

Acanthomintha obovata ssp. *duttonii* (San Mateo thornmint),
Cirsium fontinale var. *fontinale* (fountain thistle),
Pentachaeta bellidiflora (white-rayed pentachaeta)

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



Pentachaeta bellidiflora
Doreen Smith, CNPS Marin Chapter



Cirsium fontinale var. *fontinale*
Elizabeth Warne, USFWS



Acanthomintha obovata ssp. *duttonii*
Christal Niederer, Creekside Center for
Earth Observation

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

August 2010

5-YEAR REVIEW

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Cirsium fontinale var. *fontinale* (fountain thistle),
Pentachaeta bellidiflora (white-rayed pentachaeta)

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 status 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:

Acanthomintha obovata ssp. *duttonii*, *Cirsium fontinale* var. *fontinale*, and *Pentachaeta bellidiflora* are addressed together in this 5-year review because all three species are found on serpentine soils in San Mateo County. At one time they co-occurred on an area called the "Triangle", located southwest of the intersection of Edgewood Road and the I-280 overpass and west of Redwood City. Additionally, all three species are threatened by some of the same factors, particularly loss of habitat.

Acanthomintha obovata ssp. *duttonii*.

Acanthomintha obovata ssp. *duttonii* (San Mateo thornmint) is a strongly-scented annual herb in the mint family (Lamiaceae), found only in serpentine soils with inclusions of heavy clay. The plants are typically unbranched and are 4 to 20 centimeters (cm) (1.6 to 7.9 inches (in.)) tall. The flowers, which appear from April to June, are white or tinged with lavender and occur in tight clusters surrounded by spined bracts. The only known extant population is located in Edgewood County Park and Natural Preserve (hereafter Edgewood Park) in San Mateo County.

Cirsium fontinale var. *fontinale*.

Cirsium fontinale var. *fontinale* (fountain thistle) is a perennial herb in the aster family (Asteraceae) and is currently found only in San Mateo County. *C. fontinale* var. *fontinale* is 30

to 60 cm (1 to 2 feet) tall and is restricted to perpetually moist serpentine seeps or streams in chaparral, valley, or foothill grasslands. (Keil and Turner 1993; CNPS 2001). Generally, the flower heads are grouped into clusters and are nodding when in bloom. Flowers are white to pink or lavender and appear from June to October (Keil and Turner 1993). *C. fontinale* var. *fontinale* is associated with coyote brush (*Baccharis pilularis*), deerweed (*Lotus scoparius*), needlegrasses (*Nasella pulchra*, *N. lepida*), seep monkeyflower (*Mimulus guttatus*), and the federally-listed threatened Marin dwarf-flax (*Hesperolinon congestum*).

Pentachaeta bellidiflora

Pentachaeta bellidiflora (white-rayed pentachaeta) is a small annual plant in the aster family (Asteraceae) found only San Mateo County. The plants are 6 to 17 cm (2.3 to 6.6 in) tall. The flower heads consist of 7 to 16 white, strap-shaped petals surrounding 16 to 38 yellow ray flowers. The plants bloom from March to May. The single known population is found on serpentine grassland and co-occurs with dwarf plantain (*Plantago erecta*), purple needlegrass (*Nasella pulchra*), and coastal tidy-tips (*Layia platyglossa*).

Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from the 1998 Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (U.S. Fish and Wildlife Service 1998), survey information from experts who have been monitoring various localities of these species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game. The Recovery Plan and personal communications with experts were our primary sources of information used to update the species' status and threats. We received no information from the public in response to our Federal 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 provides an indication of their 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:

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Lead Field Office: Kirsten Tarp, Recovery Branch, Fish and Wildlife Biologist, Sacramento Fish and Wildlife Office, Region 8, California and Nevada; (916) 414-6600.

Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of these taxa and the opening of a 60-day period to

receive information from the public was published in the Federal Register on March 25, 2009 (74 FR 12878). No reports of information were received.

Listing History:

Table 1. Original Listings of *Acanthomintha obovata* ssp. *duttonii*, *Cirsium fontinale* var. *fontinale*, and *Pentachaeta bellidiflora*

Plants listed	FR Notice	Date Listed	Entity Listed	Classification
<i>Acanthomintha obovata</i> ssp. <i>duttonii</i>	50 FR 37858	Sept 18, 1985	subspecies	Endangered
<i>Cirsium fontinale</i> var. <i>fontinale</i>	60 FR 6671	Feb. 3, 1995	variety	Endangered
<i>Pentachaeta bellidiflora</i>	60 FR 6671	Feb. 3, 1995	species	Endangered

State Listings: *Acanthomintha obovata* ssp. *duttonii*, *Cirsium fontinale* var. *fontinale* and *Pentachaeta bellidiflora* were listed by the state of California as endangered in 1979, 1979, and 1982 respectively.

Associated Rulemakings: No associated rulemakings have been made.

Review History: No previous 5-Year Reviews or other relevant documents have been written for *Acanthomintha obovata* ssp. *duttonii*, *Cirsium fontinale* var. *fontinale*, or *Pentachaeta bellidiflora*.

Species’ Recovery Priority Numbers at Start of 5-Year Review: The recovery priority numbers for the three species are shown in Table 2 below according to the Service’s 2009 Recovery Data Call for the Sacramento Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates whether the taxon is a monotypic genus, species, subspecies or variety; the degree of threat; and the potential for recovery. The “C” indicates conflict with construction or other development projects or other forms of economic activity.

Table 2. Recovery Priority Numbers for *Acanthomintha obovata* ssp. *duttonii*, *Cirsium fontinale* var. *fontinale*, and *Pentachaeta bellidiflora* at Start of 5-Year Review

Plants listed	Priority number	Conflict
<i>Acanthomintha obovata</i> ssp. <i>duttonii</i>	6C	Conflict with development upslope of population.
<i>Cirsium fontinale</i> var. <i>fontinale</i>	6	
<i>Pentachaeta bellidiflora</i>	8	

Recovery Plan or Outline

Name of Plan or Outline: Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area.

Date Issued: The final recovery plan was published September 30, 1998. No revisions have been made to the plan.

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 are plants, the DPS policy is not applicable, and the application of the DPS policy to the species’ listings is not addressed further in this review.

Information on the Species and their Status

Species Biology and Life History

Spatial Distribution

Acanthomintha obovata ssp. *duttonii*

At the time of listing in 1985, *Acanthomintha obovata* ssp. *duttonii* was known from one occurrence in Edgewood Park in San Mateo County, California. In 1987, a second smaller occurrence of less than 20 plants was found in an area called the “Triangle”, southwest of the intersection of Edgewood Road and the I-280 overpass and west of Redwood City (CNDDDB 2009). However, the species has not been seen at the Triangle since 2001 (CNDDDB 2009, Niederer *et al.*, 2010). The species is currently known only from the single location in Edgewood Park and occupies 0.05 acre (Niederer *et al.*, 2010).

Cirsium fontinale var. *fontinale*

At the time of listing in 1995, *Cirsium fontinale* var. *fontinale* was known from three locations in San Mateo County. One occurrence consisting of several subpopulations was located east of Crystal Springs Reservoir, a second occurrence was found 10 km (6 mi) to the south in the Triangle area, described in the section above for *Acanthomintha obovata* ssp. *duttonii*, and the third occurrence consisted of a single plant in Edgewood Park. During surveys conducted by the San Francisco Public Utilities Commission (SFPUC) in December 2009, plants continued to be found at Element Occurrence 1 (in the CNDDDB), east of Crystal Springs Reservoir. In CNDDDB, plant taxa, animal taxa, and natural communities are referred to as “elements.” An “element occurrence” is a location record for a site which contains an individual, population, nest site, den,

or stand of a special status element. Populations, individuals, or colonies located within 0.25 mile of each other generally constitute a single occurrence, sometimes with multiple “parts.” In recent years some small subpopulations of Element Occurrence 1 could not be relocated; however, during the December 2009 surveys a new large subpopulation was discovered which is also part of Element Occurrence 1. Element Occurrence 1 comprises 97 percent of all known plants of this species. The Triangle and Edgewood Park occurrences have been extirpated (S. Foree, San Francisco Water District, pers. comm., August 5, 2009). Two additional small occurrences have been found since the time of listing. One occurrence (Element Occurrence 7) was discovered at Stulsaft Park, in Redwood City, in 2007. Another occurrence (Element Occurrence 8) was found east of Woodside Glens in 2003. Therefore, three occurrences of *C. fontinale* var. *fontinale* are currently known to exist.

