Draft Revised Recovery Plan for the Santa Cruz Long-toed Salamander

(*Ambystoma macrodactylum croceum*)

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for the

Santa Cruz Long-toed Salamander

(*Ambystoma macrodactylum croceum*)

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Region 1

U.S. Fish and Wildlife Service

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Note: Technical terms used in this draft recovery plan are italicized at their first occurrence in the manuscript and defined in the glossary (Appendix A). Exceptions to this include: scientific names of species, which occur in parentheses after the first mention of the species; bibliographical terms such as "in press" and "pers. comm.", and; references to the Federal Register.

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Cover art of *Ambystoma macrodactylum croceum* by…

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EXECUTIVE SUMMARY

Current Species Status: The Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) is federally listed as endangered. It is currently known from four population clusters in Santa Cruz and Monterey Counties, California. Critical habitat was proposed in 1978 (Service 1978) but has not been designated.

Habitat Requirements: This salamander inhabits freshwater wetlands for breeding and adjacent upland scrub and woodland areas during the non-breeding season. These wetlands and adjacent scrub and woodland habitats are restricted naturally to relatively few areas along the central coast of California. Direct habitat loss due to agriculture, urbanization, and road construction is the main cause for this salamander's decline. Other known threats include: pollution, siltation, and declining water quality in breeding ponds due to nearby development and agricultural activities; loss of non-breeding habitat and food resources due to the spread of exotic plants; predation by introduced fishes and bullfrogs; and parasites.

Recovery Objectives: 1) Reclassify from endangered to threatened status. 2) Delist.

Recovery Priority: 3 on a scale of 1 to 18. The priority is based on its being a subspecies (rather than a full species) with a high degree of threat and high recovery potential.

Recovery Criteria: The Santa Cruz long-toed salamander may be reclassified to threatened status when breeding and upland habitats are conserved, maintained, and/or restored so that three self-sustaining subpopulations are supported for a minimum of 20 years at the following complexes: (in Santa Cruz County) Valencia-Seascape, Ellicott-Buena Vista, Freedom, and Larkin Valley; (in Monterey County) McClusky and Elkhorn. Each complex must include at least three functional breeding ponds, adequate upland scrub or woodland habitats within migration distance for the salamanders, and protected corridors connecting subpopulations. The Santa Cruz long-toed salamander may be considered for delisting when the above criteria are met, with the added stipulation that there shall be at least four functional breeding ponds in each complex. Due to this salamander's limited distribution, relatively small population sizes, and the dynamic nature of its habitats, all populations or subpopulations warrant protection and appropriate management. A self-sustaining population is defined as a population exhibiting a healthy adult sex ratio of and successful breeding and recruitment, as evidenced by an age structure indicative of a stable or growing population.

Actions Needed:

1. Develop self-sustaining populations of Santa Cruz long-toed salamanders by managing aquatic and upland habitats, establishing and maintaining genetic connectivity between subpopulations, and reducing the threat of chemical contamination in aquatic and upland habitats.
2. Implement monitoring, research, management, and surveys associated with breeding populations, in order to determine viability of subpopulations, determine genetic relationships between subpopulations, and monitor threats such as diseases and chemical contamination of aquatic and upland habitats.
3. Ensure adequate regulatory mechanisms, through coordination with Federal, State, and local governments.
4. Encourage and develop outreach and public awareness at locations where public has access, and by participating in public awareness programs.

Estimated Cost of Recovery: $x [update years and costs]

Costs, in thousands of dollars:

Year	Minimum Costs: ($000's)
2005	
2006	
2007	
2008	
2009	

Date of Recovery: If recovery criteria are met, reclassification to threatened status could be initiated in 2020.

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A. Introduction

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.), establishes policies and procedures for identifying, listing and protecting species of wildlife that are endangered or threatened with *extinction*. The Act defines an "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range." A "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

The Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) was listed as endangered (under the Endangered Species Preservation Act) in 1967 (Service 1967) and received federal protection with the passage of the Endangered Species Act (hereafter, Act) in 1973. It should be noted that since the Santa Cruz long-toed salamander was designated as an endangered species prior to enactment of the Act, there was no formal listing package identifying threats to the *subspecies*, as required by Section 4(a)(1) of the Act. Critical habitat was proposed in 1978 (Service 1978) but has not been designated.

The Secretary of the Interior is responsible for administering the Act's provisions as they apply to this species. Day-to-day management authority for endangered and threatened species under the Department's jurisdiction has been delegated to the U.S. Fish and Wildlife Service (Service).

To help identify and guide species recovery needs, section 4(f) of the Act directs the Secretary to develop and implement recovery plans for listed species or *populations*. Such plans are to include: (1) a description of site-specific management actions necessary to conserve the species or population; (2) objective measurable criteria which, when met, will allow the species or populations to be removed from the

endangered species list; and (3) estimates of the time and funding required to achieve the plan's goals and intermediate steps. Section 4 of the Act and regulations (50 CFR Part 424) promulgated to implement its listing provisions, also set forth the procedures for reclassifying and delisting species on the federal lists. A species can be delisted if the Secretary of the Interior determines that the species no longer meets the endangered or threatened status based upon these five factors listed in Section 4(a)(1) of the Act:

(1) the present or threatened destruction, modification, or curtailment of its habitat or range;
(2) overutilization for commercial, recreational, scientific, or educational purposes;
(3) disease or predation;
(4) the inadequacy of existing regulatory mechanisms; and
(5) other natural or manmade factors affecting its continued existence.

Further, a species may be delisted, according to 50 CFR Part 424.11(d), if the best scientific and commercial data available substantiate that the species or population is neither endangered nor threatened for one of the following reasons: (1) extinction; (2) recovery; or (3) original data for classification of the species were in error.

The original recovery plan (Service 1977) was prepared by the Santa Cruz Long-Toed Salamander Recovery Team and approved by the Service in 1977. In response to the discovery of additional populations of Santa Cruz long-toed salamanders, revised draft recovery plans were prepared and approved in 1985-1986 (Service 1986) and in 1998-1999 (Service 1999). These draft recovery plans had been revised to incorporate important new information on the status and distribution of Santa Cruz long-toed salamanders and their habitats, and to apply recent advances in *metapopulation* theory and dynamics to the management of the populations and *subpopulations*.

In the 27 years since approval of the original draft recovery plan, a tremendous

amount of knowledge of Santa Cruz long-toed salamander biology and *ecology* has been obtained, and significant protection programs have been implemented, through the guidance provided by the recovery planning process. This third revision of the Santa Cruz long-toed Salamander Draft Recovery Plan reflects many of those accomplishments, addresses current threats and needs, and specifically addresses the planning requirements of the Act.

B. Overview

The Santa Cruz long-toed salamander was originally discovered on December 2, 1954 at Valencia Lagoon, Rio del Mar, Santa Cruz County, California (Russell and Anderson 1956). In 1955, this breeding pond was reduced in size by highway construction along California State Highway 1 (Robert C. Stebbins, University of California at Berkeley, unpublished field notes, 1955). Subsequent surveys in the southern part of Santa Cruz County revealed only one other *breeding site*, at Ellicott Slough, in 1956 (Anderson 1967). Herpetologists, who believed this to be the extent of the Santa Cruz long-toed salamander's range, recommended that the two known habitats be protected from housing developments (Grobman 1955; Ferguson 1963). Despite these recommendations, public agencies remained generally unaware of the salamander's existence and its distribution. When the California Department of Transportation converted California State Highway 1 to a freeway in 1969, it nearly eliminated the Valencia Lagoon breeding pond (Bury and Ruth 1972). During the same period, the breeding pond at Ellicott Slough was threatened by a proposed mobile home park (Ferguson 1963), for which developers obtained permits in 1970 (Ruth 1974, 1988a). Threats such as these, along with the inherently limited distribution of the Santa Cruz long-toed salamander, resulted in its listing as an endangered species by the Service and the California Fish and Game Commission (Bury 1972; Bury and Ruth 1972).

Twenty additional breeding sites for Santa Cruz long-toed salamanders have been identified since the subspecies was initially listed. Actions are being taken to protect, restore, and manage the Santa Cruz long-toed salamander and its *aquatic* and upland habitats. These actions include habitat acquisition, conservation easements, and the development and implementation of habitat management plans, habitat conservation plans, safe harbors agreements, and watershed management plans. The details are presented in the Regulatory Protection and Management

Actions section of this plan. This revised recovery plan identifies ongoing and potential threats to Santa Cruz long-toed salamander and its habitats, management actions that have been implemented, and management actions necessary for its recovery.

C. Description and Taxonomy

The Santa Cruz long-toed salamander (Figure 1) is a small dark-colored salamander of the

(a) eggs (photograph taken by x)

Insert image here

(b) small larva (approximately x days old) (photograph taken by x)

Insert image here

(c) large larva (approximately x days old) (photograph taken by Wes Savage)

(d) juvenile (photograph taken by Wes Savage)

(e) adult (photograph taken by Dana Bland)

Figure 1. Photographic images of life stages of the Santa Cruz long-toed salamander, including (a) eggs, (b) small larva, (c) large larva, (d) juvenile, and (e) adult. Images depicted here are not represented in scale to each other.

Ambystomatidae, and is one of five subspecies of long-toed salamander (*A. macrodactylum*) (Stebbins 2003). The Santa Cruz long-toed salamander differs from the other four subspecies of long-toed salamander by a series of discrete, irregular patches of dull orange or metallic yellow markings on its *dorsal* side and by greatly reduced dorsal head markings of small scattered dots, which are often absent, *anterior to* the eyes (Ferguson 1961; Stebbins 1966, 2003). The *ventral* surface is sooty black. Adult Santa Cruz long-toed salamanders (see Figure 1) have an average snout-to-vent length of 42 to 71 millimeters (1.7 to 2.8 inches), an average total length of 105 to 150 millimeters (4.2 to 6.0 inches), and weigh approximately 3.0 to 9.8 grams (0.1 to 0.4 ounce). Anderson (1967) reported minimum adult size (snout to vent length) as 52 millimeters (2.1 inches) for females and 46 millimeters (1.8 inches) for males. Reed (1981) reported minimum adult size as 42 millimeters (1.7 inches), and Ruth (1994) reported minimum adult size of 52 millimeters (2.1 inches).

Differences in biochemistry (Sage 1978), physiology, and life history traits (Anderson 1960, 1967, 1968a, 1968b, 1972a, 1972b, 1972c) support the separation of the Santa Cruz long-toed salamander as a distinct species. However, until a more thorough investigation of the genetics of the species is conducted and a revision of the *taxonomy* published in a peer-reviewed journal, the Santa Cruz long-toed salamander will continue to be considered a subspecies of long-toed salamander.

D. Habitat, Life History, and Ecology

The Santa Cruz long-toed salamander spends a substantial portion of its life in upland habitat. The species finds shelter underground in burrows of mice (*Peromyscus* spp.), California voles (*Microtus californicus*), Botta pocket gophers (*Thomomys bottae*), California moles (*Scapanus latimanus*) and other small mammals, or among the root systems of plants in upland *chaparral* and woodland areas of coast live oak (*Quercus agrifolia)* or Monterey pine (*Pinus radiata*) and in strips of *riparian* vegetation, such as arroyo willows (*Salix lasiolepis*), cattails (*Typha* spp.), and bulrush (*Scirpus* spp.). These upland and riparian habitat features are desirable because they protect Santa Cruz long-toed salamanders from heat and the drying rays of the sun (Reed 1979, 1981).

Santa Cruz long-toed salamanders breed in shallow, usually *ephemeral*, freshwater ponds. The extent of the upland habitat used by salamanders adjacent to the ponds varies from a narrow ring of riparian vegetation on the perimeter of a pond to extensive riparian vegetation adjacent to the ponds, and oak woodlands and chaparral as far as 1.6 kilometers (1.0 mile) or more from the ponds (Ruth and Tollestrup 1973).

The distance between known aquatic and upland locations varies from site to site and apparently depends on soil type, slope, aspect, vegetation structure and composition, and the size of the breeding pond. Upon leaving the pond for upland retreats, adult Santa Cruz long-toed salamanders disperse farther than newly-*transformed juveniles* (citation). During studies at Valencia Lagoon and the Ellicott site, up to 90 percent of the adults were captured within 125 meters (400 feet) of the breeding pond and subsequently not caught in more distant trap lines (Reed 1979, 1980, 1981). Conversely, Ruth (1988b) found that significant numbers (22 percent) of Seascape Pond's adult salamanders were migrating more than 250 meters (800 feet) through grasslands to reach suitable sheltering habitat in oak woodlands. Data from Ruth's (1994) study at Willow Canyon indicated that Santa Cruz long-toed salamanders may be migrating up to 800 meters (2640 feet) between breeding ponds and upland habitats. Based on data from pitfall trap studies at a known breeding pond (Seascape Pond 1) and adjacent uplands (Willow Canyon), Biosearch Surveys (2002) estimated that between 26 percent and 36 percent of the population of Santa Cruz long-toed salamanders from the pond traveled at least 335 meters (1100 feet) to reach

suitable upland habitat.

Adult Santa Cruz long-toed salamanders leave their upland chaparral and woodland summer retreats at the onset of the rainy season in mid- to late-November or December, and begin their annual *nocturnal* migration to the breeding ponds (Anderson 1960). They often forage for *invertebrate*s on the soil surface. Prey consist of isopods, but also include beetles, slugs and earthworms (Anderson 1968b). Adult Santa Cruz long-toed salamanders migrate primarily on nights of rain or mist (Anderson 1960, 1967; Ruth and Tollestrup 1973; Reed 1979, 1981), or one night following a rain event (M. Allaback, *pers. comm.*, 2002). Adults arrive at the breeding ponds from November through March, with most arrivals occurring in January and February (Anderson 1967, Reed 1979, Ruth 1988b). Peak breeding occurs during January and February because earlier rains are usually insufficient to fill the breeding ponds (Anderson 1967).

Adults may skip breeding for one or more years if little or no surface water is present (Russell and Anderson 1956). Males usually migrate to pond sites 1 to 2 weeks before the females (Reed 1979, 1981; Ruth 1988a), although they may move up to 6 weeks earlier depending on rainfall patterns (Ruth and Tollestrup 1973). As female adult salamanders enter the pond, they pair with males, court, and breed (Anderson 1961, 1967; Reed 1979, 1981). Males apparently remain in ponds twice as long (1 to 5 weeks) as females (Ruth 1988a) and may successfully breed with more than one female each season (Reed 1981). Sex ratios of sampled populations vary depending on site, time of year, and distance from the pond. However, most studies using standard *mark-recapture* methods have found sex ratios of one to two males per female at the breeding sites, with more females found farther from the ponds (0.6 males per female) (Reed 1981; Ruth 1988b, 1994).

Female Santa Cruz long-toed salamanders have specialized and selective egg laying habits. Eggs are laid singly on submerged stalks of spikerush (*Eleocharis* spp.) or other aquatic vegetation about 2 to 3 centimeters (1 inch) apart (Anderson 1960, 1967). Unattached and clustered eggs have also been observed (Reed 1981). Each female lays about 300 (range 215 to 411) eggs per year (Anderson 1967). The eggs and *larvae* are unattended by the adults.

After courtship and egglaying, adult Santa Cruz long-toed salamanders leave the aquatic habitat and return to the same general upland areas where they spent the previous summer, often foraging while en route. By the end of March, most adult Santa Cruz long-toed salamanders have returned to their upland retreats (M. Allaback, *pers. comm.*, 2002). Some adults may remain in the vicinity of the breeding site for a year or more before returning to more distant terrestrial retreats (Ruth 1988b).

Eggs (see Figure 1) usually hatch 15 to 30 days after egg laying (Reed 1979, 1981; Ruth 1988a); the actual development time depends on water temperature (Anderson 1972b). The larvae (see Figure 1) subsist primarily on aquatic invertebrates such as mosquito larvae and worms, as well as larval amphibians (e.g., Pacific treefrogs (*Hyla regilla*) and salamander larvae) (Anderson 1968b). The larval salamanders remain in the pond environment for 90 to 145 days until they reach about 32 millimeters (1.3 inches) snout to vent length (Anderson 1960). The body size at initiation of *metamorphosis* is variable, ranging from 26 to 48 millimeters (1.0 to 1.8 inches) snout to vent length (Anderson 1967, Reed 1981, Ruth 1988b). Metamorphosis may extend from early May to mid-August, but all of the larvae may metamorphose in a relatively short period of time if the aquatic environment becomes unsuitable (Anderson 1967; Ruth and Tollestrup 1973; Reed 1979, 1981; Ruth 1988a).

Many factors determine the timing of metamorphosis in *ambystomatid* salamanders (Wilbur and Collins 1973, Wilbur 1976, Smith-Gill and Berven 1979, Werner 1986). In the closely-related mole salamander (*A. talpoideum*), metamorphosis can be induced in the laboratory by starvation, water pollution, increased water temperatures, or drying of the aquatic habitat (Shoop 1960). If water quality remains suitable, remaining in the pond for a longer period of time may be advantageous to the larvae. Time of hatching can influence size at metamorphosis, length of larval period, and survival to metamorphosis (Boone et al. 2002). A larger body size at metamorphosis increases resistance to *desiccation*, makes the individual less vulnerable to predation, and increases the size range of food items that can be eaten (Werner 1986).

Generally, success at the population level is determined primarily by the number and quality of metamorphosing larvae leaving an aquatic environment, and thus the number recruited into the terrestrial population (Semlitsch 2002). As the ponds begin to dry, newly-transformed juvenile Santa Cruz long-toed salamanders (see Figure 1) move at night and may seek refuge underground, in decaying plant matter at the pond site, or in adjacent willow stands (Anderson 1967; Reed 1979, 1981). Andoli (1995) and Jennings (1995) found that most juvenile Santa Cruz long-toed salamanders moved at least 30 to 60 meters (100 to 200 feet) from the breeding pond during the initial dispersal phase, which in this study, was associated with unusually heavy rains in mid-June. During the next rainy season, the juveniles disperse farther away from the pond, not returning until they reach sexual maturity at 2 to 3 years (Ruth 1988a). Few data exist regarding dispersal movements of juveniles, *foraging ecology*, habitat use, or movements of adult salamanders during the non-breeding season.

Santa Cruz long-toed salamanders apparently are long-lived creatures, possibly living for a decade or more. An adult Santa Cruz long-toed salamander confiscated by law enforcement officials was kept in captivity for more than 8 years until its death (Stephen B. Ruth, Science Research and Consulting Services, Marina, Calif., *in litt*., 1998). Adults of the closely related southern long-toed salamander (*A. m. sigillatum*) have lived more than 6 years in captivity (Snider and Bowler 1992), and the eastern long-toed salamander (*A. m. krausei*) have been known to survive 10 years in the wild (Russell et al. 1995).

Santa Cruz long-toed salamanders are vulnerable to several predators. Eggs and larvae may be preyed upon by *mosquitofish* (*Gambusia* spp.) and crayfish (*Procambarus* spp.). These introduced species have also been implicated in the declines of other amphibian species (Blyth 1994, Axelsson *et al*. 1997, Gillespie and Hero 1999). Larvae are also eaten by adult Santa Cruz long-toed salamanders, California tiger salamanders (*A. californiense*) (Blau 1972), predacious aquatic insects, and a few bird species including mallard ducks (*Anas platyrhynchos*) (Jennings, pers. obs.). Larvae and juveniles probably are preyed upon by herons (*Ardea herodias, Butorides striatus, Egretta* spp.), grebes (*Podilymbus podiceps*, *Podiceps* spp.), and kingfishers (*Ceryle alcyon*). Predators of juvenile Santa Cruz long-toed salamanders include introduced opossums

(*Didelphis virginiana*), striped skunks (*Mephitis mephitis*), and ringneck snakes (*Diadophis punctatus*) (Reed 1979). Adults and juveniles also can be preyed upon by raccoons (*Procyon lotor*). Juveniles and adults are prey to California tiger salamanders, coast garter snakes (*Thamnophis atratus*), western terrestrial garter snakes (*T. elegans*), and common garter snakes (*T. sirtalis*) (Ruth 1988a). Predation of adult salamanders by birds is minimized by the availability of sufficient cover and by the primarily nocturnal activities of adults. Burrowing mammals such as California moles apparently avoid Santa Cruz long-toed salamanders because of toxic skin secretions (Anderson 1963).

Larval Santa Cruz long-toed salamanders are parasitized by a *digenetic trematode* (flatworm, fluke; Family Plagiorchiidae) that can cause the creation of extra limbs as well as other limb deformities (Sessions and Ruth 1990). In 1986 and 1987, 39 percent of the larval and juvenile salamanders and 72 percent of the larval Pacific tree frogs at Seascape Pond had limb abnormalities caused by massive infestations of trematodes, compared to less than 5 percent of the adult salamanders and less than 3 percent of the adult treefrogs captured (Sessions and Ruth 1990). Heavily-infested larval salamanders may be unlikely to survive to metamorphosis because of an increased risk to predation by garter snakes and other predators in which the trematode's life cycle presumably is completed. Given their habitats and life history traits, larval, juvenile, and adult Santa Cruz long-toed salamanders probably harbor a number of internal *parasites*.

