

*Navarretia fossalis*  
(Spreading navarretia)

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



Photo by J. Snapp-Cook CFWO

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

**August 10, 2009**

## 5-YEAR REVIEW

*Navarretia fossalis* (spreading navarretia)

### 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 five years. The purpose of a 5-year review is to evaluate whether the species' status has changed since it was listed or since the most recent 5-year review was completed. 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:**

*Navarretia fossalis* (spreading navarretia) is an annual herb in the Polemoniaceae (phlox family). It occurs in vernal pool and alkali playa habitat in southern California, United States and Baja California, Mexico. *Navarretia fossalis* is dependent on the ephemeral inundation cycle found in vernal pool habitat and playas, but may also occur in man-made depressions and ditches that have the same hydrological dynamics. Plants usually flower in May and June because vernal pools must be devoid of standing water before plants begin to flower.

#### **Methodology Used to Complete This Review:**

This review was prepared by the Carlsbad Fish and Wildlife Office (CFWO), following the Region 8 guidance issued in March 2008. We incorporated information from the Recovery Plan for Vernal Pools of Southern California (Recovery Plan) (USFWS 1998b), survey information from experts who monitor various occurrences of this species, and data from the California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Game (CDFG) (CNDDDB 2009). Additionally, information from personal communications with species and habitat experts was used to update the species' status and threats. We received one letter from a private, non-profit organization in response to our *Federal Register* Notice initiating this 5-year review. Any relevant information received in that letter is included in subsequent sections of this review. This 5-year review contains updated information on the species' biology and threats, and an assessment of this information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes 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 initiated or completed within the next five years.

**Contact Information:**

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**Cooperating Field Office(s):** Julie Vanderwier, Region 8, Ventura Fish and Wildlife Office; (805) 644-1766. Review provided by Julie Vanderwier July 2009.

**Federal Register (FR) Notice Citation Announcing Initiation of This Review:** A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day comment period to receive information from the public was published in the FR on March 22, 2006 (USFWS 2006a, 14598). We received one letter regarding this 5-year review. Relevant information provided in this letter was included in this review.

**Listing History:**

**Original Listing**

**FR Notice:** 63 FR 54975

**Date of Final Listing Rule:** October 13, 1998

**Entity Listed:** *Navarretia fossalis* (spreading navarretia), a plant species

**Classification:** Threatened

**Associated Rulemakings:**

**Designation of Critical Habitat (Final Rule)**

**FR Notice:** 70 FR 60658

**Date of designation:** October 18, 2005

**Species' Recovery Priority Number at Start of 5-Year Review:** A recovery priority number of 2 was accorded *Navarretia fossalis* in the Service's 2008 Recovery Data Call based on a 1-18 range with 1 being the highest-ranked recovery priority (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates the species faces a high degree of threat and also has a high potential for recovery.

**Recovery Plan or Outline**

**Name of Plan or Outline:** Recovery Plan for Vernal Pools of Southern California

**Date Issued:** September, 1998

## 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

*Navarretia fossalis* (spreading navarretia), a member of the Polemoniaceae (phlox family), is a low, mostly spreading or ascending annual plant, 4 to 6 inches (10 to 15 centimeters ) tall. The leaves are 0.4 to 2 inches (1 to 5 centimeters) long and finely divided into slender spine-tipped lobes. The lower portions of stems are mostly hairless (glabrous). The flowers are arranged in flat-topped, compact, leafy heads. The white to lavender-white petals (corolla) are joined at their bases to form a tube, although the tips (lobes) are free. The fruit is an ovoid, two-chambered capsule. Each seed is covered by a layer that becomes sticky and viscous when the capsule is moistened. The range of *N. fossalis* overlaps with two other species in the genus *Navarretia*: *N. intertexta* (needle-leaved navarretia) and *N. prostrata* (prostrate navarretia). *Navarretia fossalis* is distinguished from the other two species by its linear corolla lobes, spreading or ascending habit, flat topped inflorescences, calyx size and shape (sepals collectively), and the position of the corolla relative to the calyx (Day 1993, p. 846).

