

Brodiaea filifolia
(thread-leaved brodiaea)

**5-Year Review:
Summary and Evaluation**



Photo by Marci Koski/USFWS

**U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California**

August 13, 2009

5-YEAR REVIEW

Brodiaea filifolia (thread-leaved brodiaea)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Brodiaea filifolia (thread-leaved brodiaea) is a perennial herb with underground bulb-like storage stems in the Themidaceae family. Individual plants are less than 16 inches (40 centimeters) tall, with narrow leaves and saucer-shaped violet flowers arranged in a loose umbel. Sixty-eight discontinuous occurrences are distributed across southern California from the foothills of the San Gabriel Mountains at Glendora (Los Angeles County), east to Arrowhead Hot Springs in the western foothills of the San Bernardino Mountains (San Bernardino County), and south through eastern Orange and western Riverside Counties to Rancho Santa Fe in central San Diego County, California. This species is usually found in herbaceous plant communities that occur in open areas on clay soils, soils with a clay subsurface, or clay lenses within loamy, silty loam, loamy sand, silty deposits with cobbles, or alkaline soils; they may range in elevation from 100 feet (30 meters) to 2,500 feet (765 meters), depending on soil series.

Methodology Used to Complete the Review:

This review was conducted by the Carlsbad Fish and Wildlife Office. We relied on our 1998 listing rule (Service 1998, pp. 54975-54994), 2005 final critical habitat rule (Service 2005, pp. 73820-73856), recent biological opinions, reports, and information in our files or obtained from interviews with individuals involved in surveys, research, or management of this plant. We received no information from the public in response to our *Federal Register* Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the

Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Region 8; (916) 414-6464.

Lead Field Office: Bradd Baskerville-Bridges, and Jane Hendron, Carlsbad Fish and Wildlife Office; (760) 431-9440.

Federal Register (FR) Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review for this species and the opening of a 60-day period to receive information was published in the *Federal Register* on March 22, 2006 (Service 2006, pp. 14538-14542). We did not receive any information relative to this species in response to this notice.

Listing History:

Original Listing

FR notice: 63 FR 54975

Date of Final Listing Rule: (October 13, 1998)

Entity Listed: *Brodiaea filifolia* (thread-leaved brodiaea), a plant species

Classification: Threatened

State Listing: *Brodiaea filifolia* was listed as an endangered species by the State of California in January 1982 (CNDDDB 2009, p. 4).

Associated Rulemakings:

Proposed critical habitat for *Brodiaea filifolia* was published in the *Federal Register* on December 8, 2004 (Service 2004a, pp. 71284-71319). On December 13, 2005, the Service published in the *Federal Register*, a final rule designating approximately 597 acres (242 hectares) of critical habitat for *B. filifolia* (Service 2005a, pp. 73820-73856).

Review History: None

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for this species is "2" according to the 2008 Recovery Data Call for the Carlsbad Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-

ranked recovery priority and 18 is the lowest (Service 1983, pp. 43098-43105). This number indicates that the species faces a high degree of threat, but has a high recovery potential.

Recovery Plan or Outline:

To date, a recovery plan has not been prepared for *Brodiaea filifolia*. An unpublished Draft Recovery Plan for *Allium munzii* (Munz's onion), *Atriplex coronata* var. *notatior* (San Jacinto Valley crownscale), and *Brodiaea filifolia* (thread-leaved brodiaea) was prepared in January 2004, by David E. Bramlet and Scott D. White, under contract to the Service (Bramlet and White 2004, Table 3). Portions of the unpublished Draft Recovery Plan were cited in the Service's 2004 proposed rule to designate critical habitat for *B. filifolia*, but because this Draft Recovery Plan was not approved and finalized by the Service, we are not using the recovery criteria identified in the Draft Recovery Plan to determine the status of *B. filifolia* in this 5-year review.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status:

Species Description

Brodiaea filifolia is a perennial herb with dark-brown, fibrous-coated corms (underground bulb-like storage stem). The flower stalks (scapes) are 8 to 16 inches (20 to 40 centimeters) tall. The leaves are basal, narrow, and shorter than the scape. The flowers are arranged in a loose umbel. The six perianth (collective term for sepals and petals) segments are violet, spreading, and 0.4 to 0.5 inches (9 to 12 millimeters) long. The broad and notched anthers are 0.1 to 0.2 inches (3 to 5 millimeters) long. The fruit is a capsule (Munz 1974, pp. 877-878; Keator 1993, pp. 1180-1182). *Brodiaea filifolia* can be distinguished from the other species of *Brodiaea* that occur within its range (*B. orcuttii*, *B. jolonensis*, and *B. terrestris* ssp. *kernensis*) by its narrow, pointed staminodia (characteristic sterile stamens), rotate perianth lobes (i.e., a saucer-shaped flower), and a thin perianth tube, which is subsequently split by developing fruit (Niehaus 1971, p. 37; Munz 1974, pp. 877-878).

In our final listing rule, the flowering period was reported to extend between May and June (Munz 1974, p. 878; Service 1998, p. 54976). Since listing, the California Native Plant Society (CNPS) reported that the flowering period extends from March to June (CNPS 2001, p. 99).

Habitat

As described in the listing rule, *Brodiaea filifolia* typically occurs on gentle hillsides, valleys, and floodplains in mesic, southern needlegrass grassland and alkali grassland plant communities in association with clay, loamy sand, or alkaline silty-clay soils. Occurrences of this plant may be intermixed with, or near, vernal pool complexes (CDFG 1981, p. 3; Bramlet 1993, pp. 6-7). The description of suitable habitat was refined by the Service in its final rule designating critical habitat for the plant (Service 2005a, pp. 73820-73856). Based on new information, this species is usually found in herbaceous plant communities such as valley needlegrass grassland, valley sacaton grassland, nonnative grassland, alkali playa, southern interior basalt vernal pools, San Diego mesa hardpan vernal pools, and San Diego mesa claypan vernal pools (Holland 1986, pp. 34-37, 41, 44). *Brodiaea filifolia* grows in interstitial areas (often narrow bands of habitat surrounded by other vegetation) in association with coastal sage scrub in some locations (Service 2005a, p. 73837). These herbaceous communities occur in open areas on clay soils, soil with clay subsurface, or clay lenses within loamy, silty loam, loamy sand, silty deposits with cobbles or alkaline soils; they may range in elevation from 100 feet (30 meters) to 2,500 feet (765 meters), depending on soil series. These soils facilitate the natural processes of seed dispersal and germination, cormlet disposition to an appropriate soil depth, and corm persistence through seedling and adult phases of flowering and fruit set (Service 2005a, p. 73837) (see “Species Biology and Life History” below).

Species Biology and Life History

The annual growth cycle of *Brodiaea filifolia* begins in late summer with the growth of 3-5 leaves from each corm (Niehaus 1971, pp. 4-5; Keator 1993, p. 1180). When conditions are adequate, a solitary flower stalk may emerge from a mature corm, reaching the soil surface in January (Niehaus 1971, p. 7). The corms function similarly to bulbs in storing water and nutrients during the dormant season (Smith 1997, p. 28). While corms and vegetatively produced cormlets are the principal means of perpetuation from one growing season to another (Niehaus 1971, p. 4), the species also sets seeds. As mentioned above, *B. filifolia* blooms from March through June (CNPS 2001, p. 99). Upon maturity, the three segments of the vertically oriented capsules split apart, revealing many small (0.08 to 0.10 inches; 2 to 2.5 millimeters long) black seeds (Munz 1974, p. 878). The seeds are then dispersed as wind rattles the capsules and releases the seeds (Smith 1997, p. 29).

Clay soils dry out and exhibit surface cracks as moisture is depleted prior to the next rainy season. During this period the capsules of many bulb and corm-forming species mature. The seeds are released to fall to the ground, either on the surfaces or into the cracks in the soil. In this manner some seeds are dispersed into several horizons in the soil. With the fall and winter rains, the clay matrix hydrates, softens, expands and the cracks close up. Seedlings at first only produce leaves and a specialized root. Seedlings of *Brodiaea filifolia* are equipped with a specialized, succulent contractile root. This organ, lost by mature corms, facilitates the seasonal downward movement of the young plant (Niehaus 1971, p. 4). The contractile root swells with moisture in the wet season, creating space below the developing cormlet. As the soil dries the contractile root dries and shrinks longitudinally, drawing the young cormlet downward in the soil. This process continues to a point at which the soil moisture is adequate to keep the

contractile root from shrinking, resulting in the location of the corm in the appropriate soil horizon for survival. Cormlets produced annually from existing older corms also produce contractile roots which draw them laterally away from the parent corm (Niehaus 1971, p. 4).

All species of *Brodiaea* examined so far are self-incompatible (incapable of producing seeds with pollen from flowers on the same plant or from flowers of plants with the same allele, or different form of a gene, at the self-incompatibility gene locus/loci), so pollination between individuals must take place in order to produce seed (Niehaus 1971, p. 27). Dispersal of seeds from an individual is likely localized, leading to patches of plants with the same self-incompatible alleles. This means that effective pollination for seed set requires pollen dispersal over a distance between plants with different self-incompatible alleles. Members of the genus *Brodiaea* reportedly rely on Tumbling Flower Beetles (Mordellidae, Coleoptera) and Sweat Bees (Halictidae, Hymenoptera) for cross-pollination (Niehaus 1971, p. 27). The home ranges and species fidelity of these pollinators is not known. Bell and Rey (1991) report that native bees observed pollinating *Brodiaea filifolia* on the Santa Rosa Plateau in Riverside County included *Bombus californicus* (Apidae, Hymenoptera), *Hoplitis* sp. (Megachilidae, Hymenoptera), *Osmia* sp. (Megachilidae, Hymenoptera), and an unidentified Anthophorid (digger-bee) (Bell and Rey 1991, p. 3). Anthophoridae and Halictidae are reported to be important pollinators of *B. filifolia* at a study site in Orange County (GLA 2004, p. 3). Alternative pollen source plants may be necessary for the persistence of these insects when *B. filifolia* is not in flower seasonally or annually because of poor environmental conditions.

Spatial Distribution and Historical Range

The historical range of *Brodiaea filifolia* extends from the foothills of the San Gabriel Mountains at Glendora (Los Angeles County), east to Arrowhead Hot Springs in the western foothills of the San Bernardino Mountains (San Bernardino County), and south through eastern Orange and western Riverside Counties to Rancho Santa Fe in central coastal San Diego County, California (Figure 1 below; CNDDDB 2007). The Service identified 46 historical occurrences of *Brodiaea filifolia* at the time the plant was listed under the Act (Service 1998, p. 54977). Nine of them, most from San Diego County, were considered extirpated, leaving 37 occurrences presumed extant at the time of listing. Nine extant occurrences were in northern San Diego County, six were on the Santa Rosa Plateau in southwestern Riverside County (Service 1998, p. 54977).