From 1900-1992, California experienced eight dry periods, or droughts (Department of Water Resources 2004). During this time period, droughts averaged approximately 3.5 years in duration, the longest drought lasted 6 years, the length of time between droughts averaged approximately 9 years, and the longest time period between droughts was 15 years (Department of Water Resources 2004). Droughts could affect aquatic habitat of Santa Cruz long-toed salamanders by reducing the availability of water in ephemeral ponds; in drought years, rainfall is sometimes insufficient to allow normal breeding and larval development to occur. Droughts could benefit Santa Cruz long-toed salamanders by reducing the number of exotic fish and bullfrogs in aquatic habitats. Drought could affect upland habitat for the species by being a cause

of mortality of some coast live oaks (Regents of the University of California 2000).

E. Distribution and Abundance

The Santa Cruz long-toed salamander is a *relict* form of a species that probably was widespread throughout much of California during and immediately after the last *Pleistocene* ice advance about 10,000 to 12,000 years ago (Ruth and Tollestrup 1973). Scientists believe that during climatic changes and drying conditions in California following the end of the Pleistocene epoch (Stebbins 1949, Raven and Axelrod 1978), a population of the ancestral salamander species became isolated in the area of present-day Santa Cruz County, California, about 840 kilometers (520 miles) south of the nearest coastal population of the long-toed salamander and about 240 kilometers (150 miles) southwest of the nearest Sierra Nevada population (Russell and Anderson 1956).

The Santa Cruz area is geologically active, so the dynamic processes of pond, lagoon, and slough formation have created breeding sites for Santa Cruz long-toed salamanders. Breeding sites have also been created by human activities, such as the impoundment of water for use as *stock ponds*. Ephemeral breeding ponds vary greatly in size and duration of persistence from year to year and may not fill with water during periods of subnormal rainfall. However, breeding ponds are likely to fill with water at least once over a period of five to ten years, enabling successful *recruitment* into Santa Cruz long-toed salamander populations, and the populations' survival over many generations. All ponds eventually become filled with silt and new ones are formed by geologic processes or, as in more recent times, by human activities. This creates a dynamic mosaic in space and time of suitable aquatic and upland habitats for the salamander throughout its limited range (Ruth 1988a).

To date, 22 breeding sites for Santa Cruz long-toed salamanders have been identified; seventeen breeding sites in Santa Cruz County, and five in Monterey County (Figure 2, Table 1). The species likely no longer occurs at two of these locations (Rancho Road and Bennett Slough/Struve Pond, in Santa Cruz County). Breeding has been documented at 18 locations

since the last draft revised recovery plan for the species (Service 1999) was published.

Prior to European settlement of Santa Cruz and Monterey Counties, freshwater marshes, *vernal pools*, and upland habitats were more contiguous and in greater abundance, in comparison to present-day habitat characteristics (Rainey 1985a; E. Van Dyke, pers. comm., 2004). Based upon *anthropogenic* modifications of the landscape (urbanization and cultivation) that have occurred since the mid-19th century, upland and aquatic habitats suitable for Santa Cruz long-toed salamanders has been removed and altered, and barriers to dispersal have been created, resulting in subpopulations which are isolated from each other. Based upon current knowledge

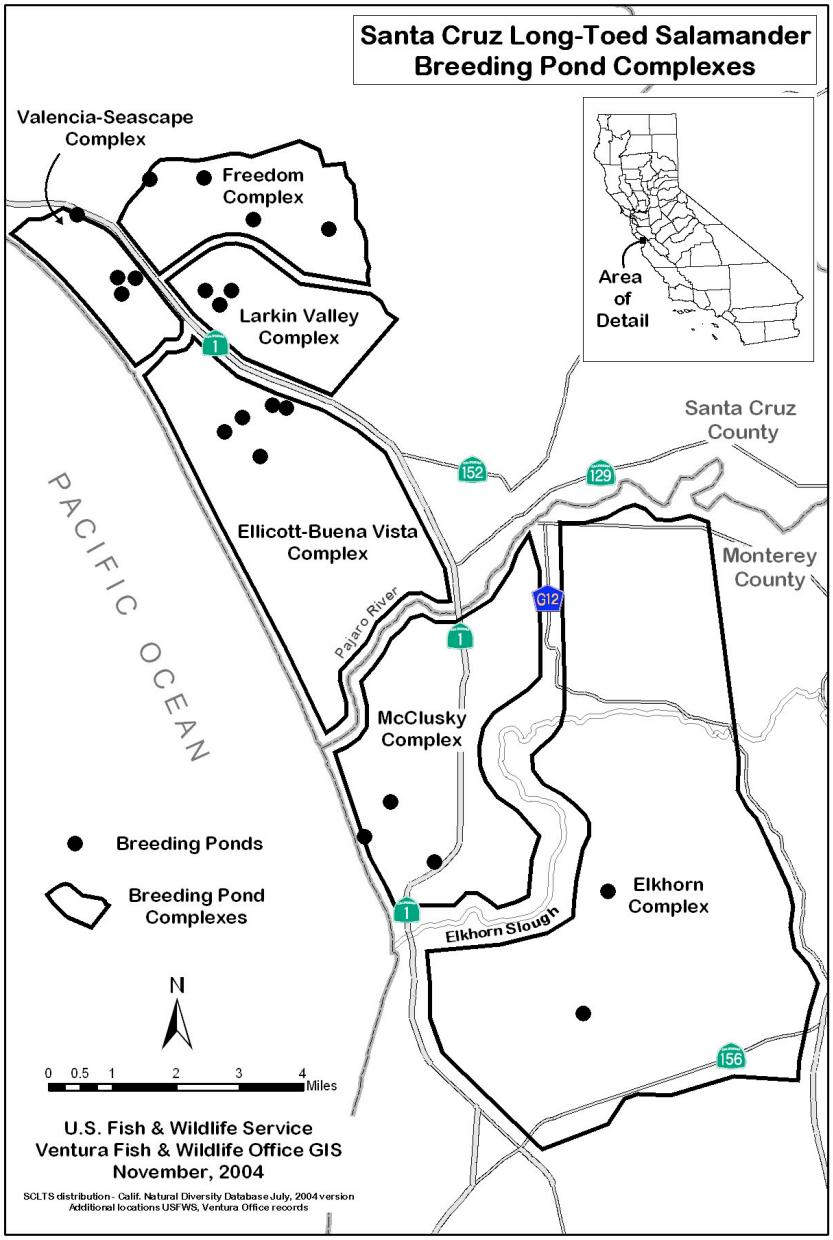

Figure 2. Current known distribution of breeding locations of the Santa Cruz long-toed salamander in Santa Cruz and Monterey Counties, California.

Table 1. Approximate acreages of aquatic and upland habitats, types of ownership, management activities, and year of most recent confirmed breeding at 22 known breeding locations of the Santa Cruz long-toed salamander, Santa Cruz and Monterey Counties, California.

Breeding Site	Aquatic Habitat (acres)	Upland Habitat (acres)	Ownership[a]	Management activities	Most Recent Breeding
Valencia-Seascape Complex			State, NGO		
Valencia Lagoon			CDFG	In development	2004
Seascape Pond 1		150	CNLM	HCP in progress	2004
Seascape Pond 2		150	CNLM	HCP in progress	2004
Seascape Pond 3		150	CNLM	HCP in progress	2004
Ellicott-Buena Vista Complex			Federal, State, Private		
Ellicott Pond	0.9	139	SFBNWR	In progress	2004
Green's Pond	2.5		Private	Unknown	1989
Buena Vista Pond	0.09	289	CDFG	In development	2004
Rancho Road Pond			Private	None	1996
Anderson's Pond			Private	Unknown	1960s
Freedom Complex			Private		
Palmer Pond			Private	Potential SHA	2004
Tucker Pond	0.4	100	Private	HCP in development	2004
Millsap Pond	0.2	50	Private	HCP in development	2004
Merk Pond			Private	None	2004
____ Pond			Private	None	2004
Larkin Valley Complex			Federal, Private		
Calabasas Pond		31	SFBNWR	In progress	2004
Suess Pond			Private	None	2004
Olives Pond	0.04		Private	In development	2004
McClusky Complex			State, NGO, private		
McClusky Slough	65	30	Private	In development	2004
Zmudowski Pond	4.3	5	CDPR, private	In development	2004
Bennett Slough/Struve Slough	27.5		NC	Conservation easement	1985
Elkhorn Complex			Federal/State, Private	In development	
Lower Cattail Swale			ESNERR	In development	2004
Moro Cojo Slough			Private	Conservation easement	2004

Footnotes: [a] Acronyms for land ownership are as follows: CDFG = California Department of Fish and Game; CDPR = California Department of Parks and Recreation; CNLM = Center for Natural Lands Management; ESNERR = Elkhorn Slough National Estuarine Research Reserve; NC = Nature Conservancy; NGO = non-government organization; SFBNWR = U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge.

[b] Acronyms used are as follows: HCP = habitat conservation plan; SHA = safe harbors agreement.

of the distribution of breeding sites and associated upland habitats for the species, it is probable that, prior to large-scale urbanization and conversion of lands for agricultural uses, genetic exchange likely occurred between subpopulations of the species within present-day Santa Cruz and Monterey Counties. It is not known when genetic exchange last occurred between Santa Cruz County and Monterey County subpopulations, but current genetic research by Wes Savage at the University of California, Davis, will likely better describe genetic relationships between subpopulations of Santa Cruz long-toed salamanders.

The previous draft recovery plan (Service 1999) described the distribution of the Santa Cruz long-toed salamander as consisting of three metapopulations, based upon available survey data, and the speculation that large rivers, sloughs, or extensive areas of grassland separated these metapopulations. The current draft recovery plan recognizes the Pajaro River as a substantial barrier to dispersal of Santa Cruz long-toed salamanders between Santa Cruz and Monterey Counties. However, due to the contiguity and greater abundance of habitat in Monterey County prior to European settlement of the area, the known distribution of Santa Cruz long-toed salamanders there, and preliminary results of genetic research (Wes Savage, *pers. comm.*, 2004), the current draft recovery plan describes the Monterey subpopulations as occurring in one metapopulation, rather than two. Thus, the current draft recovery plan recognizes two metapopulations for the Santa Cruz long-toed salamander: the Santa Cruz County metapopulation (Figure 3) and the Monterey County metapopulation (Figure 4).

New breeding sites for the Santa Cruz long-toed salamander are likely to be discovered, due to the amount of non-surveyed privately-owned habitat in the region, and reports of salamanders by local residents (S. B. Ruth, *in litt.* 1996). Based upon a review of recent aerial photographs, in Santa Cruz County, additional breeding sites may occur: south of Freedom Road and north of White Road in Larkin Valley, near Merk Pond, and near Ellicott Pond. Based upon a review of recent aerial photographs and preliminary survey information, additional breeding sites in Monterey County may occur near Elkhorn Slough, in isolated locations adjacent to and south of Trafton Road, and along Vega Road.

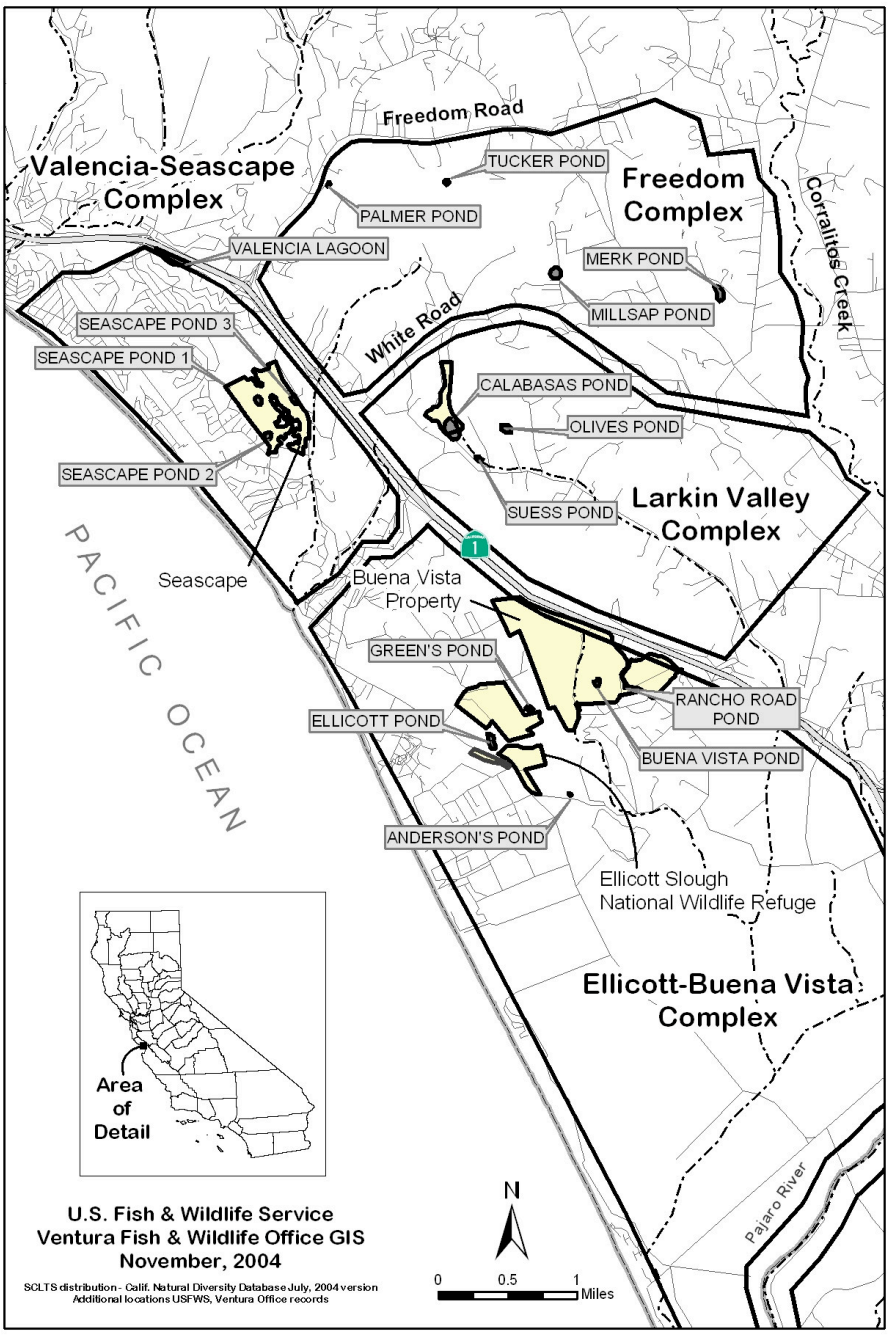

Figure 3. Metapopulation complexes and breeding locations of the Santa Cruz long-toed salamander in Santa Cruz County, California.

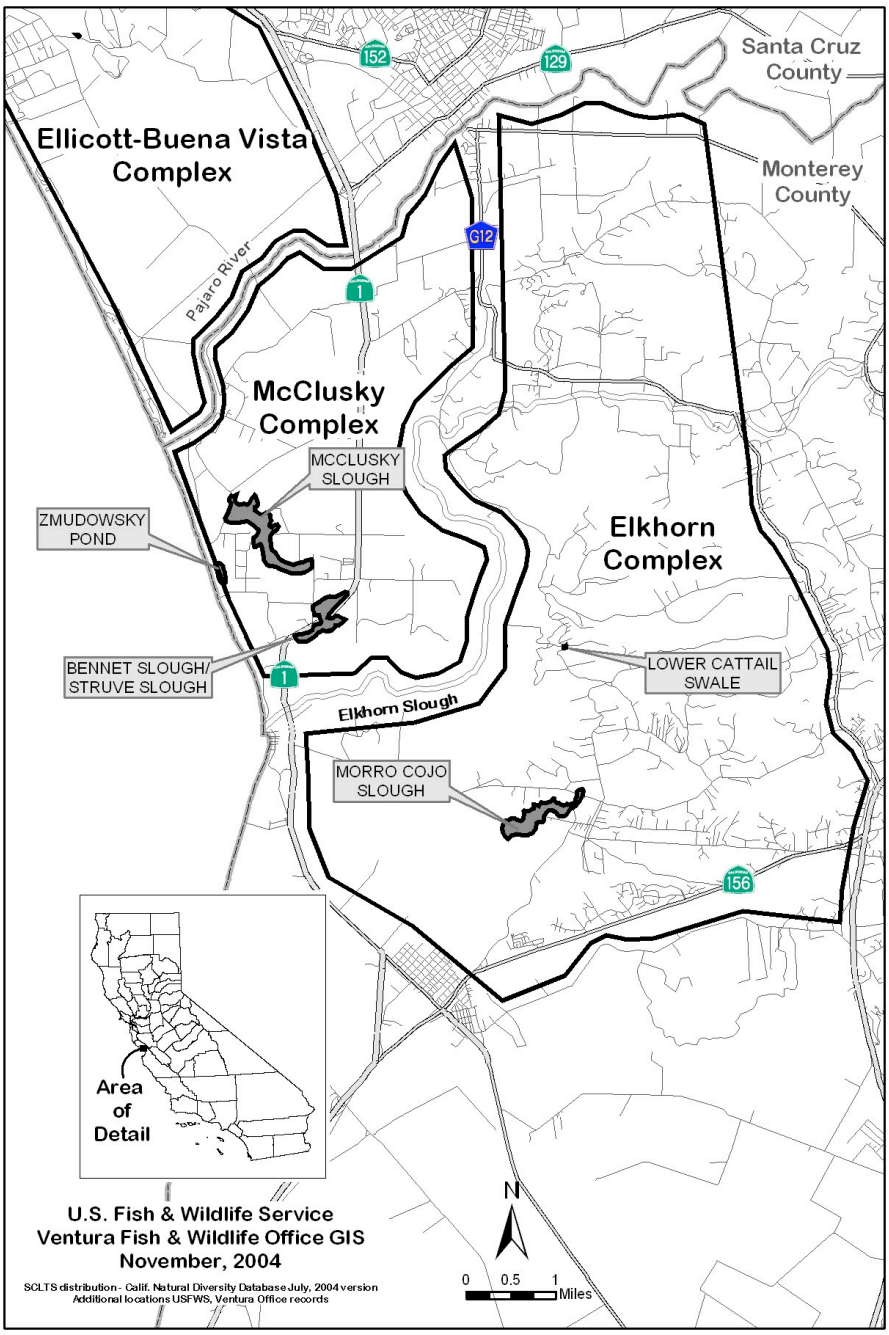

Figure 4. Metapopulation complexes and breeding locations of the Santa Cruz long-toed salamander in Monterey County, California.

Since 1972, minimum adult population sizes have been determined, or adult population sizes have been estimated at nine locations (Appendix B). Estimating total population size for the species is difficult due to the scarcity of data from many locations. However, based upon past estimates of adult population size, and numbers of larvae detected during aquatic sampling, the total population size may be on the order of 10,000-20,000 individuals.

F. Threats

Climate changes and geologic activity in California over the last 10,000 to 12,000 years have led to a restricted and patchy distribution of habitat suitable for Santa Cruz long-toed salamanders, resulting in a naturally restricted distribution of the subspecies. The disjunct distribution of the subpopulations has made the Santa Cruz long-toed salamander especially susceptible to possible population declines resulting from both human-associated and natural factors.

Factors which endanger populations of the Santa Cruz long-toed salamander include the degradation, fragmentation, and loss of aquatic and upland habitats through agriculture, road construction, and urbanization (Table 2). Roads, highways, buildings, walls, and fences are barriers to dispersing Santa Cruz long-toed salamanders. Additionally, vehicular traffic kills Santa Cruz long-toed salamanders attempting to cross roads and highways. Together, these factors result in genetically isolated subpopulations, and mortality of Santa Cruz long-toed salamanders. The loss of upland habitat through urbanization reduces or eliminates terrestrial retreats, such as viable root systems and small mammal burrows, necessary to the species during the non-breeding season. Invasive non-native plants such as eucalyptus and pampas grass reduce the area available for native vegetation, and thus reduce the availability of root systems needed by the species. Additionally, the presence of non-native invasive plants may reduce the numbers of invertebrates available as prey for Santa Cruz long-toed salamanders.

Degraded water quality through chemical contamination (e.g., *pesticides*, *herbicides*, petroleum products) and sedimentation via runoff is known to reduce the growth or survival of salamander

Table 2. Status of and threats to Santa Cruz long-toed salamanders at 22 known breeding locations, Santa Cruz and Monterey Counties, California.

