad et al., 2016), and we can develop a sub-panel of this gene capture array that we can use for the Santa Barbara Distinct Population Segment. This requires a preliminary analysis with our larger SNP panel to determine which SNPs are most variable, and a re-design of the capture array that focuses on those SNPs that are

segregating at high allele frequencies within the Santa Barbara population.

Both programs COLONY and LDNe return estimates of N_e and their 95% confidence estimates, and those estimates can be tracked over time to gain insights into trends in population size. However, given that the 95% confidence levels for N_e can be fairly large (about +/- 20% of the point estimate for our work on CTS using microsatellites, see Wang et al. 2011), using these data to determine population trends can be difficult. Of course, the same is true for population estimates of breeding adults from drift fence studies or larval numbers from seining surveys for pond breeding amphibians (for CTS, see Trenham et al., 2000, Searcy and Shaffer, unpublished data). There is no simple solution for this sampling problem, as has been widely recognized by the community for many years. In anticipation of trying to solve this problem, I have initiated discussions with Professor Jamie Lloyd-Smith, a mathematical ecologist at UCLA, and his initial thinking is that a mixed model that takes into account rainfall as a covariate, and the hierarchical structure of years nested within ponds, and ponds nested within metapopulations, is probably the way to go with these data.

Finally, all tissue samples should be archived in a stable repository where they will be well-curated and available for future analyses.

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Appendix C. The Declining Amphibian Populations Task Force Fieldwork Code of Practice (DAPTF 1998)

The Declining Amphibian Task Force (DAPTF) was established in 1991 by the World Conservation Union to address multiple conservation issue related to amphibians. The DAPTF prepared a code of practice to provide guidelines for use by anyone conducting field work at amphibian breeding sites or in other aquatic habitats. Observations of diseased and parasite-infected amphibians are now being frequently reported from sites all over the world. This has given rise to concerns that releasing amphibians following a period of captivity, during which time they can pick up unapparent infections of novel disease agents, may cause an increased risk of mortality in wild populations. Amphibian pathogens and parasites can also be carried in a variety of ways between habitats on the hands, footwear, or equipment of fieldworkers, which can spread them to novel localities containing species which have had little or no prior contact with such pathogens or parasites. Such occurrences may be implicated in some instances where amphibian populations have declined. Therefore, it is vitally important for those involved in amphibian research (and other wetland/pond studies including those on fish, invertebrates and plants) to take these steps to minimize the spread of disease and parasites between study sites:

1. Remove mud, snails, algae, and other debris from nets, traps, boots, vehicle tires and all other surfaces. Rinse cleaned items with sterilized (e.g. boiled or treated) water before leaving each study site.
2. Boots, nets, traps, etc., should then be scrubbed with 70% ethanol solution (or sodium hypochlorite 3 to 6%) and rinsed clean with sterilized water between study sites. Avoid cleaning equipment in the immediate vicinity of a pond or wetland.
3. In remote locations, clean all equipment as described above upon return to the lab or "base camp". Elsewhere, when washing machine facilities are available, remove nets from poles and wash with bleach on a "delicates" cycle, contained in a protective mesh laundry bag.
4. When working at sites with known or suspected disease problems, or when sampling populations of rare or isolates species, wear disposable gloves and change them between handling each animal. Dedicate sets of nets, boots, traps, and other equipment to each site being visited. Clean and store them separately and the end of each field day.
5. When amphibians are collected, ensure the separation of animals from different sites and take great care to avoid indirect contact between them (e.g. via handling, reuse of containers) or with other captive animals. Isolation from un-sterilized plants or soils which have been taken from other sites is also essential. Always use disinfected/disposable husbandry equipment.
6. Examine collected amphibians for the presence of diseases and parasites soon after capture. Prior to their release or the release of any progeny, amphibians should be quarantined for a period and thoroughly screened for the presence of any potential disease agents.
7. Used cleaning materials (liquids, etc.) should be disposed of safely and if necessary taken back to the lab for proper disposal. Used disposable gloves should be retained for safe disposal in sealed bags.

Appendix D. Metapopulation Maps

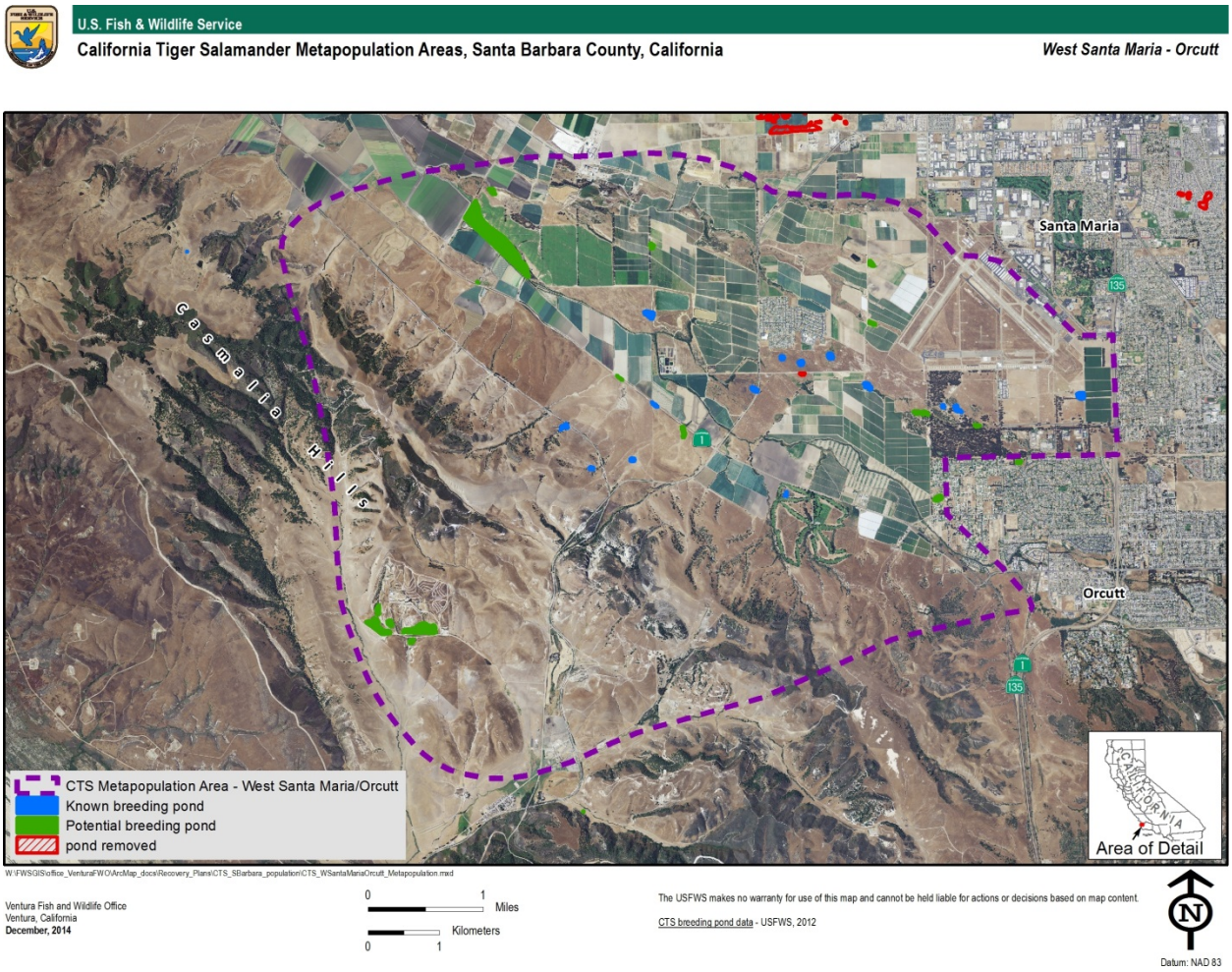

Figure 2. West Santa Maria/Orcutt Metapopulation Area.