Pentachaeta bellidiflora

At the time of listing, *Pentachaeta bellidiflora* was known from a single large occurrence in the Triangle area which extended east of I-280 into Eastwood Regional Park. Historically, the species was more widespread and was known from at least nine locations in Marin, San Mateo, and Santa Cruz Counties. Most of the occurrences were lost due to urbanization or disturbance from off-road vehicles (CNDDDB 2010). The Triangle remains the only known verified occurrence of *P. bellidiflora* (CNDDDB 2010); however, since the time of listing, a small occurrence of *P. bellidiflora* may have been found on the west side of Upper Crystal Springs Reservoir in San Mateo County (M. Vasey, San Francisco State University, *in litt.*, May 28, 2010). Further surveys need to be done to confirm this occurrence.

Abundance

Acanthomintha obovata ssp. *duttonii*

At the time of listing of *Acanthomintha obovata* ssp. *duttonii* in 1985, the single occurrence located in Edgewood Park, was estimated to contain 1,000-2,000 plants. In 1994, Pavlik and Espeland (1998) estimated over 53,000 individuals in this occurrence. This occurrence has been in decline in subsequent years. In 2008, only 249 individuals were censused and in 2009, 395 individuals were censused (Niederer *et al.* 2010). The area which supported 395 in 2009 only supported 250 in 2010 (C. Niederer pers. comm., July 21, 2010) indicating that the species is continuing to decline.

Cirsium fontinale var. *fontinale*

At the time of listing in 1995, three *Cirsium fontinale* var. *fontinale* occurrences were known to exist: 1) the occurrence located east of Crystal Springs Reservoir which contained between 1,000 and 2,800 plants, 2) the occurrence located 10 km (6 mi) to the south in the Triangle area which contained between 100 and 200 plants, and 3) the third occurrence in Edgewood Park which consisted of a single plant in 1987. The most recent data show that a newly discovered portion (Boat Ramp) of the Crystal Springs Reservoir occurrence, Element Occurrence 1, had 19,342 plants in December 2009 (S. Foree, *in litt.*, January 12, 2010). Survey data collected from 2007 to 2009 estimate that the entire Crystal Springs occurrence consists of approximately

25,000 plants (Environmental Science Associates 2010). The Triangle area occurrence declined to 7 plants by 2000 (CNDDDB 2010) and is no longer considered extant as of 2009 (S. Foree, San Francisco Water District, pers. comm., August 5, 2009). The single plant in Edgewood Park disappeared in 1996 (CNDDDB 2010). Two small occurrences have been found since the time of listing. An occurrence of 50 plants (Element Occurrence 7) was discovered at Stulsaft Park, in Redwood City, in 2007. Another occurrence of about 20 plants (Element Occurrence 8) was found east of Woodside Glens in 2003 (CNDDDB 2010). Currently, three occurrences of *Cirsium fontinale* var. *fontinale* are known to exist.

Pentachaeta bellidiflora

Surveys conducted prior to the listing in 1995 showed that the occurrence at the Triangle contained about 1.5 million plants in each of the two years the plant was surveyed in the early 1990's (U.S. Fish and Wildlife Service 1995). The most recent surveys reported to the CNDDDB in 2000 noted only that the species numbered in the millions of plants. This population extends to the east side of I-280 on Edgewood Park land; this portion of the population was found to contain 43 plants in 2004 (CNDDDB 2010). No abundance information is available for the possible occurrence near Crystal Springs Reservoir.

Habitat or Ecosystem

Acanthomintha obovata ssp. *duttonii*

The existing habitat for *Acanthomintha obovata* ssp. *duttonii* at Edgewood Park in San Mateo County is about 0.17 acres, with *A. obovata* ssp. *duttonii* plants occurring in about 0.05 acres of this area. This habitat consists of a roughly triangular serpentine vertisol slump with a north northwest aspect and an 8 degree slope. The uphill edge is delineated by Hillcrest Drive, with a residential development uphill of this road. A gutter along the uphill side of the road intercepts runoff and moves it away from the thornmint site. The western edge of the site is a mixed evergreen forest dominated by coast live oak (*Quercus agrifolia*), bay laurel (*Umbellularia californica*), and poison oak (*Toxicodendron diversilobum*). Coyote brush (*Baccharis pillularis*) and leather oak (*Quercus durata*) are found in the transition area. The eastern edge of the thornmint habitat is rocky serpentine grassland with thin soils, dominated by native annual forbs such as tidy tips (*Layia platyglossa*), dwarf plantain (*Plantago erecta*), and goldfields (*Lasthenia californica*), as well as nonnative annual grasses such as Italian ryegrass (*Lolium multiflorum*) and soft chess (*Bromus hordeaceus*). Perennial grasses such as purple needlegrass (*Nasella pulchra*) and squirreltail (*Elymus multisetus*) are also found. Elevation of the site is approximately 800 feet (Niederer *et al.*, 2010).

Cirsium fontinale var. *fontinale*

Cirsium fontinale var. *fontinale* is found in serpentine seeps in grasslands or chaparral. The largest occurrence of the species, which is a group of approximately 10 subpopulations, is located on the east side of Crystal Springs Reservoir and is approximately 400 feet in elevation. Other plant species which occur there are tufted hairgrass (*Deschampsia caespitosa* ssp.

holciformis), bugle hedgenettle (*Stachys ajugoides*), seep monkeyflower (*Mimulus guttatus*), creeping wild rye (*Leymus triticoides*), coyote brush (*Baccharis pillularis*) and the invasive species, pampas grass (*Cortaderia selloana*). The Stulsaft Park occurrence is found in a serpentine seep in an opening in a coast live oak-bay (*Quercus agrifolia* – *Umbellularia californica*) woodland. The elevation of this site is 150 feet and the associated plants are spike bentgrass (*Agrostis exarata*), twotooth sedge (*Carex serratodens*), blue wildrye (*Elymus glaucus*) and iris-leaf rush (*Juncus xiphioides*) (CNDDDB 2010). The occurrence east of Woodside Glens is located on a serpentine seep in an open area associated with sedges (*Carex* sp.), willows (*Salix* sp.), and monkeyflower (*Mimulus* sp.) (CNDDDB 2010). The elevation of this site is not known.

Pentachaeta bellidiflora

The single verified location of *Pentachaeta bellidiflora* is located largely on the Triangle with a small portion consisting of approximately 43 plants east of I-280 on Edgewood Park. CNDDDB describes the habitat of this species as open, dry rocky slopes and grasslands often on soils derived from serpentine bedrock. The elevation of the Triangle site is 520 feet. Plants which co-occur with *P. bellidiflora* on this site are dwarf plantain (*Plantago platyglossa*), purple needlegrass (*Nasella pulchra*), and brodiaea (*Brodiaea* sp.) (CNDDDB 2010).

Changes in Taxonomic Classification or Nomenclature

The taxonomic classification of *Acanthomintha obovata* subsp. *duttonii* has not changed; however it was elevated to species rank by Jokerst (Jokerst 1991, p. 278) since the taxon was listed in 1985. Jokerst treated the taxon as a full species in his treatment for the genus in the Jepson Manual (Jokerst 1993, p. 713). In this five-year review we will refer to the listed entity as *Acanthomintha (obovata)* subsp. *duttonii*; however, we will shortly contact the current author(s) of treatments of the genus for the revision of the Jepson Manual (John Miller) and upcoming relevant volume of Flora of North America. We will verify the current name and rank of the taxon and submit an addendum to this document if necessary.

No changes to classification or nomenclature for *Cirsium fontinale* var. *fontinale* or *Pentachaeta bellidiflora* have occurred since the time of listing.

Genetics No new genetic information is available for any of these species.

Species-specific Research and/or Grant-supported Activities

Acanthomintha obovata ssp. *duttonii*

In 1991, an experimental population was started at Pulgas Ridge using seeds collected from Edgewood Park (Pavlik and Espeland 1998). Additional seed was sown annually for four years; however, the number of plants produced from these seeds declined progressively. The reintroduction effort was considered a biological failure by 1998 although a few plants were expected to germinate in subsequent years (Pavlik and Espeland 1998).