#### Species Biology and Life History

*Navarretia fossalis* depends on the inundation and drying cycles of its habitat for survival. This regime allows for germination and other life history phases of the plant. This annual species germinates from seeds left in the seed bank. For many vernal pool plant species, temperature and moisture affect the timing of plant germination (Myers 1975, p. 67). Although not proven, it is likely that *N. fossalis* uses these same cues for germination. Most *Navarretia* species have indehiscent fruit, or fruit with fibers that absorb water and expand to break open the fruit after a substantial rain (Spenser et al. 1998, p. 82). The timing of germination is important so that the plant germinates under favorable conditions in the spring rather than the summer, autumn, or winter. *Navarretia fossalis* abundance also varies from year to year depending on precipitation and the inundation/drying time of the vernal pool. This annual variation makes it impossible to obtain an accurate count of the number of individuals in the population because the proportion of standing plants to remaining seeds in the seed bank that makes up the population cannot be measured. Additionally, the occurrences can vary spatially in alkali playa habitat where pools are not in the same place from year to year. After germination, the plant usually flowers in May and June as the vernal pool is devoid of water (Glenn Lukos 2000, p. 17). The plant then produces fruit, dries out, and senesces in the hot, dry summer months.

Pollination and dispersal mechanisms are not well known for *Navarretia fossalis*. The plant has the ability to self-pollinate but is not an obligate self-pollinator (Spenser and Rieseberg, 1998, p. 81). *Navarretia fossalis* has a low pollen to ovule ratio, suggesting there is frequent self-pollination (Spenser et al. 1998, p. 81; D. Boose, Gonzaga University, pers. comm. 2008). Outcrossing, rather than self-pollination, could be advantageous for many vernal pool specialists because it provides a way to better adapt and evolve to the changing conditions of vernal pool habitat through the recombination of beneficial genes (Spenser et al. 1998, p. 81). Outcrossing requires annual plants to flower for longer periods of time in order to attract pollinators (Spenser et al. 1998, p. 81). We have no information on the pollinators of *N. fossalis*. Hypothetically, insects would be the main pollinators of the flowers. For example, the Hymenopteran insect *Perdita navarretiae* (a type of mining bee in the Andrenidae family) has been documented to make repeated visits to *N. fossalis*, possibly for pollination (Krombein 1979, p. 1880). Many vernal pool plants are pollinated by insects that collect pollen in the vernal pool and nest upland of the pool (Thorpe et al. 1998, p. 169). This relationship between plant and pollinator connects the upland areas to the vernal pools and shows how important the upland areas are for the vernal pools' sustainability.

We have minimal information on the dispersal of *Navarretia fossalis* seeds. However, we know the seed has a layer that becomes viscous and sticky when wet. The seed could stick to an animal or bird passing through the vernal pool, providing a method of dispersal. On the other hand, theories also suggest the layer helps secure the seed during seed establishment (Sorenson 1986, p. 444). More research is needed to discover the actual methods of pollination and dispersal for *N. fossalis*.