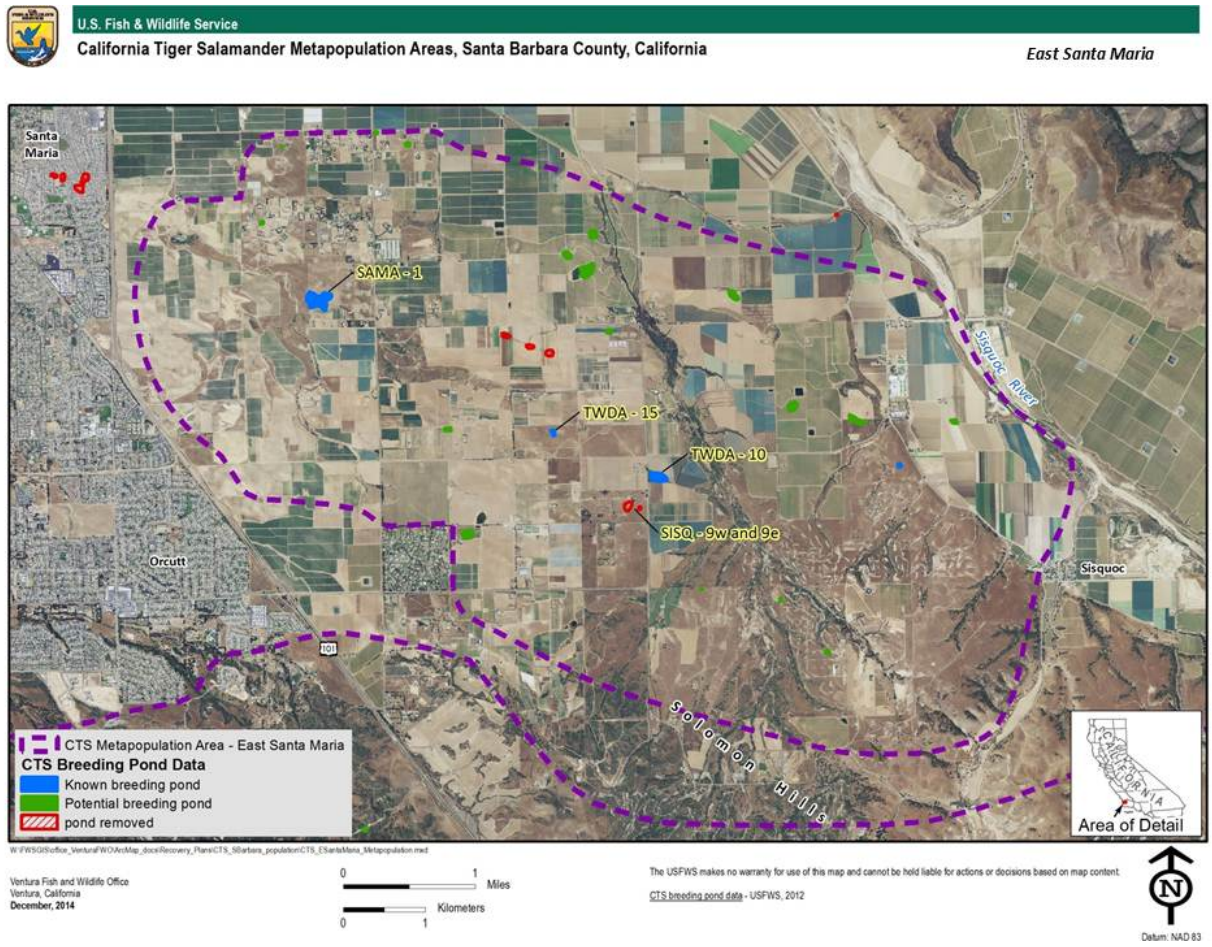

Figure 3. East Santa Maria Metapopulation Area

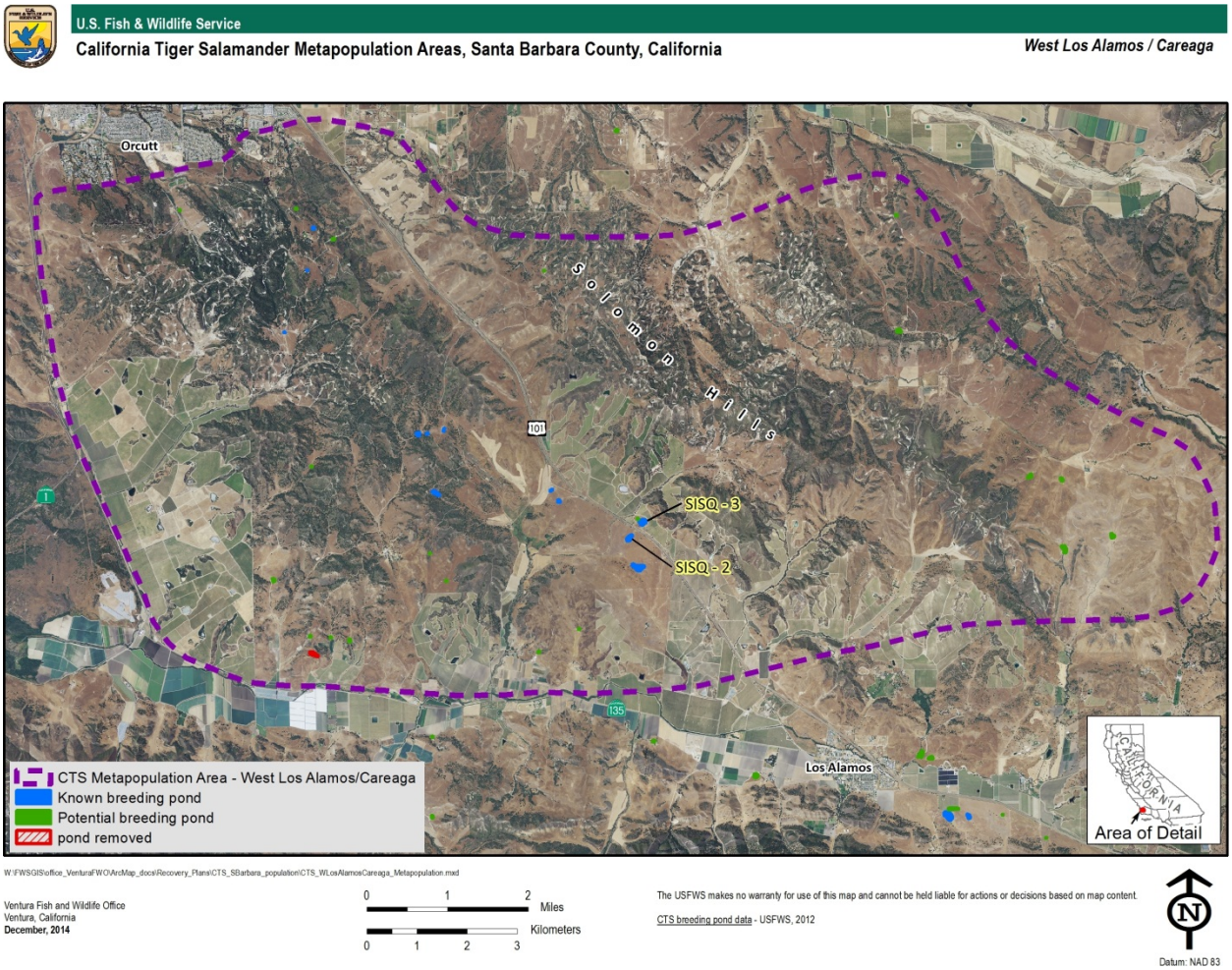

Figure 4. West Los Alamos/Careaga Metapopulation Area.