Breeding Location	Status	Threats								
		Agriculture	Grazing	Urbanization	Exotic Animals	Exotic Plants	Disease/ Infection	Sedimentation	Contaminants	Salinization
Santa Cruz County	P, X?		○	● 1,2,3		●	T?	●	● lv, p, h	
Valencia-Seascape Complex		○	○	● 1,2,3		●	C,U	●	● rol, ror	
Valencia Pond	P	○	○	● 1,2,3	○	●	U	●	● lv, ror	
Seascape Pond 1	P	○	○	● 1,2	○	●	C	●		
Seascape Pond 2	P	○	○	● 1,2		●	?	●		
Seascape Pond 3	P	○	○	● 1,2		●	?	●		
Ellicott-Buena Vista Complex	P, X?	○●	○	○● 1,2		●	C,T,U	●		
Buena Vista Pond	P	○	○	○		●	U	●		
Rancho Road Pond	X?	○	○	○		●	U	●	○ ro	
Green's Pond	P	●	○	● 1,2		●	U	●		
Ellicott Pond	P	○	○	● 2		●	C,T	●		
Anderson's Pond	P	●	○	● 1,2		●	U	●		
Freedom Complex	P		○	● 1,2		●	U	●	● p, h	
Palmer Pond	P	○	○	● 1,2		●	U	●		
Tucker Pond	P	○	○	● 2		●	U	●		
Millsap Pond	P	○	○	● 1,2		●	U	●		
Merk Pond	P	○	○	● 2		●		●	● p, h	
___ Pond								●		
Larkin Valley Complex	P	○	○	● 1,2		●	U	●		
Calabasas Pond	P	○	○	● 2		●	U	●		
Suess Pond	P	○	○	● 1,2		●	U	●		
Olives Pond	P	○	○	● 1,2		●	U	●		
Monterey	P, X	○● 1,2,3				●	C,U	○●	● p, h	○●

Breeding Location	Status	Threats								
		Agriculture	Grazing	Urbanization	Exotic Animals	Exotic Plants	Disease/ Infection	Sedimentation	Contaminants	Salinization
County										
McClusky Unit Complex	P, X	● 1,2,3				●	U	○●	● lv, p, h	○●
McClusky Slough	P	● 1,2,3	○	● 1,3		●	T?	●	● p, h	●
Zmudowski Pond	P	● 1,2,3	○	● 1,3		●	U	●	● p, h	
Bennett Slough/Struve Slough	X	○ 1,2,3	○	○		○	○	○	○ p, h	○ ●
Elkhorn Complex	P	● 1,2,3	○●	● 1,2,3		●	U	●	● p, h	
Lower Cattail Swale	P	● 1,2,3	○	● 1,2,3		●	U	●	● p, h	
Moro Cojo Slough	P	● 1,2,3	●	● 1,2,3		●	U	●	● p, h	

Key to threats identified in table:
P = present, X = extirpated, ? = unknown
○ = past threat, ● = current threat
1 = loss of upland habitat; 2 = mortality on roads or in fields; 3 = isolation from other subpopulations
 = bullfrogs, = non-native fish (*e.g.,* mosquitofish, bass)
C = chytrid fungus (chytridiomycosis), T = trematode infections, U = unknown
h = herbicides, lv = larvicides (*e.g.,* methoprene), p = pesticides, ror = run-off contaminants (petroleum products) from roads

larvae (Semlitsch 2002). *Methoprene*, an insect growth regulator and *larvicide*, has been used at Valencia Lagoon and other ponds to control mosquito populations. Although methoprene did not cause increased mortality of gray treefrog (*Hyla versicolor*) tadpoles (Sparling and Lowe 1998), it has been implicated in reduced survival rates and the development of malformations in northern leopard frogs (*Rana pipiens*)(Ankley *et al.* 1998), and with malformations in southern leopard frogs (*R. utricularia*) (Sparling 1998). Blumberg *et al.* (1998) also correlated exposure to methoprene with delayed metamorphosis and high mortality rates in northern leopard and mink (*R. septentrionalis*) frogs. Other *insecticides* (e.g., temephos) have caused reductions in the growth rates of gray treefrog tadpoles and increased mortality rates in green frog (*R. clamitans*) tadpoles (Sparling and Lowe 1998), and increased mortality rates in southern leopard frogs (Sparling 1998).

Natural threats to the Santa Cruz long-toed salamander include native predators (see section "Habitat, Life History, and Ecology") and disease. Santa Cruz long-toed salamanders are also threatened by introduced predators such as bullfrogs and non-native fish. Trematode infestations naturally occur, but their rate of incidence may be increased due to human-related factors such reduced water quality. *Chytrid fungus* has been found to infect a number of amphibian populations that are known to be declining, and has been identified in the closely related California tiger salamander, from individuals collected in adjacent Santa Clara County (Semlitsch 2002, Padgett-Flohr *in press*). The disease (chytridiomycosis) is currently being studied in greater detail to understand its origin, incidence, and distribution.

The type and degree of threats vary by geographic location, and Santa Cruz long-toed salamanders are endangered by more than one threat at all locations (see Table 2). In Santa Cruz County, the primary threats have been road construction and urbanization; in the past, agriculture conducted at relatively low intensity apparently did not severely reduce the subpopulation sizes nor the extent or quality of available habitat. In Monterey County, the primary threats are extensive and intensive agricultural practices and urbanization.

G. Regulatory Protection and Management Actions

Since the 1967 listing of the Santa Cruz long-toed salamander, several management actions (conservation measures) have been undertaken by various Federal, State, and local agencies and private organizations. The following briefly describes some regulatory protection and management actions accomplished to date.

Federal Regulatory Protection. The Santa Cruz long-toed salamander was first listed as an endangered species under the Endangered Species Preservation Act of 1966 (Service 1967). The Endangered Species Conservation Act of 1969 continued to recognize the Santa Cruz long-toed salamander as an endangered species (35 *Federal Register* 16047), and the Santa Cruz long-toed salamander was also among the original species listed as endangered pursuant to the Endangered Species Act of 1973. Critical habitat was proposed in 1978 (Service 1978) but has not been designated.

Section 9 of the Endangered Species Act of 1973, as amended, prohibits any person subject to the jurisdiction of the United States from taking (i.e., harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting) listed wildlife species. It is also unlawful to attempt such acts, solicit another to commit such acts, or cause such acts to be committed. Regulations implementing the Endangered Species Act (50 Federal Register 17.3) define "harm" to include significant habitat modification or degradation that results in the killing or injury of wildlife, and intentional or negligent "harassment" as acts that significantly impair essential behavioral patterns (i.e., breeding, feeding).

Section 10(a)(1)(A) of the Endangered Species Act and related regulations provide for permits that may be granted to authorize activities otherwise prohibited under section 9, for scientific purposes or to enhance the propagation or survival of a listed species. Section 10(a)(1)(B) of the Endangered Species Act allows permits to be issued for take that is "incidental to, and not the purpose of, carrying out an otherwise lawful activity" if we determine that certain conditions have been met that will minimize the impacts to the listed species. Under this section, an

applicant must prepare a habitat conservation plan that specifies the impacts of the proposed project and the steps the applicant will take to minimize and mitigate the impacts. There are habitat conservation plans currently being implemented and developed that include measures to protect the Santa Cruz long-toed salamander.

Section 7(a)(2) of the Endangered Species Act requires Federal agencies, including us, to ensure that actions they fund, authorize, or carry out do not destroy or adversely modify critical habitat to the extent that the action appreciably diminishes the value of the critical habitat for the survival and recovery of the species. Individuals, organizations, states, local governments, and other non-Federal entities are affected by the designation of critical habitat only if their actions occur on Federal lands, require a Federal permit, license, or other authorization or involve Federal funding. Critical habitat for the Santa Cruz long-toed salamander was proposed in 1978, but has not been finalized, due to prioritization of workload based upon limited budgetary resources available to the Service.

Since the listing, we have entered into section 7(a)(2) consultations with other Federal agencies (see below) on numerous project proposals per the requirements of the Endangered Species Act. Examples include interagency section 7(a)(2) consultations on proposed road and bridge construction and maintenance, and improvements of utilities structures, and possible affects to Santa Cruz long-toed salamanders. Additionally, we have entered into intra-agency section 7(a)(2) consultations on projects involving *exotic* upland vegetation control and removal, housing developments that involve loss and conversion of upland habitat, and acquisition of land with suitable habitat for the subspecies, and possible affects to the species. Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We consult with federal agencies such as the U.S. Fish and Wildlife Service (Refuges), Federal Highway Administration, U.S. Army Corps of Engineers, and Federal Emergency Management Agency.

Incidental Take Permits. In August 1997, the Service approved and issued a section 10(a)1(B) permit (incidental take permit) for the Seascape Uplands Habitat Conservation Plan, which included a 150-acre conservation easement (Seascape Uplands Preserve), deeded to the Center for Natural Lands Management. The specific goals of the habitat conservation plan with regards to the Santa Cruz long-toed salamander are to set aside sufficient upland habitat to support the breeding aggregation in perpetuity, enhance currently degraded habitat, maintain the existing breeding pond (Seascape Pond 1) and dispersal corridors, and create two additional ponds (Seascape Pond 2 and Bonita Road Pond (Seascape Pond 3)) (Thomas Reid Associates 1997, Laabs 2004).

Results from ongoing research at the Preserve (Laabs 2004; M. Allaback, *pers. comm.*, 2004) indicate that Santa Cruz long-toed salamanders are breeding at all three ponds. The Center for Natural Lands Management has had to use already limited budgetary resources on unanticipated erosion-control work on the hillside above Pond 2; this has put a strain on the management of their population monitoring studies. Further funding will be required to adequately address erosion-control problems, as well as perform necessary population monitoring at all three ponds. Six salamander tunnels were installed beneath Ventana Way, on the ridge above Ponds 1 and 2, but recent research (Allaback and Laabs *in press*) indicate that few Santa Cruz long-toed salamanders are using the tunnels. The tunnels may need to be modified to allow a greater proportion of Santa Cruz long-toed salamanders to use the tunnels and disperse over the ridge. Data from five consecutive years of research indicate that the subpopulation of Santa Cruz long-toed salamanders breeding in Seascape Pond 1 is stable. Santa Cruz long-toed salamanders are breeding in Seascape Ponds 2 and 3, but further population studies are needed to gauge the annual *breeding success* at these ponds.

Federal Management Actions.

Ellicott Slough National Wildlife Refuge. The Ellicott Slough National Wildlife Refuge is managed by the San Francisco Bay National Wildlife Refuge, comprising a total of 200.5 acres, containing two breeding ponds (Ellicott Pond and Calabasas Pond), and one mitigation pond

(Prospect Pond) in which breeding has not yet been documented. The largest portion is the Ellicott Slough National Wildlife Refuge proper (139 acres), which occurs adjacent to the State-owned Santa Cruz Long-Toed Salamander Ecological Reserve (30.5 acres). These were acquired established by the Service in and the California Department of Fish and Game in 1975. The Refuge and Reserve are jointly managed by the Service and the California Department of Fish and Game through a Memorandum of Understanding. In 1999 the Service and California Department of Fish and Game acquired Calabasas Pond and adjacent upland habitat, comprising a total of 31 acres, and for management purposes included this property (called the Calabasas Unit by SFBNWR) as part of the Ellicott Slough National Wildlife Refuge.

Past management actions at Ellicott Slough National Wildlife Refuge focused on controlling vehicular trespass and erosion, and removing pampas grass and eucalyptus trees. All lands acquired by the Service or California Department of Fish and Game were fenced, vehicular trespass was eliminated, and habitat damaged by erosion caused by off-road vehicles was restored. Current management efforts focus on enhancing both aquatic and upland habitats for the Santa Cruz long-toed salamander. In the early 1990s, wells were developed as alternative sources of water to augment low water levels in breeding ponds during periods of low rainfall. Efforts are underway to remove non-native invasive plant species (*Eucalyptus* sp. and pampas grass) and to re-plant with native plant species. A Wildland Fire Management Plan was prepared for Ellicott Slough National Wildlife Refuge in 2002, and Service fire crews and Wildand Urban Interface funds were available to initiate removal of these exotic species in 2003 and 2004. Refuge staff also controls other invasive plant species such as Italian thistle and poison hemlock. In most years Ellicott Pond requires supplemental water to remain filled with water long enough to allow for complete metamorphosis of Santa Cruz long-toed salamanders. To remain viable, the pond will either require repair to its clay lining, or yearly water supplements. Management activities at Calabasas Pond include repair of a breach in the berm forming the pond, as well as exotic vegetation removal.

The California Department of Fish and Game owns the 289-acre Buena Vista property, located just east of the Ellicott Slough National Wildlife Refuge (proper). The Service will manage the newly-acquired (in 2004) Buena Vista Property (see subsection “California Wildlife

Conservation Board" below) as part of the Ellicott Slough National Wildlife Refuge, under a cooperative agreement with the California Department of Fish and Game. Combined, the Buena Vista Property, Ellicott Slough National Wildlife Refuge (proper), and the Santa Cruz Long-toed Salamander Ecological Reserve comprise 458.5 acres of upland habitat that occurs within dispersal distance of four presumed or known *extant* breeding ponds (Anderson's Pond, Buena Vista Pond, Ellicott Pond, and Green's Pond) in the Ellicott-Buena Vista Complex.

Federal and State of California Cooperative Management Actions. Conservation and management activities for Santa Cruz long-toed salamanders have required the cooperation of Federal and California State agencies (see subsections "National Wildlife Refuge" above, and "California Department of Fish and Game" below).

The Elkhorn Slough National Estuarine Research Reserve, in Monterey County, is one of 26 National Estuarine Research Reserves established nationwide as field laboratories for scientific research and estuarine education. The Reserve is administered by the National Oceanic and Atmospheric Administration and managed by the California Department of Fish and Game. The encouragement and support of research and management activities at Elkhorn Slough National Estuarine Research Reserve led to the discovery of breeding Santa Cruz long-toed salamanders at Lower Cattail Swale (W. Savage, *pers. comm.*, 2003).

State of California Regulatory and Management Actions.

California Coastal Commission. The California Coastal Commission (Commission) is a State coastal management and regulatory agency that in partnership with local governments, is responsible for implementation of the California Coastal Management Program. The Coastal Commission operates under legal authority granted to it by the California Coastal Act of 1976, as amended (California Public Resources Code, Division 20). Jurisdiction also depends on whether a particular activity constitutes "development, " which includes, but is not limited to: the placement or erection of any solid material or structure; discharge or disposal of any dredged material; change in the density or intensity of use of land; change in the intensity of use of water

or its access; and construction, reconstruction, demolition, or alteration of size of any structure. With regards to wetlands, the Coastal Commission's primary role is the regulation of coastal development affecting wetlands in California's coastal zone. (The coastal zone extends three miles seaward and generally about 1,000 yards inland. In particularly important and generally undeveloped areas where there can be considerable impact on the coastline from inland development, the coastal zone extends to a maximum of 5 miles inland from mean high tide line. In developed urban areas, the coastal zone extends substantially less than 1,000 yards inland. Under the federal Coastal Zone Management Act, the Commission can also regulate federal actions or federally funded projects occurring outside the coastal zone as long as they affect resources within the zone.

California Department of Fish and Game. The California Fish and Game Commission recognized the Santa Cruz long-toed salamander as endangered (CFGC; 21 May 1971) (Bury 1972), and designated the species as fully-protected under the California Endangered Species Act. The California Department of Fish and Game has initiated several conservation measures for the Santa Cruz long-toed salamander, including the acquisition of Valencia Lagoon from the California Department of Transportation in 1979, and the acquisition of [total number] lots and conservation easements on the hillside above and south of Valencia Lagoon. Fencing of the Valencia Lagoon core area and initial efforts to restore the breeding pond (California Department of Fish and Game 1975) were completed in November 1978. The mitigation pond system (see subsection "California Department of Transportation" below) has not worked well, and the Service, the California Department of Fish and Game, and the California Department of Transportation are cooperating to redesign the pond to restore suitable aquatic habitat for Santa Cruz long-toed salamander reproduction. The metal flashing along the east side of the lagoon pond was replaced in [YEAR] and will continue to require periodic maintenance. Valencia Lagoon is the type locality for the Santa Cruz long-toed salamander, and earlier estimates of the size of the breeding population include [] (citation), [] (citation). This location exemplifies the threats posed to the species; namely, extensive degradation and fragmentation of aquatic and upland habitats due to urbanization and highway construction.

The California Department of Fish and Game owns and manages (jointly, with the Service) the Santa Cruz Long-toed Salamander Ecological Reserve, located adjacent to Ellicott Slough National Wildlife Refuge (see subsection "National Wildlife Refuges above). The California Department of Fish and Game also manages Zmudowski Pond, which is owned by California Department of Parks and Recreation (see subsection "California Department of Parks and Recreation" below).

California Department of Forestry and Fire Protection. The mission of the California Department of Forestry and Fire Protection is to protect the people of California from fires, respond to emergencies, and protect and enhance forest, range, and watershed values providing social, economic, and environmental benefits to rural and urban citizens. The San Mateo and Santa Cruz Unit of the California Department of Forestry and Fire Protection developed a fire management plan (California Department of Forestry and Fire Protection 2004). The overall goal of the plan is to reduce total wildfire costs and losses from wildland fire by protecting assets at risk through focused vegetation management projects and public outreach.

California Department of Parks and Recreation. The mission of the California Department of Parks and Recreation is to provide for the health, inspiration, and education of the people of California by helping to preserve the State's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation. In addition to being included in the California Department of Parks and Recreation's primary mission, wetlands preservation is also a mandated responsibility under the Keene-Nejedly California Wetlands Preservation Act of 1976 (Pub. Res. Code Div. 5, Ch. 7). The Act directs DPR, along with the Department of Fish and Game, to recognize opportunities for protecting wetlands which lie within or adjacent to State Park System units, and to consider acquisition of wetlands in proximity of State Parks. In addition to lands directly owned by the California Department of Parks and Recreation, the Department also has certain jurisdiction over granted or ungranted tidelands or submerged lands abutting State Park System lands (Pub. Res. Code §5003.5). Forty-one acres (17 hectares) adjacent to Zmudowski State Beach, including the southern portion of the westernmost part of McClusky Slough, Zmudowski Pond and some

surrounding uplands, were acquired by the California Department of Fish and Game [in year?]. The lands are managed by California Department of Parks and Recreation specifically for Santa Cruz long-toed salamanders, and to restore the dune habitat. Biosearch (2003) estimated a population of 19 adult Santa Cruz long-toed salamanders at this breeding location in 2002-03. Upland habitat suitable for Santa Cruz long-toed salamanders at this location is sparse, and increasing salinity of the aquatic habitat is a very real threat.

California Department of Transportation. At Valencia Lagoon, in 1978 the California Department of Transportation replaced two existing mitigation ponds (constructed in 1970 and 1972) with a larger artificial breeding pond (Service 1979, Ruth 1988a). They also installed metal flashing around part of the breeding pond to prevent salamanders from entering a drainage channel and other areas not intended to be salamander habitat. This effort was not successful, and the salamanders used the drainage channel for breeding. Sediment removal occurred in 1993 from the culvert outlet at Bonita Drive to the end of the concrete lined channel section, a distance of 120 feet. Since 1993, channel vegetation has been cut to improve storm flow in the channel. In 2001, California Department of Transportation prepared a Negative Declaration with the goal of obtaining necessary environmental clearances for a one-time sediment removal and annual vegetation cutting. Due to perceived problems with the sediment aspect of the proposed work, California Department of Transportation decided to drop sediment removal from the project. In 2001, California Department of Transportation obtained a five-year Streambed Alteration Agreement from the Department of Fish and Game for annual vegetation clearing in the Valencia Channel. The Agreement contained avoidance measures proposed by the Service. The Agreement expires on December 31, 2005.

The California Department of Transportation has formally consulted (as the designated agency by the Federal Highway Administration) with the Service on road construction and maintenance projects in Santa Cruz County, concerning possible affects to Santa Cruz long-toed salamanders. The California Department of Transportation has proposed to implement habitat restoration projects at projects along Harkins Slough Road at the West Branch of Struve Slough and along Harkins Slough Road at Watsonville Slough. In recent biological opinions for road maintenance

and construction projects, the Service has recommended that California Department of Transportation implement erosion control measures for projects occurring along Freedom Road, to minimize sedimentation into Valencia Lagoon.

California Wildlife Conservation Board. The California Wildlife Conservation Board was created by legislation in 1947 to administer a capital outlay program for wildlife conservation and related public recreation. Originally created within the California Department of Natural Resources, and later placed with the Department of Fish and Game, the California Wildlife Conservation Board is a separate and independent Board with authority and funding to carry out an acquisition and development program for wildlife conservation (California Fish and Game Code 1300, et seq.). The primary responsibilities of the Board are to select, authorize and allocate funds for the purchase of land and waters suitable for recreation purposes and the preservation, protection and *restoration* of wildlife habitat.