A review of records completed after listing indicated that there were actually 49 historical occurrences of *Brodiaea filifolia* at the time of listing (39 presumed extant). An occurrence at the New Millennium site in the City of San Marcos in San Diego County was considered extirpated at the time of listing; however, records indicate this was an error. An occurrence at the Park View West site in the City of Carlsbad in San Diego County was considered extirpated at the time of listing; however, the occurrence is now considered extant because *B. filifolia*

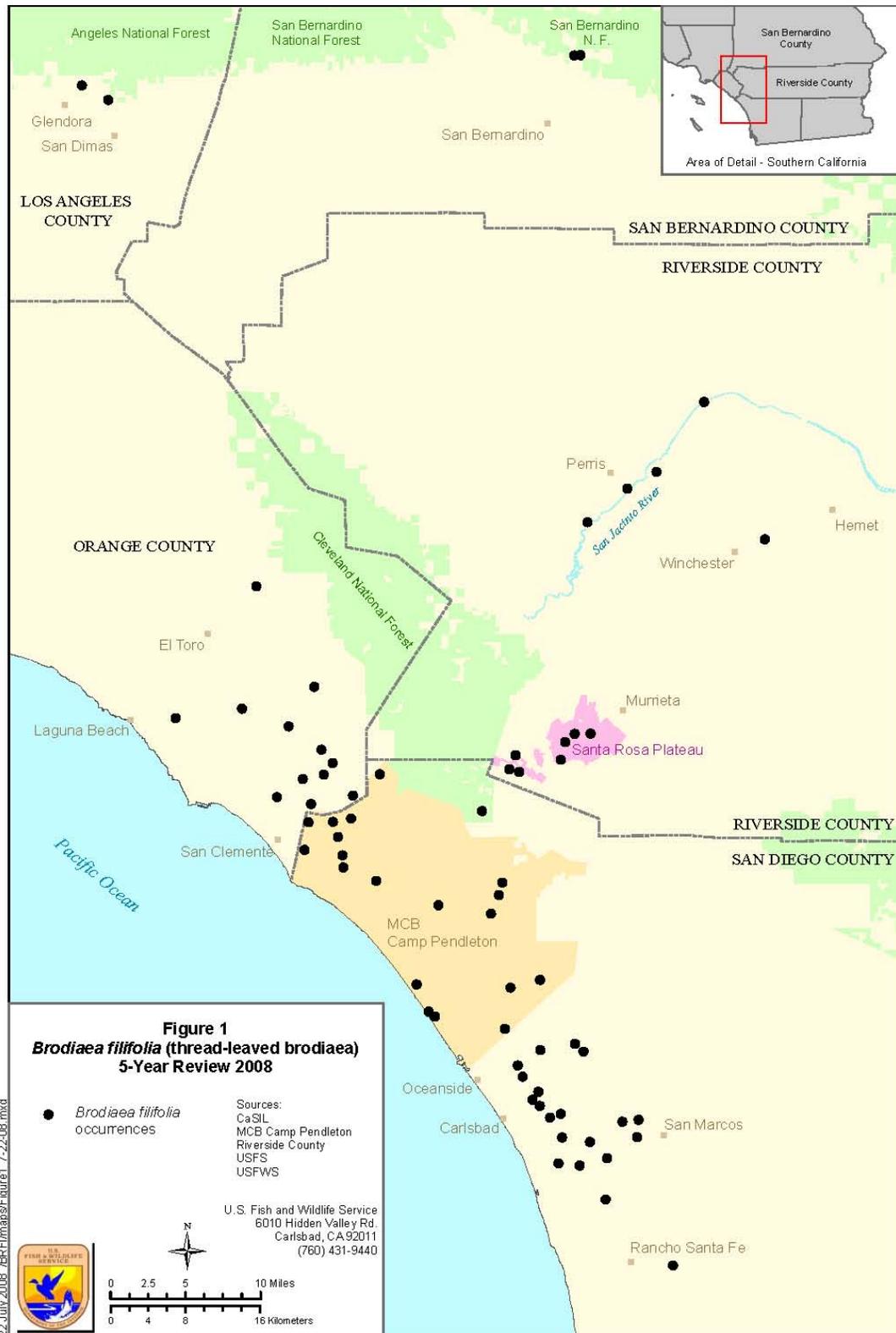


Figure 1. Distribution of known *Brodiaea filifolia* (thread-leaved brodiaea) occurrences; 5-year Review 2009.

individuals were detected in an adjacent parcel. One additional occurrence was not known to the Service at the time of listing, but was extirpated around that same time when the site was converted to citrus groves (CNDDDB 1997; V. Scheidt and S.M. Allen, *in litt.*, 2005, pp. 2, 8; CNDDDB 2007, Element Occurrence (EO) 54). Lastly, a known occurrence at Devil Canyon in the Cleveland National Forest was not included as an extant occurrence at the time of listing because it was reported to consist of hybrids between *B. filifolia* and *B. orcuttii*. We counted this as an existing occurrence in our 2005 final rule designating critical habitat for *B. filifolia* because the extent of hybridization may be less than previously assumed (Service 2005a, p. 73824).

In the 2004 proposed rule to designate critical habitat for *Brodiaea filifolia*, the Service identified a total of 84 occurrences. This figure is based on Table 3 of the unpublished Draft Recovery Plan (Service 2004b, pp. 35-46) and a new occurrence found in Highland Valley in San Diego County (Service 2004a, p. 71289). In the final designation of critical habitat for *B. filifolia*, we only considered occurrences listed in Table 3 that could be corroborated from other sources (Service 2005a, p. 73823).

One of the difficulties in determining the exact number of occurrences is related to differences in how occurrences have been identified. A plant occurrence is a plant or a group of plants more than 0.25 miles from another individual or group of plants. For purposes of this review, occurrences in close proximity to one other are considered to be a single occurrence. For example, eight occurrences known at the time of listing are grouped into four occurrences using this method. Based on corroborating the records reported in Table 3 of the unpublished Draft Recovery Plan, and grouping of occurrences in close proximity, we have determined there are a total of 68 extant occurrences of *Brodiaea filifolia* (Table 1). Of the 68 occurrences, 23 are newly identified or confirmed since listing. Two new occurrences are in Riverside County; four are in Orange County; and seven in San Diego County. Additionally, 10 more occurrences have been found on Marine Corps Base, Camp Pendleton (Camp Pendleton). Newly discovered or confirmed occurrences are denoted in Table 1 with an asterisk.

Of 11 extirpated occurrences of *Brodiaea filifolia*, all but three were extirpated prior to listing. Two occurrences we considered extirpated after listing were translocated as part of conservation measures:

- 1) Small occurrence of *Brodiaea filifolia* at the 4S Ranch location in San Diego County was translocated;
- 2) In Orange County, the Prima Descheca Landfill supported a very small occurrence of *B. filifolia* (about three plants). As part of the conservation measures identified in the Southern Orange County Subregion Habitat Conservation Plan, approved by the Service in 2007, any *B. filifolia* impacted by operations at the Landfill were translocated (Service 2007, p.153);
- 3) One occurrence at the Shelley Property in San Diego County was extirpated.

Although new occurrences of the plant have been found since listing, none of the new documented occurrences are outside of the original range identified in the final listing rule (Service 1998, p. 54975). The current range is depicted in Figure 1.

Table 1. Known occurrences of *Brodiaea filifolia*; prepared for 5-year Review, 2009.

Occurrence	Extant	Location Description	County	Owner Code	CNDBB Element Occurrence Number (EO)	Estimated Number of Plants ¹				Threats ¹ Code
						Highest Pre-listing	Year	Highest Post-listing	Year	
1	Y	Glendora	Los Angeles	GCC	20	2,000 ⁵	1992			
2	Y	San Dimas/Gordon Highlands	Los Angeles	Pvt	40			6,000 ⁵	2000	u,n
3	Y	Arrowhead Hot Springs	San Bernardino	Pvt	7	1,000 ⁵	1993			u
4	Y	Waterman Canyon	San Bernardino	Pvt	8	"few dozen" ⁵	1993			u
5	Y	San Jacinto Wildlife Area	Riverside	CDFG	43	900 ⁵	1995			h,g,n
					27	2,580 ⁵	1995			
6*	Y	San Jacinto Ave/Dawson Rd	Riverside	Pvt	65			325 ⁵	2000	u,h,d,o,g,m
7	Y	Case Road	Riverside	Pvt	2			4,555 ⁵	2000	u,h,d,o,g,m
x	N	Goetz Road	Riverside		1			0	2000	
8	Y	Railroad Canyon	Riverside	Local	25	0	1996	3,205 ⁵	2000	h,o,g
9	Y	Upper Salt Creek (Stowe Pool)	Riverside	Pvt	26	50 ⁵	1994			u,h,d,o,g
10	Y	Santa Rosa Plateau - Tenaja Rd.	Riverside	CDFG	3					
11	Y	Santa Rosa Plateau - North of Tenaja Rd.	Riverside	CDFG	31					
12	Y	Santa Rosa Plateau - South of Tenaja Rd.	Riverside	CDFG	30	400 ⁵	1992			
13	Y	Santa Rosa Plateau - Mesa de Colorado	Riverside	CDFG	5	31,725 ⁵	1990			
14	Y	East of Tenaja Guard Station	Riverside	Pvt	29	20 ⁵	1991			u,o
15	Y	Redonda Mesa	Riverside	Pvt	52	60 ⁵	1996			u,o
16*	Y	Corona Cala Camino	Riverside	Pvt				139 ⁵	2008	u
17	Y	Edison Viejo	Orange	Pvt	55	15 ⁵	1998			n

18	Y	Aliso and Woods Canyon Wilderness Park	Orange	County of Orange	56	>24 ⁵	1998	5,000 ⁴	2001	
19	Y	Cañada Gobernadora/Chiquadora Ridge	Orange	Pvt	64	2,000 ⁵	1995			u,d,g,n
20*	Y	Trampas Canyon	Orange	Pvt				250 ⁵	2003	u,d,g,n
21*	Y	Middle Gabino	Orange	Pvt				183 ⁵	2003	u,d,g,n
22	Y	Cristianitos Canyon	Orange	Pvt	62			400 ⁵	2003	u,d,g,n
		Cristianitos Canyon/Lower Gabino Canyon						6,105 ⁵	2003	
23*	Y	East Talega/Blind Canyon	Orange	Pvt				288 ⁵	2003	u,d,g,n
24	Y	Casper's Wilderness Park	Orange	County of Orange	24	850 ⁵	1995			n
25	Y	Arroyo Trabuco Golf Course/Lower Arroyo Trabuco	Orange	Pvt		0-100 ⁵	1997/1998	150 ⁵	2000	i
x*	N	Prima Deshecha ^t	Orange		61			9 ⁵	2001	
26	Y	Talega/Segunda Deshecha ^p	Orange	Pvt	57	100 ⁵	1998	3 ⁵	2001	u,i,d
27	Y	Forster Ranch ^{7p}	Orange	Pvt	58	383 ⁵	1997			i
					59	11 ⁵	1997	14,177 ⁴	2003	
					60	3,860 ⁵	1997			
28	Y	Cristianitos Canyon South	Orange	Pvt	63					u,d
29	Y	Devil Canyon	San Diego	CNF	39	"FEW-1000" ⁵	1992			
30	Y	Tributary off of Talega Canyon	San Diego	MCBCP		500 ⁵	1997			
31*	Y	Cristianitos Canyon Pendleton	San Diego	MCBCP				1,076 ⁵	2001	
32*	Y	San Mateo Creek	San Diego	MCBCP				50 ⁵	2006	
33	Y	Bravo One	San Diego	MCBCP	45	72 ⁵	1995	476 ⁵	2005	
34*	Y	Bravo Two North	San Diego	MCBCP				232 ⁵	2005	
35	Y	Bravo Two South	San Diego	MCBCP		unk	1995	1,002 ⁵	2005	
36	Y	Alpha One/Bravo Three	San Diego	MCBCP	44	216 ⁵	1995	1,943 ⁵	2005	
37*	Y	Basilone/San Mateo Junction	San Diego	MCBCP				2,313 ⁵	2005	
38	Y	Camp Horno	San Diego	MCBCP	46,47,48,49	3,662 ⁵	1995			