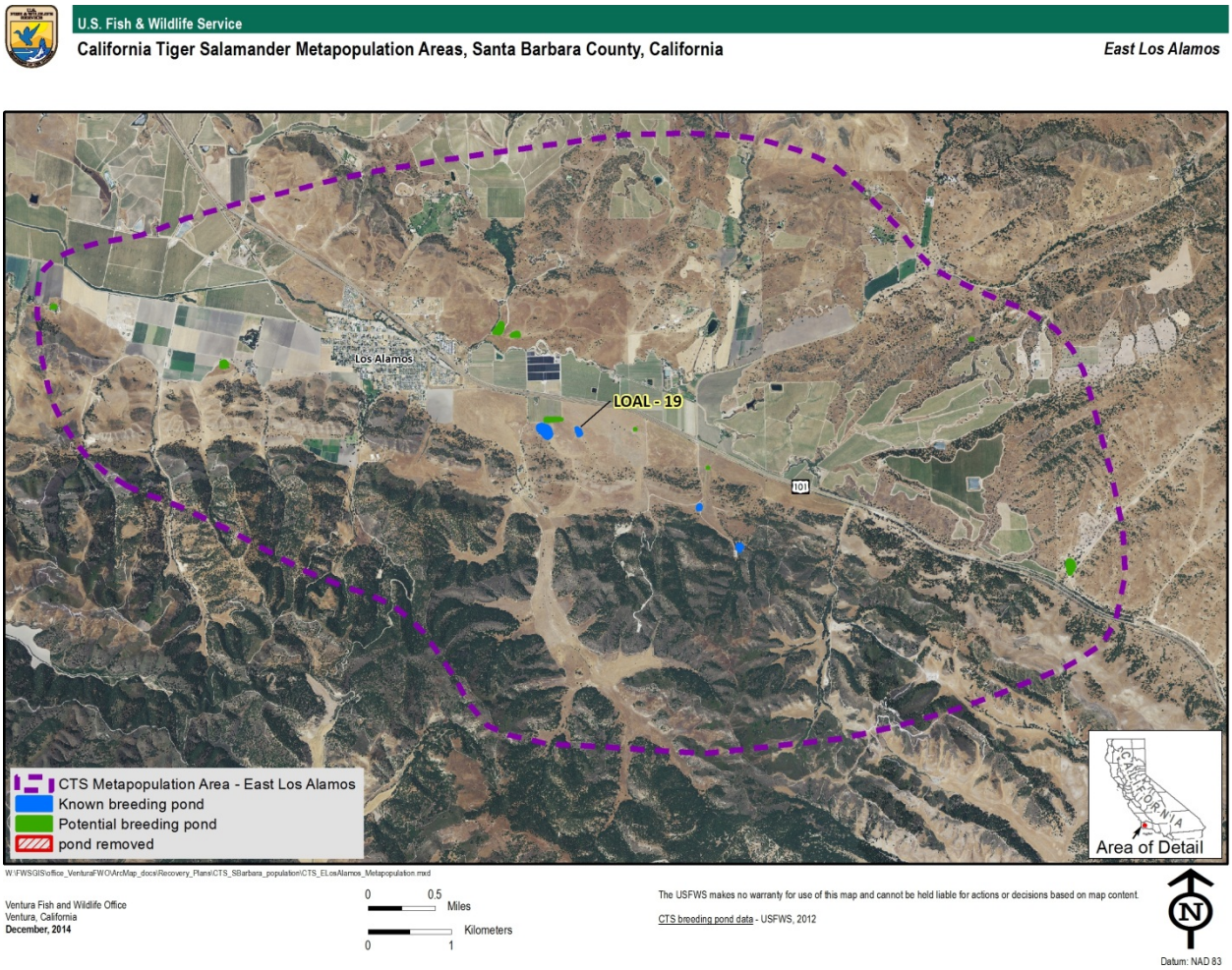

Figure 5. East Los Alamos Metapopulation Area.

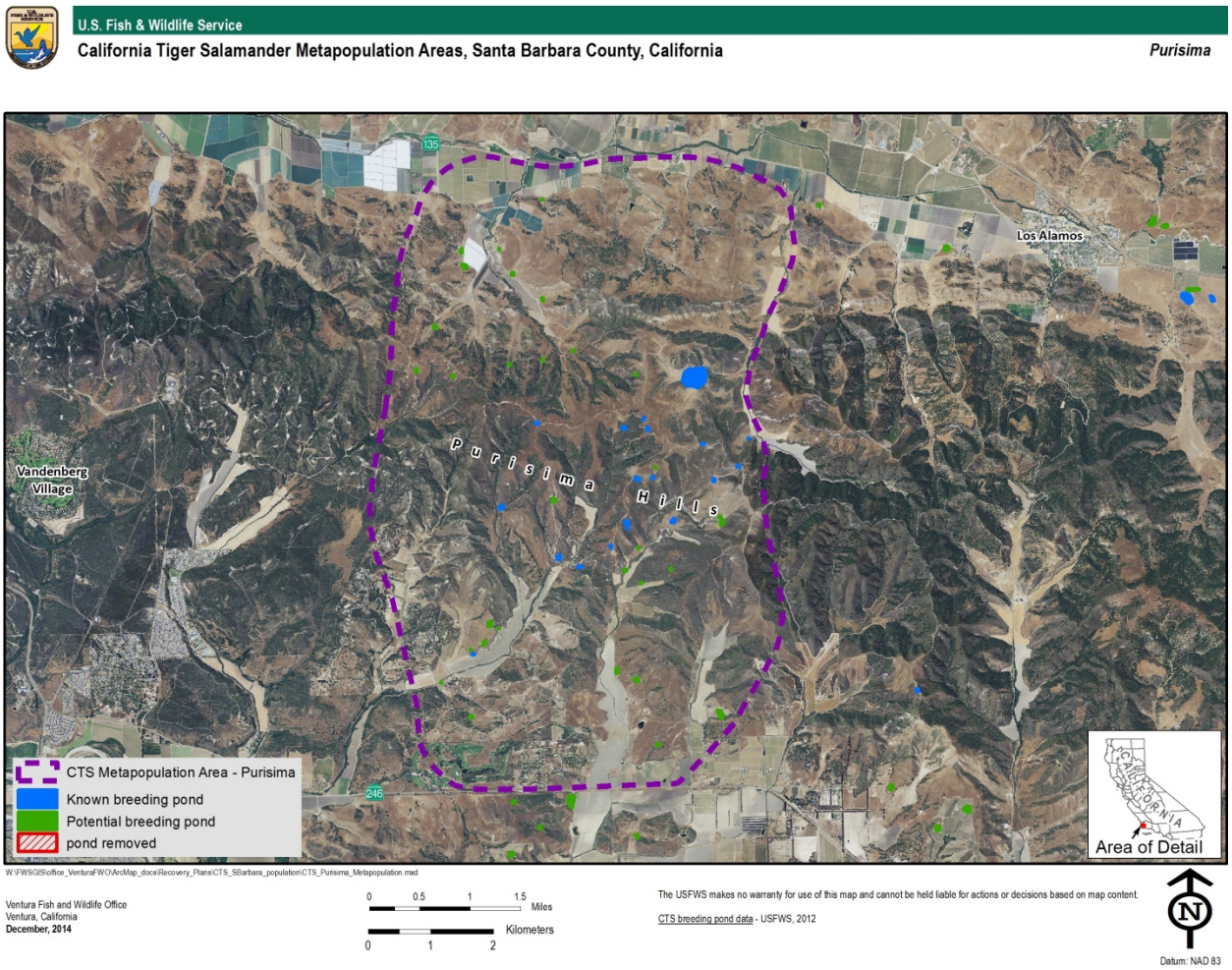

Figure 6. Purisima Metapopulation Area.