The California Wildlife Conservation Board and the Trust for Public Land purchased the 289-acre Buena Vista Property east of Ellicott Pond in 2004, for the permanent protection of the largest undeveloped area of chaparral and coastal woodlands on the west side of Highway 1, between Aptos and Watsonville. Funding for the purchase came from a variety of state and federal funding sources, including a grant from Service's Cooperative Endangered Species Conservation Fund Recovery Land Acquisition Program, federal Transportation Enhancement Activity funds, and from California voter-approved Proposition 50 bond funds through the California Wildlife Conservation Board and the California Coastal Conservancy. The 289-acre Buena Vista property is the newest addition to the California Department of Fish and Game's Santa Cruz Long-Toed Salamander Ecological Reserve. The property will be managed under a cooperative agreement with the Service as part of the nearby Ellicott Slough National Wildlife Refuge.

County of Santa Cruz Regulatory and Management Actions.

Santa Cruz County Planning Department. The Planning Department, under the authority and

policy direction of the Board of Supervisors of Santa Cruz County, is responsible for developing, implementing and enforcing County land use policies, ordinances and regulations; administering environmental protection programs; processing and issuing building, zoning, and other development permits; and carrying out long-range community development programs. In 1982 the County of Santa Cruz formed a Santa Cruz long-toed salamander protection district with strict zoning regulations to protect the remaining privately-owned upland salamander habitat. Properties south of Highway 1 and adjacent to Valencia Lagoon, and properties adjacent to and within the Seascape Upland Preserve are included in a Santa Cruz County Salamander Protection Zone.

Santa Cruz County Mosquito and Vector Control District. The Santa Cruz County Mosquito and Vector Control District does not directly conduct management activities for Santa Cruz long-toed salamanders. However, mosquito-control management activities, such as the use mosquitofish, methoprene, and a bacterium (*Bacillus thuringiensis israelensis*), commonly called "*bti*", can have detrimental affects upon populations of Santa Cruz long-toed salamanders and other amphibians. The Santa Cruz County Mosquito and Vector Control District provides citizens of Santa Cruz County with mosquitofish to control mosquitoes. Although the Santa Cruz County Mosquito and Vector Control District does caution residents that mosquitofish shouldn't be released into "large natural habitats," the agency also states that mosquitofish should be used only in "water troughs and small ponds," the latter which could apply to breeding sites for Santa Cruz long-toed salamanders. Santa Cruz County citizens living within the boundaries of the two Santa Cruz long-toed salamander complexes should be advised not to add mosquitofish to any pond, and the use of larvicides such as methoprene and bti should be examined, and methods developed, that are compatible with controlling mosquitoes and avoiding possible negative impacts to Santa Cruz long-toed salamanders.

County of Monterey Regulatory and Management Actions.

[Monterey County General Plan – what is the status of this, and are management actions for SCLTS included?]
[Also, include Northern Salinas Valley Mosquito Abatement District]

Management Actions by Non-profit Organizations.

Elkhorn Slough Foundation. The Elkhorn Slough Foundation and the Nature Conservancy developed the *Elkhorn Slough Watershed Conservation Plan* in 1999, with funding from the David and Lucile Packard Foundation. This plan outlines an approach to the conservation of critical natural resources in the Elkhorn Slough watershed. Conservation goals are: to retain, enhance, and restore wetland and upland habitats; improve water quality; reduce erosion and sedimentation; increase the extent of freshwater habitats in the lower reaches of the slough; manage flood waters, and provide opportunities for public access and education. The Elkhorn Slough Foundation owns and manages Elkhorn Slough and holds a conservation easement at Moro Cojo Slough, where Santa Cruz long-toed salamanders breed. In February 2004, the Elkhorn Slough Foundation acquired 183 acres of agricultural land in Moro Cojo Slough.

Other Non-profit Conservation Organizations. Conservation measures have been undertaken by various other private or non-profit organizations. For example, Ducks Unlimited, Monterey County, and the Natural Resources Conservation Service have worked with landowners adjacent to McClusky Slough to develop management plans that include the Santa Cruz long-toed salamander. The portions of McClusky Slough and the surrounding riparian areas that are in private ownership have been managed primarily to provide waterfowl habitat and hunting opportunities. Management activities have retained freshwater pond, marsh, and riparian areas. The Nature Conservancy purchased a conservation easement at Struve Pond (near Bennett Slough) in 1981. Studies conducted by Rainey (1985a,b) found that the freshwater wetland habitats in Bennett Slough/Struve Pond were deteriorating due to *saltwater intrusion*. This historically tidal wetland was a freshwater habitat for only 30 to 40 years, so further conservation

actions directed at the maintenance of Santa Cruz long-toed salamander breeding habitat may not be appropriate. Management time and money may be more appropriately directed toward efforts to secure the McClusky Slough and vernal pool habitats.

Conservation Measures on Private Lands. Habitat Conservation Plans. After passage of the Act in 1973, both the Federal government and non-Federal landowners became concerned that a property owner's otherwise lawful activity that might result in the unintentional take of a listed species would be prohibited, even if the landowner was willing to plan activities to conserve the species. To resolve this problem, Congress amended section 10 of the Act in 1982 to authorize "incidental take" through the development and implementation of Habitat Conservation Plans. An incidental take permit allows a property owner to conduct otherwise lawful activities in the presence of listed species. A non-Federal entity (*e.g.*, a landowner or local government) develops a Habitat Conservation Plan in order to apply for an incidental take permit under section 10(a)(1)(B) of the Act. The Habitat Conservation Plan integrates the applicant's proposed project or activity with the needs of the species. It describes, among other things, the anticipated effect of a proposed taking on the affected species and how that take will be minimized and mitigated. Such information must be submitted with any incidental take permit application.

To date, associated with Santa Cruz long-toed salamander, one habitat conservation plan has been approved (Seascape Uplands HCP), one is in the late stages of development (Tucker draft HCP), and one is in the early stages of development (Willow Canyon draft HCP). The Center for Natural Lands Management holds the conservation easement for the Seascape Uplands Preserve. Land Trust of Santa Cruz may hold the conservation easement for the Tucker Preserve.

Safe Harbor Agreements. On June 17, 1997 the Service announced a final policy regarding Safe Harbor Agreements (Service 1997). Safe Harbor Agreements are voluntary arrangements between the Service and cooperating non-Federal landowners, which benefit endangered and threatened species while giving the landowners assurances from additional restrictions. The Service will provide assurances (by issuing an "enhancement of survival" permit) that, when the Safe Harbor Agreement's term ends, the participating landowner may use the property in any

otherwise legal manner that doesn't move it below baseline conditions determined in the Safe Harbor Agreement. These assurances operate with the enrolled lands and are valid for as long as the participant is complying with the Safe Harbor Agreement and associated permit. In return for the participant's efforts, the Service will authorize incidental take through the section 10(a)(1)(A) process of the Act. This permit would allow participants to take individual listed plants or animals or modify habitat to return population levels and habitat conditions to those agreed upon as baseline. Many Safe Harbor Agreements can be developed within 3-4 months. More complex agreements may take at least 6-7months. It depends on a number of factors including, but not limited to: a) the species' ecology; b) size of project; c) number of parties to the Safe Harbor Agreement; d) state of scientific knowledge regarding the species, and; e) funding available (see "Partners for Fish and Wildlife" below) for the Safe Harbor program.

Currently, no Safe Harbor Agreements are being developed for possible benefits to the Santa Cruz long-toed salamander. However, in the spring 2004 personnel from the Service, California Department of Fish and Game, Land Trust of Santa Cruz, Santa Cruz Resource Conservation District, and others discussed the concept of developing a Safe Harbor Agreement for landowners in Larkin Valley (Larkin Valley Complex). In addition to a Safe Harbor Agreement for landowners in Larkin Valley, the Service should encourage the development of and participation of non-Federal landowners in Safe Harbor Agreements for the following locations: 1) Valencia Lagoon neighborhood, 2) Freedom Complex 3) Ellicott-Buena Vista Complex, 4) McClusky Complex, and 5) Moro Cojo Complex.

Partners for Fish and Wildlife. The Service's Partners for Fish and Wildlife program helps accomplish the Service's mission (to work with others, to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people) by offering technical and financial assistance to private (non-federal) landowners to voluntarily restore wetlands and other fish and wildlife habitats on their land. Typically, a project is developed by a private landowner and the Service, often with help from the U.S. Department of Agriculture's Natural Resources Conservation Service, state fish and game agency or other conservation organizations. Next, a Private Lands Agreement is signed by the landowner and submitted to the

Service Field Office. The Agreement specifies the landowner's cost share, project design and management plan. Pending available funding and project approval from the Service's Regional Office, the landowner is reimbursed based on the cost sharing formula in the Agreement, after project completion. Currently, no projects are being implemented to benefit the Santa Cruz long-toed salamander, in association with the Partners for Fish and Wildlife program.

Surveys and Research.

Surveys and research associated with Santa Cruz long-toed salamanders have occurred and occur at all breeding locations. Surveys include aquatic dip net surveys, drift fence/pitfall trap studies at aquatic and upland habitats, and visual surveys for adults, eggs, and larvae. Research includes population monitoring, genetic analysis of collected tissue samples, and investigating diseases such as chytridiomycosis. Surveys and research associated with each breeding location are described below. Numbers in brackets refer to the "site code" of each breeding site, as shown in Table 1.

Valencia Lagoon. Early population studies on salamanders at Valencia Lagoon were conducted in the 1970's by University of California at Berkeley graduate students (see Ruth and Tollestrup 1973, Tollestrup 1974) with funding provided by California Department of Transportation in 1973, and by the Service in 1974. Later population and migration studies were carried out by the California Department of Fish and Game, in cooperation with the Service, from 1977 through 1979. Studies to estimate population size have not been conducted here since 1978. Tissue samples were collected for genetic analysis in 2003 and 2004.

Seascape Ponds 1, 2, and 3. Seascape Pond 1 was sampled in 1974 and 1978 (Reed 1979) and population studies were conducted in 1986-87 (Ruth 1988b), and in each year from 1999-2003 (Laabs 1999, 2000, 2001, 2002, 2003, 2004). At Seascape Pond #1, tissue samples were collected for genetic analysis in 2003 and 2004.

Ellicott Pond. The population at Ellicott Pond was originally studied in the early 1970's (Aaron

1972; Blau 1972; Marlow 1972, 1973) and was censused in 1977-78 under a Service contract (Reed 1979). The studies indicated that the Ellicott Slough/Ellicott site population was healthy and viable. Since then, monitoring by U.S. Fish and Wildlife Service National Wildlife Refuge personnel and others has documented migrating juvenile and adult salamanders as well as larvae in the pond (Service, *in litt.* 1996, 1997, 1998), verifying that Santa Cruz long-toed salamanders are successfully reproducing within the reserve. At the Ellicott site during the 1980's, preliminary studies were conducted on an automatic salamander counter by California State University, Hayward (Service 1999). Tissue samples were collected for genetic analysis in 2003 and 2004.

Green's Pond. Green's Pond, a small (1 hectare; 2.5 acre) farm pond, is located approximately 0.5 kilometer (0.3 mile) west of Ellicott Pond in the Ellicott Slough watershed. Larval Santa Cruz long-toed salamanders were reported from Green's Pond during research conducted in 1972-74. Although breeding was documented at the pond in the 1970's (Reed 1979; S. B. Ruth, *in litt.*, 1988) and in 1989 (S. B. Ruth, *in litt.*, 1989), no surveys have been conducted since then. The current breeding status of this pond is unknown.

Buena Vista Pond. Buena Vista Pond, in the Gallighan Slough watershed, is about 0.8 mile west of Ellicott Pond and 0.7 mile north of Anderson's Pond. The pond apparently was created during the 1940's. Santa Cruz long-toed salamanders were first found here in 1992 (S. B. Ruth, *in litt.*, 1993), and larvae were abundant when observed in 1993 (S. B. Ruth, *in litt.*,1996). It may support several hundred adults based on trapping studies conducted during 1995 (Jennings 1995).

Rancho Road Pond. Larval Santa Cruz long-toed salamanders were found in 1996 in a small pond along Rancho Road (Service 1999). There is contiguous upland habitat (oak woodland) between this pond and the Buena Vista pond, 0.25 mile to the west. No population surveys have been conducted at the site. The current breeding status of this pond is unknown. Santa Cruz long-toed salamanders may have been extirpated from this site due to recent modifications of the blocked culvert which formed this pond.

Anderson's Pond. Anderson's Pond is along Buena Vista Drive in the Gallighan Slough watershed, and is about 0.6 mile southeast of Ellicott Pond. The Anderson's Pond site supported breeding salamanders in the 1950's and 1960's, but surveys have not been conducted since then (S. B. Ruth, pers. comm. 1998). The current breeding status of this pond is unknown.

Palmer Pond. Larval Santa Cruz long-toed salamanders were discovered in Palmer Pond in April 2004 (Gilchrist 2004). Tissue samples were collected from this location in 2004 (W. Savage, pers, comm.). Population studies have not been conducted at this breeding site.

Tucker Pond. Santa Cruz long-toed salamanders were discovered breeding at Tucker Pond in 2000 (Bland 2002). A total of 984 adults were captured in a population study at the pond in 2001-2002 (Bland 2002), and larval tissue samples were obtained in 2003 and 2004 for genetic analysis.

Millsap Pond. Santa Cruz long-toed salamanders were discovered breeding at Millsap Pond in 2000 (Biosearch 2001). A population study was conducted at the pond in 2000-2001, and an estimate of 137 ± 21 adults was derived (Biosearch 2001). Tissue samples have not been collected from this breeding site.

Merk Pond. Santa Cruz long-toed salamanders were discovered breeding at Merk Pond in 2003 (W. Savage, pers. comm.). Tissue samples were collected for genetic analysis in 2003 and 2004, and population studies have not been conducted at this breeding site.

Pond. Santa Cruz long-toed salamanders were discovered breeding here in 2004. Tissue samples were collected for genetic analysis in 2004.

Calabasas Pond. Santa Cruz long-toed salamanders were discovered breeding at Calabasas Pond in [year]. Chytrid fungal infections of Santa Cruz long-toed salamanders breeding here have been observed. Larval tissue samples were collected in 2003 and 2004 for genetic analysis. Population studies have not been conducted at this breeding location.

Suess Pond. Santa Cruz long-toed salamanders were discovered breeding at Suess Pond in [year]. Larval tissue samples were collected in 2003 for genetic analysis. Population studies have not been conducted at this breeding location.

Olives Pond. Larval Santa Cruz long-toed salamanders were discovered in Olives Pond in July 2004 (Bland 2004). Tissue samples have not been collected from this breeding location, nor has a population study been conducted here.

McClusky Slough. Santa Cruz long-toed salamanders were discovered breeding in McClusky Slough in [year]. A population study was conducted in 2001-2002 (Biosearch 2003), and 97 adult Santa Cruz long-toed salamanders were captured. Tissue samples were collected in 2003 and 2004 for genetic analysis.

Zmudowski Pond. Santa Cruz long-toed salamanders were discovered breeding in Zmudowski Pond (called McClusky Vernal Pool in Service (1999)). A population study was conducted in 2001-2002 (Biosearch 2003), and 19 adult Santa Cruz long-toed salamanders were captured. Tissue samples were collected in 2003 and 2004 for genetic analysis.

Bennett Slough/Struve Pond. Santa Cruz long-toed salamanders were discovered breeding in Bennett Slough/Struve Pond in 1973-1974 (Talent and Talent 1980). In December 1977, R.D. Sage found adult Santa Cruz long-toed salamanders in a willow stand at Struve Pond (Rainey 1985). Reed (1979) found larval Santa Cruz long-toed salamanders during aquatic dipnet surveys on April 5, 1978. Reed (1979) reported that dense vegetation and deep water made sampling difficult, and that the southern portion of the slough was not sampled. A single adult Santa Cruz long-toed salamander was observed incidentally by Nature Conservancy personnel in 1984, in the same willow stand where R.D. Sage observed adults in 1977. In March, 1985, while pushing aside vegetation to obtain a water sample, Rainey (1985) observed a single female adult Santa Cruz long-toed salamander, swollen with eggs. Rainey (1985) speculated that Santa Cruz long-toed salamanders likely experienced reproductive failure at Bennett Slough/Struve Pond in 1985, and possibly during the two preceding winters, due to increased salinity. Population

studies have not been conducted at this breeding location since 1974, and larval sampling has not been conducted here since 1978. It is not known how tolerant eggs and larvae of Santa Cruz long-toed salamanders are to salinity; Rainey (1985) reported that salinity levels in Bennett Slough/Struve Pond exceeded 10 parts per thousand. The current breeding status of this pond is unknown; it is likely that Santa Cruz long-toed salamanders are extirpated from this site due to increased salinity.

Lower Cattail Swale. Santa Cruz long-toed salamanders were discovered breeding at Lower Cattail Swale in 2003 (W. Savage, pers. comm.). Larval tissue samples were collected in 2003 and 2004 for genetic analysis. Population studies have not been conducted at this breeding location.

Moro Cojo Slough. Adult Santa Cruz long-toed salamanders were discovered among willows at Moro Cojo Slough in 1978 (Reed 1979), and larval Santa Cruz long-toed salamanders were discovered here during aquatic dip-netting surveys in May, 1978. Tissue samples have not been collected from this breeding location, nor has a population study been conducted here.

Education and Outreach. In Santa Cruz County, at the Ellicott Slough National Wildlife Refuge, the California Department of Fish and Game and the Service have permitted public use for scientific and educational purposes; the primary use has been by school groups visiting the refuge. School field trips to the preserve are important because they provide valuable educational opportunities for young students to learn to appreciate nature first hand, and they also assist in the overall protection of the reserve and its wildlife and plants by showing the usefulness of the reserve to the local community. Additionally, informational signs for visitors have been installed at the Ellicott Slough National Wildlife Refuge to explain to describe the habitat needs of Santa Cruz long-toed salamanders. In Monterey County, the Elkhorn Slough National Estuarine Research Reserve coordinates public education and outreach.

H. Associated Species

We are committed to applying an ecosystem approach to conservation to promote efficient and effective conservation of our Nation's biological diversity (Service 1994b). In recovery plans, it is our policy to incorporate ecosystem considerations by: 1) Developing and implementing recovery plans for communities or ecosystems where multiple listed species and species of concern occur; 2) Developing and implementing recovery plans for threatened and endangered species in a manner that restores, reconstructs, or rehabilitates the structure, distribution, connectivity, and function upon which those listed species depend. In particular, these recovery plans shall be developed and implemented in a manner that conserves the biotic diversity of the ecosystems upon which the listed species depend; 3) Expanding the scope of recovery plans to address ecosystem conservation by enlisting local jurisdictions, private organizations, and affected individuals in recovery plan development and implementation; and 4) Developing and implementing agreements among multiple agencies that allow for sharing of resources and decision making on recovery actions for wide ranging species. The current emphasis on multiple species protection and management reflects recognition of the way organisms interact with each other and their environments. By developing and implementing conservation measures aimed at restoring and protecting the processes that maintain healthy ecosystems, future listings may be prevented. There are several listed, proposed, or candidate fish, wildlife and plant species that occur in, or near, aquatic and upland that either historically supported, or currently support Santa Cruz long-toed salamander populations. Some of these species are included in existing or developing recovery plans. In these cases, actions taken to recover the Santa Cruz long-toed salamander will also contribute to implementation of these recovery plans (e.g., California red-legged frog, robust spineflower). Other species that are not covered by Federal regulatory processes or existing recovery planning efforts (*e.g.*, southwestern pond turtle), should also benefit from implementation of the Santa Cruz long-toed salamander recovery plan through improvements in wetland habitats where the ranges overlap with Santa Cruz long-toed salamanders.

California tiger salamander (*Ambystoma californiense*) The California tiger salamander was

listed as threatened throughout its range in 2004 (Service 2004b). Critical habitat for the California tiger salamander was proposed in 2004 (Service 2004b). A recovery plan is currently being developed. The historic distribution of the California tiger salamander apparently included large portions of the Central Valley of California, from the southern Sacramento Valley north of the Sacramento River delta into the southern San Joaquin Valley. The California tiger salamander occurs in grasslands and open oak woodlands. Necessary habitat components include rodent burrows for underground retreats and breeding ponds, such as artificial stockponds, seasonal wetlands, vernal pools, or slow-moving streams, which do not support fish. Because the California tiger salamander may migrate up to 1.2 miles (approximately 2 kilometers) from its underground retreats to breeding ponds, unobstructed migration corridors are also required. Most of the remaining range of the California tiger salamander is threatened by urban development, conversion of natural habitat and grazing lands to seasonal crops, vineyards, and orchards, introduction of nonnative predatory animals, construction of reservoirs, poisoning campaigns to destroy rodents, environmental pollution, and other anthropogenic factors (U.S. Fish and Wildlife Service 1994c, Stebbins and Cohen 1995, Service 2004b). California tiger salamanders co-occur with Santa Cruz long-toed salamanders in Santa Cruz County at Ellicott Pond, Green's Pond (?), Buena Vista Pond, and in Monterey County at Moro Cojo Slough.