The Sacramento Fish and Wildlife Office funded a 3-year restoration project to conduct habitat enhancement experiments at the natural occurrence at Edgewood Park, conduct habitat suitability surveys for potential introductions, collect and bank seed from the existing population, and initiate a seed increase program (C. Niederer *et al.*, 2010). The existing site has priority for seed reintroduction which was performed in November 2009. Key actions completed to date include:

- *Experimental seeding.* 12,500 seeds were sown experimentally into a total of 25 1-meter scraped, hand weeded, and control plots at Edgewood on November 6, 2009. Plots were also watered by hand with a total of 345 gallons over one month, for the equivalent of 2.06 inches of water during this dry period.
- *Germination counts.* On January 20, 2010, 3,777 thornmint seedlings were counted, which represents a 30% germination rate.
- *Habitat enhancement experiments.* Baseline vegetation data were collected at the existing site in April 2008, and the following enhancement treatments were completed: hand weeding, graminicide, spring mowing, fall raking, and late fall scraping. Plots were reread in April 2009, and scraping was determined to be the most effective treatment for increasing bare ground and reducing thatch. No thornmint have been found in the experimental plots, indicating a lack of seedbank response.
- *Habitat suitability surveys and soil moisture studies.* Several potential introduction sites on San Francisco Water District land were identified, and initial testing for soil composition and moisture show they are similar to the extant site.
- *Germination trials.* In 2008, the UC Berkeley Botanical Garden produced 5,715 seeds from an initial investment of 240 seeds.
- *Seed increase.* The UC Berkeley Botanical Garden sowed an additional 6 seeds from each of 90 individuals in January 2009, for a total of 540 seeds sown. As of May 7, 2009, 268 individuals were extant, and over 11,400 seeds were harvested. In January 2010, 1,080 additional seeds were sown.
- *Population monitoring and seed collection.* In 2009, 395 individuals were censused, and 171 seeds were collected from the wild population. In 2008, 249 individuals were censused, and 139 seeds were collected.
- *Seed banking.* The seeds collected from the wild collection, plus some seeds from the seed increase project, will be sent to the National Seed Storage Laboratory in Fort Collins, CO, to supplement their existing collection of 1998 stock.

Continuing efforts will include development of an adaptive management plan, enhancing the existing site by scraping and hand weeding, introducing seeds at the existing site, and continuing to examine potential introduction sites (C. Niederer *et al.*, 2010).

Additional Preventing Extinction funding was awarded by the Service in 2010 to Creekside Center for Earth Observation for an additional year of enhancement and monitoring of the single extant occurrence, continuation of the ongoing seed increase program at the UC Berkeley Botanical Garden, and instigation of introduction of the species at one to two additional sites.

Cirsium fontinale var. *fontinale*

A study on a portion of Element Occurrence 1 of *Cirsium fontinale* var. *fontinale*, near Crystal Springs Reservoir by Powell *et al.* (2009), looked at the breeding system, pollination ecology and demography of *C. fontinale* var. *fontinale*. This study compared *C. fontinale* var. *fontinale* to five other species of *Cirsium* that occur in northern California, including one invasive nonnative thistle, *Cirsium vulgare* (bull thistle). The results of the study showed that *C. fontinale* var. *fontinale* experienced a 90 percent reduction in seed production when pollinators were excluded. The primary pollinators for *C. fontinale* var. *fontinale* in this study were Vosnesenski's bumblebee (*Bombus vosnesenskii*), common honeybee (*Apis mellifera*), and sweat bees (Halictidae). *C. fontinale* var. *fontinale* had the lowest seed set of any of the six species studied. The authors suggest that successful establishment of *C. fontinale* var. *fontinale* populations may require a large number of plants in order to attract sufficient pollinators.

A second study conducted on *Cirsium fontinale* var. *fontinale* and four other *Cirsium* species that are found in northern California (Powell and Knight 2009) tested the hypothesis that *C. fontinale* var. *fontinale* is restricted to low-nutrient serpentine habitat because of its inability to compete with other species in more productive, low-stress habitats. In contrast to expected results, *C. fontinale* var. *fontinale* was found to compete well even in high-nutrient environments leaving the question of why *C. fontinale* var. *fontinale* is found only on serpentine soils unanswered. As part of this greenhouse study, *C. fontinale* var. *fontinale* seed was found to need only water to stimulate germination which occurred within one to two weeks.

A demographic study for the San Francisco Public Utilities Commission was conducted by Kroiss (2008) on the same two portions of Element Occurrence 1 of *Cirsium fontinale* var. *fontinale* near Crystal Springs Reservoir that were studied by Powell *et al.* 2009. The two study sites are separated by I-280 and are approximately 350 meters apart. One study site (referred to as the Lexington population) is located near a dry seep in a dry field and the other (called the Skyline population) is located along a stream near a woodland. Approximately 40 individual plants were tagged in each population in 2007 and were recensused in 2008. The results of this brief study showed that plants at the wetter Skyline population had a larger number of flowers per plant and higher survival rate than those at the drier Lexington site.

In 2009, funding from the American Recovery and Reinvestment Act was received by Acterra, a non-profit organization, to benefit the occurrence at Stulsaft Park in Redwood City. Approximately half of this funding will be used to remove two non-native invasive plants, giant reed grass (*Arundo donax*) and jubata grass (*Cortaderia jubata*), which are competing with the *Cirsium fontinale* var. *fontinale*. The remainder of the funding will be used to develop a management plan for the *C. fontinale* var. *fontinale* at this site (C. Elliott, Acterra, *in litt.* 2010).

Pentachaeta bellidiflora

No research or grant-supported activities are known to have been conducted specifically on this species since the time of listing. However, Weiss and Luth (2003) have conducted research on the effects of nitrogen deposition in a serpentine grassland in the Santa Clara Valley which has bearing on threats to *Pentachaeta bellidiflora*. Weiss and Luth found that nitrogen deposition

from automobiles on Interstate 280 was responsible for higher nitrogen levels within 400 meters on the west side of the roadway. Grass cover was higher in these areas. The authors noted that the only known occurrence of *P. bellidiflora* exists east of the freeway. There is an elevated zone of nitrogen-deposition extending out approximately 100 meters on the east side of the freeway and the species may be at long-term risk from invasions of nitrogen-loving grasses and other weedy plant species. *P. bellidiflora* is restricted to the thinnest soils in that 100 meter zone; beyond 100 meters, it is one of the dominant plants in the grassland. (S. Weiss *in litt*, May 25, 2010). Invasions of these nitrogen loving plants into nitrogen-limited grasslands and shrublands appears to be a common response to atmospheric nitrogen deposition.

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. See Table 3 for a summary of threats noted at the time of listing.

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

Factor A threats noted at time of listing:

Acanthomintha obovata ssp. *duttonii*. The final listing rule notes that a proposed recreation plan and golf course could adversely affect the thornmint colony on Edgewood Park and, considering the small number of plants at the single site, could easily destroy the entire population. The rule noted the possibility that additional colonies may exist on the Crystal Springs Reservoir but that none had been located recently.

Cirsium fontinale var. *fontinale*. A small project to widen Highway 92 east of Crystal Springs Reservoir was under review and removal of water from the increased road surface had the potential to adversely affect some of the plants. Proposed construction of multi-use trails on San Francisco Water Department land in the Triangle area west of I-280 was considered a threat to a small occurrence through modification of hydrologic regimes and direct loss of plants. *C. fontinale* var. *fontinale* is dependent on seeps and springs, therefore, any reduction in water flow would have threatened the plants. A single plant in Edgewood Park occurred in a drainage ditch beside a trail. Clearing of this ditch to improve drainage could have damaged or destroyed the plant and any seedlings it may have produced.

Pentachaeta bellidiflora. The final listing rule stated that proposed construction of a multi-use trail on San Francisco Water Department land within the Triangle site may threaten *Pentachaeta bellidiflora* habitat.

Factor A threats known currently:

Acanthomintha obovata ssp. *duttonii*. A golf course is no longer proposed for Edgewood Park. After many years of debate, public hearings, and analysis, the Board of Supervisors closed the issue of developing a golf course at Edgewood Park by reaffirming in 1993 that the entire 467-

acre park was a “Natural Preserve”, by amending the Joint Powers Agreement with Midpeninsula Regional Open Space District to prohibit a golf course, and by modifying the existing Open Space Easement to eliminate high-intensity recreational uses (San Mateo County - Department of Parks, no date). This action was largely based on findings that a golf course at Edgewood Park would result in take of the federally-threatened bay checkerspot butterfly (*Euphydryas editha bayensis*). No additional information is available regarding a possible occurrence of *Acanthomintha obovata* ssp. *duttonii* at Crystal Springs Reservoir.

Pavlik and Espeland (1998) documented a shift in the plant’s distribution downslope at the Edgewood Park occurrence as the result of an intense winter storm that caused soil erosion. *Acanthomintha obovata* ssp. *duttonii* seed moved downslope into an area that had not previously supported the plant. The occurrence is now found within about 10 meters of the lower edge of its potential habitat, with little room to continue dispersing downhill. Many plants are within one meter of the lateral edge of the habitat (Niederer *et al.*, 2010). The occurrence is bound on all sides by barriers of either inappropriate habitat or urban development; to the north and west are woodlands, to the east is a rocky, upland slope and to the south is a road and housing (C. Niederer, pers. comm., July 21, 2010).