39	Y	Southeast of Horno Summit	San Diego	MCBCP	50	287 ⁵	1995			
40*	Y	Top of Las Pulgas Canyon/Roblar Rd	San Diego	MCBCP				unk	2000	
41*	Y	Top of Aliso Canyon/Roblar Rd	San Diego	MCBCP				unk	2000	
42	Y	Basilone/Roblar Junction	San Diego	MCBCP	51	7 ⁵	1995			o
43	Y	East of I-5/South of Las Flores Creek	San Diego	MCBCP	67	unk	1997	>144 ⁵	2003	o
					68			7 ⁵	2003	
44*	Y	Pilgrim Creek	San Diego	MCBCP				1,816 ⁵	2005	
45	Y	Pueblitos Canyon	San Diego	MCBCP		unk	1996	300 ⁵	2005	
46*	Y	West of Whelan Lake	San Diego	MCBCP				unk	2001	
47*	Y	South of French Creek	San Diego	MCBCP				unk	2003	
48*	Y	South White Beach	San Diego	MCBCP				1,492 ⁵	2005	
49	Y	Taylor ^P	San Diego	Pvt	41	5-10 ⁴	1987	166,970 ⁶	2005	i,d,o,n
		Undeveloped parcel between Darwin properties								
		Darwin Knolls and Darwin Glen								
50*	Y	Arbor Creek/Colucci	San Diego	Pvt				620 ⁵	2005	u,d
51	Y	Mission View/Sierra Ridge	San Diego	Pvt	53	75 ⁵	1995	1,310 ³	2004	i
52	Y	Mesa Drive, SDG&E Substation	San Diego	Pvt		75 ⁵	1996	2,800 ⁵	2004	d,v
53	Y	Eternal Hills/Alta Creek	San Diego	Pvt				>1,000 ⁵	2003	u,d
		Cornerstone Community Church/Oceanside Blvd & El Camino Real						500 ⁵	2005	
54*	Y	Vista Pacific	San Diego	Pvt				20 ⁵	2006	u
55*	Y	Buena Vista Creek preserve	San Diego	CDFG				20 ⁴	2008	
56	Y	Calavera Heights Mitigation Site	San Diego	CDFG		unk	1995	41 ⁴	2000	o
57	Y	Calavera Hills Village H	San Diego	Pvt	23	300 ⁵	1991	2,243 ³	2008	i,n
58*	Y	Calavera Hills Village X	San Diego	Pvt				23 ⁴	2008	i
59	Y	Letterbox Canyon - Taylor Made ^P	San Diego	Pvt		several hundred thousand ²	1997	1.1 M ²	2005	i,n
		Letterbox Canyon - Salk/Fox-Miller ^P		Pvt				19,100 ⁴	2003	
		Letterbox Canyon - Newton Business Center		State				16	unk	
x	N	North of Carlsbad dragstrip	San Diego		14					

60*	Y	Carlsbad Oaks	San Diego	Pvt				450 ³	2008	i,n
61	Y	Rancho Carrillo	San Diego	Pvt	22	758 ⁴	1994	797,000 ⁶	2005	i
		Rancho Santa Fe Rd North ⁸				5 ⁵	1994			
62	Y	Rancho La Costa	San Diego	Pvt	33	7,000 ⁵	1992	29,589 ³	2008	i,n
					34					
63	Y	La Costa Town Square	San Diego	Pvt				215 ⁴	2006	u,d
	N	Park View West/La Costa Ave & Rancho Santa Fe Rd ^t			21	>1,000 ⁵	1993			
64	Y	Poinsettia	San Diego	Pvt		unk	1990			u,d
x	N	Shelley Property/Olivenhein & Rancho Santa Fe Rd junction	San Diego		32	43 ⁵	1992			
x	N	Calle Tres Vistas	San Diego		54	several tens of thousands ²	1997			
x	N	Vista	San Diego		15					
x	N	Brengle Terrace	San Diego		18					
x	N	Vista, east of South Melrose Ave ^t	San Diego		17					
x	N	North of Carlsbad dragstrip	San Diego		13					
x	N	SSE of Buena, near Mission Rd & RR tracks	San Diego		12					
65	Y	Rancho Santalina ^p	San Diego	Pvt	11			1,961 ⁵	2000/2001	i,o,n
		Loma Alta					45 ³	2007		
		New Millennium				>2,000 ⁴	1994	<1,000 ⁵	2001	
	N	Las Posas Road Extension Project ^t					15	2000		
66	Y	Grand Avenue/Las Posas Rd pools ^p	San Diego	Pvt	36	255 ⁵	1993	55 ⁵	2001	u,i,d,o,n
		Upham/Pacific St/Superior Ready Mix			10	342,000 ⁴	1993			
67*	Y	Oleander/San Marcos Elementary ^p	San Diego	Pvt				3,802 ⁴	2005	i
68*	Y	Artesian Trails	San Diego	Pvt	70			1,000 ⁵	2004	u,d
					66			696 ⁵	2003	
x	N	4S Ranch ^t	San Diego			15-25 ⁴	1995	10 ³	2000	

Notes:

*New occurrence since listing

Ownership Key:

CNF - Cleveland National Forest

Local - City or County

MCBCP - Marine Corps Base Camp Pendleton

Pvt - private

CDFG - California Department of Fish and Game

GCC – Glendora Community Conservancy

Threats Key (Factor: threat):

A: u - Urbanization - new development

A: i - indirect effects, including isolation and fragmentation of habitat

A: h - Alteration of hydrological conditions and channelization

A: d - Discing or mowing

A: o - Off-road vehicle (ORV) activity

A: g - Grazing

A: m - Manure dumping

E: n - Nonnative Plants

E: v - Vandalism

(1) See text for discussion of

(2) Corms

(3) Plants (may include flowering plants)

(4) Flowering plants only

(5) Estimation method unknown

(6) Population estimate using spatial extrapolation technique

(7) CNDDDB EOs 58 & 60 translocated to EO 59

(8) May have been graded by Rancho Carrillo development in 1997. CNDDDB changed EO from 42 to 22 in late 2007.

(p) partially translocated

(t) translocated

Abundance

The size of a particular population of *Brodiaea filifolia* as well as other corm and bulb forming species, is often measured by counting numbers of standing flower stalks. There are considerable difficulties in this approach. Because more plants flower in wet years than in dry years, flowering plants likely represent only a portion of the total population of plants present at any given site. In addition to the annual fluctuation in numbers of flowering plants, seedlings and young plants only produce leaves for a few years before they are able to produce flower stalks. These vegetative plants may go undetected in surveys (Service 2005a, p. 73837). The species may be present as mature but non-flowering corms or immature corms rather than flowering plants; therefore, the estimated number of individuals should be considered an estimate of the minimum number of plants present (Service 2005a, p. 73840). A field study at the Santa Rosa Plateau Preserve revealed an 8:1 ratio of non-flowering corms to flowering plants (12.5 percent flowered), and that the number of flowering plants may vary up to tenfold from wet to dry years (Morey 1995, p. 2). At a residential development site in Carlsbad, only 20 plants (0.25 percent) flowered, where 8,000 corms were later located (Taylor and Burkhart 1992, p. 1-7). In 2007—a dry year—Vinje (pers. comm. 2008) reported that 14,373 vegetative plants were counted within three research plots at the Rancho La Costa occurrence in Carlsbad, but none of the plants flowered (J. Vinje, Center for Natural Lands Management, pers. comm. 2008, p. 2). Even in a wet year, only 2 to 26 percent of the plants within these plots flowered (Vinje, pers. comm. 2008, p. 2).

As noted in the listing rule, fewer than 2,000 *Brodiaea filifolia* individuals were observed at most occurrences (“Highest Prelisting” column, Table 1). Most of these occurrences occupied less than 13 acres (5 hectares) (CNDDDB 1997; Service 1998, p. 54977). The largest extant occurrence in Riverside County, Santa Rosa Plateau, is estimated to contain over 30,000 observed individuals and occupy about 38 acres (15 hectares) of habitat (MWD 1991, p. 4-215; CNDDDB 1997, EO 5). In San Diego County, the largest reported occurrence of *B. filifolia* is at the Upham site, a 40 acre (16 hectare) parcel in the City of San Marcos. This occurrence may support as many as 342,000 individual plants (Morey 1995, p. 4; Table 1). At the time of listing, the largest occurrence in Orange County (Forster Ranch) supported about 60 percent of *B. filifolia* individuals (4,254) and about 80 percent of the occupied habitat in that county (Service 1998, p. 54977; Table 1).

Currently, the largest natural occurrences of *Brodiaea filifolia* are on the Santa Rosa Plateau in Riverside County, the San Dimas/Gordon Highlands occurrence in Los Angeles County, the Cristianitos Canyon/Lower Gabino Canyon occurrence in Orange County, and the Rancho Carrillo and Upham occurrences in San Diego County. Although each occurrence on Camp Pendleton generally supports fewer than 2,000 plants, the large number of occurrences on Camp Pendleton comprises a significant portion of all the known occurrences of the plant. In 1999, the majority of the *B. filifolia* occurrence on Forster Ranch was translocated. A survey of the translocation site in 2003 detected 14,177 individual plants (Service 1999, p. 8; NRC 1999, exhibits 1 and 3; NRC 2004, p. 2). Although this is larger than the natural occurrence at Cristianitos Canyon/Lower Gabino Canyon, the long-term success of translocation programs is not known and may be contingent upon post-translocation maintenance and monitoring (Hall 1987, pp. 415, 418-420; Service 2005a, p. 73822).

No accurate estimate of the overall abundance of *Brodiaea filifolia* is available at this time, based on the absence of comprehensive survey data of all known occurrences and differences in survey techniques used to determine abundance on those sites that have been surveyed.

Changes in Taxonomic Classification or Nomenclature

The name and description of *Brodiaea filifolia* have not changed since it was listed. However, as described below, the family in which it is placed has changed. We also discuss a recently described species of *Brodiaea* and its potential effect on the listing status of *B. filifolia*.

Family Placement—Liliaceae versus Themidaceae

When the Service listed *Brodiaea filifolia* (Service 1998, p. 54975), the species was considered to be in a large and broadly defined family, Liliaceae (Lily family). *Brodiaea* and several other genera including *Bloomeria*, *Dichelostemma*, *Triteleia*, and *Allium* historically have been placed in the Amaryllidaceae (Amaryllis family) or Liliaceae (Lily family) based on perceived importance of characters related to the position of the ovary or the inflorescence type. Since listing, molecular and anatomical studies support recognition of Salisbury's Themidaceae. Fay and Chase (1996, pp. 441-451) present evidence that several genera, including *Triteleia*, *Brodiaea*, *Bloomeria*, and *Dichelostemma* form a distinct group for which the earliest name available for this group at the family rank is Themidaceae. Salisbury (1866) recognized a group of several genera that includes taxa now named *Brodiaea*, as a family and distinct from *Allium* and other Liliaceae. He named the family Themidaceae (Salisbury 1866, pp. 84-87). The fact that the members of Themidaceae share a common ancestor (the included members are termed monophyletic) is supported by phylogenetic analyses of morphological data and plastid DNA sequences (Pires et al. 2001, pp. 601-626; Pires and Sytsma 2002, pp. 1342-1359). The Themidaceae does not include the genus *Allium*, which is included in the Alliaceae (Fay and Chase 1996, p. 442).

Brodiaea was retained in the family Liliaceae in the recent continental flora, Flora of North America (FNA); however, the author of the family description (Utech 2002, p. 52) includes a table that lists *Brodiaea* as a member of the Themidaceae and states that the available evidence strongly supports dismemberment of the Liliaceae. Pires contributed the treatment of the genus *Brodiaea* used in the FNA (Pires 2002, pp. 321-328).