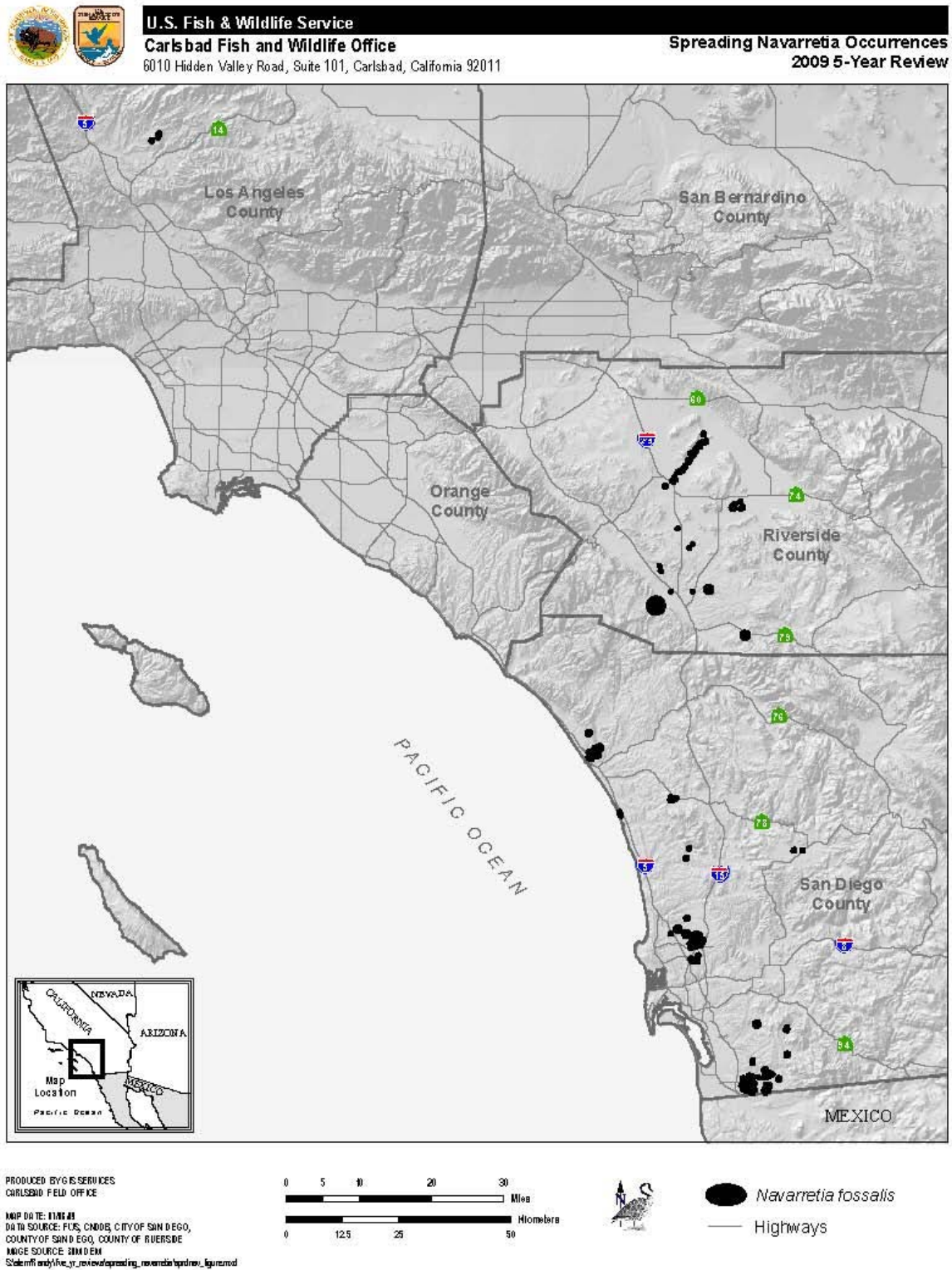
### Spatial Distribution

The range of *Navarretia fossalis* extends from northwestern Los Angeles County to western Riverside County, and coastal San Diego County in California, to San Quintin in northwestern Baja California, Mexico (Figure 1). At the time of listing, 34 populations were considered to be extant in the United States, including populations contained in the listing rule and in the Recovery Plan. Nearly 60 percent of these populations were concentrated at three locations: Otay Mesa in southern San Diego County, alongside the San Jacinto River in western Riverside County, and near Hemet in western Riverside County (Bramlet 1993, pp. 10, 14; Bauder 1986a, pp. 4-11, 4-14). At the time of listing, *N. fossalis* occupied less than 300 acres (120 hectares) of habitat in the United States (USFWS 1998b, p. 54978).

In the listing rule, use of the term "population" for places where *Navarretia fossalis* occurs implies a biological context that is unproven. Previously, vernal pools and other habitat sites that support *N. fossalis* were identified by various names. These groups of *N. fossalis* were named by association with variously defined vernal pool complexes (a group of vernal pools that are hydrologically connected), vernal pools assigned an alphanumeric reference, or portions of drainage systems.