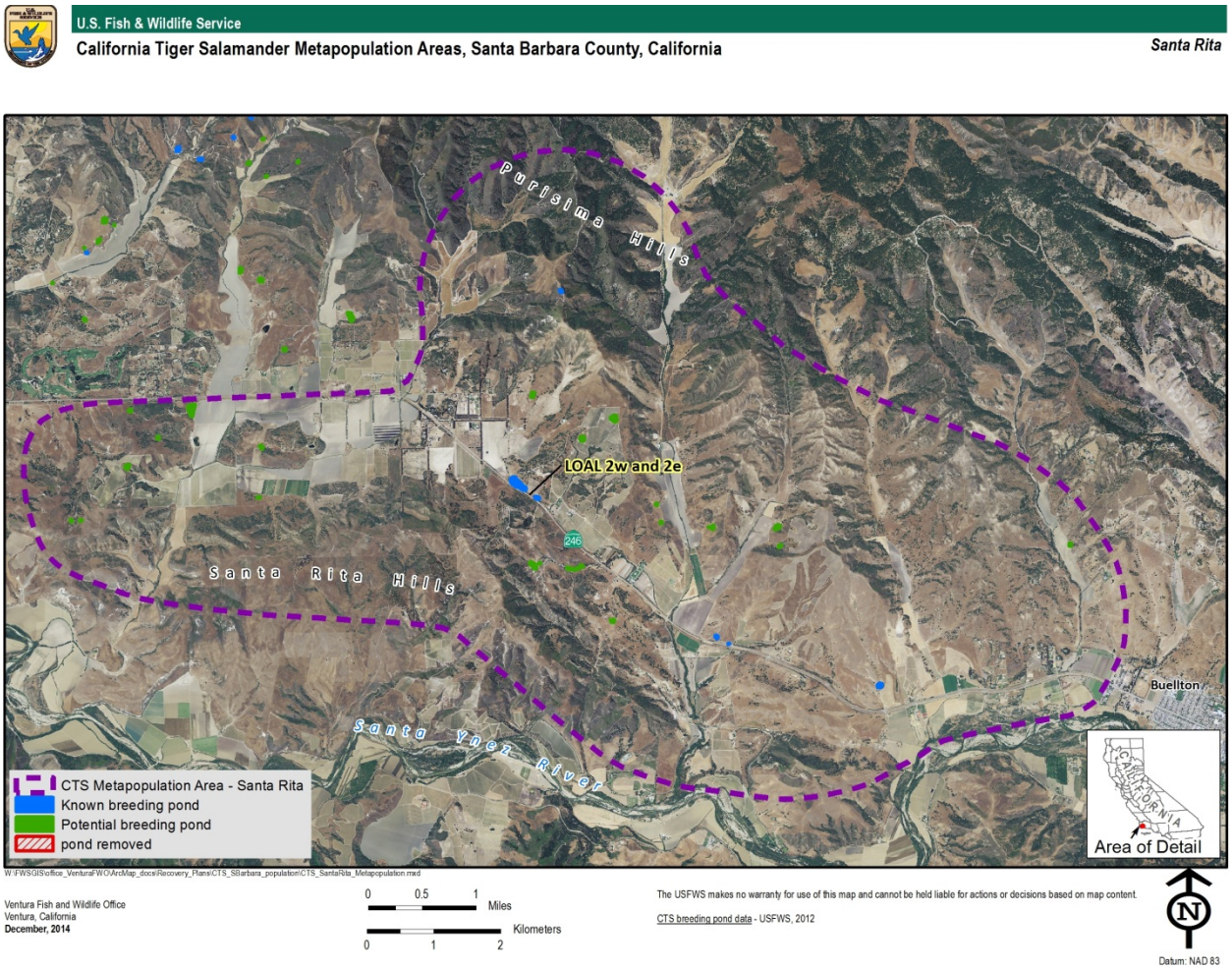

Figure 7. Santa Rita Metapopulation Area.

Appendix E. Summary of Public Comments and U.S. Fish and Wildlife Service Responses on the *Draft Recovery Plan for the Santa Barbara County DPS of the California tiger salamander*

The 60-day public comment period for the Draft Recovery Plan for the Santa Barbara County Distinct Population Segment (DPS) of the California tiger salamander was open from April 24, 2015, to June 23, 2015. Twenty three organizations or individuals provided comments on the draft recovery plan, including 2 peer reviewers, 1 state agency, and 20 comments from the public. Substantive information has been incorporated into the final plan as appropriate. We, the U.S. Fish and Wildlife Service (USFWS), address the comments in the following summary organized by topic.

Recovery Criteria

Comment: One commenter was unclear as to whether there is overlap allowed in the acreages for Criteria 1 and 2 of the draft recovery plan and that the total acres needed for recovery should be clearly stated in the plan.

> *Response:* As stated in the draft recovery plan, the functional upland habitat area for a pond may overlap with the functional upland habitat around adjacent ponds. 5,748 acres is the greatest number of acres that would need to be protected in each metapopulation to meet the recovery criteria. This 5,748 acres per pond comes from 623 acres of upland habitat in permanent protection, plus 50 percent of the adjoining 1,628 acres (814 acres) in an unfragmented state, which equals 1,437 acres. Therefore, approximately 4 preserved ponds per metapopulation, with up to 1,437 acres of upland habitat for each pond in a metapopulation, equals 5,748 acres of upland habitat per metapopulation. The total area of upland habitat needed to meet the recovery criteria for all 6 metapopulations is up to 34,488 acres.

Comment: One commenter stated that based on Orloff (2011)'s work, the acreages proposed in Criterion 2 are too small and should be increased in size.

> *Response:* The Endangered Species Act of 1973, as amended (Act) requires the USFWS to develop recovery plans on the basis of the best scientific and commercial information available. Recent work by Searcy and others (Searcy et al. 2013) allows us to use population estimates and migration distances to calculate the exact area around each pond where we expect to find a particular percentage of the California tiger salamander population.

Comment: One commenter stated that a criterion for delisting the Santa Barbara County California tiger salamander should be climate change, since this is the number one threat to the species.

> *Response:* In the listing rule for the Santa Barbara County DPS of the California tiger salamander (USFWS 2000a, b), the five year review (USFWS 2009), and this recovery plan, we have identified habitat loss as the primary threat to the species. The precise effect that climate change will have on California tiger salamanders in Santa Barbara County is unknown.

Comment: One commenter stated that the La Purisima metapopulation should be classified as "recovered" because it meets the recovery criteria with the conservation bank; therefore a delisting is warranted because USFWS should revise its definition of "sufficient" (i.e., sufficient number of ponds to meet delisting criteria).

Response: We have added to the recovery plan a discussion of the areas of the Santa Barbara County California tiger salamander's range that have already been put into conservation in "Part H. Past Conservation Efforts". These discussions identify areas that count towards meeting recovery criteria. We presently believe that the recovery criteria must be met in all six metapopulation areas for delisting to be warranted; further research and monitoring should clarify the exact number of metapopulations necessary.

Comment: Two commenters questioned average pond size under Criterion 1 and how this was calculated (arithmetic mean vs. geometric mean).

Response: The footnote for Criterion 1 in the recovery plan states that "the average size of known breeding ponds in Santa Barbara County is 1.47 acres, so four ponds with this size are required to preserve a minimum viable population for each metapopulation based on calculations in Appendix A. In metapopulation areas where ponds are smaller than 1.47 acres, more than 4 ponds may be needed to support the minimum viable population size since effective population size is related to pond area." For example, the geometric mean of known breeding ponds in Santa Barbara County is 0.6 acres. Five 0.6 acre ponds would be required to preserve a minimum viable population for each metapopulation based on calculations in Appendix A.

Comment: One commenter suggested that we consider using a wider range of depths than 40-80 centimeters in Criterion 1. Many ponds are deeper than 80 centimeters. Ponds need to hold water for more than consecutive 90 days but also should dry out in most years.

Response: We have revised the Criterion 1 based on this suggestion. Criterion 1 now reads: "At least four functional breeding ponds per metapopulation area are in fully preserved status and managed for the benefit of the Santa Barbara County California tiger salamander. The first priority is preservation of existing ponds, followed by restored or created ponds." The important aspect to consider is that a pond hold needs to water for more than 90 days, but that it also dries out most or all years; rather than include a pond depth range. We revised the Life History and Ecology section of the recovery plan to read: "…California tiger salamanders require pools with continuous inundation periods for 70-90 days (Shaffer and Trenham 2004)."

Comment: One commenter stated that if under Criterion 1 you need 4 or more ponds per metapopulation and you already have 60, it sounds like you have already solved the problem.

Response: Criterion 1 requires at least four functional breeding ponds per metapopulation area in fully preserved status and managed for the benefit of the Santa Barbara County California tiger salamander. Fully preserved status is either: (1) owned in fee title by an agency or conservation organization; or, (2) privately-owned lands protected in perpetuity with conservation easements. These lands must have funding secured for long-term management and monitoring. This criterion has not yet been achieved.