The family Themidaceae, including *Brodiaea*, will be recognized as a family separate from Liliaceae in the upcoming revision of the Jepson Manual (J. Pires, pers. comm. 2007, p. 1; R. Preston, pers. comm. 2007, p. 1). This book is currently the recognized floristic treatment for California. Upon review and in agreement with available systematic and floristic literature and consultation with species experts, we have submitted a proposal to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations to reflect the transfer of *Brodiaea filifolia* from Liliaceae to Themidaceae. This transfer does not alter the definition or distribution of *B. filifolia*.

Classification of Brodiaea; hybrids; B. santarosae

Historically, most plant classification systems were based on visible morphological traits. This is still effective but more advanced methodologies provide additional understanding of problem groups like Liliaceae. When molecular data are considered in conjunction with morphological data the resulting phylogeny (evolutionary history of genetically related taxa) is more robust than with either data set alone. Pires and Sytsma (2002) produced an evaluation of the framework of taxa in the Themidaceae including most, if not all, of the species in each included genus. They sampled 9 of the 14 species of *Brodiaea*. Analysis of sequences of three chloroplast DNA regions provide a high level of support for the monophyly (development from a single common ancestral form) of Themidaceae and support a clade (a group of taxa that share one common ancestor) consisting of *Brodiaea filifolia* and *B. orcuttii* that is separate from the other *Brodiaea* taxa included in the study.

The Service is aware of occurrences of supposed hybrids within the range of *Brodiaea filifolia* at Miller Mountain and Devil Canyon in northwestern San Diego County (Service 2004a, p. 71293; Service 2005a, p. 73841). The presumed parent taxa of these hybrids have been considered to be *B. filifolia* and *B. orcuttii* because of the apparent morphological intermediacy of the individuals and proximity of their ranges. This is supported by the close relationship of the two species noted above. The Service included the Devil Canyon occurrence as critical habitat for *B. filifolia* stating that: *Although there are some hybrids of B. filifolia and B. orcuttii in this subunit, the level of hybridization is less extensive than in the Miller Mountain area; therefore, it is likely that a minimum of 850 plants are pure B. filifolia* (Service 2005a, p. 73841). Plants of hybrid origin have been reported from the Upham site in the City of San Marcos (Chester et al. 2007, p. 188; F. Roberts, California Native Plant Society, pers. comm. 2007, p. 1). The Upham site is reported to support *B. filifolia*, *B. jolonensis*, and *B. orcuttii*. There have been no definitive studies to determine the genetic identity or exact parentage, or distribution of supposed hybrids relative to parent taxa from any sites. It is not known if hybrid individuals were included among the specimens sampled by Pires and Sytsma (2002).

Since the listing of *Brodiaea filifolia*, the description of a new species, *Brodiaea santarosae*, has been published (Chester et al. 2007, pp. 187-198). The species is considered to be restricted to basalt substrates in western Riverside County and adjacent portions of San Diego County, in close proximity to occurrences of *B. filifolia* (Chester et al. 2007, p. 190). *Brodiaea santarosae* is distinguished from other *Brodiaea* taxa in southern California by the general presence of recurved to erect staminodia that taper from base to tip and stamen filaments that are 0.08 inches (2 millimeters) or more long (Chester et al. 2007, p. 191). No molecular phylogenetic analysis was included in the discussion. Likewise, no reference was made to the previous literature on *Brodiaea* and Themidaceae cited here. The characteristics and distribution of *B. santarosae* are generally coincident with specimens that have previously been considered hybrids between *B. filifolia* and *B. orcuttii*.

Based on their assessment of Chester et al. (2007, pp. 187-198), Pires (pers. comm. 2007, p. 1) and Preston (pers. comm. 2007, p. 1) state that until they have the molecular data they will provisionally recognize this species, and intend to include *Brodiaea santarosae* as a separate species in their treatment of the genus *Brodiaea* for the revision of the Jepson Manual currently

in progress. Pires (pers. comm. 2007, p. 1). The identity and relationships of *B. santarosae* should be evident upon their completion of a molecular phylogenetic assessment. There is no time table for the analysis to be completed. This reassessment may require a re-examination of the status of *B. filifolia*.

Potential effects of Brodiaea santarosae on the distribution of Brodiaea filifolia

Because the range of *Brodiaea santarosae* is coincident with a portion of the range of *B. filifolia*, we will encourage detailed field surveys of all occurrences in and peripheral to the range of *B. santarosae* to determine the presence and distribution of *B. santarosae* and any other species or hybrids of *Brodiaea*. This will be difficult because the normally diagnostic traits of staminode form and stamen filament length are variable in *B. santarosae* (Chester et al. 2007, p. 188). Museum specimens recently verified by a species expert (Dr. Pires) indicate that *B. filifolia* and *B. orcuttii* are found within the local range of *B. santarosae*. There are conflicting reports of the fidelity of *B. santarosae* and putative hybrid plants to particular substrates.

It is anticipated that material of *Brodiaea santarosae* will be analyzed either using the same methodologies employed in the analysis of nine other *Brodiaea* taxa (Pires and Sytsma 2002) or by methods suited to discriminate between sympatric species and hybrids. If, upon analysis *B. santarosae* is shown to be a distinct taxon, and/or considerable numbers of individuals or occurrences are shown to represent hybrids, we will reassess its impact on the status of *B. filifolia*.

Taxonomy – Summary

We will now recognize *Brodiaea filifolia* and its congeneric relatives as members of the family Themidaceae. This does not affect the definition of the listed species. We will await the phylogenetic assessment of *B. santarosae* to provide a rigorous analysis of the distinctiveness and relationships of the taxon before considering a reevaluation of the geographical and ecological range of *B. filifolia*. Inclusion of *B. santarosae* in a floristic treatment, such as the revision of the Jepson Manual, does not require the same level of assuredness as a phylogenetic assessment. The significance and status of some threats discussed below under the listing factors may change if the range, distribution, and occurrences of *B. filifolia* are changed.

Five-Factor Analysis:

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act. The final rule listing *Brodiaea filifolia* as threatened identified loss of habitat from urbanization and agricultural conversion as the most significant threats to *B. filifolia* (Service 1998, p. 54983). Other threats to the plant included alteration of hydrology and impacts from livestock grazing, primarily in Riverside and Orange Counties; unauthorized off-highway vehicles (OHV); discing for fire suppression, and competition from nonnative plants. At the time of listing, the Service estimated that approximately 18 of the 37 presumed extant occurrences of *B. filifolia* were threatened by development, discing for fire suppression, or agricultural practices (Service 1998, p. 54983).

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

The final rule listing *Brodiaea filifolia* as threatened identified loss of habitat from urbanization and agricultural conversion as the most significant threats to *B. filifolia* (Service 1998, p. 54983). Additional threats since listing include discing and mowing.

Urbanization

Since the time of listing, urbanization has remained the primary threat to *Brodiaea filifolia*. Development may directly impact *B. filifolia* plants through removal, reduction of suitable habitat, and increased isolation between occurrences. However, a variety of conservation efforts have been undertaken since listing to address the long-term conservation needs of *B. filifolia*.

Los Angeles County

In Los Angeles County, one of the two known occurrences of *Brodiaea filifolia* is permanently conserved by the Glendora Community Conservancy. A portion of the occurrence at San Dimas/Gordon Highlands was impacted by illegal grading in 2002. At least 151 individuals in three locations within the San Dimas/Gordon Highlands occurrence were destroyed (LDC 2006, pp. 1, 47-48) and the remaining individuals are likely to be impacted by future development (M. Meyer, California Department of Fish and Game, *in litt.* 2005, p. 1).

San Bernardino County

Neither of the two occurrences in San Bernardino County are conserved.

Riverside County

Four occurrences in Riverside County are permanently conserved as part of the Santa Rosa Plateau Ecological Reserve, and a fifth occurrence is part of the San Jacinto Wildlife Area, all of which are managed by the California Department of Fish and Game. These five occurrences are all within the plan area of the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP), approved by the Service in 2004. The MSHCP indicates that 90 percent of all occurrences of *Brodiaea filifolia* will be conserved, though no occurrences outside of the Santa Rosa Plateau and San Jacinto Wildlife Area have yet been placed into permanent conservation. A proposed channelization associated with the San Jacinto River Flood Control Project may result in the translocation of the Railroad Canyon occurrence (Dudek 2003, p. 438; Service 2004b, pp. 384-385).

Orange County

At the time of listing, the Service was uncertain whether known occurrences of *Brodiaea filifolia* would be conserved under the proposed Southern Subregion HCP (Service 1998, p. 54986). There are currently 12 extant occurrences in Orange County and 11 of them are within the plan

area of the Orange County Southern Subregion Habitat Conservation Plan (Southern Subregion HCP).

The occurrence at Aliso and Woods Canyon Wilderness Park falls within the boundary of the Orange County Central/Coastal Natural Community Conservation Plan (NCCP)/HCP (Central/Coastal NCCP/HCP). Though the plant is not specifically covered by the Central/Coastal NCCP/HCP, the occurrence at the Aliso and Woods Canyon Wilderness Park is protected from development and is managed by the County of Orange. In 2009, a comprehensive Management Plan for the Park was developed that includes a variety of actions to conserve and restore the natural resources in the Park, including fire management, nonnative plant removal, and annual surveys of the *B. filifolia* occurrence (estimated to support about 5,000 plants) (LSA Associates 2009).

Within the boundaries of the Southern Subarea HCP, the largest historical occurrence of *Brodiaea filifolia* at Forster Ranch was largely translocated as was the smaller Talega/Segunda Desecha occurrence, as discussed earlier. One occurrence numbering about 850 plants, is within the Caspers Wilderness Park and is managed similarly to the Aliso and Woods Canyon Wilderness Park. Emphasis placed on preservation of the wilderness characteristics in the Park by minimizing development of structures and trails. Additionally, the County of Orange is a party to the Southern Subregion HCP and has committed these lands as part of the Habitat Reserve to be established under the HCP.

The small occurrence of *Brodiaea filifolia* on the Arroyo Trabuco Golf Course/Lower Arroyo Trabuco was addressed in a section 7 consultation with the Army Corps of Engineers. In that consultation, the Service determined *B. filifolia* would not be negatively impacted by construction of the golf course (Service 2002). Most recent survey information indicates approximately the same number of plants occur at the site (see Table 1). Although this occurrence has not been placed under a permanent conservation easement, it is currently being managed.

Seven occurrences that support an estimated 9,312 individuals are on lands owned by Rancho Mission Viejo, a permittee under the Southern Orange Subregion HCP. The HCP anticipates conserving 9,168 of the estimated 9,312 plants as part of the Habitat Reserve. An additional 145 individuals already conserved through prior actions will also be part of the Habitat Reserve, providing for a total of 9,248 individuals included in the Habitat Reserve that will be monitored and actively managed for the benefit of *Brodiaea filifolia* (Service 2007, p.155).

The other extant occurrence of *Brodiaea filifolia* in Orange County (identified as Edison Viejo in Table 1) is located on land that is included in a proposed conservation bank. The mitigation bank is not finalized, but the Service anticipates it will be operational in the near future and the occurrence will be conserved and managed.

San Diego County

One occurrence in northern San Diego County (Devil Canyon) is on land managed by the U.S. Forest Service's Cleveland National Forest and is not subject to development, nor is it being

impacted by grazing (L. Young, Cleveland National Forest, pers. comm. 2009). Most of the remaining occurrences of *Brodiaea filifolia* in San Diego County have already been or will likely be impacted by development.