Cirsium fontinale var. *fontinale*. The occurrences on the Triangle and Edgewood Park are now considered extirpated. No further information is available regarding impacts to the plants from the Highway 92 road widening project. The largest subpopulation of Element Occurrence 1, the Boat Ramp subpopulation on the east side of Crystal Springs Reservoir, which was found since the time of listing, is threatened by the proposed increased water surface elevation and habitat conversion at Crystal Springs Reservoir (City and County of San Francisco 2010). The San Francisco Public Utilities Commission (SFPUC) is proposing to implement the Lower Crystal Springs Dam Improvements Project. This project would modify the Lower Crystal Springs Dam to comply with requirements of the California Department of Water Resources, Division of Safety of Dams (DSOD). Implementation of the project would result in the removal of the DSOD operating restrictions on Crystal Springs Reservoir and restoration of the historical storage capacity of the reservoir. The March 2010 Draft Environmental Impact Statement states that 0.30 acre of occupied fountain thistle habitat supporting an undetermined number of plants would be lost (City and County of San Francisco 2010). Because Element Occurrence 1 represents at least 97 percent of all known plants of this species, any loss of habitat at this site is a significant loss to the species.

Construction of a trail is no longer proposed on the San Francisco Water Department land within the Triangle site (S. Foree, *in litt.*, May 19, 2010). Therefore, this threat to the species from changes in hydrologic regime and direct loss of plants has been removed.

Pentachaeta bellidiflora. Construction of a trail is no longer proposed on the San Francisco Water Department land within the Triangle site (S. Foree, *in litt.*, May 19, 2010) which alleviates this source of non-native plants as a threat. The SFPUC is proposing to create the Adobe Gulch Grassland Restoration Site near the southwest edge of Crystal Springs Reservoir, immediately adjacent to the possible location of a second occurrence of *P. bellidiflora* (Winzler and Kelly 2010). The proposed actions within the Restoration Site include enhancing the coastal terrace prairie by shrub removal. Potential habitat for *P. bellidiflora* may exist within the Restoration

Site; however, surveys have not been conducted to determine if the area supports additional plants. Disturbance to the Restoration Site may encourage invasive plants to become established (M. Vasey pers. comm., June 29, 2010) and compete with the *Pentachaeta bellidiflora* if it exists there.

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

Factor B threats noted at time of listing:

Acanthomintha obovata ssp. *duttonii*. The final listing rule notes that patches of soil containing individuals of *Acanthomintha obovata* ssp. *duttonii* were removed for unknown reasons and without authorization from Edgewood Park in 1981 and 1983.

Overutilization was not known to be a factor for *Cirsium fontinale* var. *fontinale* or *Pentachaeta bellidiflora* in the 1995 final listing rule.

Factor B threats known currently:

Acanthomintha obovata ssp. *duttonii*. No additional soil or plant removal has been observed at the Edgewood Park site (C. Niederer, pers. comm., July 21, 2010).

Overutilization for any purpose does not appear to be a threat at this time for any of these three species.

FACTOR C: Disease or Predation

Factor C threats known at time of listing:

Acanthomintha obovata ssp. *duttonii* and *Pentachaeta bellidiflora*. Disease or predation were not known to be a factor for these species in their final listing rules.

Cirsium fontinale var. *fontinale*. Seed predation by an unspecified species of beetle larvae was reported to occur on this species; however, the impact of this predation was not known.

Factor C threats known currently:

Acanthomintha obovata ssp. *duttonii* and *Pentachaeta bellidiflora*. Disease or predation are not known to be a threat at this time.

Cirsium fontinale var. *fontinale*. Seed predation by unspecified insect larvae continued to be observed in seed collected from the Crystal Springs Reservoir occurrence in 2009 and 2010 (M. Wall *in litt.*, 2009, 2010); however the effects of insect predation on *C. fontinale* var. *fontinale* have not been studied.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

Factor D threats known at the time of listing for all species:

At the time of listing, the California Endangered Species Act was not considered to provide adequate protection to the species in their natural habitats.

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA): 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. *Acanthomintha obovata ssp. duttonii*, *Cirsium fontinale var. fontinale* and *Pentachaeta bellidiflora* are listed as endangered by CESA.

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 listed plants. We do not consider salvage to provide adequate protection for these species because transplanting often results in failure due to unknown reproduction and survival requirements of the species and inappropriate or inadequate reintroduction sites.

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for these species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. 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 CFR 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.

Section 9 prohibits the taking of any federally listed endangered or threatened species. 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." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt

normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). 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. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program.

With regard to federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the "take" of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of a state law or regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

Section 404 of the Clean Water Act: Section 404 of the Clean Water Act regulates the placement of dredge and fill materials into waters of the United States (including small acreages above the headwaters of streams). The U.S. Army Corps of Engineers is the agency responsible for administering the section 404 program. The final listing for *Cirsium fontinale* var. *fontinale* noted that the loss of upland watersheds that are not protected may result in altered wetland hydrology. In practice, therefore, the Corps' actions would not adequately protect the *C. fontinale* var. *fontinale*.

Summary of Factor D: In summary, the Endangered Species Act is the primary Federal law that has provided protection for these species since the dates of their listing as endangered in 1985 and 1995. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent their status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Endangered Species Act.

Factor D threats known currently for all species:

No substantial changes have been made to the above regulations. No additional legal protections are afforded to the species.

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

The 1995 rule to list the *Cirsium fontinale* var. *fontinale* and *Pentachaeta bellidiflora* also noted in the Background section that the destruction of serpentine habitat due to urban development increased the risks of extinction due to chance events such as fire, pest, or disease outbreaks, reproductive failure, or other natural or human-caused disaster. Although this threat was not specifically noted under Factor E in the listing rule for the species, it was considered to be a threat to the species and continues to be a threat at this time.

Factor E threats known at time of listing:

Acanthomintha obovata ssp. *duttonii*. The threats identified for *Acanthomintha obovata* ssp. *duttonii* were an unstable slope above the colony, landslides onto the road above the colony, and low numbers of plants leading to genetic depletion and reduced reproductive potential.

Cirsium fontinale var. *fontinale*. Several subpopulations were known to be threatened by non-native plant species including pampas grass (*Cortaderia selloana*). Dumping of garden debris from households on the ridge above the plants covered the plants and rendered the habitat unsuitable for plant establishment and growth. Seed predation had been observed and was thought to increase the vulnerability of the species to elimination by chance events. Low occurrence numbers indicated genetic depletion could threaten the species. This threat was also noted in Factor C in the listing rule.

Pentachaeta bellidiflora. Factor E in the listing package noted that competition from non-native plant species was a potential threat if there is soil disturbance. If the proposed trail was constructed on the Triangle, the soil disturbance could result in encroachment and competition with non-native plant species.

Factor E threats known currently:

Acanthomintha obovata ssp. *duttonii*. Current threats to this species are largely unchanged since the time of listing. The species is still represented by a single, small occurrence which is downslope of a development. Numbers of plants at this occurrence have declined steadily from 53,000 plants in 1994 (Pavlik and Espeland 1998) to 395 plants in 2009 (Niederer *et al.*, 2010). Although seed sowing trials at the Edgewood Park site have been successful, the area which supported 395 in 2009 only supported 250 in 2010 (C. Niederer pers. comm., July 21, 2010) suggesting that the species is continuing to decline unless supplemental seed is applied to the site. The low numbers of plants continues to threaten the species with genetic depletion and reduced reproductive potential. Additionally, this occurrence which is small in area and in numbers of plants is readily threatened by stochastic events such as fire, erosion from flooding, herbivory, and disease.

Cirsium fontinale var. *fontinale*. A portion of Element Occurrence 1 near the intersection of Highway 92 and Interstate 280 is impacted by jubata grass (*Cortaderia jubata*) (S. Foree, pers. comm., August 5, 2009). No further information is available on garden debris dumping in *C. fontinale* var. *fontinale* habitat. Because, the species is still only represented by three occurrences, the low numbers of occurrences continue to threaten the species with genetic

depletion.

A threat that has become evident since the time of listing, is the species' dependence on a limited number of pollinators, one of which (the common honeybee) is in decline. The Powell *et al.* (2009) study on *Cirsium fontinale* var. *fontinale* found that seed production was reduced by 90 percent when pollinators were excluded. The primary pollinators were the yellow-face bumblebee (*Bombus vosnesenskii*) and the honeybee (*Apis mellifera*). Native bumblebees and honeybees are in serious decline. The numbers of managed honeybee hives in the United States have declined steadily since the 1940's (Pettis and Delaplane 2010). In the winter of 2004–2005, California beekeepers began reporting unusual colony losses from unknown reasons (Pettis and Delaplane 2010). A decline in the abundance and distribution in North America of several native bumblebees has been noted since the mid 1990's (Evans *et al.* 2008). Although it is not known whether *B. vosnesenskii* is experiencing losses, the severe decline of several previously common bumblebees, including the recent disappearance of the western bumblebee (*Bombus occidentalis*) from northern and central California, is cause for concern. A similar loss of the primary pollinators for *C. fontinale* var. *fontinale* would result in greatly reduced seed production and fewer numbers of plants.