Documentation for many of the sites that support *Navarretia fossalis* has been provided to the CNDDDB and incorporated into individual element occurrences (EO), each of which has a

Figure 1. Current distribution of *Navarretia fossalis* (spreading navarretia)<sup>1</sup>.



<sup>1</sup> Size of point on map does not reflect size of the occurrence.

consecutive unique number. This system is the most reliable, data-driven reference system that is trackable and generally available. Therefore, we adopted the reference term “occurrence” used by the CNDDDB for this review (CNDDDB 2009). The previous nomenclatural references used for each of the occurrences are provided in Table 1. For analysis and organization, Table 1 includes named and grouped pools that are connected and related to each other.

Rangewide, comprehensive surveys for *Navarretia fossalis* have not occurred since listing. The distribution of *N. fossalis* presented in this 5-year review is based on a variety of sources. Surveys are disjointed across space and time, and lack uniform variables that quantify the extent and precise location of occurrences, thus making it difficult to comprehensively evaluate the status and trend of the species. As noted above, there were 34 extant, documented occurrences of *N. fossalis* at the time of listing. Seventeen additional occurrences have been identified since listing (Table 1). Three of these recently detected occurrences have since been extirpated by development. Currently, there are 48 extant occurrences of *N. fossalis*. It is probable these 17 new occurrences existed at the time of listing, but had not been detected and therefore were not analyzed in the final listing rule. Surveys have failed to locate *N. fossalis* at 12 occurrences known at listing (Table 1); however, *N. fossalis* does not express itself every year. This natural phenomenon, where not all of the seeds in the soil germinate in a given year even when conditions are suitable, is a form of reserve termed a seed bank. Because suitable habitat is still considered present at these 12 occurrences, they are considered extant. It is possible that *N. fossalis* was present only in the seed bank and therefore not observed as standing plants when surveys were conducted. During drier years, the species is not as abundant and more difficult to find, especially during casual surveys. Also presumed extant are 7 occurrences known at listing that have not been resurveyed since listing.

In summary, the overall distribution of *Navarretia fossalis* has not changed because the new found occurrences are within the historical range of the species. Since listing, standing plants have not been observed during surveys at 12 of the known occurrences. However, it is likely that *N. fossalis* still occurs because complete surveys were not conducted every year and seeds may persist in the seed bank. The number of identified occurrences of *N. fossalis* has increased from 34 to 48 extant occurrences. It is probable that newly found occurrences existed at the time of listing but were not detected at the time of listing.

### Abundance

The germination success of most annual plants, including *Navarretia fossalis*, differs annually depending on amount of rainfall and temperature. The number of standing individuals at an occurrence differs from year to year in response to the local weather conditions of that particular year. Additionally, surveying methodology often differs from year to year for each occurrence and likely each biologist recording data for the occurrence (see Table 1). The species is also present as seeds in the seed bank. Therefore, the abundance of *N. fossalis* is difficult to measure and compare among occurrences and over time.

The listing rule characterizes the size of *Navarretia fossalis* populations as highly variable, identifying two locations in Riverside County with 300,000 and 100,000 individuals (Stowe Pool and San Jacinto River, respectively), while the majority of populations contain fewer than 1,000



individuals, such as occurrence M4 with 49 plants (USFWS 1998b, p. 54978; Table 1). At the time of listing, the seven sites in Stowe Pool and MWD Preserve (Salt Creek occurrence) contained an estimated 375,500 plants, including 300,000 in Stowe Pool (Table 1; RECON 1995, Table 1, Figure 6; USFWS 1998a, Appendix E; CNDDDB 2008, EO# 24). The highest report for Upper Salt Creek since listing is 10,500 (Appendix A). Additional occurrences along the San Jacinto River have been detected since listing. At the time of listing, occurrences along three of the sections of the river were observed to support approximately 63,500 individuals. In 2005, those same three sections were recorded as supporting 361,000 individuals (B. Jones, consultant, pers. comm. 2008). The changes in abundance of *N. fossalis* along the San Jacinto River and at Stowe Pool illustrate the dynamic nature of the seasonally-flooded alkali playa habitat, impacts from agriculture, the results of different methodologies for measuring abundance, and recent climatic variation. As such, abundance of standing plants is not a good measure of health for *N. fossalis* occurrences. Also, impacts from development have been offset by conservation measures resulting from section 7 consultations and mitigation measures implemented as part of Habitat Conservation Programs (HCPs). Examples of these measures include restoration, preservation, and enhancement (e.g., trash removal, nonnative plant control, re-introduction of *N. fossalis* in restored pools).