Of the 20 occurrences in San Diego County, identified in Table 1, 12 of them have been impacted by development. In some cases, occurrences were avoided during development and placed under a conservation easement with monitoring and management provisions. Seven of the occurrences have been partially or wholly translocated. At the Rancho Santalina site in the City of San Marcos, *Brodiaea orcuttii* was introduced to the site by an approved translocation from another site (ZSSD 2004, p. 1). The long-term effect of this introduction on *B. filifolia* at the Rancho Santalina site is not known, but putative hybrids have been reported at several locations within the range of *B. filifolia* where these two species overlap.

At the Loma Alta occurrence in the City of San Marcos, unforeseen impacts to *Brodiaea filifolia* occurred when approximately 4,000 plants, that were to be conserved, were buried by a manufactured slope, leaving only 13 plants (Roberts, *in litt.* 2001, pp. 1-5; CDFG and Service 2002, p. 2; Roberts, *in litt.* 2004a, p. 1). In addition, a culvert was installed near the center of the *B. filifolia* occurrence (W. Haas, Pacific Coast Conservation Alliance, pers. comm. 2007, p. 1).

The Northwest San Diego County Multiple Habitat Conservation Plan (MHCP) includes seven cities. The City of Carlsbad is the first of the cities to have an approved Habitat Management Plan (HMP) under the MHCP. Under the HMP, all known occurrences of *Brodiaea filifolia* within existing preserve areas will be fully conserved and managed in order to provide for the long-term conservation of the plant (City of Carlsbad 2004, Appendix C-7). The Letterbox Canyon occurrence listed in Table 1 was subsequently addressed by the City of Carlsbad after completion of its HMP, with 95 percent of the plants on the property conserved and incorporated into the City's HMP preserve system.

The Rancho La Costa occurrence was addressed under the Villages of La Costa Habitat Conservation Plan (originally known as the Fieldstone/LaCosta HCP) which provides for the permanent protection of 83 percent of the occurrence in an open space preserve configured to provide connectivity to significant areas of natural habitat; monitoring; restoration; and enhancement of habitat, and control of nonnative plants (City of Carlsbad 1994). One new occurrence (La Costa Town Square) falls within the Villages of La Costa HCP plan area that is not covered by the HCP, because it was discovered after the mitigation provisions of the HCP had already been established for the Rancho La Costa occurrence. The Service is currently looking into the most appropriate way to address the conservation of this occurrence.

Occurrences of *Brodiaea filifolia* in the cities of Oceanside and San Marcos are not yet addressed under the MHCP because these cities have not completed their respective subarea plans; *B. filifolia* occurrences in these cities are not yet assured of conservation or management and remain threatened by development.

Summary

Long-term conservation of *Brodiaea filifolia* is dependent on protecting extant occurrences and working to minimize continued loss due to development. Current conservation efforts address 51 out of the 68 extant occurrences. Twelve occurrences are conserved by the County of Orange, California Department of Fish and Game, Cleveland National Forest, or the Villages of La Costa HCP. If the Western Riverside County MSHCP, the Southern Subregion HCP, the Carlsbad HMP, and the proposed Edison Viejo Conservation Bank are fully implemented, an additional 20 occurrences will be either wholly or partially conserved. This number does not include additional occurrences that were conserved in conjunction with section 7 consultations with the Service. The 19 occurrences of *B. filifolia* on Camp Pendleton are protected from development, but are still vulnerable to impacts from military-related activities, and nonnative plants. However, Camp Pendleton does have an Integrated Natural Resource Management Plan (INRMP) that includes conservation measures for *B. filifolia* (see Factors D and E for further discussion).

Alteration of Hydrological Conditions and Channelization

The listing rule stated that alteration of hydrological conditions and channelization poses some degree of threat to *Brodiaea filifolia*, primarily in the San Jacinto River floodplain and at Upper Salt Creek in Riverside County (Service 1998, p. 54983).

The alkali vernal plain habitat of *Brodiaea filifolia* along the San Jacinto River is unique because it is the only area within the range of the species found in irregularly flooded river valley bottom lands (Roberts, *in litt.* 2005b, p. 12). Altering the hydrology along the river may have an adverse effect on the alkali vernal plain habitat in which *B. filifolia* occurs because it may alter or eliminate natural flooding processes (Roberts, *in litt.* 2005b, p. 14).

Alteration of site hydrology as a result of urbanization potentially threatens *Brodiaea filifolia*. *Brodiaea filifolia* requires moist clay soils to facilitate seedling and cormlet disposition to an appropriate soil depth, and corm persistence through seedling and adult phases of flowering and fruit set. Development projects upslope and adjacent to *B. filifolia* occurrences may dewater the site, interfering with these processes. Conversely, water runoff from nearby developments may inundate *B. filifolia* occurrences with excessive amounts of water, depositing silt, and drowning plants. Alteration of hydrological conditions and channelization currently pose a threat to five *B. filifolia* occurrences in Riverside County (Table 1).

Discing or Mowing

The listing rule identified discing for dry land farming and fire suppression as a threat to *Brodiaea filifolia*, most notably along the San Jacinto River in Riverside County (Service 1998, p. 54983). Following the listing of *B. filifolia* under the Act, the Service now identifies mowing as a potential threat to the plant.

There are at least 12 occurrences of *Brodiaea filifolia* threatened by discing or mowing, but additional occurrences may also be subject to this because site-specific threats are not fully

known for all of the extant occurrences identified in Table 1. Discing may cut up and/or bury the entire plant, including the underground corms. Either of these actions suppresses growth and reduces reproductive output. Systematic discing up to four times a year has been reported on some sites along the San Jacinto River (Roberts, *in litt.* 2003, p. 1). Since listing, discing has been reported at two of the four occurrences of *B. filifolia* along the San Jacinto River. In 2004, “heavy discing” was observed within an occurrence of the federally listed *Atriplex coronata* var. *notatior* (San Jacinto Valley crownscale), which overlaps the San Jacinto Avenue/Dawson Road occurrence of *B. filifolia* (Roberts, *in litt.* 2004c, p. 3). In 2008, Service staff noted habitat degradation and recent discing within the Case Road occurrence (A. Braswell, U.S. Fish and Wildlife Service, pers. obs. 2008, p. 3). Illegal discing was also reported at the Oleander/San Marcos Elementary occurrence in the City of San Marcos, San Diego County, impacting an estimated 3,802 individual plants (Dudek 2005, p. 19).

Mowing may reduce the production and dispersal of seeds, alter the associated vegetation needed for pollinator activity, or reduce the number and vigor of plants present by cutting off the leaves (Service 2005a, p. 73839). Mowing has occurred at two sites in the City of Oceanside. In 2003, 2005, and 2008, we were informed of mowing at the Mesa Drive occurrence, located within a San Diego Gas and Electric easement. In each year, all of the *Brodiaea filifolia* individuals were mowed at the height of the flowering season (Roberts, *in litt.* 2004b, pp. 1-2; Roberts, *in litt.* 2005c, p. 2; Roberts, *in litt.* 2008b, p. 1). At the undeveloped Darwin parcel, about 6,000 plants were mowed shortly after being counted in the spring of 2005; the same site was mowed again during the flowering season in 2008 (Roberts, *in litt.* 2006, p. 2; Roberts, *in litt.* 2008b, p. 3).

Summary of Factor A

Currently, 31 of the 68 extant occurrences of *Brodiaea filifolia* are protected from development because they are located on National Forest Service land, State park land, County park land, private conservation land, or are located on Department of Defense lands. Implementation of the Western Riverside County MSHCP, the City of Carlsbad’s HMP under the Northwestern San Diego County MHCP, and the Southern Subregion HCP will ultimately provide for the conservation of at least 20 additional occurrences, providing for the ultimate protection of 75 percent of the extant occurrences of *B. filifolia*. The regional HCPs are long-term planning efforts, and lands identified for inclusion in preserve areas, particularly those supporting occurrences of *B. filifolia* in Riverside County, have not yet not been acquired or placed into conservation status. Therefore, urbanization (development) remains the primary rangewide threat to *B. filifolia*.

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

The potential threat from unrestricted collection by individuals as a result of increased publicity was noted in the listing rule (Service 1998, p. 54985). However, we have no evidence that collection is currently a threat to this species.

FACTOR C: Disease or Predation

As stated in the final listing rule (Service 1998, p. 54985), disease is not known to be threat. The listing rule discussed the indirect effect of grazing on *Brodiaea filifolia*, but the threat to the plant is not from direct consumption by grazing animals, but rather the potential for trampling of plants and pathway for the introduction of nonnative plants. Therefore, we have determined that predation is not a threat to *B. filifolia*. Please see Factor E for a discussion of the potential threat of grazing.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

There are several state and Federal mechanisms currently in place that may provide a conservation benefit to *Brodiaea filifolia*, as follows:

State Protections in California

The State's authority to conserve rare wildlife and plants is comprised of four major pieces of legislation: the Native Plant Protection Act (NPPA), California Endangered Species Act (CESA), California Environmental Quality Act (CEQA), and the Natural Community Conservation Planning (NCCP) Act.

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA)

Brodiaea filifolia was listed as an endangered species by the State of California in 1982 and is afforded protections under CESA. The CESA (California Fish and Game Code, section 2080 *et seq.*) prohibits the unauthorized take of State-listed threatened or endangered species. The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species. The CESA requires State agencies to consult with the California Department of Fish and Game on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities.

Furthermore, with regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners have been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of plants.

In the case of *Brodiaea filifolia*, several occurrences have been translocated in conjunction with approved development projects. These translocated occurrences have demonstrated highly variable rates of success. Transplanting of *B. filifolia* seeds has met with limited success and the most common method entails translocating corms and the soils supporting them to another suitable location. Given the unproven long-term success of translocation, this is not to be

considered an alternative that should be widely used. Rather, it should be used only when no other option for onsite conservation is possible.

California Environmental Quality Act (CEQA)

The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

Natural Community Conservation Planning Act (NCCP)

The NCCP program is a cooperative effort between the State of California and numerous private and public partners with the goal of protecting habitats and species. The NCCP helps identify and provide for area wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. Many NCCP plans are developed in conjunction with HCPs pursuant to the Endangered Species Act. On June 22, 2004, NCCP Approval and Take Authorization were issued by the CDFG for the Western Riverside County MSHCP. *Brodiaea filifolia* is a “covered species” under the MSHCP. The CDFG also approved the City of Carlsbad’s HMP under the Northwestern San Diego County MHCP, which also includes *B. filifolia* as a covered species. These two NCCP/HCPs are discussed in greater detail under the Act below.

Federal Protections

National Environmental Policy Act (NEPA)

NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the Federal agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.14F). These mitigations can provide some level of protection for listed species. However, NEPA does not require that environmental impacts be avoided, only that effects be assessed and the analysis disclosed to the public. Therefore, this regulatory mechanism may not be adequate to fully protect the species.

National Forest Management Act (NFMA)

The NFMA (36 C.F.R. 219.20(b)(i)) has required the USDA Forest Service to incorporate standards and guidelines into Land and Resource Management Plans, including provisions to support and manage plant and animal communities for diversity and for the long-term, rangewide viability of native species. Recent changes to NFMA may affect future management of listed species, particularly rare plant occurrences, on National Forests. On January 5, 2005, the Forest Service revised National Forest land management planning under NFMA (70 FR 1023). The new planning rule changed the nature of Land Management Plans so that plans generally would

be strategic in nature and could be categorically excluded from NEPA analysis, and thus not subject to public review. Under this new planning rule, the primary means of sustaining ecological systems, including listed species, would be through guidance for ecosystem diversity. If needed, additional provisions for threatened and endangered species could be provided within the overall multiple-use objectives required by NFMA. The final rule did not include a requirement to provide for viable populations of plant and animal species, which had previously been included in both the 1982 and 2000 planning rules. On March 30, 2007, however, the United States District Court in *Citizens for Better Forestry et al. v. USDA* (N.D. Calif.) enjoined the USDA from implementing and utilizing the 2005 rule until it complies with the court's opinion regarding Administrative Procedure Act, the Act, and NEPA. On May 14, 2007, the Forest Service published a Notice of Intent to prepare an environmental impact statement to analyze and disclose potential environmental consequences associated with a National Forest System Land management planning rule. The impact of any revisions of this rule to listed species is unknown at this time.