Pentachaeta bellidiflora. Current Factor E threats to this species are largely unchanged since the time of listing. *P. bellidiflora* continues to be limited to a single verified occurrence at the Triangle. Because the species is found at a single site, it is threatened by natural catastrophes that could effect the entire occurrence such as fire, disease, genetic depletion, or drought. These events could increase the risk of genetic changes that decreases the ability of the species to survive. A multi-use trail is no longer proposed to be constructed in the Triangle (S. Foree, *in litt.*, May 19, 2010) alleviating this threat from additional invasive plants. Invasive plant species that are present on the Triangle site are teasel, jubata grass, fennel, harding grass, hoary mustard, bull thistle, and Spanish broom; however, these plants do not directly threaten the *Pentachaeta bellidiflora* which is located on a hillside that supports fewer weedy plants (S. Foree, *in litt.*, May 21, 2010). Weiss and Luth (2003); however, have conducted research on the effects of nitrogen deposition in a serpentine grassland in the Santa Clara Valley which has bearing on threats to *P. bellidiflora*. Weiss and Luth found that nitrogen deposition from automobiles on Interstate 280 were responsible for higher nitrogen levels within 400 meters on the west side of the roadway. Grass cover was higher in these areas. The authors noted that the only known occurrence of *P. bellidiflora* exists east of the freeway. There is an elevated zone of nitrogen-deposition extending out approximately 100 meters on the east side of the freeway and the species may be at long-term risk from invasions of nitrogen-loving grasses and other weedy plant species. *P. bellidiflora* is restricted to the thinnest soils in that 100 meter zone; beyond 100 meters, it is one of the dominant plants in the grassland. (S. Weiss *in litt.*, May 25, 2010). Invasions of these nitrogen loving plants into nitrogen-limited grasslands and shrublands appears to be a common response to atmospheric nitrogen deposition.

Climate Change (for all species). Climate is predicted to change in California during the 21st century (Field *et al.* 1999; Cayan *et al.* 2005). Even modest changes in warming could result in a reduction of the spring snowpack, earlier snowmelt, and more runoff in winter with less runoff in spring and summer, more winter flooding, and drier summer soils (Field *et al.* 1999; Cayan *et al.* 2005). The predicted impacts on California's ecosystems projected with a high certainty include

higher sea level; decreased suitable habitat for many terrestrial species as climate change intensifies human impacts; and increased competition among urban, agricultural, and natural ecosystem uses (Field *et al.* 1999). Although the specific effects of climate change on *Acanthomintha obovata* ssp. *duttonii*, *Cirsium fontinale* var. *fontinale*, and *Pentachaeta bellidiflora* are unknown, the effects of increased winter flooding and drought conditions in the spring have the potential to adversely affect these species.

Table 3. Threats to *Acanthomintha obovata* ssp. *duttonii*, *Cirsium fontinale* var. *fontinale*, and *Pentachaeta bellidiflora* noted at the time of listing.

Species	Factor A <i>Present or threatened destruction, modification, or curtailment of its habitat or range.</i>	Factor B <i>Overutilization for commercial, recreational, scientific, or educational purposes.</i>	Factor C <i>Disease or predation.</i>	Factor D <i>Inadequacy of existing regulatory mechanisms.</i>	Factor E <i>Other natural or manmade factors affecting its continued existence.</i>
<i>Acanthomintha obovata</i> ssp. <i>duttonii</i>	Proposed golf course development. Other populations may exist on Crystal Springs Reserve but have not been substantiated.	In 1981 and 1983 soil and plants were removed for unknown reasons. Further unauthorized removal may threaten the species.	No diseases reported but small population may make the colony vulnerable to disease.	County regulations and State law allow salvage of plants.	Unstable slope above the colony was graded to stabilize it. Further landslides may occur. OHV use and trash dumping were threats in the past and could reoccur. Low population numbers may mean genetic depletion could threaten the species.
<i>Cirsium fontinale</i> var. <i>fontinale</i>	Habitat fragmentation and loss from Highway 92 widening. Construction of trails on San Francisco Public Utilities Commission land in the Triangle could result in loss of plants or modification of hydrology. One plant in Edgewood Park	Not a threat.	Seed predation by beetle larvae. Effects are unknown.	Loss of upland watersheds, which are not protected under Section 404 of the Clean Water Act may adversely affect wetland hydrology. Actions of the Army Corps of Engineers would not adequately protect the species in riparian serpentine seeps.	Alien plants such as <i>Cortaderia selloana</i> (pampas grass) are established near the <i>C. fontinale</i> var. <i>fontinale</i> and may threaten several subpopulations. Garden refuse dumping covers the plants.

Species	Factor A <i>Present or threatened destruction, modification, or curtailment of its habitat or range.</i>	Factor B <i>Overutilization for commercial, recreational, scientific, or educational purposes.</i>	Factor C <i>Disease or predation.</i>	Factor D <i>Inadequacy of existing regulatory mechanisms.</i>	Factor E <i>Other natural or manmade factors affecting its continued existence.</i>
	occurs in a drainage ditch and could be damaged by ditch maintenance.				
<i>Pentachaeta bellidiflora</i>	Proposed trail construction on Water Department land on the Triangle.	Not a threat.	Not a threat.	State law allows salvage or removal of plants.	Potentially threatened by invasive plant species, particularly at potential trail construction sites on Triangle.

III. RECOVERY CRITERIA

An approved final recovery plan, *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (USFWS 1998), which included these three species was published in 1998. Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and the threats to its survival are neutralized, so that its long-term survival in nature can be ensured. The goal of this process is the maintenance of secure, self-sustaining wild populations of the species. Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated. The recovery plan

recommends that *Acanthomintha obovata* ssp. *duttonii* and *Cirsium fontinale* var. *fontinale* should not be delisted; therefore, no delisting criteria are given for these two species.

Progress toward meeting recovery criteria and relevance of criteria to current status:

Acanthomintha obovata ssp. *duttonii* may be downlisted to threatened status when:

1. **Occupied habitat at the following locations has been secured and protected from incompatible uses: Edgewood Park, the Triangle, and Pulgas Ridge with adjacent unoccupied habitat and a 150-meter (500-foot) buffer; two additional populations (5 total).** (This criterion addresses listing factors A, B and E). This criterion is only partially up-to-date and relevant to the species status because the Triangle and Pulgas Ridge occurrences are no longer extant.

This criterion has not been met. Potential habitat at the Pulgas Ridge site has not been protected for this species. The species has not been found at the Triangle since 2000 (CNDDDB 2010) and the introduction effort at Pulgas Ridge failed. Only the Triangle occurrence is known to be currently extant (CNDDDB 2010). Additional sites need to be chosen for introductions or reintroductions.

2. **A management plan is approved and implemented for recovery areas and includes survival of the species as an objective for all five populations and any adjacent areas identified as essential to continued survival of the species.** (This criterion addresses listing factors A and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has been partially met. A management plan for the *Acanthomintha obovata* ssp. *duttonii* occurrence at Edgewood Park has been developed by Creekside Center for Earth Observation as part of a Preventing Extinction grant. This plan includes general management guidelines that can be applied to additional sites if introduction of the plant occurs at other areas.

3. **Population monitoring in specified recovery areas shows stable or increasing numbers of plants over 20 years (or longer if suggested by the results of demographic monitoring).** (This criterion addresses listing factors A, B, C and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been met. Monitoring of the Edgewood Park occurrence has been conducted intermittently since 1978 but not for a consecutive 20-year period. Results of the monitoring show that numbers of plants have declined significantly since 1978.

4. **Seeds stored in at least two Center for Plant Conservation-certified facilities; seed germination and propagation techniques understood.** (This criterion addresses listing factors C and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has been largely met. Successful seed germination and propagation have been conducted at the University of California Botanical Garden at University of California at Berkeley in 2008 and 2009. Seeds collected in 1998 are currently being stored at the National Seed Storage Laboratory in Fort Collins, Colorado (C. Niederer *et al.* 2010).