California red-legged frog (*Rana aurora draytonii*) The California red-legged frog was listed as threatened by the Service in 1996 (Service 1996). Critical habitat for the California red-legged frog was designated on March 13, 2001 (Service 2001). On November 6, 2002, the United States District Court for the District of Columbia set aside the designation and ordered the Service to publish a new critical habitat proposal for the California red-legged frog by March 2004 (*Home Builders Association of Northern California et al. versus Gale A. Norton, Secretary of the Department of Interior et al.* Civil Action No. 01-1291 (RJL) U.S. District Court, District of Columbia). We re-proposed critical habitat for the California red-legged frog on April 13, 2004 (Service 2004a). A final determination on this proposal is due November 2005. The Service has published a final recovery plan for the California red-legged frog (Service 2002). This subspecies of red-legged frog occurs from sea level to elevations of about 5,200 feet (1,500 meters). It has been *extirpated* from 70 percent of its former range and now is found primarily in coastal

drainages of central California, from Marin County, California, south to northern Baja California, Mexico. Potential threats to the species include elimination or degradation of habitat from land development and land use activities and habitat invasion by non-native aquatic species. The California red-legged frog requires a variety of habitat elements with aquatic breeding areas embedded within a matrix of riparian and upland dispersal habitats. Breeding sites of the California red-legged frog are in aquatic habitats including pools and backwaters within streams and creeks, ponds, marshes, springs, sag ponds, dune ponds and lagoons. Additionally, California red-legged frogs frequently breed in artificial impoundments such as stock ponds. California red-legged frogs co-occur with Santa Cruz long-toed salamanders in Santa Cruz County at Tucker Pond, Millsap Pond, Calabasas Pond, and Olives Pond, and in Monterey County at McClusky Slough, Lower Cattail Swale and Moro Cojo Slough.

Southwestern pond turtle (*Clemmys marmorata pallida*) The southwestern pond turtle is not federally listed; it is a California State Species of Concern. The southwestern pond turtle is one of two subspecies of western pond turtle (*Clemmys marmorata*), and is found in coastal drainages from the vicinity of Monterey, California south to northwestern Baja California, Mexico. Western pond turtles are habitat generalists and occur in a wide variety of permanent and intermittent aquatic habitats (Holland 1991). In streams and rivers, southwestern pond turtles generally avoid fast-moving and shallow waters and are concentrated in pools and backwater areas. Southwestern pond turtles are uncommon in heavily shaded areas and prefer openings in the streamside canopy that provide sufficient sunlight for basking. Threats to southwestern pond turtles include introduced and native predators, habitat alteration, urbanization, poaching, historic commercial exploitation, water pollution, and disease. Excessive grazing activities in riparian areas adversely impact turtle populations by collapsing undercut banks used as shelter, and by consuming emergent vegetation used as habitat by hatchling and first-year turtles (Holland 1991). Southwestern pond turtles co-occur with Santa Cruz long-toed salamanders in Monterey County at Elkhorn Slough.

Monterey spineflower (*Chorizanthe pungens* var. *pungens*) Monterey spineflower, a small, prostrate annual in the buckwheat family, was listed as threatened on February 4, 1994 (Service

1994a). A recovery plan (Service 1998) has been published. Monterey spineflower occurs in sandy soils within coastal habitats from the Monterey Peninsula (Monterey County) northward along the coast to southern Santa Cruz County, and inland to the coastal plain of the Salinas Valley. At more inland sites within the Salinas River watershed, Monterey spineflower occurs on sandy, well-drained soils in a variety of plant communities, most frequently maritime chaparral, valley oak woodlands, and grasslands. Within grassland communities, Monterey spineflower occurs along roadsides, in firebreaks, and in other disturbed sites, while in oak woodland, chaparral, and scrub communities, it occurs in sandy openings between shrubs. In older stands with a high cover of shrubs, the plant is restricted to roadsides, firebreaks, and trails that bisect these communities. Prior to onset of human use of this area, Monterey spineflower may have been restricted to openings created by wildfires within these communities (Service 1998). At some inland locations, Monterey spineflower occurs in close proximity with Yadon's piperia and robust spineflower. Monterey spineflower is a short-lived annual species. It germinates during the winter months and flowers from April through June. Although pollination ecology has not been studied for this taxon, Monterey spineflower is likely visited by a wide array of pollinators; observations of pollinators on other species of *Chorizanthe* that occur in Santa Cruz County have included leaf cutter bees (megachilids), flies, sphecid wasps, and at least six species of butterflies. Each flower produces one seed; depending on the plant vigor, dozens, if not hundreds, of seeds could be produced per individual. The plants turn a rusty hue as they dry through the summer months, eventually shattering during the fall. Seed dispersal is facilitated by the involucral spines, which attach the seed to passing animals. While animal vectors most likely facilitate dispersal between colonies and populations, the prevailing coastal winds undoubtedly play a part in scattering seed within colonies and populations. Residential development, agricultural land conversion, recreational use, sand mining, dune stabilization, and competition with non-native plants, such as European beach grass and iceplant, have all reduced the populations and habitat of the Monterey spineflower. Habitat loss and conversion from agricultural and residential development, activities at military institutions, and invasion by non-native plants were identified as the primary threats to Monterey spineflower (Service 1994a). Hikers and equestrians may trample these plants at various locations throughout its range. Most of the historical locations of the Monterey spineflower in the Salinas Valley have probably been

extirpated by conversion of grassland and valley oak woodland habitats to agricultural fields. The Monterey spineflower co-occurs with Santa Cruz long-toed salamanders in Santa Cruz County in upland areas near Palmer Pond and Tucker Pond.

Robust spineflower (*Chorizanthe robusta* var. *robusta*) The robust spineflower was federally listed as endangered on February 4, 1994 (Service 1994a). Critical habitat was designated in May 2002 (Service 2002). A final recovery plan (Service 2004c) has been published. Robust spineflower occurs in loose, sandy soil in coastal and near-coastal sites currently within Santa Cruz County. Historical occurrences have been documented within Monterey County south of the city of Watsonville, and inland near the cities of Soledad and San Lucus in the Salinas River valley. At coastal sites, robust spineflower is found at the base of backdunes in openings of coastal scrub. On coastal dunes, the distribution of suitable habitat is subject to dynamic shifts caused by patterns of dune mobilization, stabilization, and successional trends in coastal dune scrub that increase in cover over time. Accordingly, individual colonies of robust spineflower, found in gaps between stands of scrub, shift in distribution and size over time. Other native plants associated with robust spineflower include seaside woolly sunflower (*Eriophyllum staechadifolium*), coastal sagewort (*Artemesia pycnocephala*), mock heather (*Ericameria ericoides*), and coyote bush (*Baccharis pilularis*). At more inland sites, robust spineflower occurs on sandy soils in openings surrounded by coastal scrub or chaparral habitats, or in openings of oak woodland, chaparral or scrub. Associated species include coyote brush, bracken fern (*Pteridium aquilinum*), smooth cat's ear (*Hypochaeris glabra*), four-spot (*Clarkia purpurea* ssp. *quadrivulnera*), filaree (*Erodium cicutarium*), Horkelia (*Horkelia* sp.), and native and non-native grasses. Robust spineflower has also been documented in disturbed areas. Robust spineflower is a short-lived annual species. It germinates during the winter months and flowers from April through June. Seed dispersal is facilitated by involucral spines that attach the robust spineflower seeds to passing animals. Although pollination ecology has not been studied for this taxon, robust spineflower is likely visited by a wide array of pollinators; observations of pollinators on the related Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*) have included wasps, bees, flies, and butterflies. Because of the close relationship with other species of *Chorizanthe*, some confusion has occurred during identification between robust

spineflower and Monterey spineflower. Many sites where robust spineflower historically occurred have been modified by development and agriculture. The existing populations of robust spineflower are threatened by continuing loss of habitat from residential and golf course development, recreational use, and competition with non-native species. The measures recommended for recovery of the robust spineflower in the draft recovery plan are similar to the measures proposed for the Monterey spineflower. The robust spineflower co-occurs with Santa Cruz long-toed salamanders in Santa Cruz County near Palmer Pond and Buena Vista Pond.

Santa Cruz tarplant (*Holocarpha macradenia*) The Santa Cruz tarplant is an aromatic annual herb in the aster family (Asteraceae) that is restricted to coastal terrace prairie habitat along the coast of central California. The Santa Cruz tarplant is one of only four species of the genus Holocarpha. All four are geographically restricted to California. The plant grows to the height of 10 to 50 centimeters (cm) (4 to 20 inches (in)). The yellow daisy-like flower head is surrounded from beneath by individual bracts (small leaf-like structure associated with flower head). The Santa Cruz tarplant is distinguished from other members of the genus by its numerous ray flowers and black anthers. The Santa Cruz tarplant is threatened primarily by historic and recent habitat destruction caused by residential development and habitat alteration caused primarily by land management practices that favor the increase of other species which compete with the Santa Cruz tarplant. The Santa Cruz tarplant is currently known from approximately 14 native and eight experimentally seeded populations in Contra Costa, Monterey, and Santa Cruz Counties. The Santa Cruz tarplant co-occurs with Santa Cruz long-toed salamanders in Santa Cruz County in upland areas in the Freedom and Calabasas Complexes, and in Monterey County in upland areas adjacent to Elkhorn Slough.

II. RECOVERY STRATEGY

Threatened by urban development and highway construction, and known from only two locations, the Santa Cruz long-toed salamander was listed as endangered under the Endangered Species Preservation Act in 1967 and received federal protection with the passage of the Endangered Species Act in 1973. The species has been

discovered at 22 breeding locations since its initial discovery in 1954, but no longer occurs at two of these locations. The primary threats to the Santa Cruz long-toed salamander are urbanization, road construction, and intensive agriculture, resulting in the loss, fragmentation, and degradation of upland and aquatic habitats, loss of genetic exchange between subpopulations, and mortality of Santa Cruz long-toed salamanders on roads and in fields. Although factors such as disease, invasive species, and chemical contamination are potential threats, habitat degradation and alteration are considered by many biologists to be the major cause of declines of amphibians (Semlitsch 2002). Ongoing conservation programs include the management of aquatic and upland habitats by Federal and State agencies, land acquisition, and the implementation and development of habitat conservation plans. Future management actions should include continued management of aquatic and upland habitats, creation or discovery of additional breeding locations, land acquisition, and the continued development and implementation of habitat conservation plans and safe harbor agreements. Estimates of population size have been determined at eight breeding locations, but these estimates have occurred sporadically over the past 27 years, primarily due to limited funding for research. Additional breeding locations may occur on presently non-surveyed private lands.

The revised recovery strategy presented here focuses on:

1) perpetuating self-sustaining populations of Santa Cruz long-toed salamanders at Seascape, Ellicott, Freedom, Calabasas, McClusky, and Elkhorn complexes by managing pond and upland habitats, reducing human-related mortality, and monitoring populations;
2) maintaining and creating upland habitat corridors between subpopulations within Santa Cruz and Monterey Counties;
3) conducting surveys in the general area of each complex to locate additional breeding sites and suitable upland habitat areas, and to identify parcels that would be appropriate for conservation agreements or easements, acquisition, or other management actions;
4) assessing the distribution and population status of Santa Cruz long-toed salamanders in

the Merk Road drainage, in upper Moro Cojo Slough, and at any other new locations found through the surveys, planning and implementing appropriate management strategies and actions where appropriate;

5) supporting the management of Santa Cruz long-toed salamander habitats and populations with appropriate research; and
6) maximizing public support for conservation of this salamander through continuing and expanding a program of public education, outreach, and information.

The primary needs to continue recovery of the Santa Cruz long-toed salamander are, in order of relative priority:

1) protecting existing aquatic and upland habitats;
2) enhancing genetic exchange between subpopulations through the creation of migration corridors within and between complexes within each county; enhancing upland habitat through re-vegetation and removal of exotic vegetation;
3) enhancing aquatic habitat through the removal of exotic vegetation, reduction in sedimentation of wetlands, and reduction of chemical contamination (pesticides, herbicides, and petroleum products), and;
4) reducing the threat of predation by removing bullfrogs and exotic fish from aquatic habitats.

Urbanization and agricultural development has separated and isolated subpopulations of Santa Cruz long-toed salamanders in Santa Cruz and Monterey Counties. In Santa Cruz County, subpopulations are separated isolated by residential developments and Highway 1. In Monterey County, subpopulations are separated and isolated by agricultural fields and Highway 1. Therefore, in this draft recovery plan subpopulations are grouped into six complexes, based upon geographic location (see Figures 2, 3, and 4). Within these complexes, human land-use practices and threats to Santa Cruz long-toed salamanders are similar; thus, these complexes can be used conceptually to guide future management actions.

The complexes and their boundaries are defined as follows:

Santa Cruz County

1) Valencia-Seascape Complex: bounded by the Pacific Ocean on the west, Highway 1 on the north and east, and Mar Monte Drive on the south.

2) Ellicott-Buena Vista Complex: bounded by the Pacific Ocean on the west, Mar Monte Drive on the north, Highway 1 on the east, and the Pajaro River on the south.

3) Freedom Complex: bounded by Freedom Road to the north, Highway 1 to the west, Corralitos Creek on the east, and, to the south, White Road and the ridge forming the north edge of Larkin Valley.

4) Larkin Valley Complex: bounded by (on the north) White Road and the ridge forming the north edge of Larkin Valley, Highway 1 on the west, Corralitos Creek on the east, and the northwestern limits of the City Watsonville on the south.

Monterey County

5) McClusky Complex: bounded by the Pajaro River on the north, Pacific Ocean on the west, and Elkhorn Slough on the east and south.

6) Elkhorn Complex: bounded by the Pajaro River on the north, Elkhorn Slough on the west, San Miguel Canyon on the east, and Blackie Road on the south.

STATUS REVIEW

The 1967 Federal Register Notice (32 *Federal Register* 406) designating the Santa Cruz long-toed salamander and several other species as "endangered" did not provide a detailed explanation for the listing. Since the Santa Cruz long-toed salamander was designated as an endangered species prior to enactment of the ESA (1973), there was no formal listing package identifying threats to the species, as required by Section 4(a)(1). Under section 4(c)(2) of the ESA, the Service is charged with periodically reviewing the status of species included in the List of Endangered and Threatened Wildlife to determine whether any species should change in status

from a threatened species to an endangered species, change in status from an endangered species to a threatened species, or be removed from the List.

During the 27 years since approval of the first Santa Cruz long-toed salamander draft recovery plan, a tremendous amount of knowledge has been gained about Santa Cruz long-toed salamander biology and ecology and significant protection programs have been implemented. The knowledge and the results of these protection programs are reflected in this recovery plan. In year 2010, a status review for the Santa Cruz long-toed salamander should be performed, to update and review the science and population ecology of Santa Cruz long-toed salamanders, including an assessment of the recovery criteria presented in this plan.

The review should include:
(1) a detailed evaluation of the population status using the most up to date demographic data and other biological indices available;
(2) an evaluation of the status of Santa Cruz long-toed salamander habitat as it relates to recovery;
(3) an evaluation of the existing threats to the species and the effectiveness of existing mechanisms to reduce or remove those threats (e.g., land acquisition, habitat conservation plans, education and compliance have resulted in the protection of aquatic and upland habitats) as prescribed in this recovery plan;
(4) recommendations, if any, regarding reclassification of the Santa Cruz long-toed salamander; and
(5) if necessary, recommendations to update or modify recovery criteria.

III. RECOVERY GOALS AND CRITERIA

The first objective is to recover the Santa Cruz long-toed salamander sufficiently to warrant reclassification to threatened species status (downlisting). The second objective is to recover the species sufficiently to warrant removal from the List of Endangered and Threatened Wildlife (delisting).

The actual downlisting or delisting of a listed entity (*i.e.*, species, subspecies, or distinct population segment) is achieved through a formal rulemaking process. The recovery criteria set forth in a recovery plan are intended to serve as objective, measurable guidelines to assist us in determining when a listed entity has recovered to the point that the protections afforded by the Endangered Species Act are no longer necessary. However, the actual downlisting or delisting process is not solely dependent upon achieving the recovery criteria; it is achieved through the formal rulemaking process based upon a five factor analysis (per section 4(a)(1) of the Endangered Species Act), in conjunction with an analysis of the recovery criteria, that results in a determination that the threats to the listed entity have been sufficiently controlled or eliminated such that downlisting or delisting is warranted.

A. Reclassification to Threatened Status

The previous draft revised recovery plan (Service 1999) stated that the Santa Cruz long-toed salamander would be considered for reclassification from threatened to endangered status "when the following four complexes are protected and managed such that habitat is conserved, maintained, and/or restored: Valencia-Seascape, Larkin Valley, Ellicott-Buena Vista, and McClusky Slough." Service (1999) did not recognize the Freedom and Elkhorn complexes, defined in this current recovery plan, because breeding sites for the Santa Cruz long-toed salamanders were discovered in the Freedom and Elkhorn complexes subsequent to publication of that recovery plan. The six metapopulation complexes, as defined in the current plan, likely encompass the entire distribution of breeding sites for the species. The Santa Cruz long-toed salamander will be considered for reclassification from endangered to threatened status when the following six complexes are protected and managed such that habitat is conserved, maintained, and/or restored: Seascape, Ellicott, Freedom, Calabasas, McClusky, and Elkhorn. Each complex must contain at least three self-sustaining subpopulations (defined below), as well as sufficient upland habitat to support self-sustaining populations. Cooperation among landowners, Federal

and State agencies, and non-governmental organizations for the management of aquatic and upland habitat for the species has been increasing, and is expected to develop further.

A self-sustaining subpopulation is defined as one exhibiting an adult sex ratio of one to two males per female, and either a stable age distribution (*i.e.*, not skewed toward larger, presumably older, individuals, nor strongly skewed toward smaller, presumably newly-matured animals), or evidence of a population stable or increasing in size (*i.e.*, more small adults than expected in a stable age distribution, without loss of older, larger individuals). Evidence of continued breeding success and recruitment of adults must be documented over a 20-year period. Twenty years should be long enough to monitor the salamander and its habitat through at least one drought cycle, and will allow sufficient time for evaluation of management actions, determination of population trends, and alteration of management actions if necessary. At the end of this 20-year period, each secured subpopulation must be self-maintaining; that is, not requiring any direct human assistance to reproduce successfully and maintain a stable or growing population during years of average or above average precipitation. All protected areas must provide sufficient acreage and habitat diversity to ensure that each subpopulation is capable of self-maintenance, even after adverse environmental conditions such as drought, heavy rains, or catastrophic fires. Upland scrub or woodland habitats must be adjacent to the breeding ponds or within migration distance, protected corridors for migration to upland habitat must be established and maintained where necessary, and protected corridors for dispersal to other ponds within each complex must be established and maintained. The most effective way to achieve this goal is to protect the whole drainage surrounding the breeding pond, as well as protecting and enhancing existing ponds or creating one or more new breeding ponds within 1 kilometer (0.6 mile) of currently protected or managed breeding sites.

The requirement of 20 years until the Santa Cruz long-toed salamander can be considered for reclassification to threatened status or delisted means this animal will have been listed as endangered for some 52 years before reclassification (downlisting or delisting) is considered. Although this salamander has already had a recovery plan in effect since 1977, population monitoring has occurred in association with only a few breeding locations (see Appendix B).

B. Delisting

The Santa Cruz long-toed salamander will be considered for delisting when the reclassification criteria are met, with the added stipulation that there shall be at least four self-sustaining subpopulations in each complex. In Santa Cruz and Monterey Counties, Santa Cruz long-toed salamanders must be able to disperse between subpopulations within complexes. In Santa Cruz County, Santa Cruz long-toed salamanders will need to be able to disperse between the Valencia-Seascape and Freedom complexes, and between the Ellicott-Buena Vista and Larkin Valley complexes, without significant risk to mortality on Highway 1. In Monterey County, Santa Cruz long-toed salamanders will need to be able to disperse between the McClusky and Elkhorn complexes, without a significant risk of mortality to Santa Cruz long-toed salamanders on Highway 1 and due to agricultural activities.

IV. RECOVERY PROGRAM

A. Recovery Action Outline

1. Develop self-sustaining populations of Santa Cruz long-toed salamanders.
    1.1. Manage aquatic habitats so that they remain, or become, functional breeding sites.
        1.1.1. Improve management actions for Valencia Lagoon.
        1.1.2. Continue management actions for the three Seascape Ponds.
        1.1.3. Develop and implement management actions for Ellicott Pond.
        1.1.4. Implement management actions for Prospect Pond.
        1.1.5. Develop and implement management actions for Green's Pond.
        1.1.6. Develop and implement management actions for Buena Vista Pond.
        1.1.7. Develop and implement management actions for Rancho Road Pond.
        1.1.8. Develop and implement management actions for Anderson's Pond.
        1.1.9. Develop and implement management actions for Palmer Pond.
        1.1.10. Implement management actions for Tucker Pond.