At the time of listing, the two known occurrences within the Cleveland National Forest (Miller Mountain and Devil Canyon) were thought to consist mostly of hybrids of *Brodiaea filifolia* and *B. orcuttii* (Service 1998, p. 54988). Cleveland National Forest management policies affecting *B. filifolia* were not discussed.

Since listing, plants at the Devil Canyon occurrence (Table 1) are reported to contain fewer hybrid individuals than previously thought, and are now recognized as important for conservation of the species; therefore, this occurrence was included in our designation of critical habitat (Service 2005a, p. 73841).

Cleveland National Forest does not currently have a management plan specific to *Brodiaea filifolia* (Service 2005a, p. 73841). However, in 2005, a non-jeopardy biological and conference opinion (BiOp) (Service 2005b) was issued that addressed the Revised Land and Resource Management Plans (Revised LRMP) for four southern California national forests, including Cleveland National Forest.

These plans described the strategic direction for these four forests at a broad program-level for land and resource management. Included in these plans are: land use zones that identify management intent and anticipated levels of public use in any area of the forests; and standards which are fundamental requirements that define the parameters for the activities that the Forest Service anticipates. In the BiOp for the Revised LRMP, the Service concluded that no new permanent loss of habitat occupied by *Brodiaea filifolia* is expected. New projects will be implemented so that they promote the recovery of the plant, and expansion of facilities or new facilities will be designed to focus public use away from *B. filifolia* habitat. Exceptions were included in the plans for fuel treatments in wildland-urban interface areas and to allow for projects with short-term effects and long-term benefits (USFS 2005, p. 6). We are not aware of any new information that would change our conclusion. The Revised LRMP standards can be changed by a forest plan amendment (USFS 2005, p. 1). Although the plans set important parameters for authorization of specific projects, the plans do not themselves authorize the projects. Actual authorization of projects depends on analysis of site-specific effects, project-level section 7 consultation under the Act, and consistency with appropriate management

direction and applicable legal requirements (Service 2005b, p. 8). On June 8, 2009, the United States District Court in *Center for Biological Diversity et al. v. U.S Fish and Wildlife Service et al.* (N.D. Calif) determined the BiOp issued by the Service for the revised LRMPs for the four southern California forests was not in accordance with law due to failure to issue incidental take statements as part of the BiOp. Currently, the court ruling is under review by the Service and Department of Justice.

The Sikes Act

The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans for conservation and rehabilitation programs, and to establish outdoor recreation facilities on military installations. The Sikes Act also provides for the Secretaries of Agriculture and the Interior to develop cooperative plans for conservation and rehabilitation programs on public lands under their jurisdiction. The Sikes Act was amended in 1997 (Sikes Act Improvement Act) to require that military installations prepare INRMPs. Consistent with the use of military installations to ensure readiness of the Armed Forces, INRMPs provide for the conservation and rehabilitation of natural resources on military lands. They incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While not technically a regulatory mechanism because their implementation is subject to funding availability, INRMPs address the conservation of natural resources on military lands and can be an added conservation tool in promoting recovery of endangered and threatened species.

In 2001, Camp Pendleton adopted an INRMP (U.S. Marine Corps 2001, p. ES-1), which was further revised in 2007 (U.S. Marine Corps 2007, p. ES-1). Like other INRMPs, it is largely ecosystem-based except where biological opinions under section 7 of the Act direct species-specific actions. The Service and Camp Pendleton are currently consulting under section 7 of the Act on a programmatic plan that will address a wide variety of military activities while providing for measures to avoid and minimize the effects of these activities on federally listed species, including *Brodiaea filifolia*, that occur on approximately 105,000 acres of upland habitats. Conservation measures resulting from this section 7 consultation are expected to be incorporated into future revisions of the INRMP, and are anticipated to provide specific direction to guide management and conservation of *B. filifolia*. Pending completion of this consultation, the Marine Corps has incorporated interim management and conservation measures for *B. filifolia* under Camp Pendleton's INRMP (U.S. Marine Corps 2007, pp. 4-24, F-78).

Endangered Species Act of 1973, as amended (Act)

Since listing, the Act is the primary Federal law that provides protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that actions they fund, authorize, or carry out do not "jeopardize" a listed species or result in the "destruction or adverse modification" of habitat in areas designated by the Service to be "critical." A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). A non-jeopardy

opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project. Critical habitat was designated by the Service in 2005 at the Glendora, San Dimas/Gordon Highlands, Devil Canyon, and Upham occurrences (Service 2005a, pp. 73840-73841; Table 1).

Under section 9(a)(2) of the Act, it is unlawful to remove and reduce to possession (i.e. collect), and maliciously damage or destroy any listed plants from lands under Federal jurisdiction. In addition, it is unlawful to remove, cut, dig up, or damage or destroy listed plants on non-Federal lands in knowing violation of any law or regulation of any state or in the course of any violation of a state criminal trespass law. As mentioned above, *Brodiaea filifolia* is listed under CESA as endangered in the State of California. Therefore, *B. filifolia* is afforded protections under section 9 of the Act on non-Federal lands. Any impacts to this species require consultation with the California Department of Fish and Game.

Section 10(a) of the Act allows for exceptions to section 9 prohibitions. Under section 10(a)(1)(A) of the Act there are provisions for collection of plants or plant parts for scientific purposes or to enhance the propagation and survival of the species. Under section 10(a)(1)(B), the Service may issue “incidental take” permits for listed animal species to non-Federal applicants. Section 3(18) defines “take” to mean “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” “Incidental take” refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project’s adverse impacts to listed species. Section 10(a)(1)(B) provides a mechanism to permit incidental take of listed animal species—as mentioned above—but it does not permit incidental take of listed plant species. However, state listed plants such as *Brodiaea filifolia* must be addressed in the HCP process in order for the California Department of Fish and Game to issue an incidental take permit for the HCP. Moreover, issuance of an incidental take permit by the Service is a Federal action subject to section 7 of the Act; thus, the Service is required to ensure that the actions proposed in the HCP are not likely to jeopardize any listed species or result in the destruction or adverse modification of critical habitat. Therefore, HCPs may provide an additional layer of regulatory protection for *B. filifolia*. As mentioned above, many HCPs are coordinated with the related NCCP-State program. Discussions in the listing rule of the following HCPs are updated below: Western Riverside County Multiple Species Habitat Conservation Plan, Orange County Southern Subregion HCP, and City of Carlsbad Habitat Management Plan. In addition, the Villages of La Costa HCP (not discussed in the listing rule) is discussed below.

Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP)

The Western Riverside County MSHCP was finalized and approved on June 22, 2004. This NCCP/HCP establishes a multiple species conservation program to minimize and mitigate the expected loss of habitat values and incidental take of “covered” species, including *Brodiaea filifolia*. The MSHCP Plan Area includes all occurrences of *B. filifolia* in Riverside County. The Service concluded that the MSHCP would not jeopardize the continued existence of *B. filifolia* in our Biological and Conference Opinion (Service 2004b, p. 386).

As part of the MSHCP implementation, approximately 153,000 acres (61,917 hectares) of new conservation lands will be established to compliment the 347,000 acres (140,426 hectares) of pre-existing natural and open space areas within the 1.26 million acres (510,000 hectares) boundary of the MSHCP (Service 2004b). The MSHCP is a long-term conservation plan, and there are five conservation objectives that will be implemented to provide for the conservation of *Brodiaea filifolia*, as follows: (1) inclusion of at least 6,900 acres (2,792 hectares) of grassland and playa/vernal pool habitat within the San Jacinto River, Mystic Lake, and Salt Creek areas; (2) inclusion of at least 11 locations supporting *B. filifolia* in two core areas along the San Jacinto River and Santa Rosa Plateau; (3) surveys of *B. filifolia* in certain areas of suitable habitat (in accordance with the “Additional Survey Needs and Procedures” policy within the Criteria Area Species Survey Area (CASSA), which calls for avoidance of 90 percent of property with long-term conservation value until the species’ conservation objectives are met); (4) inclusion of the floodplain along the San Jacinto River within the MSHCP Conservation Area to maintain floodplain processes; and (5) inclusion of the floodplain along Salt Creek from Warren Road to Newport Road, and the vernal pools in the Upper Salt Creek west of Hemet as part of the MSHCP Conservation Area (Service 2004b, pp. 383-385).

According to the MSHCP, floodplain processes will be maintained along the San Jacinto River in order to allow the distribution of the species to shift over time as hydrologic conditions and seed bank sources change (Dudek 2003, p. 436). In addition, the MSHCP requires surveys to be conducted for *Brodiaea filifolia* within the MSHCP Conservation Area at least every eight years to verify occupancy at a minimum of 75 percent of the known locations. Management measures will be triggered, as appropriate, if a decline in species distribution is documented below this threshold. Other management actions will help maintain habitat and populations of *B. filifolia* by preventing alteration of hydrology and floodplain dynamics, off-road vehicle use, grazing and competition from nonnative plants (Service 2004b, p. 385). However, recent proposals to implement the San Jacinto River Flood Control Project include the construction of berms and dams to protect highways (Ramona Expressway and Highway 215) and lands upstream of *B. filifolia* occurrences (SJRC 2008, p. 2).

Occurrences of *Brodiaea filifolia* are frequently associated with or near vernal pool complexes. The Western Riverside County MSHCP provides for special protection of vernal pool complexes and associated species through its Protection of Species Associated with Riparian/Riverine areas and Vernal Pools policy. Implementation of this policy will assist in providing protection to this species’ essential habitat by avoiding and minimizing direct impacts to vernal pools and associated habitats. In addition, *B. filifolia* is considered an Additional Survey Needs and Procedures species under the MSHCP. Under this policy, surveys for *B. filifolia* will be conducted where suitable habitat is present in identified species survey areas until such time as the conservation objectives for this species are met. Finally, the MSHCP’s Guidelines Pertaining to the Urban/Wildlands Interface provides some assurance that future urbanization will maintain the existing water quality and quantity needed to maintain floodplain areas and vernal pools supporting *B. filifolia* along the San Jacinto River and at upper Salt Creek west of Hemet. Thus, the Western Riverside County MSHCP may provide significant conservation benefits to *B. filifolia*, including a MSHCP Conservation Area that protects core habitat areas and known occurrences, long-term management and monitoring of the preserve area, and special guidelines, policies, and survey requirements to ensure that significant occurrences of *B. filifolia* and its

essential habitat are protected under the plan. However—as mentioned above under Factor A—a significant occurrence at Railroad Canyon will be translocated pursuant to the plan (Dudek 2003, p. 438; Service 2004b, pp. 384-385; Table 1).

Orange County Southern Subregion HCP (Southern Subregion HCP)

The Southern Subregion HCP was approved by the Service on January 10, 2007. Approval by the California Department of Fish and Game as an NCCP is still pending; thus, any impacts to *Brodiaea filifolia* will be permitted under CESA (CDFG 2008b, p. 2). The plan encompasses the majority (10 of 12) of *B. filifolia* occurrences in Orange County, including the largest natural occurrence in the County at Cristianitos Canyon (Table 1). The Service concluded that the HCP would not jeopardize the continued existence of *B. filifolia* in its Biological and Conference Opinion (Service 2007, p. 155). Ninety-seven percent of *B. filifolia* individuals in the action area will be permanently conserved within designated Habitat Reserve lands. These lands will be maintained and managed in perpetuity for the benefit of *B. filifolia*. Management actions would include the control of invasive species. Minor impacts to two *B. filifolia* occurrences—Chiquadora Ridge and Cristianitos Canyon—are anticipated; however, these occurrences will be monitored long-term (Service 2007, pp. 152-153).