Cirsium fontinale var. *fontinale* may be downlisted to threatened status when:

1. **Occupied and former known habitat along with adjacent unoccupied habitat and a 150-meter (500-foot) buffer at three known sites (Crystal Springs Reservoir, Triangle, and Edgewood Park) are secured and protected from incompatible uses.** (This criterion addresses listing factors A, D and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been met. The occurrences at Triangle and Edgewood Park, are no longer considered extant. The single plant at Edgewood Park was not observed after 1993. Plants at the Triangle site declined to 7 plants by 2000 (CNDDDB 2010) and this occurrence is no longer considered extant as of 2009 (S. Foree, San Francisco Water District, pers. comm., August 5, 2009); however the habitat may still present. Occupied habitat at Crystal Springs Reservoir is threatened by Lower Crystal Springs Dam Improvement Project. The largest subpopulation of Element Occurrence 1, the Boat Ramp subpopulation on the east side of Crystal Springs Reservoir, which was found since the time of listing, is threatened by the proposed increased water surface elevation and habitat conversion at Crystal Springs Reservoir (City and County of San Francisco 2010). The March 2010 Draft Environmental Impact Statement states that 0.30 acre of occupied fountain thistle habitat supporting an undetermined number of plants would be lost (City and County of San Francisco 2010). Because Element Occurrence 1 represents at least 97 percent of all known plants of this species, any loss of habitat at this site is a significant loss to the species.

2. **A management plan is approved and implemented for recovery areas and includes survival of the species as an objective for all populations and any adjacent areas identified as essential to continued survival of the species.** (This criterion addresses listing factors A and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not yet been met; however, in 2009, funding from the American Recovery and Reinvestment Act was received by Acterra, a non-profit organization, to benefit the *C. fontinale* var. *fontinale* occurrence at Stulsaft Park in Redwood City. Approximately half of this funding will be used to develop a management plan for the *C. fontinale* var. *fontinale* at this site (C. Elliott, Acterra, *in litt.*, 2010). The San Francisco Public Utilities Commission has developed and implemented the Peninsula Watershed Management Plan (San Francisco Public Utilities Commission. Available at: http://sfwater.org/detail.cfm/MC_ID/20/MSD_ID/177/C_ID/2162, accessed May 25, 2010). This plan covers the Lower Crystal Springs Reservoir and the Triangle. The plan addresses rare plants (S. Foree, *in litt.*, May 21, 2010). Policy V5 and V6 of the

Peninsula Watershed Management Plan are as follows: V5. Protect, preserve, and enhance significant botanical resources, including populations of rare, threatened, endangered, and sensitive plant species and their habitat; V6. Encourage and allow investigations of special status plants and communities on the watershed to further the SFPUC's understanding of the watershed's vegetation and its condition.

3. **Population monitoring in specified recovery areas shows stable or increasing numbers of plants with evidence of increasing numbers over a 20-year period that includes a normal precipitation cycle (or longer if suggested by the results of demographic monitoring).** (This criterion addresses listing factors A, C, D, and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been met. Periodic monitoring has shown that numbers of occurrences and numbers of plants are not stable or increasing. At least two small occurrences have apparently been extirpated since the time of listing although two additional occurrences have been discovered. Monitoring has not been continuous over a 20-year period.

4. **Seeds stored in at least two Center for Plant Conservation-certified facilities; seed germination and propagation techniques understood.** (This criterion addresses listing factors C and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has been largely met. Seed has been stored at two Center for Plant Conservation-certified facilities. Seed collected in August 2008, January 2009, and September 2009 was tested, for percent live seed and germination rate, and stored at the Rancho Santa Ana Botanic Garden between 2008 and 2010 (M. Wall, Rancho Santa Ana Botanic Garden, *in litt.*, 2008, 2009, and 2010). Seed was also submitted to U.S.D.A. National Center for Genetic Resource Preservation in Fort Collins, Colorado (S. Foree, *in litt.*, January 12, 2010).

Some data are available regarding *C. fontinale* var. *fontinale* seed germination. A study by Powell and Knight (2009) found that *C. fontinale* var. *fontinale* needed only water to stimulate seed germination. M. Wall found that few of the seed collected from the Crystal Springs Reservoir occurrence in January were viable and the seed heads were infested with insect larvae (M. Wall, Rancho Santa Ana Botanic Garden, *in litt.*, 2009). This group of seeds had a lower germination rate compared to the seeds collected in August or September.

Pentachaeta bellidiflora may be downlisted to threatened status when:

1. **A total of five populations are secured and protected from incompatible uses. These include occupied and former known habitat at the Triangle and Edgewood Park and at the new potential occurrence if it is confirmed to be *P. bellidiflora* along with additional populations and adjacent unoccupied habitat and a 150-meter (500-foot)**

buffer. (This criterion addresses listing factors A and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been met. No occurrences other than the Triangle site occurrence have been verified. No introductions or reintroductions of the species have taken place. No additional information about the potential new occurrence near Crystal Springs Reservoir is available.

- 2. A management plan is approved and implemented for recovery areas and includes survival of the species as an objective for all populations and any adjacent areas identified as essential to continued survival of the species.** (This criterion addresses listing factors A and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has partially been met. As noted above in the section on *Cirsium fontinale* var. *fontinale*, the San Francisco Public Utilities Commission has developed and implemented the Peninsula Watershed Management Plan (http://sfwater.org/detail.cfm/MC_ID/20/MSID_ID/177/C_ID/2162, accessed May 25, 2010). This plan covers the Lower Crystal Springs Reservoir and the Triangle. The plan addresses rare plants (S. Foree, in litt., May 21, 2010). Policy V5 and V6 of the Plan are as follows: V5. Protect, preserve, and enhance significant botanical resources, including populations of rare, threatened, endangered, and sensitive plant species and their habitat; V6. Encourage and allow investigations of special status plants and communities on the watershed to further the SFPUC's understanding of the watershed's vegetation and its condition. This plan does not specifically identify which areas are essential to the continued survival of the species.

- 3. Population monitoring in specified recovery areas shows stable or increasing numbers of plants with evidence of increasing numbers over a 20-year period that includes a normal precipitation cycle (or longer if suggested by the results of demographic monitoring).** (This criterion addresses listing factors A, C, and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been met. Monitoring in the late 1980's and early 1990's (CNDDDB 2010) has shown numbers of plants at the Triangle were apparently stable; however, no monitoring has been reported since 2000. The portion of the occurrence that is located in Edgewood Park has declined from 100 plants in 1989 to 43 plants in 2004 (CNDDDB 2010). No monitoring data is available at the potential Crystal Springs Reservoir site. Monitoring has not been continuous over a 20-year period. Only the Triangle occurrence is known to occur. No introductions or reintroductions have taken place.

- 4. Seeds stored in at least two Center for Plant Conservation-certified facilities; seed germination and propagation techniques understood.** (This criterion addresses listing factors C and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has been partially met. Approximately 15,000 seeds were collected from the Triangle occurrence in 2010 by staff from San Francisco Public Utilities Commission and UC Berkeley Botanical Garden. Seed will be sent to U.S.D.A. National Center for Genetic Resource Preservation in Fort Collins, Colorado for germination testing.

Pentachaeta bellidiflora may be delisted when:

1. **A total of ten populations are secured and protected from incompatible uses with at least 3 populations in each of Marin, San Mateo, and Santa Cruz Counties.** (This criterion addresses listing factors A and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been met. No occurrences other than the single Triangle site occurrence in San Mateo County have been verified. A second occurrence near the Crystal Springs Reservoir has been reported but must be confirmed. No information is available regarding whether other occurrences which are presumed by CNDDDB to be extirpated have been revisited since the time of listing.

2. **A management plan is approved and implemented for recovery areas and includes survival of the species as an objective for all populations and any adjacent areas identified as essential to continued survival of the species.** (This criterion addresses listing factors A and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been completely met. The San Francisco Public Utilities Commission has developed and implemented Peninsula Watershed Management Plan (http://sfwater.org/detail.cfm/MC_ID/20/MS_C_ID/177/C_ID/2162, accessed May 25, 2010). This plan covers the Lower Crystal Springs Reservoir and the Triangle. The plan addresses rare plants (S. Foree, in litt., May 21, 2010). Policy V5 and V6 of the Peninsula Watershed Management Plan are as follows: V5. Protect, preserve, and enhance significant botanical resources, including populations of rare, threatened, endangered, and sensitive plant species and their habitat; V6. Encourage and allow investigations of special status plants and communities on the watershed to further the SFPUC's understanding of the watershed's vegetation and its condition. This plan does not specifically identify which areas are essential to the continued survival of the of the species.

3. **Population monitoring in specified recovery areas shows no decline in numbers of plants after downlisting with evidence of increasing numbers over a 20-year period that includes a normal precipitation cycle (or longer if suggested by the results of demographic monitoring).** (This criterion addresses listing factors A, C, and E). This criterion is up-to-date and relevant to the species' current status and threats.

This criterion has not been met. The downlisting criterion has not been met. Only one verified occurrence is known to exist. Monitoring in the late 1980's and early 1990's (CNDDDB 2010) has shown numbers of plants were apparently stable; however, no

monitoring has been reported since 2000. The portion of the occurrence that is located in Edgewood Park declined from 100 plants in 1989 to 43 plants in 2004 (CNDDDB 2010). Monitoring has not been continuous over a 20-year period.