Comment: One commenter stated that under Criterion 2, the amount of 623 acres of functional upland habitat around each preserve pond being in fully preserved status should be changed to include preservation of all habitat within 896 meters of the breeding pond because placement of the pond in the protected area will affect how many of the California tiger salamanders are protected. This 896 meters equates to 623 acres, but includes an area equidistant from the pond in all directions. Alternatively, you could state that the pond would need to be 417 meters away from the edge of the parcel. This would encompass 95 percent of the metamorphs. This is equivalent to having a setback around the pond and would ensure that metamorphs could find an upland retreat.

Response: We have added this suggestion to footnote 6. This addition to the footnote reads: "Ideally, the 623 acres would include all habitat within 896 meters of the breeding pond because placement of the pond in the protected area will affect how many of the salamanders are protected." Given the level of fragmentation in this landscape, the commenter's suggestion would not be possible in some metapopulations.

Comment: One commenter stated that under Criterion 3, "partially preserved habitat" would be difficult to manage accurately and count toward delisting of the species. Even if land use is compatible at the time, there is no guarantee that incompatible land uses will not enter the area once the California tiger salamander is delisted and USFWS has no jurisdiction.

Response: Partially preserved habitat was included in an effort to make Criterion 3 attainable while being biologically appropriate. Partially preserved lands refer to areas with land uses that are compatible with successful growth and survival of juvenile and adult California tiger salamanders, but may not necessarily be fully preserved.

Comment: One commenter suggested, in regards to Criterion 3, that future ecological research should focus on compatible versus incompatible land uses for the California tiger salamander and added explicitly to recovery planning.

Response: Under the recovery actions related to conducting research on threats to the Santa Barbara County California tiger salamander, we have added a new action (Action 5.3) to explicitly evaluate how California tiger salamanders use and respond to compatible versus incompatible land uses.

Comment: In regards to Criterion 4, one commenter questioned how can we determine recovery if we don't know the population count for the Santa Barbara County California tiger salamander.

Response: As stated in Appendix B of the recovery plan, for any pond-breeding amphibian, there are at least three ways to estimate population size and trend over time. One is to use drift fences to estimate the number of adults or metamorphs at a site. A second is to count the number of larvae in a breeding site at some time in the larval period. The third is to use molecular genetic techniques to estimate the size of the population. The first two approaches return point samples of the census population size, which is difficult to interpret toward a population trend, given that only some individuals in the population breed in any year. In particular for California tiger salamanders, there is strong evidence that in low rain years, most individuals do not breed; whereas, in high rain years, more individuals come out to breed and are likely to be counted. This makes the interpretation of counts within and across years difficult, because the count reflects the rain year, the time of year when the count is done relative to breeding and

metamorphosis, and the actual census size of the true population. Using genetic approaches to estimate the effective population size (N_e) is a more accurate indication of the total population size, rather than just the number of individuals that happened to breed in a particular year. In that sense, changes in N_e are a more accurate representation of population trends than any given estimate of the census size for a given year.

Comment: In regards to Criterion 4, one commenter asked if there is a stable/diverse gene pool to promote recovery of the Santa Barbara County California tiger salamander.

Response: Although published data indicate reduced mitochondrial variation in California tiger salamanders across Santa Barbara County, unpublished data indicate that there is a high level of variation within and between ponds in microsatellite markers within the Santa Barbara County California tiger salamander (Shaffer, pers. comm. 2015). When combined with the continued persistence and successful breeding of many California tiger salamander populations within Santa Barbara County, there is every indication that there is sufficient genetic variation to support recovery of this DPS.

Comment: In regards to Criterion 4, one commenter stated that 10 years does not seem like a sufficient amount of time to determine if a population is stable. Because the oldest age recorded of a wild caught California tiger salamander is 13 years, two turnovers would be 26 years. It is a long time, but it takes a long time to accurately estimate population trends. If genetic samples were collected every 5 years over 26 years, this would be a much more robust estimate of the population than estimating every 3 years as is currently in the draft recovery plan.

Response: We have revised the monitoring recommendation to be once per year for 10 consecutive years, aiming for one full generational turnover. Sampling would include three to five ponds per metapopulation, and doing so each year for 10 consecutive years. This will greatly reduce the effects of variability in climate and rainfall, allowing one to account for that variation when estimating population trends.

Conservation Easements / Conservation Banks

Comment: Three commenters stated that we underestimated costs for conservations easements, and one commenter stated we miscalculated.

Response: The $5,000 per acre easement cost is based on an estimate of approximate easement value for a 1,000 acre parcel with development rights removed by the easement. If the 1,000 acre parcel were grazing land only (no development rights), the easement value would be closer to $2,000 per acre. Easement values in California tiger salamander habitats in Santa Barbara County are highly variable and depend upon individual property characteristics. Price per acre values range broadly depending on development potential and extent of grazing-only lands, from $2,500 per acre to $20,000 per acre (Hammock, pers. comm. 2014). Estimates are for easement costs only; acquisition costs would be much higher. We have revised the text to reflect the accurate cost estimate.

Comment: One commenter stated that we should review the conservation bank permitting process to see if it could be made easier, as they theorized more landowners would participate.

Response: The USFWS and California Department of Fish and Wildlife (CDFW) conservation banking programs are constantly being improved. Please see the following conservation banking websites for the latest: http://www.fws.gov/endangered/landowners/conservation-banking.html; https://www.wildlife.ca.gov/Conservation/Planning/Banking

Comment: One commenter stated that startup costs for conservation easements and conservation banks are very expensive.

Response: Conservation banking is an investment just like any other, with requisite startup costs. Different easements may not require large startup costs, depending on how they are funded.

Comment: One commenter stated that USFWS should offer landowners compensation for development rights and pay for conservation easement costs and endowment costs.

Response: Recovery plans do not come with associated funding; however, they can help conservation partners leverage funds for recovery efforts from various sources. Funding for implementation could come from non-profit organizations, academia, and/or discretionary funds of Federal and state resource agencies and local municipalities working to help recover endangered species.

Comment: One commenter stated the draft recovery plan does not mention conservation easements that are already in place, and another stated that lands already conserved should count towards recovery.

Response: We agree with the commenters and have added to the recovery plan a discussion of the areas of the Santa Barbara County California tiger salamander's range that have already been put into conservation in "Part H. Past Conservation Efforts". This discussion identifies areas that count towards meeting recovery criteria.

Comment: One commenter was concerned that land will be involuntarily taken if landowners do not volunteer to participate in conservation easements or sell their land into easements.

Response: The recovery plan lays out a strategy to recover the Santa Barbara County California tiger salamander by recommending actions to alleviate the primary threats impacting the species including habitat loss and fragmentation. One action in the recovery plan is to protect habitat for California tiger salamanders through acquisition of conservation easements. The actions outlined in the recovery plan are voluntary and not regulatory in nature.

Comment: One commenter suggested that to reduce costs, we should implement predator control to increase populations rather than purchasing expensive easements.

Response: Habitat loss is the primary threat to the California tiger salamander. Without habitat conservation, the Santa Barbara County California tiger salamander cannot recover.

Hybridization / Non-native Species

Comment: One commenter stated that hybrid control should be included in every upland drift fence and aquatic California tiger salamander survey that the USFWS approves and that ponds near the La Purisima Golf Course and Lompoc Federal Penitentiary should be accessed and prioritized.

> *Response:* The USFWS and CDFW have funded a $130,000 study to develop and begin implementing a plan to survey for and control non-native and hybrid salamanders around the La Purisima Golf Course area. This project could incorporate data taken during pre-project surveys.

Comment: One commenter stated that drying up ponds to control non-native species could harm other native species.

> *Response:* Native species are adapted to vernal (seasonal) ponds that dry up for part of the year. Ponds that are dried out to remove invasive species (i.e., fish and bullfrogs) are dried out in the summer or early fall when native species would not be using the ponds.

Comment: One commenter asked what the actual impact of hybrids is. Another commenter stated that the USFWS has not proven that hybridization with non-native tiger salamanders is harmful to the Santa Barbara County California tiger salamander.

> *Response:* Non-native tiger salamanders breed with native tiger salamanders to create hybrids. Non-native and hybrid tiger salamanders outcompete native California tiger salamanders because they are more voracious predators and can reach a larger size while still in the aquatic phase (Ryan et al. 2009). Thus, non-native and hybrid tiger salamanders can contribute to the extirpation of native California tiger salamanders because they have a selective advantage and can harm natural ecosystem processes by altering natural food weds (Searcy et al. 2016).