### Habitat or Ecosystem

*Navarretia fossalis* is typically found in vernal pool (seasonal depression wetlands) habitat, particularly in Los Angeles and San Diego Counties. In western Riverside County, however, *N. fossalis* is associated with seasonally flooded alkali vernal plain habitat that includes alkali playa (highly alkaline, poorly drained), alkali scrub, alkali vernal pool, and alkali annual grassland components.

Vernal pools form in swales, shallow drainages, and depressions that are part of an undulating landscape where soil mounds are interspersed with basins, all above water-impervious soil layers. This landscape is called “mima-mound” topography (Cox 1984, p. 1397). The listing rule states that *Navarretia fossalis* can also occur in ditches and other artificial depressions often associated with degraded vernal pool habitat (USFWS 1998b, p. 54978; Moran 1977, p. 155). For convenience of reference as noted above, groups of vernal pools are sometimes referred to as vernal pool complexes that may include two to several hundred individual vernal pools. Pools range in size from 10 to 164 feet (3 to 50 meters) across (Zedler 1987, p. 1). In recent history, more and larger pools existed, but most of this habitat has been developed. Vernal pools within a complex are generally hydrologically connected such that water flows over the surface from one vernal pool to another or water flows and collects below ground, saturating the soil and filling the vernal pool with water (Hanes et al. 1990, p. 51). Vernal pool complexes are best described from a watershed perspective, which includes all areas needed to collect rainfall and adequately fill the vernal pools within the complex. Some pools in a complex have substantial watersheds that contribute to filling the vernal pools, while others fill almost entirely from direct rainfall (Hanes et al. 1990 p. 53; Hanes and Stromberg 1998, p. 38). Additionally, subsurface inflows from surrounding soils may be an important factor in filling some vernal pools (Hanes et al. 1990, p. 51; Hanes and Stromberg 1998, p. 48).



Vernal pools support unique vegetation. Typically vernal pool species require a certain amount and duration of inundation each year, but are not as water-tolerant as true wetland vegetation. *Navarretia fossalis* is considered an obligate wetland species (found almost always in wetland areas) but is more tolerant of the ephemeral inundation of vernal pool habitat than a true wetland plant. However, more typical wetland plants can also occur in the pools. The vernal pool habitat is neither terrestrial nor aquatic, but rather a combination of both. This specialized habitat supports a diversity of rare species.

Hydrology (movement and distribution of water) is an important factor in the natural history of a vernal pool directly related to the pool's capacity to sustain biota. The complex hydrology of vernal pools is supported by both surface flows within a pool's topographic watershed (i.e., the surface area in which water drains into a vernal pool) and subsurface flows that may extend beyond the surface watershed. Surface and subsurface lateral flows between vernal pools and the surrounding uplands influence the onset and level of inundation, and the seasonal drying of vernal pools (Hanes and Stromberg 1998, p. 46). The ephemeral inundation/drying cycles and patterns of the pool dictate the distribution and phenology of vernal pool endemic species as well as the colonization of upland and wetland vegetation (Bauder 2005, p. 2130). Changes to this hydrology caused by development or other disturbance can impact the capacity of the pool to support various vernal pool taxa.