1.1.11. Develop and implement management actions for Millsap Pond.

1.1.12. Develop and implement management actions for Merk Pond.

1.1.13. Develop and implement management actions for ___ Pond.

1.1.14. Develop and implement management actions for Calabasas Pond.

1.1.15. Develop and implement management actions for Suess Pond.

1.1.16. Develop and implement management actions for Olives Pond.

1.1.17. Develop and implement management actions for McClusky Slough.

1.1.18. Develop and implement management actions for Zmudowski Pond.

1.1.19. Determine viability of Bennett Slough/Struve Pond.

1.1.20. Develop and implement management actions for Lower Cattail Swale.

1.1.21. Develop and implement management actions for Moro Cojo Slough.

1.2. Ensure viability and protection of upland habitats associated with breeding sites.

1.2.1. Protect and improve upland habitat within the Valencia-Seascape Complex.

1.2.1.1. Protect oak woodlands upslope from Valencia Lagoon.

1.2.1.2. Develop a management plan to implement an adequate habitat. conservation plan for Willow Canyon.

1.2.1.3. Continue management actions at Seascape Uplands Preserve.

1.2.2. Enhance upland habitat within the Ellicott-Buena Vista Complex

1.2.2.1 Continue management actions at the Ellicott Slough National Wildlife Refuge.

1.2.2.2 Develop and implement management actions near Green's Pond.

1.2.2.3 Enhance upland habitat at Buena Vista.

1.2.2.4 Develop and implement management actions near Anderson's Pond.

1.2.3. Protect and improve upland habitat within the Freedom Complex

1.2.3.1 Enhance upland habitat near Palmer Pond.

1.2.3.2 Implement upland habitat enhancement near Tucker Pond.

1.2.3.3 Enhance upland habitat near Millsap Pond.

1.2.3.4 Enhance upland habitat near Merk Pond.

1.2.3.5 Enhance upland habitat near _____ Pond.

1.2.4. Protect and improve upland habitat within the Larkin Valley Complex.

1.2.4.1 Implement upland habitat enhancement and management actions at the Calabasas Unit of the Ellicott Slough National Wildlife Refuge.

1.2.4.2 Enhance upland habitat near Suess Pond.

1.2.4.3 Enhance upland habitat near Olives Pond.

1.2.5 Protect and improve upland habitat within the McClusky Complex.

1.2.6 Protect and improve upland habitat within the Elkhorn Complex.

1.3. Establish and maintain connectivity and genetic exchange between subpopulations.

1.3.1. Enhance and maintain upland habitat corridors between subpopulations within Santa Cruz County.

1.3.1.1. Create and maintain wildlife corridors between the Valencia-Seascape and Freedom Complex.

1.3.1.2. Create and maintain wildlife corridors between the Ellicott-Buena Vista and Larkin Valley Complexes.

1.3.1.3. Enhance and maintain upland habitat and connectivity between the Valencia-Seascape and Ellicott-Buena Vista Complexes.

1.3.1.4. Enhance and maintain upland habitat corridors between the Freedom and Larkin Valley Complexes.

1.3.2. Enhance and maintain upland habitat corridors between subpopulations within Monterey County.

1.3.2.1. Create and manage upland habitat between McClusky and Zmudowski ponds.

1.3.2.2. Enhance and maintain upland habitat and connectivity between Lower Cattail Swale and Moro Cojo Slough.

1.3.2.3. Create and maintain wildlife corridors between the McClusky

and Elkhorn Complexes.

1.4. Manage the use of pesticides, herbicides, rodenticides, fertilizers, petroleum products, and other chemicals in aquatic and upland habitats.

2. Implement monitoring, research, management, and surveys associated with breeding populations.

2.1. Conduct long-term population dynamics studies.

2.2. Conduct larval sampling at breeding sites.

2.3. Continue research to determine genetic relationship within and among subpopulations.

2.4. Conduct research to monitor diseases and infections.

2.5. Conduct research on effects of contaminants.

2.6. Remove exotic predators from aquatic habitats.

2.7. Conduct upland drift fence/pitfall trap surveys.

2.8. Conduct surveys to compile data on roadkills.

2.9. Conduct surveys for additional breeding sites.

2.10. Create additional breeding ponds.

3. Ensure adequate regulatory mechanisms.

3.1. Continue developing conservation measures in section 7(a)(2) consultations with Federal agencies.

3.2. Encourage and assist in the development of Habitat Conservation Plans.

3.3. Continue developing conservation measures in coordination with the California Department of Fish and Game.

3.4. Work with County planners to minimize effects of urban and suburban development.

3.4.1. Work with the Counties of Santa Cruz and Monterey in development of a Regional Habitat Conservation Plan(s),

3.4.2. Ensure that Salamander Protection Zone regulations are enforced in Santa Cruz County,

3.4.3. Extend Salamander Protection Zones in Santa Cruz County.

3.4.4. Determine whether Salamander Protection Zones can be created in

Monterey County.

3.5. Coordinate with Aptos-La Selva Fire Protection District and the California Department of Forestry and Fire Protection to create effective vegetation management plans in Santa Cruz and Monterey Counties.

4. Encourage and develop outreach and public awareness.

4.1. Encourage public participation in Safe Harbor Agreements.

4.2. Continue public outreach programs at Ellicott Slough NWR and Elkhorn Slough National Estuarine Research Reserve.

4.3. Install and maintain informational signs around protected areas to educate the public.

4.4. Conduct public education and information programs.

B. Recovery Action Narrative

1. Develop self-sustaining populations of Santa Cruz long-toed salamanders.

Manage pond and upland habitats, establish and maintain connectivity between subpopulations, establish additional breeding ponds, reduce human-related mortality, and manage the use of chemicals in aquatic and upland habitats at the four complexes in Santa Cruz County (Seascape, Ellicott, Freedom, Calabasas), and at the two management units in Monterey County (McClusky and Elkhorn). These actions are focused toward achieving the first recovery objective, namely, the reclassification of the Santa Cruz long-toed salamander to threatened status.

1.1. Manage aquatic habitats so that they remain, or become, functional breeding sites.

If existing ponds are not capable of supporting breeding, larval development, and metamorphosis, they act as sinks, draining the population of individuals and *genetic diversity*. In the absence of recruitment of juvenile salamanders into a breeding population, salamander numbers will decline until the population is no longer capable of self-maintenance, either numerically or genetically. Management actions at aquatic habitats could include but are not limited to: removal of bullfrogs, exotic fishes, and exotic plants; repairs to pond bottoms (clay linings), culverts, or berms; reduction in sedimentation, and; reduction in chemical contamination. The Service should work with private landowners, Federal, State, and local agencies to implement these actions.

1.1.1. Improve management actions for Valencia Lagoon, such as recontouring the lagoon based on dimensions of ponds that are currently successful, developing a vegetation management plan for the lagoon and drainage channel, developing a channel maintenance plan, providing appropriate vegetative cover, and managing runoff into the lagoon and channel to ensure appropriate water level and water quality.

1.1.2. Continue management actions for the three Seascape Ponds, in association with the current Seascape Uplands Habitat Conservation Plan and Seascape Uplands Preserve.

1.1.3. Continue management actions for Ellicott Pond, especially regarding the ability of the pond to adequately retain water into the summer months, to ensure metamorphosis of juvenile Santa Cruz long-toed salamanders.

1.1.4. Implement management actions for Prospect Pond, at the Ellicott Slough National Wildlife Refuge. Management actions should include obtaining funds to implement drafted designs to deepen the pond to reach the water table as well as to provide an outlet for drainage, so that the pond can retain water into the summer months.

1.1.5. Develop and implement management actions for Green's Pond, beginning with re-establishing contact with the owner. Management actions should include, but are not limited to: inspecting the pond to determine if SCLTS still breed there; determining whether the pond holds water long enough through the year; determining the presence of exotic predators such as bullfrogs and mosquitofish, and removing them, if present.

1.1.6. Develop and implement management actions for Buena Vista Pond, recently acquired by the California Department of Fish and Game and to be managed as part of the Ellicott Slough National Wildlife Refuge.

1.1.7. Develop and implement management actions for Rancho Road Pond, beginning with determining if this breeding site exists anymore. If this site exists, we should re-establish contact with the owner. If the pond exists,

management actions should include, but are not limited to: inspecting the pond to determine if SCLTS still breed there; determining whether the pond holds water long enough through the year; determining the presence of exotic predators such as bullfrogs and mosquitofish, and removing them, if present.

1.1.8. Develop and implement management actions for Anderson's Pond, beginning with re-establishing contact with the owner. Management actions should include, but are not limited to: inspecting the pond to determine if SCLTS still breed there; determining whether the pond holds water long enough through the year, and; removing exotic predators such as bullfrogs and mosquitofish, if present.

1.1.9. Develop and implement management actions for Palmer Pond, including ensuring that water levels are adequately maintained into the summer months, to ensure complete metamorphosis. A culvert and/or the clay lining of the pond may need to be repaired, or water levels supplemented from an external source. A Safe Harbors Agreement could be developed between the current landowner and Aptos High School, located on a property adjacent to this pond.

1.1.10. Implement management actions for Tucker Pond, in association with a Habitat Conservation Plan currently being developed, and a proposed Tucker Preserve. Management actions at the pond would include removal of bullfrogs.

1.1.11. Develop and implement management actions for Millsap Pond, including the possible acquisition of the parcel on which this pond occurs. Management actions at the pond should include removal of exotic plants.

1.1.12. Develop and implement management actions for Merk Pond, including developing a working relationship with the owner. Management actions should include removal of bullfrogs, exotic fishes, and exotic plants, and using outreach and education to discourage the introduction of exotic fishes by local residents.

1.1.13. Develop and implement management actions for ___ Pond, including developing a working relationship with the owner. Management actions could

include ensuring that water quality of the pond is maintained.

1.1.14. Develop and implement management actions for Calabasas Pond, including repairing the breach in the pond's berm.

1.1.15. Develop and implement management actions for Suess Pond, including developing a working relationship with the owner. Management actions should include determining whether the pond holds water long enough through the year, and removing exotic predators such as bullfrogs and mosquitofish, if present.

1.1.16. Develop and implement management actions for Olives Pond, including working with the owner to establish a conservation easement for the pond. Management actions should include determining whether California red-legged frogs and bullfrogs are present; if bullfrogs are present, they should be removed. Water quality should be monitored at this site, to ensure that sedimentation is not a problem.

1.1.17. Develop and implement management actions for McClusky Slough in collaboration with landowners, the Natural Resources Conservation Service, Ducks Unlimited, and other parties, as necessary. Management activities should include but are not limited to removal of exotic predators such as bullfrogs and mosquitofish, reducing sedimentation and the input of chemical contaminants, and annual testing of the salinity of the water.

1.1.18. Develop and implement management actions for Zmudowski Pond, in collaboration with the California Department of Parks and Recreation. Management activities should include but are not limited to removal of any exotic predators such as bullfrogs and mosquitofish, reducing sedimentation and the input of chemical contaminants, and annual testing of the salinity of the water.

1.1.19. Determine viability of Bennett Slough/Struve Pond, by testing the salinity levels of the water, and conducting aquatic sampling for larvae. This location is no longer considered suitable breeding habitat for the species; however, the

potential presence of the species here should be monitored.

1.1.20. Develop and implement management actions for Lower Cattail Swale. Management activities should include but are not limited to: monitoring for the presence of bullfrogs and crayfish, and removing them, if present; improving water quality by reducing sedimentation and the input of chemical contaminants, and; controlling exotic plants.

1.1.21. Develop and implement management actions for Moro Cojo Slough. Management activities should include but are not limited to: monitoring for the presence of bullfrogs and crayfish, and removing them, if present; improving water quality by reducing sedimentation and the input of chemical contaminants, and; controlling exotic plants.

1.2. Ensure viability and protection of upland habitats associated with breeding sites. If upland habitats are degraded in quality or insufficient in size, mortality levels of juveniles, subadults, and adults would be too high for the local subpopulation to survive. Additionally, the subpopulation would not provide sufficient numbers of individuals to disperse to nearby ponds, decreasing genetic diversity. Upland habitats should be protected, enhanced through revegetation with native species (e.g., oaks) and the elimination of exotic plant species, and populations of small *fossorial* mammals (*e.g.*, gophers, mice, moles), and hence viable burrows, should be maintained. Populations of fossorial mammals in upland habitats should be controlled only as necessary, and control methods should be limited to mechanical methods only, such as trapping. The use of gas, rodenticides, and disking of burrows should be prohibited.

1.2.1. Protect and improve upland habitat within the Valencia-Seascape Complex.

1.2.1.1. Protect oak woodlands upslope from Valencia Lagoon, through purchasing undeveloped lots, establishing conservation agreements or easements, limiting loss of uplands on developed lots, and encouraging participation of landowners in Service programs such as Partners for Fish and Wildlife. Cooperation with the County of Santa Cruz and the Aptos-La Selva Fire

Protection District will be important to the protection of the remaining upland habitat in densely urbanized area, to ensure that Salamander Protection Zones are properly enforced, and to ensure that fire-control practices are designed to effectively meet fire codes, protect homes, while ensuring the existence of viable upland habitat which is sufficient to maintain a self-sustaining population of Santa Cruz long-toed salamanders at Valencia Lagoon.

1.2.1.2. Develop a management plan to implement an adequate habitat conservation plan for Willow Canyon that includes removal of exotic vegetation, revegetation with appropriate native species, and control of erosion and runoff. The Bush Gulch/Cuesta (Willow) Canyon drainage probably serves as a migration and dispersal corridor between Seascape Pond and Valencia Lagoon, and may provide a route for migrating salamanders to naturally reestablish the Valencia Lagoon subpopulation, if that pond and upland habitats can be restored to functional status.

1.2.1.3. Continue management actions at Seascape Uplands Preserve, including revegetation with native species, removal of exotic plant species, and erosion-control and slope stabilization measures. The current budget for the Seascape Uplands Preserve is inadequate to fund all necessary annual management actions at the Preserve, and will need to be supplemented.

1.2.2. Enhance upland habitat within the Ellicott-Buena Vista Complex. Management actions should include but are not limited to revegetation with native species, removal of exotic plant species (*e.g.*, eucalyptus, pampas grass), erosion-control measures to reduce sedimentation, and maintenance of populations (and thus, active burrows) of small fossorial mammals. Management actions will need to occur through cooperation with Federal agencies (the Refuge) and private landowners. Private landowners should be encouraged to participate in Service programs such as Partners for Fish and Wildlife, to enhance and maintain upland habitats.

1.2.2.1 Continue management actions at the Ellicott Slough National Wildlife Refuge, including removal of exotic plant species and maintenance of populations of small fossorial mammals.

1.2.2.2 Develop and implement management actions near Green's Pond, by establishing contact with the current landowner, and encouraging participation in a Service program like Partners for Fish and Wildlife, to enhance upland habitats. Management actions in upland habitats should include replanting with native vegetation, removal of exotic plant species, and maintenance of populations of small fossorial mammals.

1.2.2.3 Enhance upland habitat at Buena Vista uplands, which was acquired by Trust for Public Lands in year 2004, and will be managed by the Ellicott Slough National Wildlife Refuge. Management actions in upland habitats should include removing exotic plant species and maintaining populations of small fossorial mammals.

1.2.2.4. Develop and implement management actions near Anderson's Pond, by establishing contact with the current landowner, and encouraging participation in a Service program like Partners for Fish and Wildlife, to enhance upland habitats. Management actions in upland habitats should include replanting with native vegetation, removal of exotic plant species, and maintenance of populations of small fossorial mammals.

1.2.3. Protect and improve upland habitat within the Freedom Complex.
Management actions in uplands should include but are not limited to replanting with native species, removal of exotic plant species (*e.g.*, eucalyptus, pampas grass), erosion-control measures to reduce sedimentation into ponds, and maintenance of populations (and thus, active burrows) of small fossorial mammals. Management actions should occur through cooperation with California Department of Transportation, private landowners, and the Pajaro Valley Unified School District. Private landowners should be encouraged to participate in Service programs such as Partners for Fish and Wildlife, to enhance and maintain upland habitats. Private landowners should be encouraged to coordinate with the Service, the County, and possibly non-profit land trusts to develop conservation easements, to protect upland areas near breeding ponds.

1.2.3.1. Enhance upland habitat near Palmer Pond, by establishing contact with the landowner and the Pajaro Valley Unified School District, who

owns adjacent Aptos High School, and encouraging their cooperation in enhancing upland habitat. Management actions should include replanting with native species, removal of exotic plant species (*e.g.*, eucalyptus, pampas grass), erosion-control measures to reduce sedimentation, and maintenance of populations of small fossorial mammals.

1.2.3.2. Implement upland habitat enhancement near Tucker Pond. Management actions will occur during the implementation of the Tucker Pond Habitat Conservation Plan, and subsequent management of the Tucker Preserve, and will include removal of exotic plant species, erosion-control measures, and maintenance of populations of small fossorial mammals.

1.2.3.3. Enhance upland habitat near Millsap Pond. Management actions should include removal of exotic plant species (primarily eucalyptus trees), replanting with native vegetation, and maintenance of populations of small fossorial mammals. This pond and associated parcel may be sold to the California of Fish and Game by the landowner.

1.2.3.4. Enhance upland habitat near Merk Pond, by establishing contact with the current landowner, and encouraging participation in a Service program like Partners for Fish and Wildlife, to enhance upland habitats. Management actions in upland habitats should include replanting with native vegetation, removal of exotic plant species, and maintenance of populations of small fossorial mammals.

1.2.3.5. Enhance upland habitat near _____ Pond, by establishing contact with the current landowner, and encouraging participation in a Service program like Partners for Fish and Wildlife, to enhance upland habitats. Management actions should include…

1.2.4. Protect and improve upland habitat within the Larkin Valley Complex. Management actions should include but are not limited to replanting with native species, removal of exotic plant species (*e.g.*, eucalyptus, pampas grass),

erosion-control and slope-stabilization measures to reduce sedimentation into ponds, and maintenance of populations (and thus, active burrows) of small fossorial mammals. Management actions will need to occur through cooperation with Federal agencies (the Refuge), the County of Santa Cruz, and private landowners. The Service should work with the County of Santa Cruz in developing a Regional Habitat Conservation Plan for landowners in Larkin Valley. Private landowners should be encouraged to participate in Service programs such as Partners for Fish and Wildlife, to enhance and maintain upland habitats.

1.2.4.1. Implement upland habitat enhancement and management actions at the Calabasas Unit of the Ellicott Slough National Wildlife Refuge. Management actions should include inspections of boundary fencing ensure that trespass by horseback riders and motorcyclists is not occurring, as well as replanting maintaining native vegetation, removing exotic plant species, and maintaining populations of small fossorial mammals.

1.2.4.2. Enhance upland habitat near Suess Pond, by establishing contact with the current landowner, and encouraging participation in a Service program like Partners for Fish and Wildlife, to enhance upland habitats. Management actions in upland habitats should include replanting with native vegetation, removal of exotic plant species, and maintenance of populations of small fossorial mammals.

1.2.4.3. Enhance upland habitat near Olives Pond, though cooperation with current landowner. Management actions should include replanting willows and oaks, removing exotic plants such as eucalyptus and pampas grass, implementing erosion-control measures, and maintaining populations of small fossorial mammals. The landowner should be encouraged to participate a Service program such as Partners for Fish and Wildlife, to enhance upland a habitat.

1.2.5. Protect and improve upland habitat within the McClusky Complex, in collaboration with landowners, the California Department of Fish and Game, California Department of Parks and Recreation, Elkhorn Slough Foundation,

Natural Resources Conservation Service, Ducks Unlimited, and other parties as appropriate. Agricultural land adjacent to the existing upland habitats should be purchased, especially between McClusky Slough and Zmudowski Pond, and replanted with suitable upland plant species. The Service should coordinate with the County of Monterey and private landowners adjacent to McClusky Slough and Zmudowski Pond to develop Safe Harbor Agreements. Management actions should include but are not limited to replanting native species, removing exotic plant species, reducing sedimentation into ponds by implementing erosion-control measures, reducing and managing the use of pesticides and herbicides, coordinating the timing of certain agricultural activities with the breeding season of the Santa Cruz long-toed salamander, and maintaining populations (and thus, active burrows) of small fossorial mammals.

1.2.6. Protect and improve upland habitat within the Elkhorn Complex, in collaboration with landowners, the California Department of Fish and Game, Elkhorn Slough Foundation, Elkhorn Slough National Estuarine Research Reserve, Natural Resources Conservation Service, and other parties as appropriate. Agricultural land adjacent to the existing upland habitats should be purchased, in the Elkhorn Highlands, and next to Moro Cojo Slough, and enhanced and replanted with suitable upland plant species. The Service should coordinate with the County of Monterey and private landowners (especially agricultural landowners) adjacent to Moro Cojo Slough to develop Safe Harbor Agreements. Management actions should include but are not limited to replanting native species, removing exotic plant species, reducing sedimentation into ponds by implementing erosion-control measures and modifying agricultural practices, reducing and managing the use of pesticides and herbicides, coordinating the timing of certain agricultural activities with the breeding season of the Santa Cruz long-toed salamander, and maintaining populations (and thus, active burrows) of small fossorial mammals.