Comment: One commenter stated that hybrid tiger salamanders should be addressed before money is spent on implementation of the recovery plan. If they are out of control, then nothing can be done.

> *Response:* Addressing hybrids is part of the recovery plan.

Education and Outreach

Comment: Two commenters stated that there should be more open forum to discuss collaboration and cooperation and the public should be given knowledge of how agencies will interact to implement the recovery plan.

> *Response:* We have changed Action 7 to read: "Foster collaboration and cooperation through education, outreach, and regular meetings." Action 7.1 was revised to become: “Organize and implement a 'Santa Barbara CTS Recovery Collaborative' including agencies and stakeholders to foster collaboration and cooperation in recovery implementation. (Priority 1)”

Comment: One commenter stated that developing outreach and communicating with the public is important to undertake, as is developing a website to educate the public about the Santa

Barbara County California tiger salamander. They added, local landowners lack information about California tiger salamander occurrence on private lands and its implications.

Response: We agree.

Comment: One commenter suggested an advertising campaign for public outreach to foster collaboration.

Response: We have revised Action 7.3 (formerly Action 7.4, the previous action 7.3 has been deleted) to read: "Conduct public outreach to foster collaboration, including public awareness about the biology and threats to the Santa Barbara County California tiger salamander."

Economic Impacts / Costs

Comment: One commenter wondered how many jobs will be lost and how the local economy will be impacted. They stated that the economic impacts of implementing recovery actions should be addressed in the plan. They also stated that taxpayer money will fund the plan and it will be wasted if the USFWS or CDFW backs out before they are finished implementing the recovery plan. Additionally, they stated that cost cannot be accurately estimated because 20 percent of recovery actions in the implementation table are "TBD."

Response: Estimating the cost of many of the recovery actions is difficult. The USFWS currently estimates the total cost of this recovery plan at $181,340,000 over the next 30 years. Most of these funds would be invested in the local community where California tiger salamanders occur, because the associated costs are, among other things, for identification and protection of occurrences through fee-title acquisition or conservation easement from willing sellers, wetlands restoration, habitat management, and research necessary to guide the recovery of the species. Recovery plans do not come with associated funding; however, they can help conservation partners leverage funds for recovery efforts from various sources. Funding for implementation could come from non-profit organizations, academia, and/or discretionary funds of Federal and state resource agencies and local municipalities working to help recover endangered species. The USFWS is obligated under the Endangered Species Act to recover listed species.

Comment: One commenter stated that we should ensure adequate set-asides for recovery, but avoid excessive set-asides that would impact the local economy.

Response: The recovery plan lays out a strategy to recover the Santa Barbara County California tiger salamander by recommending actions to alleviate the primary threats impacting the species including habitat loss and fragmentation. One action in the recovery plan is to protect habitat for California tiger salamanders through acquisition of conservation easements. The actions outlined in the recovery plan are voluntary and not regulatory in nature; we will not create "set-asides" on these lands. Willing landowners would be compensated for creating conservation easements on their lands.

Comment: One commenter was concerned with economic impacts and wondered what would be the estimated economic loss resulting from the conversion of currently productive agricultural land by reaching recovery criteria.

Response: A recovery plan is advisory in nature and does not mandate agreement to or implementation of any of the recovery actions proposed. A recovery plan is a reference document that identifies actions that, if implemented, are expected to recover a species. Economic effects of implementing recovery actions will depend on particular local circumstances; specific proposals to implement actions may be evaluated through processes such as the National Environmental Policy Act (NEPA) or the California Environmental Quality Act (CEQA). Some agricultural practices, such as cattle grazing, represent compatible land uses in California tiger salamander habitat and can continue while reaching recovery criteria.

Comment: Four commenters were concerned about the estimated costs of recovery.

Response: The USFWS currently estimates the total cost of implementing this recovery plan at $181,374,000 over the next 30 years. Most of these funds would be invested in the local community in Santa Barbara County where California tiger salamanders occur because the associated costs are, among other things, for identification and protection of occurrences through fee-title acquisition or conservation easement from willing sellers, wetlands restoration, habitat management, and research necessary to guide the recovery of the species. Recovery plans do not come with associated funding; however, they can help conservation partners leverage funds for recovery efforts from various sources. Funding for implementation could come from non-profit organizations, academia, and/or discretionary funds of Federal and state resource agencies and local municipalities working to help recover endangered species.

Comment: Two commenters stated that the cost of the recovery plan is a lot, considering salamanders are of benefit to no one and there is no need to save the Santa Barbara County California tiger salamander.

Response: Depending on life stage, California tiger salamanders eat aquatic insects, earthworms, small crustaceans, and insect larvae, or secondary consumers like small frogs and toads. Because they feed on a wide range of species, California tiger salamanders prevent insect and amphibian overpopulation. Because of their thin permeable skin, California tiger salamanders can also act as an indicator species, detecting if a habitat's pollution levels are too high. The California tiger salamander is also a food source for many other species, including herons, egrets, fish, bullfrogs, terns, raccoons, skunks, and snakes. Congress answered why we should save endangered species in the preamble to the Endangered Species Act, recognizing that endangered and threatened species of wildlife and plants "are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people." In this statement, Congress summarized convincing arguments made by scientists, conservationists, and others who were concerned by the disappearance of unique creatures. Congress further stated its intent that the Act should conserve the ecosystems upon which endangered and threatened species depend.

Comment: Three commenters stated that the USFWS needs to identify its funding sources for implementing the recovery plan.

Response: Recovery plans do not come with associated funding; however, they can help conservation partners leverage funds for recovery efforts from various sources. Funding

for implementation could come from non-profit organizations, academia, and/or discretionary funds of Federal and state resource agencies and local municipalities working to help recover endangered species.

Population Status and Monitoring

Comment: Two commenters questioned monitoring methods in Appendix B regarding genetic approaches to estimate N_e. They questioned whether monitoring under this approach was really a better way to estimate population trends. They stated that too few ponds would be surveyed for basing decisions and added that some ponds may be used by more California tiger salamanders than others. They also stated that sampling should be done yearly to get the most accurate data.

Response: We have revised the monitoring recommendation to be once per year for 10 consecutive years, aiming for one full generational turnover. Sampling would include three to five ponds per metapopulation, and doing so each year for 10 consecutive years. This will greatly reduce the effects of variability in climate and rainfall, allowing one to account for that variation when estimating population trends.

Comment: One commenter asked is there some other way to assess California tiger salamander populations without taking tail clips? They thought it would harm California tiger salamander populations.

Response: Tail clipping does not affect survival of California tiger salamanders (Polich et al. 2013).

Comment: One commenter asked: (1) how will the USFWS determine that N_e is increasing over a 10-year period, and (2) is there a baseline established? Additionally, they wondered if the California tiger salamander population is high but not increasing, would the USFWS consider it recovered.

Response: In Appendix B, Dr. Brad Shaffer (UCLA) recommends that for each metapopulation of the Santa Barbara County California tiger salamander, molecular estimates of N_e from three to five ponds per metapopulation each year for 10 consecutive years be collected. The trend in N_e will then be evaluated statistically over this timeframe starting with the first year that samples are taken as a baseline. Sample sizes of 30 to 50 larval tail tips for each pond will provide adequate information on N_e, and ideally those samples should be collected during the late-larval period, probably in April in most years. Tissue samples should be sufficiently large to ensure that there is plenty of tissue for multiple DNA extractions and sequencing experiments, since the technology will almost certainly evolve and change every few years. If population estimates indicate that a minimum viable population is conserved and not declining, then the USFWS could determine that the intent of the recovery criteria would have been met and that the population is recovered.

Comment: Four commenters stated that because we do not currently have population information for the Santa Barbara County California tiger salamander, we could not determine its population status after the monitoring in the recovery plan is initiated; first we need to determine the baseline population.