IV. SYNTHESIS

Acanthomintha obovata ssp. *duttonii*:

At the time of listing in 1985, one population of *Acanthomintha obovata* ssp. *duttonii* was known to occur in Edgewood Park in San Mateo County. In 1987, a second smaller population of less than 20 plants was found in an area called the “Triangle”, southwest of the intersection of Edgewood Road and the I-280 overpass and west of Redwood City. However, the species has not been seen at the Triangle since 2001. Currently the Edgewood Park occurrence remains the only known location of this species. In 1985, this occurrence consisted of 1,000 to 2,000 plants and in 1994 was estimated at 53,000 plants. The number of plants has varied over time; however, a survey conducted in 2009 found only 395 plants. An experimental outplanting begun in 1991 initially increased in numbers of plants but the number subsequently declined until the effort was determined by the researchers to have failed to produce a self-sustaining population. Since 2008, through the Service’s Preventing Extinction Program, the Service has funded a research and monitoring program that includes field surveys, monitoring, research of methods to encourage *A. obovata* ssp. *duttonii* seed germination, weed eradication, greenhouse propagation to increase seed available for outplanting, sowing of seed at the Edgewood Park location, identifying areas for future outplanting, and the development of a management plan. Research and reintroduction efforts will continue through 2012 with current funding from the Preventing Extinction Program. The research has resulted in information on optimum conditions for seed germination, a successful seed increase program, and experimental seeding at Edgewood Park in 2009 with resulting seedlings in 2010. Despite these efforts, the status of the species remains endangered due the low numbers of individuals, the existence of a single population, and low reproductive success in the field. Therefore, we believe *Acanthomintha obovata* ssp. *duttonii* still meets the definition of endangered, and recommend no status change at this time.

Cirsium fontinale var. *fontinale*:

At the time of listing in 1995, *Cirsium fontinale* var. *fontinale* was known from three locations in San Mateo County. One occurrence consisting of several subpopulations is located east of Crystal Springs Reservoir, a second small occurrence was found in the Triangle area, and the third occurrence consisted of a single plant in Edgewood Park. The Triangle and Edgewood Park occurrences are now considered extirpated. Two additional small occurrences have been found since the time of listing. One occurrence was discovered at Stulsaft Park, in Redwood City, in 2007. Another occurrence was found east of Woodside Glens in 2003. Therefore, three occurrences of *C. fontinale* var. *fontinale* are currently known to exist. During surveys conducted by the San Francisco Public Utilities Commission in December 2009 within the Crystal Springs Reservoir occurrence, a new large subpopulation (Boat Ramp) was discovered. This new subpopulation comprises 75 percent of all known plants of this species. A new threat to the species since the time of listing is loss of plants and habitat from inundation by the Lower

Crystal Springs Dam Improvements Project. The San Francisco Public Utilities Commission (SFPUC) is proposing to implement the project which would modify the Lower Crystal Springs Dam resulting in restoration of the historical storage capacity of the reservoir. The March 2010 Draft Environmental Impact Statement states that the increased water level would impact at least 0.30 acre of occupied fountain thistle habitat supporting an undetermined number of plants. Because the subpopulations at the Reservoir represent at least 97 percent of all known *C. fontinale* var. *fontinale* plants, any loss of habitat at this site would be a significant loss to the species. Recent research on *C. fontinale* var. *fontinale*, shows that two pollinators, *Bombus vosnesenskii*, a native bumblebee, and the honey bee, are extremely important to successful seed production. The status of the species remains endangered due the low numbers of individuals at two of the occurrences, the existence of only three occurrences, and threats to the largest occurrence from Lower Crystal Springs Dam Improvements Project. Therefore, we believe still *Cirsium fontinale* var. *fontinale* meets the definition of endangered, and recommend no status change at this time.

Pentachaeta bellidiflora:

At the time of listing, *Pentachaeta bellidiflora* had become restricted to a single remaining large occurrence in San Mateo County and had declined from at least nine historical occurrences from Marin, San Mateo, and Santa Cruz Counties . The single occurrence in the Triangle remains the only verified extant occurrence of *P. bellidiflora*. The occurrence is located largely on the Triangle, west of Interstate 280 with a small portion consisting of 100 to 200 plants east of Interstate 280 on Edgewood Park. Another small occurrence may have been found west of Crystal Springs Reservoir; however, this location needs further examination. No research or grant-supported activities are known to have been conducted specifically on this species since the time of listing. However, Weiss and Luth (2003) have conducted research on the effects of nitrogen deposition in serpentine grassland in the area of the Triangle. Weiss and Luth found that nitrogen deposition from automobiles on Interstate 280 were responsible for higher nitrogen levels in a 100-meter zone on the east side of the roadway; grass cover was higher in these areas. *P. bellidiflora* may be at long-term risk from invasions of nitrogen-loving grasses and other weedy plant species. *P. bellidiflora* is restricted to the thinnest soils in the 100 meter zone; beyond that, it is one of the dominant plants in the grassland. No other changes to threats to the species are known to have occurred since the time of listing. The numbers of plants at the Triangle is reported to be stable although no surveys have been conducted since 2000. In spite of the apparent stability of the occurrence, the status of the species remains endangered due the existence of only one occurrence and potential threats from nitrogen deposition. The species is only represented as a single occurrence, it also threatened by chance events which could effect the entire site such as drought, fire, genetic depletion, and disease. Therefore, we believe *Pentachaeta bellidiflora* still meets the definition of endangered, and recommend no status change at this time.

V. RESULTS

Recommended Listing Action:

- Downlist to Threatened
- Uplist to Endangered
- Delist (indicate reason for delisting according to 50 CFR 424.11):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No Change

New Recovery Priority Number and Brief Rationale:

Acanthomintha obovata ssp. *duttoni*: 6C. We recommend that the recovery priority number remain 6C because the species continues to experience a high degree of threat from invasive plants, low numbers of individuals, genetic depletion, and soil erosion from flooding. The occurrence is small in both area and numbers of plants, therefore, it is at high risk from chance events such as fire, herbivory, and disease. The “C” indicates that some degree of conflict exists with the housing and roads that have been constructed upslope of the occurrence and continue to influence the hydrology of the site. The recovery potential is low for this species. Previous efforts to introduce the species to Pulgas Ridge ultimately failed to create a self-sustaining population. Currents efforts have shown some early promise, however, additional years of research are needed to determine whether these reintroduction methods are successful.

Cirsium fontinale var. *fontinale*: 6C. We recommend that the recovery priority number be changed from 6 to 6C. In addition to the threats known at the time of listing, including competition with non-native plants, such as pampas grass, lack of sufficient protection under section 404 of the Clean Water Act, low numbers of populations, and seed predation by beetle larvae, the largest occurrence of the species is now threatened by implementation of the Crystal Springs Dam Improvements Project. Inundation of the shoreline resulting from raising the water level of Crystal Springs Reservoir would result in loss of plants and habitat. The “C” reflects the conflict between development of this project and the recovery of the species. The recovery potential is low for this species because it’s habitat requirements are not yet fully understood. Additionally, it is highly dependent on only two pollinators, one of which is in decline.

Pentachaeta bellidiflora 8. We recommend that the recovery priority number remain 8 because the species continues to experience a moderate degree of threat from the existence of only a single verified occurrence of the species and potential long-term effects from nitrogen deposition from automobile exhaust on Interstate 280. The nitrogen deposition could result in increased habitat for invasive, non-native grasses which could then compete with the *P. bellidiflora* for space and nutrients. The species is also threatened by chance events which could effect the entire site such as drought, fire, genetic depletion, and disease. Recovery potential for this species is ranked as high although no experimental propagation or seeding efforts of the species are known to have occurred.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Conduct surveys at occurrences of all three species which have not been visited for five years to determine if habitat remains and whether these areas would be suitable reintroduction sites if the species is no longer present.
2. Collect information on habitat preferences for all species in order to facilitate the search for suitable habitat for outplanting. Data to be collected should include associated plant communities, soil types, soil nutrients, pollinators, and hydrology of the currently occupied habitat as well as the historically occupied sites. Conditions at currently occupied sites may not represent the habitat that supported the species at historic locations, particularly for *Pentachaeta bellidiflora* which had a far greater range historically and likely more variability between sites.
3. Conduct research on propagation methods for the *Cirsium fontinale* var. *fontinale* and *Pentachaeta bellidiflora* for future outplantings and habitat restoration.
4. Conduct research on the relationship between *Cirsium fontinale* var. *fontinale* and *Deschampsia caespitosa* ssp. *holciformis* (tufted hairgrass). Determine if *D. caespitosa* ssp. *holciformis* is critical to outplantings and restoration of *C. fontinale* var. *fontinale* occurrences.
5. Determine identity and importance of pollinators for *Acanthomintha obovata* ssp. *duttonii* and *Pentachaeta bellidiflora*. (This information has already been collected for *Cirsium fontinale* var. *fontinale*). Determine habitat needs of the pollinators and ways to incorporate this information into management and restoration/outplanting plans for the species.