1.3. Establish and maintain connectivity and genetic exchange between subpopulations, by enhancing upland habitat, developing urban wildlife corridors, and installing salamander tunnels between subpopulations. The Service should collaborate with researchers, landowners, the Federal Highway Administration, the California Department of Transportation, the Santa Cruz County Planning Department, and the

Monterey County Planning Department to design and construct urban wildlife corridors under and/or over California Highway 1, in order to allow for genetic exchange between subpopulations currently separated and isolated from each other by the highway. The Service should coordinate with researchers and the Counties of Santa Cruz and Monterey to design and install salamander tunnels or under-road crossings, where practicable and necessary. Management actions should include but are not limited to elevating Highway 1 at appropriate locations, to allow for passage of Santa Cruz long-toed salamanders under the freeway, designing and installing salamander tunnels, replanting native upland plant species, and removing exotic species (e.g., eucalyptus, pampas grass).

1.3.1. Enhance and maintain upland habitat corridors between subpopulations within Santa Cruz County.

1.3.1.1. Create and maintain wildlife corridors between the Valencia-Seascape and Freedom Complexes, by coordinating with private individuals, researchers, the Federal Highway Administration, and California Department of Transportation to design, find appropriate locations to place, construct, and maintain urban wildlife corridors, such as underpasses, to allow Santa Cruz long-toed salamanders to cross under Highway 1 with a reduced risk of mortality.

1.3.1.2. Create and maintain wildlife corridors between the Ellicott-Buena Vista and Larkin Valley Complexes, by coordinating with private individuals, researchers, the Federal Highway Administration, and California Department of Transportation to design, find appropriate locations to place, construct, and maintain urban wildlife corridors, such as underpasses, to allow Santa Cruz long-toed salamanders to cross under Highway 1 with a reduced risk of mortality due to vehicles.

1.3.1.3. Enhance and maintain upland habitat and connectivity between the Valencia-Seascape and Ellicott-Buena Vista Complexes, by coordinating with the County of Santa Cruz, researchers, and private landowners. Management actions should include but are not limited

to: replanting native upland plant species; removing exotic plant species (*e.g.*, eucalyptus, pampas grass), and; designing, establishing locations for, and installing salamander tunnels or underpasses.

1.3.1.4. Enhance and maintain upland habitat corridors between the Freedom and Larkin Valley Complexes, by coordinating with the County of Santa Cruz, researchers, and private landowners. Management actions should include but are not limited to: replanting native upland plant species; removing exotic plant species (e.g., eucalyptus, pampas grass), and; designing, establishing locations for, and installing salamander tunnels or underpasses.

1.3.2. Enhance and maintain upland habitat corridors between subpopulations within Monterey County.

1.3.2.1. Create and manage upland habitat between McClusky and Zmudowski ponds, by coordinating with private landowners, the California Department of Fish and Game, California Department of Parks and Recreation, County of Monterey, Nature Conservancy, Elkhorn Slough Foundation, and others as appropriate, to purchase land on which to create and manage upland habitat. Management actions should include the planting of native trees such as willows and oaks, and maintenance of populations of small fossorial mammals.

1.3.2.2. Enhance and maintain upland habitat and connectivity between Lower Cattail Swale and Moro Cojo Slough, by coordinating with private landowners and the Elkhorn Slough Foundation to purchase, enhance, and manage upland habitat in the Elkhorn Highlands, upper reaches of Moro Cojo Slough, and areas between Lower Cattail Swale and Moro Cojo Slough. Management actions should include the planting native trees such as willows and oaks, and maintaining populations of small fossorial mammals. The Service should coordinate with the County of Monterey, private landowners, and researchers to design, develop, establish locations for, and install salamander tunnels or underpasses along Castroville Boulevard.

1.3.2.3. Create and maintain wildlife corridors between the McClusky and Elkhorn Complexes. The service should cooperate with the Elkhorn Slough Foundation, private landowners, the California Department of Fish and Game, the Nature Conservancy, and others as appropriate, to purchase agricultural land on which upland habitat could be created, to serve as migration corridors between the McClusky and Elkhorn Complexes. Additionally, the Service should cooperate with landowners, the Federal Highway Administration, the California Department of Transportation, the County of Monterey to design, find appropriate locations to place, construct, and maintain urban wildlife corridors, such as underpasses, to allow Santa Cruz long-toed salamanders to cross under Highway 1 with a reduced risk of mortality due to vehicles.

1.4. Manage the use of pesticides, herbicides, rodenticides, fertilizers, petroleum products, and other chemicals in aquatic and upland habitats, and evaluate new information on the effects of these chemicals on amphibians and their prey base. Make recommendations for the use of such chemicals in and near Santa Cruz long-toed salamander habitat and work with appropriate agencies to implement adequate regulations and management practices to protect the salamanders.

2. Implement monitoring, research, management, and surveys associated with breeding populations.

2.1. Conduct long-term population dynamics studies, by conducting drift fence/pitfall trap research at aquatic habitats. Studies should be designed to monitor the dispersal from the pond of juveniles during the fall, and the arrival and departure of adults to and from the aquatic habitat. Additionally, understanding the natural fluctuations in population parameters (sex ratios, number of adults breeding, egg production rates, egg and larval survival, age distribution) is essential to gauge whether a subpopulation is self-sustaining, and to understand and assess how management actions affect the survival and recovery of the species.

2.2. Conduct larval sampling at breeding sites, and at sites where breeding has not yet

been confirmed, to determine whether breeding has occurred, and to measure the growth rate of Santa Cruz long-toed salamander larvae during the season.

2.3. Continue research to determine genetic relationship within and among subpopulations, using toe clippings obtained from monitoring programs and marking studies. The results can be used to determine the source of founder individuals if re-establishment of any breeding aggregation becomes necessary (for example, at Valencia Lagoon, if the pond is appropriately reconfigured but not enough salamanders migrate to it to establish a healthy breeding aggregation).

2.4. Conduct research to monitor diseases and infections, such as chytridiomycosis and trematode infections, at all breeding sites.

2.5. Conduct research on effects of contaminants.

2.6. Remove exotic predators from aquatic habitats, using qualified biologists. Exotic predators include bullfrogs, non-native fish such as mosquitofish, and crayfish.

2.7. Conduct upland drift fence/pitfall trap surveys, to better understand patterns of upland habitat use, and to better determine the distances that Santa Cruz long-toed salamanders are capable of traveling overland.

2.8. Conduct surveys to compile data on roadkills. Volunteers could be trained to identify Santa Cruz long-toed salamanders, and walk residential roads near breeding sites on rainy winter nights, to quantify and determine locations of Santa Cruz long-toed salamanders found dead on roads. Additionally, citizens should be encouraged to contact biologists, the Counties, or the Service to report the date and location of any Santa Cruz long-toed salamanders found dead on roads. Compiling these data could help to better understand patterns of overland movement of Santa Cruz long-toed salamanders, and help identify locations where salamander tunnels or underpasses could be constructed to minimize mortality due to vehicles.

2.9. Conduct surveys for additional breeding sites. Surveys should be conducted: a) in the Freedom Complex, on properties between and near Tucker and Millsap ponds, near Merk Pond, and at Corralitos Lagoon; b) in the Larkin Valley Complex, along

Larkin Valley Road, and in between Larkin Valley Road and Highway 1; c) in the McClusky Complex, on properties south of Trafton Road, approximately one to one and half miles north of McClusky Slough, and; d) in the Elkhorn Complex, in the upper reaches of Moro Cojo Slough, and in the uplands east of Elkhorn Slough. Surveys should also be conducted in each complex to determine possible locations where restoration ponds may be created . Prior permission must be obtained from private landowners of any property where surveys occur.

2.10. Create additional breeding ponds, as necessary, and based upon results from surveys for additional breeding sites. Establishing and maintaining at least three functional breeding sites in each complex would provide a "safety net" in the event that one of the ponds becomes nonfunctional as a breeding site. This could ensure that a sufficient number of Santa Cruz long-toed salamanders and an appropriate level of genetic diversity remains to allow for the persistence of subpopulations. The Service should coordinate with entities such as the California Wildlife Conservation Board to allocate funds for creation and restoration of aquatic habitats, and all agencies should coordinate with private landowners in creating and maintaining additional breeding ponds.

3. Ensure adequate regulatory mechanisms.

3.1. Continue developing conservation measures in section 7(a)(2) consultations with Federal agencies. For example, the Service has recommended that the U.S. Army Corps of Engineers and the County of Santa Cruz work with the California Department of Transportation and local landowners to identify and address drainage and erosion problems along Freedom Boulevard that are resulting in severe sedimentation near Valencia Lagoon.

3.2. Encourage and assist in the development of Habitat Conservation Plans. The Service and Counties of Santa Cruz and Monterey should encourage private landowners to participate in non-traditional Section 6 funding programs to assist in the development of habitat conservation plans. The Service should assist the Counties of Santa Cruz and Monterey in the development of regional habitat conservation plans.

3.3. Continue developing conservation measures in coordination with the California Department of Fish and Game, including land acquisition through the Wildlife Conservation Board.

3.4. Work with County planners to minimize effects of urban and suburban development.

3.4.1. Work with the Counties of Santa Cruz and Monterey in development of a Regional Habitat Conservation Plan(s), particularly regarding development projects such as the construction of houses, resulting in the loss and modification of upland habitat.

3.4.2. Ensure that Salamander Protection Zone regulations are enforced in Santa Cruz County, particularly regarding grading restrictions, installation of curbs and gutters, planting of native vegetation, and development of conservation easements.

3.4.3. Extend Salamander Protection Zones in Santa Cruz County. Currently, Salamander Protection Zones pertain to properties in the immediate vicinity of Valencia Lagoon. The Service should encourage the County of Santa Cruz to extend the Salamander Protection Zone regulations to other areas, such as properties within the Freedom and Larkin Valley Complexes.

3.4.4. Determine whether Salamander Protection Zones can be created in Monterey County. The Service should coordinate with the County of Monterey, with advice from the County of Santa Cruz, to determine if this feasible.

3.5. Coordinate with Aptos-La Selva Fire Protection District and the California Department of Forestry and Fire Protection to create effective vegetation management plans in Santa Cruz and Monterey Counties. The California Department of Forestry and Fire Protection and local government fire departments have come to recognize that the accumulation of flammable vegetation within "wildland urban interface" and "wildland urban intermix" could create a potential for loss of life, and residential and commercial properties. The Service should coordinate with fire departments and districts to implement vegetation management plans that are compatible with maintaining upland habitat for the Santa Cruz long-toed salamander.

4. Encourage and develop outreach and public awareness.

4.1. Encourage public participation in Safe Harbor Agreements, which could encourage activities such as planting of native vegetation and removal of exotic plants.

4.2. Continue public outreach programs at Ellicott Slough NWR and Elkhorn Slough National Estuarine Research Reserve, by continuing to provide information and descriptive leaflets and small pamphlets, prepared for visitors to the Ellicott Slough Ecological Reserve and National Wildlife Refuge and Elkhorn Slough National Estuarine Research Reserve. Similar pamphlets should be made available for any other sites that allow public access.

4.3. Install and maintain informational signs around protected areas to educate the public. Existing informational signs at Valencia Lagoon and Ellicott Slough National Wildlife Refuge inform visitors about the sensitivity and importance of the protected areas. These signs should be posted and maintained at all sites that are open to the public or accessible to the residents of surrounding developments.

4.4. Conduct public education and information programs. The Service should encourage or coordinate informational programs for landowners and agricultural land managers near McClusky Slough, Zmudowski Pond, and Moro Cojo Slough, describing the Santa Cruz long-toed salamander, its habitat needs, and characteristics of its life history.

V. IMPLEMENTATION SCHEDULE

The schedule that follows (Table 3) summarizes the actions and their estimated costs for the Santa Cruz long-toed salamander draft revised recovery program. It is a guide to meet the objectives of this recovery plan as elaborated in the narrative section of the plan (Section IV). This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of this salamander and protect its habitat. Because the schedule estimates the monetary needs for all parties involved in the salamander's recovery, it covers the entire estimated cost of recovery.

1. Priority. The priority for each action is given in the first column of the implementation schedule. Priorities are assigned as follows: Priorities are defined as follows:

Priority 1 - An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in the species' population or 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.

2. Action Number and Description. The action number and description are extracted from the Stepdown Narrative found in Part IV of the recovery plan. Please refer back to this narrative for a more detailed description of each action.

3. Action Duration. The action duration column indicates the number of years estimated to complete the action if it is a discrete action, or whether it is a continual or ongoing action.

Definition of action durations and costs:

Continual - An action that will be implemented on a routine basis once begun.

Ongoing - An action that is currently being implemented and will continue until the action is no

longer necessary for recovery.

TBD - To be determined.

Unknown - Action duration, responsible party, or associated costs are not known.

4. Responsible Parties. In the implementation schedule, we have identified agencies and other parties that are primary stakeholders in the recovery process. The list of potential stakeholders is not limited to the list below; other stakeholders are invited to participate. The most logical lead agency or agencies from the list of responsible parties (based on authorities, mandates, and capabilities) has been identified with an asterisk (*). The following terms and abbreviations are used to indicate the responsible party for each recovery action:

AFPD	–	Aptos-La Selva Fire Protection District
AHS	–	Aptos High School (Pajaro Valley Unified School District)
All	–	all of the parties listed here
BRD	–	Biological Resources Division, U.S. Geological Survey
CDA	–	California Department of Agriculture
CDFFP	–	California Department of Forestry and Fire Protection
CDFG	–	California Department of Fish and Game
CDPR	–	California Department of Parks and Recreation
CDT	–	California Department of Transportation
CNLM	–	Center for Natural Lands Management
DU	–	Ducks Unlimited
EPA	–	Environmental Protection Agency
ESF	–	Elkhorn Slough Foundation
ESNERR	–	Elkhorn Slough National Estuarine Research Reserve
ESNWR	–	Ellicott Slough National Wildlife Refuge
FHWA	–	Federal Highway Administration, U.S. Department of Transportation
FWS	–	U.S. Fish and Wildlife Service
LF	–	local farmers
LTSC	–	Land Trust of Santa Cruz County
LO	–	Landowners
MCPD	–	Monterey County Planning Department
NSMAD	–	Northern Salinas Valley Mosquito Abatement District

NRCS	–	Natural Resources Conservation Service
PR	–	permitted researchers
SCCPD	–	Santa Cruz County Planning Department
SCMAD	–	Santa Cruz County Mosquito Abatement District
SCRCD	–	Santa Cruz County Resource Conservation District
TBD	–	To Be Determined
TNC	–	The Nature Conservancy
TPL	–	Trust for Public Lands
WCE	–	Willow Canyon Enterprises, Inc.
WI/CSUMB	–	Wetlands Institute, California State University Monterey Bay

5. Cost Estimates. Estimated total and annual cost for each recovery action for the first 5 years after release of the recovery plan are shown. Total costs for continual and ongoing actions are based on the estimated time to recovery. The costs include estimated salaries for individuals who will carry out identified actions. However, these costs are approximate and based primarily on estimates by biologists, managers, and consultants familiar with the species. In most cases these costs were estimated without the benefit of a scope-of-work or any other type of bid process. Typically, the responsible party (or lead agency) bears the largest share of the cost, with other stakeholders as contributors. The inclusion of estimated costs in this recovery plan does not commit any agency or party to an expenditure of funds. Therefore, initiation and completion of these actions is subject to the availability of funds as well as other constraints affecting the stakeholders involved.

Table 3. Implementation schedule of recovery actions for the Santa Cruz long-toed salamander, Santa Cruz and Monterey Counties,
during the years 2005-2020.