Response: The goal of the recovery plan is to conserve a minimum viable population size such that the population trend of the Santa Barbara County California tiger salamander is stable or positive and the likelihood of extinction due to increasing threats is removed. A baseline is not required for this recovery plan and its implementation. It requires that monitoring begins as soon as possible.

Comment: One commenter stated that the more land that is conserved for the Santa Barbara County California tiger salamander, the more difficult it will be for the USFWS to get an accurate count.

Response: We believe this is untrue. Land that is conserved for the Santa Barbara County California tiger salamander is one of the easiest places to sample the population and get an accurate population estimate.

Comment: One commenter stated that monitoring of N_e should be done prior to implementing other recovery actions.

Response: Implementation of recovery actions is a concurrent process. Monitoring of N_e should be started immediately so that we can evaluate success, but we also need to begin implementation of other recovery actions so that recovery can be achieved within the given timeframe.

Specific Actions

Comment: One commenter stated that Action 1.8 (now Action 1.6) is a good win-win action for the California tiger salamander and grazing land that the USFWS should focus on because it can be easily achieved.

Response: Thank you for your supportive comment.

Comment: We received two comments on Action 2.3.2. One commenter stated there should be a monitoring study to assess effectiveness at each undercrossing installed because it is important to know the degree to which California tiger salamanders will use an undercrossing. They suggested that this information will aid in improving the design of future undercrossings. The other commenter stated that our cost estimate is high for this action.

Response: We have added "monitor effectiveness" to this action. If California tiger salamander-specific undercrossings are installed, we expect that California Department of Transportation (CalTrans) or another entity will conduct monitoring. We have revised this estimate to $50,000 per crossing as per the commenter's suggestion (Potter *in litt.* 2015).

Comment: One commenter suggested that we modify Action 3.2.1 in the draft Recovery Plan to indicate that it has been accomplished, or remove it.

Response: For the final Recovery Plan, we have deleted what was Action 3.2.1 from the recovery plan because it has been completed. We have also deleted what was Action 3.2.2 from the recovery plan, which was related to Action 3.2.1, because it is no longer relevant.

Comment: One commenter stated that Action 5.2, using environmental DNA for detecting California tiger salamanders, would be a very valuable assessment for surveys, because the current drift fence survey protocol is costly and time consuming, and can produce negative findings.

> *Response:* We agree. If this technology is found successful for detecting California tiger salamander in ponds, it could have great implications for the species' management.

Comment: Regarding Action 5.4 (now Action 5.6), one commenter asked what the long-term effects of using bacterium (*Bacillus*) to kill mosquito larvae are and questioned the effects to other native species? The commenter expressed concern that this could increase West Nile Virus in humans in the area.

> *Response:* The recovery plan indicates that the bacterium, *Bacillus*, should be studied to better understand what the potential impacts could be from its use to control mosquitos. Currently, the answers to these questions are unknown.

Comment: One commenter stated recovery should be aggressively implemented; especially Action 1.3 and (what was) Action 1.4.

> *Response:* We agree that implementation of Action 1.3 is a priority. We deleted what was Action 1.4 from the recovery plan because we received substantial feedback that this action was of a regulatory nature.

Figures / Maps

Comment: We received two comments regarding Figure 1 in the draft recovery plan. The commenters stated that this map is confusing and inaccurate and that the difference between potential distribution and metapopulation areas is unclear. They stated that this map differs from a Santa Barbara County California tiger salamander distribution map from 2004. Additionally, they suggested that a potential distribution line should be removed so landowners that clearly do not have California tiger salamander on their lands would know.

> *Response:* We have attempted to clarify the difference between potential distribution and metapopulation areas in the recovery plan. Potential distribution includes the general area of potentially suitable habitat within the range of the species that is currently occupied or has the potential to become occupied by the salamanders. This includes low-elevation vernal pools and seasonal ponds, and associated grassland, oak savannah, and coastal scrub plant communities of the Santa Maria, Los Alamos, and Santa Rita Valleys in northwestern Santa Barbara County (generally under 1,500 feet (475 meters)) (Shaffer et al. 1993, Sweet 1993). Metapopulation areas signify areas where the California tiger salamanders and their associated habitat are known to exist, thus outlining general areas where conservation efforts may be the most effective to help recover the species. The map in Figure 1 reflects our current understanding of the Santa Barbara County California tiger salamander's distribution and areas of potential occupancy based upon the best available science.

Comment: One commenter stated in regards to Figure 2 in the draft recovery plan that the five ponds at the Casmalia Hazardous Waste Management Facility should not be included as potential California tiger salamander breeding ponds because this is a superfund site.

Response: This may be a superfund site, but it is a known California tiger salamander locality. Hunt (*in litt.* 2006) observed California tiger salamanders during upland surveys at the Casmalia Hazardous Waste Management Facility in the winter of 2004 – 2005. The ponds at the Casmalia Hazardous Waste Management Facility are the only known aquatic habitats where California tiger salamanders can breed within dispersal distance of these upland observations.

Comment: One commenter stated in regards to Figure 4 in the draft recovery plan that the northern boundary of the West Los Alamos/Careaga Metapopulation Area should be moved south. The Orcutt urban area has already had California tiger salamander surveys and they are not there.

Response: The USFWS has no record of protocol-level surveys that have determined absence from within a pre-defined boundary in Orcutt.

Comment: One commenter stated in regards to Figure 5 in the draft recovery plan that this map includes rugged terrain south of Los Alamos and there is no reason to map it as California tiger salamander habitat.

Response: This area is within dispersal distance from the known California tiger salamander breeding ponds to the north.

General Comments

Comment: Another attempt should be made at developing a regional Habitat Conservation Plan (HCP) because it would guide recovery implementation, make clear what mitigation requirements are, and provide assurances to landowners.

Response: The USFWS agrees that the development of a regional HCP is a good idea.

Comment: The USFWS should more clearly define what agricultural activities could be conducted without harm to California tiger salamanders, and what is meant by "conversion", etc. to make it more clear to landowners what is allowed or not.

Response: Please see Ford et al. 2013, as cited in the recovery plan, for the details of managing rangelands to benefit the California tiger salamander. In addition, under the recovery actions related to conducting research on threats to the Santa Barbara County California tiger salamander, we have added a new action (Action 5.3) to explicitly evaluate how California tiger salamanders use and respond to compatible versus incompatible land uses.

Comment: One commenter stated that tail clipping for genetic testing is proof that California tiger salamanders are resilient enough to withstand tilling from agriculture.

Response: Tail clipping does not affect survival of California tiger salamanders (Polich et al. 2013); however, ground disturbing activities such as deep-ripping or discing can kill California tiger salamanders and substantially alter their habitat.

Comment: One commenter stated there is already significant regulation imposed on agriculture and duplicative regulatory recovery actions should be removed.

Response: Collaboration with other regulatory agencies is essential for the recovery of the Santa Barbara California tiger salamander. Additionally, recovery actions are not regulatory in nature. To be consistent with this, we deleted what was Action 1.4 from the recovery plan because we received substantial feedback that this action was of a regulatory nature.

Comment: One commenter stated that ground squirrels should be introduced around ponds because Trenham (no year or citation provided) says that travel distance is a function of fewer ground squirrels around the ponds.

Response: Although small mammal burrows provide important habitat for California tiger salamanders during the terrestrial part of their life cycle, Searcy et al. (2013) found that density of adult California tiger salamanders is independent of burrow density.

Comment: Two commenters stated that the buffer areas in Appendix A of the draft recovery plan are based on two adjacent breeding ponds in Solano County with different climate than Santa Barbara County and that we should not use information for California tiger salamanders in Solano County.

Response: The Act requires the USFWS to develop recovery plans on the basis of the best scientific and commercial information available. We do not have data on migration distances for salamanders in Santa Barbara County, nor do we have information to make this inference based on climatic data alone.

Comment: One commenter asked why the 4(d) rule is not in effect to exempt routine ranching operations from take of the Santa Barbara County California tiger salamander.

Response: The 4(d) rule only applies to species that are listed as threatened. Because the Santa Barbara DPS is listed as endangered under the Act, the 4(d) rule does not apply. One advantage to meeting the criteria for downlisting would be that the 4(d) rule could take effect for the Santa Barbara County DPS of the California tiger salamander.