City of Carlsbad Habitat Management Plan (HMP)

The City of Carlsbad HMP is a subarea plan under the northwestern San Diego County Multiple Habitat Conservation Plan (MHCP). The MHCP is a comprehensive, multi-jurisdictional planning program designed to create, manage, and monitor an ecosystem preserve in northwestern San Diego County. The incidental take permit for the City of Carlsbad HMP was issued on November 9, 2004, and the City was the first of the seven participating cities to receive a permit on their subarea plan.

Nine occurrences of *Brodiaea filifolia* exist within the City of Carlsbad. Under the HMP, all known occurrences of *B. filifolia* within existing preserve areas (7 of 9) will be conserved at 100 percent. All *B. filifolia* outside of already preserved areas are required to be consistent with the MHCP's narrow endemic policy which requires mitigation for unavoidable impacts and management practices designed to achieve no net loss of narrow endemic populations, occupied acreage, or population viability within Focused Planning Areas. In addition, cities cannot permit more than five percent gross cumulative loss of narrow endemic populations or occupied acreage within the Focused Planning Areas, and no more than 20 percent cumulative loss of narrow endemic locations, population numbers or occupied acreage outside of Focused Planning Areas (AMEC 2003, pp. 2-14, D-1). All conserved populations of *B. filifolia* will be incorporated into the preserve areas of the HMP. The HMP includes provisions to manage the populations within the preserve areas in order to provide for the long-term conservation of the species.

At the time the permit was issued, *Brodiaea filifolia* was a conditionally covered species under the HMP, as the proposed hard-lined reserve on the Fox-Miller property within the Letterbox Canyon occurrence (Table 1) did not meet the conditions for coverage of the species under the HMP. The project was subsequently redesigned to meet the narrow endemic standards by impacting less than five percent of the known population, and a long-term management plan was

submitted. On December 2, 2005, the Service and the California Department of Fish and Game concluded that the City of Carlsbad would receive full coverage for *B. filifolia* under the HMP (CDFG and Service 2005, p. 1).

Villages of La Costa HCP

The incidental take permit for the Villages of La Costa HCP (formerly called Fieldstone/La Costa Associates HCP) was issued on June 6, 1995. This project, within the City of Carlsbad, directly impacted 17 percent of the Rancho La Costa occurrence (Table 1), one of the four largest known occurrences in San Diego County at that time (Service 1995, p. 21; F. Roberts, U.S. Fish and Wildlife Service, pers. obs. 1995, p. 1). Currently, all remaining *Brodiaea filifolia* within the occurrence are conserved within reserve lands owned and actively managed by the Center for Natural Lands Management (CNLM 2007, p. 1; M. Spiegelberg, Center for Natural Lands Management, pers. comm. 2008, p. 1). These lands will be maintained and managed in perpetuity for the benefit of *B. filifolia*.

At the time of completion of the HCP, an occurrence of over 1,000 *Brodiaea filifolia* individuals was known just outside the boundary of the plan at the Park View West site, but was translocated the following year to a reserve on the other side of the city (J. Brown, Dudek & Associates, Inc., *in litt.*, 1996, pp. 1-2; CNDDDB 1997, EO 21; CNDDDB 2007, EO 21; Table 1). In 2006, the occurrence—consisting of 215 flowering *B. filifolia* individuals—was rediscovered within the plan area in an adjacent parcel across the street. This parcel, known as the La Costa Town Square site, is proposed for development (V. Lynch, City of Carlsbad, *in litt.*, 2007, pp. 1-3). Preservation of this occurrence and/or mitigation for impacts is uncertain because future take of *B. filifolia* outside of reserve lands was already approved under the HCP, but did not take into account this newly discovered occurrence (RECON 2006, pp. 1-6).

Summary of Factor D

The above laws and regulations have greatly reduced the loss of *Brodiaea filifolia* occurrences associated with development. The provisions included in regional HCPs are expected to provide for conservation of *B. filifolia* occurrences and to adaptively manage the habitat to address other threats to the plant from nonnative, invasive plants. The Act, in conjunction with State law, has been beneficial to the conservation of *B. filifolia* and its habitat. The laws, regulations, and planning efforts mentioned above have reduced the likelihood of major habitat loss and alteration. Without the status of being federally threatened, *B. filifolia* would not necessarily receive the same level of priority for avoidance as it does at this time. Areas where significant occurrences of *B. filifolia* remain that are not addressed by a completed HCP (e.g., occurrences in Oceanside and San Marcos) or subject to a section 7 consultation are still vulnerable to ongoing, smaller-scale losses.

FACTOR E: Other natural or manmade factors affecting its continued existence

The final listing rule (Service 1998, pp. 54988-54989) identified nonnative plants and drought as threats to *Brodiaea filifolia* under Factor E.

Nonnative Plants

In the listing rule, competition with nonnative plants was identified as a threat to *Brodiaea filifolia*, noting that the increased abundance of nonnative species is often an indirect result of habitat disturbance from development, alteration of hydrology, discing, and grazing (Service 1998, p. 54988). Invasive, nonnative plants may compete for space and resources, and alter habitat in an area to the extent that it no longer supports *B. filifolia*. In the listing rule, the invasion of nonnative species was noted at various locations across the range of *B. filifolia*: *Lolium* spp. (ryegrass) invading vernal pools within the City of San Marcos in San Diego County; *Cynara cardunculus* (artichoke thistle) and *Foeniculum vulgare* (fennel) impacting grassland habitat within San Diego County; and *Crypsis schoenoides* (swamp grass) seeded as a food source for waterfowl, replacing native species along the San Jacinto River and Upper Salt Creek in Riverside County (Service 1998, p. 54988).

Since listing, Dudek (2006) identified the invasion of nonnative plants as likely “the main stressor” to seven occurrences within southern Orange County (Dudek 2006, p. E-440). Dudek (2006) reported the increased abundance of *Lolium* spp. (ryegrass) and other nonnative species at the Arroyo Trabuco occurrence after cattle were removed from the area (Dudek 2006, p. E-440).

Some *Brodiaea filifolia* preserves within the City of Carlsbad in San Diego County have required significant effort to control nonnative plants (J. Vinje, Center for Natural Lands Management, pers. comm. 2007, pp. 1-3). At the Rancho La Costa occurrence (Table 1), the area was “covered in fennel” in 2005 (Vinje, pers. comm. 2007, p. 1). At least 10,000 fennel individuals were sprayed with an herbicide that year. In subsequent years, “hundreds” of fennel clumps, “hundreds” of artichoke thistle plants, and large patches of black mustard were removed in the vicinity of *B. filifolia* locations (Vinje, pers. comm. 2007, pp. 1-2). At the Calavera Hills Village H occurrence, “hundreds” of fennel clumps were sprayed in 2006 (Vinje, pers. comm. 2007, p. 2).

Vinje (pers. comm. 2007) reported the need for control of fennel and nonnative grasses at the Newton Business Center site within the Letterbox Canyon occurrence (Table 1) in the City of Carlsbad, one of the largest reported occurrences of *Brodiaea filifolia* (Vinje, pers. comm. 2007, p. 2). This site, with approximately 39,500 individuals, was set aside as a *B. filifolia* preserve and transferred to The Environmental Trust (TET) for long-term management in 1998 (RBRiggan 1998, p. 2). The site was described as “highly invaded” by nonnative plants, with fennel “dispersed throughout the site” (TET 2001, p. 1). In 2002, nonnative plant eradication was conducted by TET; “follow-up fennel treatment” was particularly noted as an important management activity planned for the next year (TET 2003, pp. 2, 4). Although the Mitigation Plan (RBRiggan 1998) for the site specified annual reporting of management activities by TET to the Service, we have not received any documentation of management activities since 2002 (RBRiggan 1998, pp. 2, 6). In 2006, TET declared bankruptcy, and ownership of the site was transferred to the California Department of Fish and Game. Currently, the site is not being managed.

The Salk/Fox-Miller site, adjacent to the Newton Business Center site and within the same Letterbox Canyon occurrence, is described as a “major population” in the City of Carlsbad’s

Habitat Management Plan (City of Carlsbad 2004, Appendix C - 7). According to the plan, major populations would be conserved and managed to minimize edge effects, including invasive nonnative plants (City of Carlsbad 2004, Appendix C – 8). Following development of the site in 2007, only a portion of the site supporting *Brodiaea filifolia* was managed for nonnative plants, with the managers of the site noting the area would “require intensive weeding each year for [the weeds] to be successfully controlled” (RECON 2008, p. 23). On May 5, 2008, during the height of the flowering season, Service biologists visited the site and observed nearly head-high *Brassica nigra* (black mustard) covering the entire site, with fennel in some locations (M. Koski, U.S. Fish and Wildlife Service, pers. obs. 2008, p. 1). Since then, the property owners were contacted and some management activities have occurred on the portion of the site mentioned above; management of the entire site remains undetermined (Koski, pers. obs. 2008, p. 1).

Brodiaea filifolia occurs immediately adjacent to and down-slope from the Salk/Fox-Miller plants on the Taylor Made site. In 1997, an estimated “several hundred thousand” individuals occurred at the Taylor Made and Salk/Fox-Miller sites prior to development (Scheidt 2007, p. 2; Scheidt, pers. comm. 2008, p. 1). In 2005, consulting biologists for the Salk/Fox-Miller project surveyed *B. filifolia* on both sites, estimating that 16 percent of the remaining *B. filifolia* in the area occur on the Taylor Made site (RECON 2005a, p. 2; RECON 2005b, p. 3). In 1997, California Department of Fish and Game reached an agreement with the property owners to translocate 45 percent of the *B. filifolia* to another location onsite and conserve the rest of the plants *in situ*, with annual monitoring for 5 years (CDFG 1997, pp. 1-2). In addition, these onsite conservation areas were to be placed “in permanent, protected open space to be included in the [Carlsbad Habitat Management Plan] or with a Conservation Easement placed on the open space” (CDFG 1997, p. 1). The Taylor Made site is not addressed in the Carlsbad Habitat Management Plan (City of Carlsbad 2004, Appendix C - 7). The Service is not aware of any management of the site or any conservation easements being placed on the site since the agreement was reached.

The New Millennium site within the Rancho Santalina/Loma Alta/New Millennium occurrence in the City of San Marcos (Table 1), another site known to be impacted by nonnatives (Service 2001, p. 17; Service 2003, p. 20), was set aside as a preserve for *Brodiaea filifolia* in conjunction with the development of the College Area Specific Plan in the late 1980s. Along with a remnant of the existing natural population that once occupied 17.8 acres (7.2 hectares), 12,000 corms were translocated to the site (Roberts and Vanderwier 1997, pp. 4-5). In 2003, property owners at the nearby Las Posas Road Extension development project agreed to weed the New Millennium preserve one time and translocate the *B. filifolia* found on their site to the preserve as mitigation for the project (D. Van Huis, KB Home, *in litt.* 2003, p. 1). The Las Posas Road Extension project was completed; however, it is uncertain whether the conservation measures were fulfilled.