The hydrologic regime in western Riverside County, however, is unique. *Navarretia fossalis* here is associated with alkali soils series (Bramlet 1993, p. 1; USFWS 1994, p. 64812), which facilitate a hydrologic regime for this habitat involving sporadic flooding in combination with slow drainage on the alkaline soils. The habitat floods locally on a seasonal basis while large-scale flooding occurs less frequently, approximately every 20 to 50 years (Roberts 2004, p. 4). During the normal, seasonal flooding regime, alkali scrub vegetation expands its distribution and crowds out other species. When large-scale flooding occurs, standing and slow draining water is present for weeks or months and results in the death of submerged alkali scrub. These conditions allow adapted annual species (such as *N. fossalis*) to regain and locally expand their range (Bramlet 2004, p. 8; Roberts 2004, p. 4).

In summary, within the United States, *Navarretia fossalis* occurs in vernal pool and alkali playa habitat of Los Angeles, Riverside, and San Diego Counties. It is adapted to the seasonal inundation and drying of this habitat and relies on the hydrology of the vernal pool or the vernal pool complex. Our definition and understanding of *N. fossalis* habitat has not significantly changed since listing.

#### Changes in Taxonomic Classification or Nomenclature

Neither the taxonomic classification nor the nomenclature of *Navarretia fossalis* have changed since listing.

## Genetics

The genetic variation and diversity of *Navarretia fossalis* have not been studied. It is reasonable to assume that genetic diversity differs between occurrences because *N. fossalis* is found in habitat of differing soils and amount of precipitation, and is subdivided by natural features. Additionally, some genetic diversity has likely been lost with the extirpation of *N. fossalis* occurrences (USFWS 1998a, p. 46). The species is capable of self-pollination, but it can also outcross to other plants. Outcrossing can be an important factor in regaining the genetic diversity lost with the disappearance of occurrences.

## **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.

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

The listing rule reports significant losses and degradation of habitat for *Navarretia fossalis* prior to listing (USFWS 1998b, 63 FR 54983). At listing, degradation and destruction of vernal pools due to widespread urbanization in Otay Mesa were the most pressing threats, followed by agricultural practices and the long-term threats from flood control and development in the San Jacinto River and Hemet areas of Riverside County (USFWS 1998b, p. 54984). Many of these threats still have an impact on the species and new threats have emerged. Since listing, threats to this species include: urbanization, direct habitat loss to development, agricultural conversion, discing (weed abatement, fire suppression, and agriculture), manure dumping, alteration of hydrology (including urban runoff and watercourse channelization), transportation and flood control projects, grading, pipeline projects, and off-highway vehicles (OHVs) (USFWS 1998b, p. 54982-54985).

## Urbanization

Planned and ongoing development projects throughout *Navarretia fossalis*' range were described in the listing rule (USFWS 1998b, pp. 54983-54984). The threat of development has lessened since listing due to a limited amount of permanent protection and some conservation measures now in place, although urbanization is still a predominant threat to *N. fossalis*. Components of urbanization include the direct loss of habitat from development, alteration of hydrology, transportation and flood control projects, grading, pipeline construction, and OHV use.

The population of Riverside County is predicted to grow 46.3 percent from 2000 to 2020 while Los Angeles and San Diego Counties are predicted to grow 20.2 and 14.6 percent, respectively (California Department of Finance 2007, Table 2). These predictions suggest urbanization pressures will continue to rise within the range of *Navarretia fossalis*, posing an increasing threat to remaining populations near growing cities in southern California.

### Direct Habitat Loss to Development

Since listing, three (possibly four) *Navarretia fossalis* occurrences were extirpated by development (S. Brown, U. S. Fish and Wildlife Service, pers. obs. 2008) (Table 1). Additionally, Service files indicate that four occurrences (Cruzan Mesa, Wickerd Pool, DD1, and Sweetwater Reservoir) were directly impacted by development (Tables 1, 2). For example, Wickerd Pool in Riverside County was affected by the installation of a water pipeline across the occurrence (USFWS 2001a, p.1). Also, 9 of the 48 occurrences are proposed for development (San Jacinto River, Stetson-Warren/Hemet, Menifee, Scott Pool, Date Street, Los Caballos, Pacific Street, Montgomery Field, J 29-30) (Tables 1, 2). Development plays a role in the fragmentation and habitat isolation of *Navarretia fossalis*. As more land around the occurrences is developed, the degree of isolation increases and restoration potential decreases..