Comment: One commenter stated that the USFWS does not recognize California tiger salamanders occurring in areas under cultivation.

Response: Many types of cultivation are not consistent with California tiger salamander persistence and recovery. California tiger salamanders are able to continue to breed in ponds that remain intact near cultivated uplands, if they are able to migrate to and from uplands that are not cultivated. Most cultivation destroys small mammal burrows, which California tiger salamanders depend on for 95 percent of their life. In addition, we have added Action 5.3 under "Conduct research on threats to the Santa Barbara County California tiger salamander" to explicitly evaluate compatible versus incompatible land uses for the California tiger salamander.

Comment: One commenter stated that the USFWS does not recognize salamanders that occur on the Los Padres National Forest lands and at the Lompoc Federal Penitentiary.

Response: We are unaware of any California tiger salamanders that occur on Los Padres National Forest lands, which is outside of the Santa Barbara County California tiger salamander's potential distribution (see Figure 1). The Ambystoma salamanders that occur at the Lompoc Federal Penitentiary are all non-native, introduced tiger salamanders from the central United States, as confirmed by genetic testing.

Comment: One commenter stated that the tiger salamanders in other portions of the U.S. could be relocated to Santa Barbara County to achieve recovery.

> *Response:* The recovery plan is specific to the native, listed entity, which has been shown to be genetically distinct from other tiger salamanders. Non-native tiger salamanders and hybridization with them are threats to the Santa Barbara County California tiger salamander, and therefore would not contribute to recovery.

Comment: One commenter stated that the USFWS proposes to ask the County of Santa Barbara to revise its grading ordinance; therefore, the USFWS's real goal is to remove land from development.

> *Response:* Because recovery plans are guidance rather than regulatory documents, we have removed what was Action 1.4, which recommended that the County of Santa Barbara revise its grading ordinance.

Comment: One commenter stated that the USFWS knows that critical habitat designations do not apply to projects sans a Federal nexus and that they have no mechanism available to them except a CEQA determination from the County of Santa Barbara that would only be possible via a revision to the grading ordinance.

> *Response:* The USFWS disagrees. While it is true that critical habitat only applies when there is a Federal nexus, the Endangered Species Act protects listed species independently of and whether or not critical habitat for that species is designated. Designated critical habitat for a species and its status as threatened or endangered each provide protections under the Act independently of one another. Listed species are afforded protections under the Act regardless of whether or not a Federal nexus exists for a project.

Comment: One commenter stated that the USFWS should ascertain whether land is able to be converted to crops (e.g., whether there is enough water to irrigate them).

> *Response:* Land conversion for intensive agriculture or urbanization will still make an area unsuitable for California tiger salamanders. Under the recovery actions related to conducting research on threats to the Santa Barbara County California tiger salamander, we have added a new action (Action 5.3) to explicitly evaluate how California tiger salamanders use and respond to compatible versus incompatible land uses.

Comment: One commenter stated that the USFWS created the recovery plan to justify keeping the species on the endangered species list.

> *Response:* We disagree. The ultimate goal of the recovery plan is to identify ways to reduce the threats to the Santa Barbara County California tiger salamander to ensure its long-term viability in the wild, promoting its recovery, and allowing for its removal from the list of threatened and endangered species. The interim goal is to recover the population to the point that it can be downlisted from endangered to threatened status.

Comment: One commenter stated that it is important to protect wildlife corridors and the food chain balance to promote delisting of the Santa Barbara County California tiger salamander.

> *Response:* The USFWS agrees.

Comment: One commenter stated that the recovery plan is thoroughly researched and seems to thoroughly address obstacles to the recovery of the Santa Barbara County California tiger salamander.

Response: Thank you.

Comment: One commenter stated that some components of the recovery plan would be beneficial to grazing landowners by providing monetary incentives to protect and create new habitat.

Response: The USFWS agrees.

Comment: Two commenters stated that the best way to accomplish recovery objectives is to enhance incentives and encourage cooperation with private landowners and that there should be monetary incentives to encourage ranchers to maintain breeding ponds, use non-chemical rodent control measures, and work with the Natural Resources Conservation Service (NRCS) to restore degraded grazing areas.

Response: The USFWS agrees. Recovery plans do not come with associated funding; however, they can help conservation partners leverage funds for recovery efforts from various sources. Funding for implementation could come from non-profit organizations, academia, and/or discretionary funds of Federal and state resource agencies and local municipalities working to help recover endangered species.

Comment: One commenter stated that they were concerned with lack of public participation in development of the recovery plan.

Response: In December 2012, the USFWS settled a lawsuit with the Center for Biological Diversity that prescribed a timeline for the completion of the recovery plan for the Santa Barbara County DPS of the California tiger salamander. The tight timeline for completion of the recovery plan under the settlement did not allow time for the public involvement that is typical of the recovery planning process. We held a public workshop Friday, May 22, 2015, from 10:30 AM to 12:00 PM in Santa Maria, CA, after the publication of the draft recovery plan and solicited input from the public. The 60-day public comment period on the draft recovery plan closed on June 23, 2015. Based on input we received during the public comment period, we have revised the draft recovery plan to develop the final recovery plan.

Comment: One commenter stated that the recovery plan does not offer monetary incentives to landowners who offer to conserve their land.

Response: Recovery plans do not come with associated funding; however, they can help conservation partners leverage funds for recovery efforts from various sources. Funding for land conservation could come from non-profit organizations, academia, and/or discretionary funds of Federal and state resource agencies and local municipalities working to help recover endangered species.

Comment: One commenter stated that the recovery plan should give more detail on how actions and criteria take drought and climate change into account.

Response: The precise effects that climate change will have on the Santa Barbara County California tiger salamander are unknown. Drought is a natural part of the climatic

variability of the ecoregion; however, drought may be exacerbated by climate change. By working to reduce all other threats to the species, we anticipate that resiliency of the population to future effects of climate change and drought will be increased.

Comment: One commenter stated that they support the recovery plan's focus on habitat and restoration, and reducing contaminants, pesticides, and rodenticides.

Response: Thank you.

Comment: One commenter stated that habitat conditions are too dry for salamanders in Santa Barbara County.

Response: The California tiger salamander inhabits low-elevation vernal pools and seasonal ponds and associated grassland, oak savannah, and coastal scrub plant communities of the Santa Maria, Los Alamos, and Santa Rita Valleys in northwestern Santa Barbara County (generally under 1,500 feet (475 meters)) (Shaffer et al. 1993, Sweet 1993). Although California tiger salamanders are adapted to natural vernal pools and ponds, they now frequently use manmade or modified ephemeral and permanent ponds. This represents a shift in habitat during historical time, from vernal pools and sag ponds generally located on valley floors to livestock ponds in the foothills.

Comment: One commenter stated that the USFWS should notify all landowners before recovery plan implementation if their land will be affected by those actions.

Response: The actions outlined in the recovery plan are voluntary and not regulatory in nature. No part of the recovery plan will be implemented without landowner knowledge or approval because they would be included any efforts on their lands.

Comment: One commenter stated that the discussion of urban sprawl is not accurate; development is limited to city lines and the language should be revised with updated information from the cities and county. They stated that urban sprawl is not an issue for the Santa Barbara County California tiger salamander.

Response: Land outside of the city limits has been and is rezoned to facilitate urban and residential development including, for example, Betteravia Farms development and Union Valley Parkway Development. Union Valley Parkway is a clear example of an intended expansion outside of the city limits.

Comment: Several commenters stated that mineral rights should be considered in land value estimates associated with actions in the draft recovery plan.

Response: Mineral rights do not have to be acquired to initiate a conservation easement for the benefit of the California tiger salamander.

Comment: One commenter stated that some components of the draft recovery plan would cause a net loss of grazing land by imposing regulation on land disturbance, regulating rodent control and chemicals, deeming what is a poor grazing practice, and forcing landowners to sell or create conditions that are not conducive to grazing operations.

Response: This recovery plan is not regulatory and will not halt new development or impose regulations on ground disturbance. While habitat loss in general is a threat to the Santa Barbara County California tiger salamander, the recovery plan provides a strategy

that guides recovery of the species within the context of future development or ground disturbance.

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