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
	1	**Develop self-sustaining populations of Santa Cruz long-toed salamanders.**	15	All							
	1.1	Manage aquatic habitats so that they remain, or become, functional breeding sites	15	APH, CDFG, CDPR, CDT, CNLM, DU, ESNWR, FWS, LO, NRCS, PR							
	1.1.1	Improve management actions for Valencia Lagoon.	15	CDFG	5	5	5	5	5	50	75
				CDT	5	5	5	5	5	50	75
				FWS	5	5	5	5	5	50	75
	1.1.2	Continue management actions for the three Seascape Ponds.	15	CNLM	7.5	7.5	7.5	7.5	7.5	75	112.5
	1.1.3	Develop and implement management actions for Ellicott Pond.	15	ESNWR	5	5	5	5	5	50	75
	1.1.4	Implement management actions for Prospect Pond.	15	ESNWR	5	5	5	5	5	50	75
	1.1.5	Develop and implement management actions for Green's Pond.	5	ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.1.6	Develop and implement management actions for Buena Vista Pond.	5	ESNWR	5	5	5	5	5	50	75
	1.1.7	Develop and implement management actions for Rancho Road Pond.	5	ESNWR	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
				FWS	0	0	0	0	0	0	0
	1.1.8	Develop and implement management actions for Anderson's Pond.	10	ESNWR	0	0	0	0	0	0	0
			10	FWS	0	0	0	0	0	0	0
			10	LO	0	0	0	0	0	0	0
	1.1.9	Develop and implement management actions for Palmer Pond.	15	APH	0	0	0	0	0	0	0
			15	CDFG	0	0	0	0	0	0	0
			15	FWS	0	0	0	0	0	0	0
			15	LO	0	0	0	0	0	0	0
	1.1.10	Implement management actions for Tucker Pond.	15	LO	9	6.4	19	6.4	6.4	49.6	96.8
	1.1.11	Develop and implement management actions for Millsap Pond.	15	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
	1.1.12	Develop and implement management actions for Merk Pond.	10	CDFG	0	0	0	0	0	0	0
			10	FWS	0	0	0	0	0	0	0
			10	LO	0	0	0	0	0	0	0
	1.1.13	Develop and implement management actions for ___ Pond.	10	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.1.14	Develop and implement management actions for Calabasas Pond.	15	ESNWR	1	1	1	1	1	10	15
	1.1.15	Develop and implement management actions for Suess Pond.	10	CDFG	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.1.16	Develop and implement management actions for Olives Pond.	10	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
	1.1.17	Develop and implement management actions for McClusky Slough.	15	CDFG	0	0	0	0	0	0	0
				DU	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				NRCS	0	0	0	0	0	0	0
	1.1.18	Develop and implement management actions for Zmudowski Pond.	15	CDFG	0	0	0	0	0	0	0
				CDPR	0	0	0	0	0	0	0
				DU	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				NRCS	0	0	0	0	0	0	0
	1.1.19	Determine viability of Bennett Slough/Struve Pond.	3	NRCS	0	0	0	0	0	0	0
	1.1.20	Develop and implement management actions for Lower Cattail Swale.	15	ESNERR	2	2	2	2	2	2	12
	1.1.21	Develop and implement management actions for Moro Cojo Slough.	15	ESNERR	2	2	2	2	2	2	12
	1.2	Ensure viability and protection of upland habitats associated with breeding sites.	15	AFPD, CDFFP, CDFG, FWS, LO, SCCPD							
	1.2.1	Protect and improve upland habitat within the Valencia-Seascape Complex.	15	AFPD, CDFFP, CDFG, FWS, LO, SCCPD							
	1.2.1.1	Protect and improve oak woodlands upslope from Valencia Lagoon.	15	CDFG	0	0	0	0	0	0	0
			10	LO	0	0	0	0	0	0	0
			15	FWS	0	0	0	0	0	0	0
			15	SCPD	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
	1.2.1.2	Develop a management plan to implement an adequate habitat conservation plan for Willow Canyon.	10	FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.2.1.3	Continue management actions at Seascape Uplands Preserve.	15	CNLM	14	14	14	14	14	112	182
			15	FWS	1	1	1	1	1	8	13
	1.2.2	Enhance upland habitat within the Ellicott-Buena Vista Complex	15	CDFG, ESNWR, FWS, LO							
	1.2.2.1	Continue management actions at the Ellicott Slough National Wildlife Refuge.	15	ESNWR	10	10	10	10	10	100	150
	1.2.2.2	Develop and implement management actions near Green's Pond.	10	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.2.2.3	Enhance upland habitat at Buena Vista.	15	ESNWR	5	5	5	5	5	50	75
	1.2.2.4	Develop and implement management actions near Anderson's Pond.	10	CDFG	0	0	0	0	0	0	0
			10	FWS	0	0	0	0	0	0	0
			10	LO	0	0	0	0	0	0	0
	1.2.3	Protect and improve upland habitat within the Freedom Complex.	15	AHS, CDFG, FWS, LO, LTSC							
	1.2.3.1	Enhance upland habitat near Palmer Pond.	10	AHS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.2.3.2	Implement upland habitat enhancement near Tucker Pond.	10	CNLM, LO	14	1.5	1.5	1.5	1.5	12.5	32.5
	1.2.3.3	Enhance upland habitat near Millsap Pond.	10	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.2.3.4	Enhance upland habitat near Merk Pond.	10	CDFG	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
			10	FWS	0	0	0	0	0	0	0
			10	LO	0	0	0	0	0	0	0
	1.2.3.5	Enhance upland habitat near _____ Pond.	10	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.2.4	Protect and improve upland habitat within the Larkin Valley Complex.	15	APH, CDFG, ESNWR, FWS, LO, LTSC							
	1.2.4.1	Implement upland habitat enhancement and management actions at the Calabasas Unit of the Ellicott Slough National Wildlife Refuge.	15	ESNWR	5	5	5	5	5	50	75
	1.2.4.2	Enhance upland habitat near Suess Pond.	10	CDFG	0	0	0	0	0	0	0
			10	FWS	0	0	0	0	0	0	0
			10	LO	0	0	0	0	0	0	0
	1.2.4.3	Enhance upland habitat near Olives Pond.	10	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.2.5	Protect and improve upland habitat within the McClusky Complex.	15	CDFG CDPR DU ESF FWS LO MCPD NC NRCS	0	0	0	0	0	0	0
	1.2.6	Protect and improve upland habitat within the Elkhorn Complex.	15	CDFG ESF ESNERR	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
				FWS LO MCPD NRCS							
	1.3	Establish and maintain connectivity and genetic exchange between subpopulations.	15								
	1.3.1	Enhance and maintain upland habitat corridors between subpopulations within Santa Cruz County.	15	CDFG, CDT, FHWA, FWS, LO, SCPD							
	1.3.1.1	Create and maintain wildlife corridors between the Valencia-Seascape and Freedom Complexes.	15	CDFG	0	0	0	0	0	0	0
				CDT	0	0	0	0	0	0	0
				FHWA	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	1.3.1.2	Create and maintain wildlife corridors between the Ellicott-Buena Vista and Larkin Valley Complexes.	15	CDFG	0	0	0	0	0	0	0
				CDT	0	0	0	0	0	0	0
				FHWA	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	1.3.1.3	Enhance and maintain upland habitat and connectivity between the Seascape and Ellicott-Buena Vista Complexes.	15	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
	1.3.1.4	Enhance and maintain upland habitat corridors between the Freedom and Larkin Valley Complexes.	15	CDFG, FWS, LO, SCPD	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	1.3.2	Enhance and maintain upland habitat corridors between subpopulations within Monterey County.	15	CDFG, CDPR, CDT, ESF, FHWA, FWS, LO, MCPD, NC							
	1.3.2.1	Create and manage upland habitat between McClusky and Zmudowski Ponds.	15	CDFG	0	0	0	0	0	0	0
				CDPR	0	0	0	0	0	0	0
				ESF	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				NC	0	0	0	0	0	0	0
	1.3.2.2	Enhance and maintain upland habitat and connectivity between Lower Cattail Swale and Moro Cojo Slough.	15	CDFG	0	0	0	0	0	0	0
				ESF	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
	1.3.2.3	Create and maintain wildlife corridors between the McClusky and Elkhorn Complexes.	15	CDFG	0	0	0	0	0	0	0
				CDT	0	0	0	0	0	0	0
				ESF	0	0	0	0	0	0	0
				FHWA	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
				MCPD	0	0	0	0	0	0	0
				NC	0	0	0	0	0	0	0
	1.4	Manage the use of pesticides, herbicides, rodenticides, fertilizers, petroleum products, and other chemicals in aquatic and upland habitats.	15	CDFG	0	0	0	0	0	0	0
				EPA	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LF	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				NSMAD	0	0	0	0	0	0	0
				SCMAD	0	0	0	0	0	0	0
	2	**Implement monitoring, research, management, and surveys associated with breeding populations.**	15	BRD, CDFG, CNLM, ESNERR, ESNWR, FWS, LTSC							
	2.1	Conduct long-term population dynamics studies.	15	BRD	0	0	0	0	0	0	0
				CDFG	0	0	0	0	0	0	0
				CNLM	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LTSC	0	0	0	0	0	0	0
	2.2	Conduct larval sampling at breeding sites.	15	BRD	0	0	0	0	0	0	0
				CDFG	0	0	0	0	0	0	0
				CNLM	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LTSC	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
	2.3	Continue research to determine genetic relationship within and among subpopulations.	2	PR	0	0	0	0	0	0	0
	2.4	Conduct research to monitor diseases and infections.	5	PR	0	0	0	0	0	0	0
	2.5	Conduct research on effects of contaminants.	15	CDFG	0	0	0	0	0	0	0
				EPA	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				NRCS	0	0	0	0	0	0	0
	2.6	Remove exotic predators from aquatic habitats.	15	CDFG	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	2.7	Conduct upland drift fence/pitfall trap surveys.	15	BRD	0	0	0	0	0	0	0
				CDFG	0	0	0	0	0	0	0
				CNLM	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
	2.8	Conduct surveys to compile data on roadkills.	5	BRD	0	0	0	0	0	0	0
				CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	2.9	Conduct surveys for additional breeding sites.	2	BRD	0	0	0	0	0	0	0
				CDFG	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
				FWS	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	2.10	Create additional breeding ponds.	5	CDFG	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	3.	**Ensure adequate regulatory mechanisms.**	15	CDFG, FWS, MCPD, SCPD							
	3.1	Continue developing conservation measures in section 7(a)(2) consultations with Federal agencies.	15	CDT	0	0	0	0	0	0	0
				EPA	0	0	0	0	0	0	0
				FHWA	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
	3.2	Encourage and assist in the development of Habitat Conservation Plans.	15	FWS	0	0	0	0	0	0	0
				LO	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	3.3	Continue developing conservation measures in coordination with the California Department of Fish and Game.	15	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
	3.4	Work with County planners to minimize effects of urban and suburban development.	15	CDFG, FWS, LO, MCPD, SCPD							
	3.4.1	Work with the Counties of Santa Cruz and Monterey in development of a Regional Habitat Conservation Plan(s).	5	FWS	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	3.4.2	Ensure that Salamander Protection Zone regulations are enforced in Santa Cruz County.	15	FWS	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	3.4.3	Extend Salamander Protection Zones in Santa Cruz County.	15	FWS	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	3.4.4	Determine whether Salamander Protection Zones can be created in Monterey County.	15	FWS	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
	3.5	Coordinate with Aptos/La Selva Fire Protection District and the California Department of Forestry to create effective vegetation management plans in Santa Cruz and Monterey Counties.	15	AFPD	0	0	0	0	0	0	0
				CDFFP	0	0	0	0	0	0	0
				CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	4.	**Encourage and develop outreach and public awareness.**	15								
	4.1	Encourage public participation in Safe Harbor Agreements.	15	CDFG	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0

Action Priority	Action No.	Action Description	Action Duration (years)	Participants	2005	2006	2007	2008	2009	2010-2020	Total Costs
				LO	0	0	0	0	0	0	0
				LTSC	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				NRCS	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
	4.2	Continue public outreach programs at Ellicott Slough NWR and Elkhorn Slough National Estuarine Research Reserve.	15	CDFG	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
	4.3	Install and maintain informational signs around protected areas to educate the public.	15	CDFG	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
	4.4	Conduct public education and information programs.	15	CDFG	0	0	0	0	0	0	0
				DU	0	0	0	0	0	0	0
				ESNERR	0	0	0	0	0	0	0
				ESNWR	0	0	0	0	0	0	0
				FWS	0	0	0	0	0	0	0
				MCPD	0	0	0	0	0	0	0
				NSMAD	0	0	0	0	0	0	0
				SCMAD	0	0	0	0	0	0	0
				SCPD	0	0	0	0	0	0	0
Grand total of estimated costs of recovery actions 1 through 4, for years 2005-2020											

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VII. APPENDICES

Appendix A. Glossary of Terms

alluvium a general term for clay, silt, sand, gravel, or similar unconsolidated material deposited by a stream or other body of running water.

ambystomatid a salamander belonging to the Family Ambystomatidae.

anterior to in front of.

anthropogenic made by people or resulting from human activities.

aquatic of or in water; streams, lakes, rivers, ponds, and marshes are aquatic habitats.

breeding site for Santa Cruz long-toed salamanders, refers to aquatic habitat in which breeding has been confirmed, by presence of eggs, larvae, or adults in breeding condition.

breeding success for Santa Cruz long-toed salamanders, defined here as the normal development and hatching of eggs, and metamorphosis of larvae.

bti a naturally occurring bacterium (*Bacillus thuringiensis israelensis*) that is marketed commercially as a larvicide.

chaparral a thicket of shrubby evergreen oaks or a low-growing type of vegetation, composed mainly of species which are adapted to seasonal and periodic drought.

chytrid fungus (pronounced KIT-rid) a recently described fungus (*Batrachochytrium dendrobatidis*) that affects the keratinized epidermis of amphibians, such as occurs in the mouthparts.

chytridimycosis a disease of amphibians caused by a fungus (*Batrachochytrium dendrobatidis*), which has been detected worldwide over an increasing geographic range. Why amphibians with chytridiomycosis die is not known.

colonization the act or process of establishing a new colony or population.

desiccation drying out.

digenetic requiring two or more hosts.

dorsal	referring to the back or upper side of an organism.
ecology	the study of the relationships between living organisms and their environment.
ephemeral	short-lived; existing or continuing for a short time only. For Santa Cruz long-toed salamanders, ephemeral ponds contain water generally from November through August.
exotic	not native to the area, introduced from another region or country.
extant	still in existence; not extinct, destroyed or lost.
extinction	no longer in existence.
extirpation	elimination of a species in part of its range.
foraging ecology	the study of how organisms search for and capture prey.
fossorial	leading a burrowing, digging lifestyle.
genetic	determined by genes or chromosomes.
herbicide	any chemical substance that is toxic to plants; usually used to kills specific unwanted plants, especially weeds.
insecticide	a chemical used to kill or control certain populations of insect pests.
invertebrate	an animal without a backbone.
juvenile	physiologically immature.
larva	(plural 'larvae'; adjective 'larval') the early form of an animal (*e.g.*, amphibians, fish, insects) that at birth or hatching is unlike its parent and must transform to assume the adult characters.
larvicide	a chemical used to kill larval pests.
mark-recapture	the tagging or marking, release and recapture of organisms to estimate population size, movements, migrations, mortality and growth.
metamorphosis	for salamanders, the process of changing from an aquatic form (larva) to a form adapted for a terrestrial lifestyle. This process includes the resorption of gills, the development and use of lungs, and the development and use of limbs.

metapopulation a group of subpopulations that are genetically interconnected through occasional exchange of animals. While individual populations may go extinct, a metapopulation is likely to persist through colonization or recolonization events that establish new subpopulations.

methoprene an insecticide (chemical formula ' $C_{19}H_{34}O_3$) that arrests growth at the larval stage of development.

mosquitofish silvery topminnow (genus *Gambusia*) of tropical North America and West Indies; used in mosquito control.

nocturnal active during the night.

pesticide a general term for compounds used to kill invertebrate organisms considered pests, including slugs, nematodes, insects, and mites.

parasite an animal or plant that lives in or on a host (another animal or plant); the parasite obtains nourishment from the host without benefiting or killing the host.

pesticide a chemical substance that kills pests, such as insects.

Pleistocene epoch the time period between about 10,000 years before present and about 1,650,000 years before present. Best known as a time of extensive continental ice sheets.

population in the wider sense, all members of a species throughout its range. In the narrower sense, used to refer to all members of a species in one particular locality; a collection of individuals that share a common gene pool.

recruitment the addition of new members to a population or subpopulation.

relict an organism or species surviving as a remnant of an otherwise extinct flora or fauna in an environment much changed from that in which it originated.

restoration the process of reestablishing a self-sustaining habitat that closely resembles a natural condition in terms of structure and function.

riparian pertaining to rivers, or occurring on the bank of a river or other body of water.

rodenticide any chemical used to kill rodents (*e.g.*, mice, voles, gophers).

saltwater intrusion movement of saltwater into freshwater aquifers.

sex ratio	the relative number of males and females in a population; expressed as a simple ratio.
stock pond	a body of water used solely for watering livestock or wildlife.
subpopulation	a population that is part of a larger population.
subspecies	a taxonomic subdivision of a species.
taxonomy	the science of naming and classifying organisms.
transformation	completion of metamorphosis of salamanders from a larval to a juvenile form.
trematode	parasitic flatworms having external suckers for attaching to a host.
ventral	referring to the underside of an organism.
vernal pool	seasonally-flooded depression found on soils with an impermeable layer such as a hardpan, claypan, or volcanic basalt.
wildlife corridor	a strip or block of habitat connecting otherwise isolated units of suitable habitats that allows the dispersal of organisms and the consequent mixing of genes.

Appendix B. Data from surveys and population-monitoring research at 22 breeding locations for the Santa Cruz long-toed salamander, Santa Cruz and Monterey Counties, California.

Breeding Location	Year	Data	Adult Population Estimate or [Actual]	Adult ♂:♀ sex-ratio (*n*)	Adult (♂/♀) avg. svl	Adult (♂/♀) avg. wt.	Juv. max. avg. svl	Juv. max. avg. wt.	Source
Santa Cruz County									
Valencia-Seascape Complex									
Valencia Lagoon	1977-1978	est. 2208 ± 1344 juveniles	2,583 ± 120	1:1 (911:916)	52.1/54.4				Reed 1979
	1997	Larvae present							Service 1999
	2001	Larvae present							Service files
	2003	Larval tissue collected							Savage, pers comm
	2004	Larval tissue collected							Savage, pers comm
Seascape Pond 1	1986		1468 ± 60						
	1998-1999	4,330 juveniles (estimate)	1,833 ± 131		61.17/61.63	5.01/5.91	38.2	1.06	Laabs 2002
	1998-1999		2,863 ± 381	1.6:1 (797:501)					Laabs 2000, Laabs 2004
	1999-2000	1,124 juveniles (estimate)	2,041 ± 193	1.3:1 (704:523)	60.90/62.06	4.70/5.65	45.1	2.37	Laabs 2001, Laabs 2004
	1999-2000		3,385 ± 516						Laabs 2001
	2000-2001	1,356 juveniles (estimate)	2,310 ± 310	2.7:1 (813:303)	60.69/61.25	4.73/5.98	42.7	1.85	Laabs 2002, Laabs 2004
	2001-2002	288 juveniles (estimate)	2,927 ± 289	1.3:1 (869:658)	60.45/60.81	4.27/5.42	45.6	2.01	Laabs 2003, Laabs 2004
	2002-2003	2,207 juveniles (estimate)	2,234 ± 178	1.3:1 (805:611)	ND	ND	ND	ND	Laabs 2004
	2003	Larval tissue collected							Savage, pers comm
	2004	Larval tissue collected							Savage, pers comm
Seascape Pond 2	2003	Larvae present							Allaback, pers. comm.
Seascape Pond 3	2002-2003	82 larvae observed	311 ± 50	1.1:1 (118:109)					Laabs 2004
	2004								

Breeding Location	Year	Data	Adult Population Estimate or [Actual]	Adult ♂:♀ sex-ratio (*n*)	Adult (♂/♀) avg. svl	Adult (♂/♀) avg. wt.	Juv. max. avg. svl	Juv. max. avg. wt.	Source
Ellicott-Buena Vista Complex									
Buena Vista Pond	1993	Hundreds of eggs present	[23]						Ruth 1993
	2004	Larval tissue collected							Savage, pers. comm.
Rancho Road Pond	1996	Larvae present							Service 1999
Green's Pond	1972-1974	Larvae present							Reed 1979
Ellicott Pond	1972		10,080						Marlow 1972
	1978	Larvae present					48.4		Reed 1979
	1979-1980	4 juveniles caught		1.8:1 (318:173)					Reed 1980
	1999	14 larvae caught							Service files
	2004	Larvae present							Savage, pers. comm.
Anderson's Pond	1989	Larvae present							Service 1999
Freedom Complex									
Palmer Pond	2004	Larvae present							Gilchrist 2004
Tucker Pond	2001-2002	10 juveniles caught	[984]	1.2:1 (543:441)					Bland 2002
	2003	Larval tissue collected							Savage, pers. comm.
	2004	Larval tissue collected							Savage, pers. comm.
Millsap Pond	2000-2001	8 juveniles late fall	137 ± 21	1.7:1 (54:32)					Biosearch 2001
Merk Pond	2003	Larval tissue collected							Savage, pers. comm.
	2004	Larval tissue collected							Savage, pers. comm.
___ Pond									
Larkin Valley Complex									
Calabasas Pond	1999	13 larvae caught							Service files

Breeding Location	Year	Data	Adult Population Estimate or [Actual]	Adult ♂:♀ sex-ratio (*n*)	Adult (♂/♀) avg. svl	Adult (♂/♀) avg. wt.	Juv. max. avg. svl	Juv. max. avg. wt.	Source
	2004	Larval tissue collected							Savage, pers. comm.
Suess Pond	1999	4 larvae caught							Service files
	2004	No larvae detected							Savage, pers. comm.
Olives Pond	2004	Larvae present							Bland 2004
Monterey County *McClusky Complex*									
McClusky Slough	2001-2002	53 juveniles caught	97	1:1 (16:16)					Biosearch 2003
	2004	Larval tissue collected							Savage, pers. comm.
Zmudowski Pond	2001-2002	6 juveniles caught	19	1:1 (5:5)					Biosearch 2003
	2004								Savage, pers. comm.
Bennett Slough / Struve Pond	1973-1974	Larvae and adults present							Talent and Talent (1980)
Elkhorn Complex									
Lower Cattail Swale	2003	Larval tissue collected							Savage, pers. comm.
	2004	Larval tissue collected							Savage, pers. comm.
Moro Cojo Slough	2003	Larval tissue collected							Savage, pers. comm.

Appendix C. Summary of threats and recommended recovery actions.

Listing Factor	Threat	Recovery Criteria	Recovery Action Numbers
A	Agriculture		1.1.17-1.1.21, 1.2.5, 1.2.6, 1.3.2.1, 1.3.2.2, 1.3.2.3 1.4, 2.1, 2.3, 2.7, 2.9, 2.10, 3.4.1, 3.4.4, 4.1, 4.2, 4.4
A	Grazing		1.1.21, 2.6
A	Sedimentation		1.1.1, 1.1.2, 1.1.9, 1.1.12, 1.1.13, 1.1.17-1.1.21, 2.2, 4.2, 4.4
A	Salinization		1.1.17-1.1.19, 1.2.5, 2.1, 4.4
A, D	Urbanization		1.1.4, 1.1.7, 1.1.8, 1.1.12, 1.1.15, 1.1.16, 1.2.1.1, 1.2.1.2, 1.2.1.3, 1.2.2.1-1.2.2.4, 1.2.3.1-1.2.3.4, 1.2.4.1-1.2.4.3, 1.3.1.1-1.3.1.4, 2.1, 2.3, 2.7, 2.8, 2.9, 2.10, 3.1-3.3, 3.4.1-3.4.4, 3.5, 4.1-4.4
A, D	Contaminants		1.1.1, 1.1.12, 1.4, 2.5, 4.2
B	Not applicable		
C	Exotic Animals		1.1.9, 1.1.12, 1.1.17, 2.6, 4.2, 4.4
C	Exotic Plants		1.1.1-1.1.21, 1.2.1.1, 1.2.1.2, 1.2.1.3, 1.2.2.1-1.2.2.4, 1.2.3.1-1.2.3.4, 1.2.4.1, 1.2.4.2, 1.2.4.3, 4.1, 4.2, 4.4
C	Disease/Infection		1.1.1-1.1.21, 2.4, 4.2, 4.4
E	Contaminants		1.1.1, 1.1.12, 1.4, 2.5, 4.2

Listing Factors:
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
E. Other Natural or Manmade Factors Affecting Its Continued Existence

Appendix D. Agencies and Organizations

Aptos High School (Pajaro Valley Unified School District)
Aptos-La Selva Fire Protection District
Biological Resources Division, U.S. Geological Survey
California Department of Agriculture
California Department of Forestry and Fire Protection
California Department of Fish and Game
California Department of Parks and Recreation
California Department of Transportation
Center for Natural Lands Management
Ducks Unlimited
Environmental Protection Agency
Elkhorn Slough Foundation
Elkhorn Slough National Estuarine Research Reserve
Ellicott Slough National Wildlife Refuge
Federal Highway Administration, U.S. Department of Transportation
Land Trust of Santa Cruz County
Monterey County Planning Department
Nature Conservancy
Natural Resources Conservation Service
Northern Salinas Valley Mosquito Abatement District
Santa Cruz County Planning Department
Santa Cruz County Mosquito Abatement District
Trust for Public Lands
U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge
U.S. Fish and Wildlife Service, Ventura Field Office
Willow Canyon Enterprises, Inc.
Wetlands Institute, California State University Monterey Bay

Appendix E. Index