Habitat fragmentation within *Navarretia fossalis* occurrences or groups of nearby occurrences may also disrupt hydrological systems and create barriers to dispersal. The Service encourages project proponents to develop projects that avoid isolating vernal pools or dividing occurrences into ecologically separate fragments, and to configure preserved or restored sites adjacent to and continuous with existing preserve areas. Whenever vernal pools in a complex are impacted by development, some degree of fragmentation occurs within and among complexes. Fragmentation and associated impacts to hydrology and dispersal continue to threaten *N. fossalis* throughout its range.

The magnitude of the development threat has been lessened since *Navarretia fossalis* was listed and critical habitat designated (USFWS 1998b, p.54984). In contrast to the 30 percent of occurrences impacted by development (current impacts or proposed) listed above, 65 percent (32) of the *N. fossalis* occurrences are at least partially (portions of the occurrence) protected from land use conversion (Table 2 and included references). This latter number includes occurrences on lands under conservation easements or protected in perpetuity, lands conserved through mitigation, areas included in military Integrated Natural Resources Management Plans (INRMPs), and lands that have varying levels of protection from development (Table 2; see also discussion under Factor D below). Although occurrences on military lands are not considered fully protected because the military must maintain the flexibility to adapt the defense mission to political and technological developments (Department of Defense Instruction 4715.3, para. F.1.i(4)), these lands are currently managed in part for *N. fossalis* pursuant to section 7 consultations and implementation of INRMPs.

Since listing, many *Navarretia fossalis* occurrences impacted by development have been restored or partially restored (Table 1). These restorations help offset impacts from development of vernal pool habitat. The threat to *N. fossalis* habitat from urbanization has decreased since listing, although habitat loss from development is an ongoing predominant threat.

### Agricultural Conversion

Conversion of land for the purposes of grazing or farming was cited in the listing rule as a threat to *Navarretia fossalis*, especially in Riverside County (USFWS 1998b, p. 54985). These factors continue to threaten the San Jacinto River and flood plain in Riverside County, but are not

threats in San Diego or Los Angeles Counties (Table 2). Five occurrences in Riverside County are documented as affected by agricultural practices (San Jacinto River, Stowe Pool, Meniffee Pool, Wickerd Pool, and Johnson Ranch) (Table 2).

### Discing

Discing for weed abatement, fire suppression, and dry-land farming were listed as threats to *Navarretia fossalis* in the final listing rule (USFWS 1998, 63 FR 54984). Discing turns up the soil and inhibits *N. fossalis* from germinating. It can destroy vernal pools and affect the long-term viability of *N. fossalis*. Vernal pools are frequently selected as sites to implement fire prevention measures, such as discing, because they are in open areas near development and often support a considerable cover of highly flammable, nonnative grass.

Since listing, discing along roads and around development for weed abatement or fuel modification has continued. Discing for agricultural conversion is most abundant in Riverside County, where often such land is considered historically agricultural and therefore is exempt from many of the conservation measures in the Western Riverside County Multiple Species HCP (Western Riverside County MSHCP). *Navarretia fossalis* habitat was observed to be disced at Stowe Pool, historically one of the most abundant occurrences of the species (Brown, pers. obs. 2006a). Discing continues to be a threat to *N. fossalis*.