In summary, approximately 25 percent (17 of 68) of *Brodiaea filifolia* occurrences are currently reported to be threatened by nonnative plants (Table 1). This estimate is likely a minimum number, as site specific threats have not been identified at all occurrences. We estimate that at least 15 occurrences of *B. filifolia* are threatened by nonnative plants as an indirect effect of urbanization. The Service is aware of only four percent (3 of 68) of *B. filifolia* occurrences that

are currently managed in their entirety to control nonnative plants: Calavera Hills Village H, Carlsbad Oaks, and Rancho La Costa occurrences (Table 1). Parts of an additional three percent (2 of 68) of *B. filifolia* occurrences are currently managed to control nonnative plants. The Service anticipates that implementation of the Western Riverside County MSHCP and Southern Subregion HCP will provide for management of *B. filifolia* occurrences within those plan areas, including eradication of invasive, nonnative plants.

Grazing

The listing rule identified grazing as a threat to *Brodiaea filifolia*, noting habitat degradation associated with trampling of plants, and the potential for an increased abundance of nonnative plants (Service 1998, p. 54985). Threats from nonnative plants are discussed above. Five *B. filifolia* occurrences along the San Jacinto River and Upper Salt Creek in Riverside County were identified as threatened by sheep grazing in the listing rule (Service 1998, p. 54985). Since listing, we have not received any updated information regarding sheep grazing at the five occurrences mentioned above. Dudek (2006, p. E-440) identified cattle-related impacts, including trampling and crushing of soils, and browsing of vegetation and flower stalks during the growing season as an “environmental stressor” to seven occurrences of *B. filifolia* in southern Orange County (Dudek 2006, p. E-440) (Table 1). However, the Service’s BiOp on the Southern Subregion HCP indicates grazing as likely affecting only two occurrences within the plan area – Chiqadora Ridge and lower Cristianitos Canyon. Furthermore, grazing at the Chiqadora Ridge occurrence is focused on barley fields and is outside the blooming seed-setting period for *B. filifolia*. Additionally, some grazing has the potential to reduce the abundance of nonnative plants. Grazing has occurred within the Southern Subregion HCP for a long period of time and *B. filifolia* has persisted (Service 2007, p.151). The combination of monitoring and adaptive management that is expected to occur with implementation of this HCP will ensure maintenance of *B. filifolia* within the plan area.

Grazing may be a threat to about 18 percent (12 of 68) of *Brodiaea filifolia* occurrences, primarily by trampling of plants (Table 1), but rangewide it is not likely to pose a threat to the continued existence of *B. filifolia*.

Off-Highway Vehicle (OHV) Activity

The listing rule identified OHV activity as a threat to *Brodiaea filifolia*, noting habitat degradation and the threat of plants being crushed from OHV use at vernal pools in Riverside and San Diego counties and at alkali wetland habitats along the San Jacinto River in Riverside County (Service 1998, p. 54984).

At least 18 percent (12 of 68) of *Brodiaea filifolia* occurrences are noted as threatened by OHV activity (Table 1). In addition, occurrences impacted or threatened by development may be threatened by this activity due to lack of protection from OHV access and close proximity to roads. Four of the 12 occurrences threatened by OHV activity (Upper Salt Creek, East of Tenaja Guard Station, Redonda Mesa, and the Upham site) are associated with vernal pools in Riverside and San Diego Counties. Three out of four occurrences in alkali wetland habitats along the San Jacinto River (San Jacinto Ave/Dawson Road, Case Road, and Railroad Canyon) in Riverside

County likewise are not protected from OHV activities. In addition, the California Natural Diversity Database (CNDDDB 2007) identifies military-related OHV activity as a threat at two of the 19 occurrences on Marine Corps Base Camp Pendleton (Basilone/Roblar junction and East of I-5/South of Las Flores Creek). One occurrence in the City of San Marcos at the Rancho Santalina/Loma Alta/New Millennium site is also noted as being threatened by OHV use (CNDDDB 2007, EOs 11, 51, 67, 68). The Rancho Santalina/Loma Alta/New Millennium occurrence, which consists of three locations of *B. filifolia*, was set aside for conservation in conjunction with development. Preserves at the Rancho Santalina and Loma Alta sites are fenced and are currently being managed. The New Millennium site is partially fenced and is not being managed, so OHVs may pose a threat at this site.

Manure Dumping

Manure dumping was not identified as a threat in the listing rule. Since listing, manure dumping was recognized by the Service as a threat to 2 of the 4 occurrences of *Brodiaea filifolia* along the San Jacinto River in Riverside County (Service 2005a, p. 73821; Table 1). As mentioned above, the alkali vernal plain habitat of *B. filifolia* along the San Jacinto River is unique because it is the only area within the range of the species found in irregularly flooded river valley bottom lands.

Dumping of livestock manure results in physical disturbance of the soil surface, burial of the plants and seed bank, and dilution or alteration of the alkali character of soil or soil chemistry (Roberts, *in litt.* 2005a, p. 1). These changes create conditions more favorable to invasive nonnative plants that would otherwise be hampered by the higher alkaline nature of the soil (Roberts, *in litt.* 2005a, p. 1). Starting in 1998 and persisting through 2008, we were informed of an elevated level of manure dumping along the San Jacinto River (Roberts, *in litt.* 2005a, p. 1; Roberts, pers. comm. 2008a, p. 1). In 2004, manure dumping was observed within an occurrence of the federally listed *Atriplex coronata* var. *notatior* (San Jacinto Valley crownscale) which overlaps the San Jacinto Avenue/Dawson Road occurrence of *B. filifolia* (Roberts, *in litt.* 2004c, p. 3). Roberts (*in litt.* 2005a) describes ongoing dumping of manure for at least several months within the Case Road occurrence, the largest reported occurrence of *Brodiaea filifolia* in Riverside County outside of the Santa Rosa Plateau with approximately 4,555 individuals (Roberts, *in litt.* 2005a, p. 2; Table 1). Maps provided by Roberts indicate that manure dumping occurred on, and adjacent to, stands of *B. filifolia* individuals (Roberts, *in litt.* 2005a, Figure 1). In 2008, manure dumping was observed again at the Case Road occurrence (Roberts, pers. comm. 2008a, p. 1).

Although manure dumping threatens *Brodiaea filifolia* where such activity occurs, this threat is localized to certain areas within Riverside County and is not a rangewide threat to the species.

Drought and Climate Change

Although drought was identified as a threat in the listing rule (Service 1998, p. 54989), we are not aware of any occurrence that has been extirpated by drought since listing. However, it is likely that cyclic drought reduces local populations over the long term. Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999,

p. 1; Cayan et al. 2006, pp. 1, 7-8; IPCC 2007, pp. 8-9). However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. One study has predicted that 5 to 10 percent of California's native plant species would no longer find suitable habitat within the state, and thus be vulnerable to extinction, if average temperatures warmed 5–6° F (Morse et al. 1995, p. 393). Whether or not this would include *Brodiaea filifolia* is unknown. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to *B. filifolia* at this time.

Vandalism

Vandalism was not identified as a threat in the listing rule. In 2004, we were informed that vandalism had taken place at the Mesa Drive occurrence in the City of Oceanside. Roberts (*in litt.* 2004b, pp. 1-2) estimated that at least 1,000 individuals were dug up and removed from the site where 2,800 plants were found earlier in the year. As mentioned above, mowing was reported at the same site in 2003, 2005, and 2008. However, vandalism does not appear to be a threat to the species.

Summary of Factor E

Nonnative plants continue to significantly threaten *Brodiaea filifolia* and/or its habitat. Twenty-five percent (17 of 68) of *B. filifolia* occurrences are reported to be threatened by nonnative plants; fifty-one percent of *B. filifolia* occurrences are likely threatened by nonnative plants as an indirect effect of development. Drought may threaten *B. filifolia*; however, the Service is not aware of any occurrence that has been extirpated by drought since listing.

III. RECOVERY CRITERIA

Does the species have a final, approved recovery plan containing objective, measureable criteria? No.

IV. SYNTHESIS

The current geographical range of *Brodiaea filifolia* is the same as it was at the time of listing. Sixty-eight occurrences are scattered across southern California in discontinuous populations at elevations from 100 feet to 2,500 feet (30 meters to 765 meters); only three occurrences are considered to be extirpated since listing. The current threats to this species are essentially the same as they were at listing and include urbanization, alteration of hydrological conditions and channelization, discing, unauthorized OHV activity, grazing, and nonnative plants. Additional threats since listing include manure dumping and mowing.

Development remains the most prominent rangewide threat to *Brodiaea filifolia*, though the protective provisions of the Act have had a significant impact relative to addressing this threat through the development of regional HCPs and section 7 consultations. As habitat continues to be placed into permanent conservation with adaptive management, the threats to *B. filifolia* will

be further reduced rangewide; current conservation efforts address approximately 75 percent of occurrences. The second most significant rangewide threat to *B. filifolia* is competition from invasive, nonnative plants, which impact at least 15 of the known occurrences. Other threats from unauthorized OHV use, grazing, and manure dumping threaten specific occurrences of *B. filifolia*, and while they are not rangewide threats to the species, these threats hinder recovery of the species.

Due to the threats mentioned above, both rangewide and localized, *Brodiaea filifolia* remains likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. We recommend that the current listing status for *B. filifolia* remain unchanged, as threatened.

V. RESULTS

Recommended Listing Action:

We recommend that no change in listing status be undertaken at this time.

- Downlist to Threatened**
 Uplist to Endangered
 Delist (Indicate reasons for delisting per 50 CFR 424.11):
 Extinction
 Recovery
 Original data for classification in error
 No change is needed

New Recovery Priority Number and Brief Rationale: 8C

The new recovery priority number indicates that the species faces a moderate degree of threat and has a high recovery potential. *Brodiaea filifolia* has persisted throughout its range since listing, with only three occurrences found to be extirpated. Development continues to be the predominant threat, though development of HCPs has helped to reduce impacts to the habitat. Current conservation efforts have addressed 51 of 68 extant occurrences.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Work with partners to help conserve *Brodiaea filifolia*. Identify opportunities through the Service's Partners for Fish and Wildlife Program to seek habitat restoration and enhancement opportunities. Acquire and protect sites with large or geographically distinct *B. filifolia* occurrences, such as those found at: San Dimas, Arrowhead Hot Springs, the San Jacinto River, Cristianitos Canyon, the undeveloped Darwin parcel, the Upham site, and Artesian Trails.
2. Determine the status of management and monitoring, and control on nonnative plants at sites that have been set aside for conservation including, but not limited to: Darwin

Knolls and Darwin Glen, Arbor Creek/Colucci, Calavera Heights Mitigation site, Fox-Miller, Taylor Made, Rancho Carrillo, and New Millennium.

3. Reestablish effective management at sites formerly managed by TET, including the Newton Business Center site and the Mission View/Sierra Ridge site.
4. Work with partners to conduct research for the conservation of *Brodiaea filifolia*:
 - a. Determine the home ranges and species fidelity of pollinators of *B. filifolia* and their impact on recruitment.
 - b. Work with Camp Pendleton in the design and implementation of a study investigating soil characteristics that facilitate *B. filifolia* establishment and propagation.
 - c. Work with Rancho Santa Ana Botanic Garden's to design and implement a germination study.
 - d. Determine the relationship of *B. santarosae* to *B. filifolia*, its habitat specificity, and its distribution.

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U.S. FISH AND WILDLIFE SERVICE
5-Year Review of *Brodiaea filifolia*
(thread-leaved brodiaea)

Current Classification: Threatened

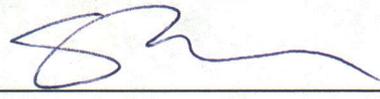
Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

ACTING Lead Field Supervisor, Fish and Wildlife Service

Approve  Date AUG 13 2009

Scott A. Sobiech