VII. REFERENCES CITED

- Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America? U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.
- City and County of San Francisco. 2010. Draft Environmental Impact Report. Volume 1 of 3. For the San Francisco Public Utility Commission's Lower Crystal Springs Dam Improvements Project. San Francisco Planning Department Case No. 2006.0536E, State Clearinghouse No. 2007012002. 760pp. .March.
- [CNDDDB] California Department of Fish and Game, Natural Diversity Data Base. 2009. Element Occurrence Reports for *Acanthomintha obovata* ssp. *duttonii*, *Cirsium fontinale* var. *fontinale*, and *Pentachaeta bellidiflora*. Unpublished cumulative data current to 2009.
- [CNPS] California Native Plant Society. 2001. Inventory of Rare and Endangered Plants of California (sixth edition). Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. California Native Plant Society, Sacramento, CA x + 388pp.
- Evans, E., R. Thorp, S. Jepsen, and S. H. Black. 2008. Status Review of Three Formerly Common Species of Bumble Bee in the Subgenus *Bombus*. *Bombus affinis* (the rusty patched bumble bee), *B. terricola* (the yellowbanded bumble bee), and *B. occidentalis* (the western bumble bee). Unpublished manuscript. 63pp. (Available at <http://www.xerces.org>. Accessed May 27, 2010).
- Environmental Science Associates. 2010. Lower Crystal Springs Dam Improvements Project. Terrestrial Biological Assessment. June. (ESA 207544.09) San Francisco, CA. Prepared for: San Francisco Public Utilities Commission.
- Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.
- Jokerst, J. D. 1991. A revision of *Acanthomintha obovata* (Lamiaceae) and a key to the taxa of *Acanthomintha*. *Madrono*, 38: 278-286.
- Jokerst, J. D. 1993. *Acanthomintha*. Page 713 in J.C. Hickman (editor), *The Jepson Manual: Higher Plants of California*. U.C. Press, Berkeley, California.
- Keil D. J. and C. E. Turner. 1993. *Cirsium*. Pages 232-239 in J.C. Hickman (editor), *The Jepson Manual: Higher Plants of California*. U.C. Press, Berkeley, California.
- Niederer, C., S. Weiss, and H. Forbes. 2010. San Mateo Thornmint (*Acanthomintha duttonii*)

Restoration Project at Edgewood County Park and Natural Preserve Year 2, Quarter 4. Status Report January 31, 2010. Unpublished report submitted to the U.S. Fish and Wildlife Service, Region 8, Sacramento, California.

Pavlik, B. M. and E. K. Espeland. 1998. Demography of natural and reintroduced populations of *Acanthomintha duttonii*, an endangered serpentine annual in northern California. *Madrono*. 45 (1):31-39.

Pettis, J.S. and K.S. Delaplane. 2010. Coordinated responses to honey bee decline in the USA. *Apidologie*. EDP Sciences. www.apidologie.org. 8pp.

Powell, K. I. and T. M. Knight. 2009. Effects of nutrient addition and competition on biomass of five *Cirsium* species (Asteraceae), including a serpentine endemic. *Int. J. Plant Sci.* 170(7):918-925.

Powell, K. I., K. N. Krakos, and T. M. Knight. 2009. Comparing the reproductive success and pollination biology of an invasive plant to its rare and common native congeners: a case study in the genus *Cirsium* (Asteraceae). Department of Biology, Washington University in St. Louis, St. Louis, MO. 63130. Unpublished manuscript. 14pp.

San Francisco Public Utilities Commission. No date. Peninsula Watershed Management Plan. Chapter 4: Watershed Management Goals and Policies. (San Francisco Public Utilities Commission. Available at: http://sfwater.org/detail.cfm/MC_ID/20/MSC_ID/177/C_ID/2162, accessed May 25, 2010.

San Mateo County - Department of Parks. Undated. Final Edgewood Park and Natural Preserve Master Plan, Main Body. <http://www.co.sanmateo.ca.us/portal/site/parks>. 21pp. Accessed May 27, 2010.

U.S. Fish and Wildlife Service. 1985. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for *Acanthomintha obovata* ssp. *duttonii* (San Mateo thornmint). *Federal Register* 50:37858-37862.

U.S. Fish and Wildlife Service. 1995. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Ten Plants and Threatened Status for Two Plants from Serpentine Habitats in the San Francisco Bay Region of California. *Federal Register* 60:6671-6685.

U.S. Fish and Wildlife Service. 1998. Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area. Portland, Oregon. 330+ pp.

Weiss, S. and D. Luth. 2003. Impacts of N-deposition on biodiversity in a grassland ecosystem. *Eos Trans. American Geophysical Union*, 84(46) Fall Meeting Suppl. Abstract B31B-03, 2003.

Winzler and Kelly. 2010. Mitigation and Management Plan for San Francisco Public Utilities Commission. Adobe Gulch Grassland Restoration Site. July.

Personal Communications

Foree, Sonya. 2009. San Francisco Water District. Telephone conversation with Betty Warne, Sacramento Fish and Wildlife Office, August 5. Subject: Status of *Cirsium fontinale* var. *fontinale* plants at four locations.

Niederer, Crystal. 2010. Creekside Center for Earth Observation. Telephone conversation with Betty Warne, Sacramento Fish and Wildlife Office, July 21, 2010. Subject: Decline in numbers of *Acanthomintha obovata* ssp. *duttonii* plants.

Vasey, Mike. 2010. San Francisco State University. Site visit with Betty Warne, SFWO, and Sonya Foree, San Francisco Water District, to location of observation of *Pentachaeta bellidiflora* at Upper Crystal Springs Reservoir. June 29.

In Litteris

Elliott, Clair. 2010. Electronic message to Betty Warne, Sacramento Fish and Wildlife Office, January 11. Subject: Received ARRA funding for pampas grass control in Stulsaft Park. Part of money will be used to write management plan.

Foree, Sonya. 2010. Electronic message to Betty Warne, Sacramento Fish and Wildlife Office, January 12. Subject: Census of *Cirsium fontinale* var. *fontinale* at Boat Ramp site and *Cirsium fontinale* var. *fontinale* seed submitted to NCGRP in Fort Collins, CO.

Foree, Sonya. 2010. Electronic message to Betty Warne, Sacramento Fish and Wildlife Office, May 19. Subject: No trail in the Triangle.

Foree, Sonya. 2010. Electronic message to Betty Warne, Sacramento Fish and Wildlife Office, May 21. Subject: weeds don't really threaten *Pentachaeta bellidiflora*, plants are on rocky soil.

Kroiss, Steve. 2010. Research Report written for San Francisco Public Utilities Commission. 2008.

Vasey, Mike. 2010. Electronic message to Betty Warne, Sacramento Fish and Wildlife Office, May 28. Subject: Presence of *Pentachaeta bellidiflora* at Upper Crystal Springs Reservoir.

Wall, Michael. 2008. *Cirsium fontinale* var. *fontinale* seed collection report. 13 November 2008.

Wall, Michael. 2009. *Cirsium fontinale* var. *fontinale* seed collection report. 11 March 2009.

Wall, Michael. 2010. *Cirsium fontinale* var. *fontinale* seed collection report. 21 January 2010.

Weiss, Stuart. 2010. Electronic message to Betty Warne, Sacramento Fish and Wildlife Office, May 25. Subject: Impacts to *Pentachaeta bellidiflora* from nitrogen deposition.

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW**

Acanthomintha obovata ssp. *duttonii* (San Mateo thornmint)

Current Classification: Endangered

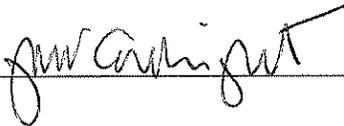
Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Betty Warne

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve  Date Aug 10, 2010

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW**

Cirsium fontinale var. *fontinale* (fountain thistle)

Current Classification: Endangered.

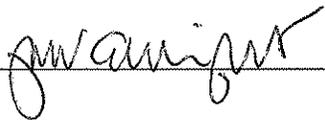
Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Betty Warne

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve  Date Aug 10, 2010

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW**

Pentachaeta bellidiflora (white-rayed pentachaeta)

Current Classification: Endangered.

Recommendation Resulting from the 5-Year Review:

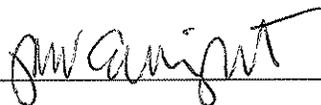
- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Review Conducted By: Betty Warne

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve



Date

Aug 10, 2010