### Manure Dumping

Although not identified at the time of listing, manure dumping has become a threat to the long-term viability of *Navarretia fossalis* in some areas of western Riverside County. This threat is especially evident along the San Jacinto River, which harbors the most extensive occurrences of *N. fossalis* (Roberts 2005, p. 4 and Attachment A; Brown, pers. obs. 2006b; F. Roberts, USFWS, pers. comm. 2008; A. Braswell, pers. obs. 2008; E. Kashac, Santa Ana Regional Water Quality Control Board, pers. comm. 2008). The Wickerd Pool occurrence has also been affected by manure dumping (Table 2). When manure or water that leaches through it washes into the flood plain and river, it changes the pH and the soil composition. This inhibits germination of *N. fossalis* and increases nutrients, which promotes the growth of invasive nonnative plant species such as *Chenopodium spp.* (goosefoot), *Brassica nigra* (black mustard), and *Salsola tragus* (Russian thistle) (Roberts 2004, p. 7).

There is no protection to listed plants from manure dumping without local ordinances to prohibit that practice. The City of Hemet, a permittee under the Western Riverside County MSHCP, adopted two ordinances designed to halt manure dumping within the City limits. With this exception, manure dumping is a threat for the occurrences of *Navarretia fossalis* in Riverside County.

### Alteration of Hydrology

The listing rule states that increased urban runoff and channelized drainage of lands can change the inundation of a pool (USFWS 1998b, pp. 54984-54985). We include these subjects under the umbrella term of alteration of hydrology for this analysis.

At listing, alteration of hydrology was considered a predominant threat to *Navarretia fossalis*. Instances of wetlands drainage for purposes of agriculture or development in Riverside County resulted in the loss of *N. fossalis* populations (USFWS 1998b, p. 54985). The Service considered the remaining wetlands available to *N. fossalis* as smaller and more vulnerable to the effects of surrounding development than they were earlier in the century.

Since listing, there have been five accounts (San Jacinto River, Scott Pool, Mesa de Burro, Pacific Street, and Sweetwater High School) of direct alteration of hydrology to vernal pools or complexes that support *Navarretia fossalis* (Table 2). Though altered hydrology continues to threaten this species, the Service has been relatively successful in ensuring implementation of measures to reduce this threat through section 7 consultations. For example, the use of best management practices reduces the amount of runoff entering vernal pool watersheds, and restoration projects are designed to minimize water draining off impervious surfaces into vernal pool watersheds. Even with runoff minimization practices, runoff issues have been observed at the Sweetwater High School, San Jacinto Wildlife Area, Cruzan Mesa, Scott Pool, and Mesa de Burro occurrences (Table 2). However, the specific impact runoff has on *N. fossalis* is unknown because site specific monitoring has not been conducted. Preserved pools should be monitored for these runoff impacts to identify remediation where feasible and prevent further damage to vernal pool systems.

Development can alter the timing, frequency, and duration of vernal pool inundation as well as water temperature. Modifications to the uplands surrounding a vernal pool can negatively affect the pool's hydrology, even if such modifications occur outside the pool's surface watershed. For example, grading cuts near pools can accelerate the flow of water out of the subsoil (Bauder 1986b, p. 210). As such, graded slope-cuts adjacent to the watersheds of depressional features may result in "leakage" of water out of the watersheds. Such grading of the watershed was observed at the Mesa de Burro occurrence when a road adjacent to the vernal pool was graded in 2003 without authorization (D. Stadlander, U. S. Fish and Wildlife Service, pers. obs. 2003). Disturbance may also allow invasive plants or non-vernal pool species to occupy the pools and compete with vernal pool plant species (Bauder 1986a, pp. 21-22), or may also alter the composition of native species of a vernal pool.

As an obligate wetland species, *Navarretia fossalis* depends on compatible, seasonal inundation. *Navarretia fossalis* is vulnerable to changes in water levels and periods of inundation. Although some watersheds have been conserved and instances of runoff avoided through section 7 consultations, alteration of hydrology remains a predominant threat to many *N. fossalis* occurrences (Table 2).

#### Transportation and Flood Control Projects

The listing rule identified SR 125 construction on Otay Mesa as a project that could impact *Navarretia fossalis* habitat. This transportation project is completed and directly impacted the occurrences at Sweetwater Reservoir and J 29-30 vernal pool complexes (Table 2). State Route

11 (associated with a new U.S./Mexico border crossing) is planned southeast of SR 125 on Otay Mesa. Though habitat is present, *N. fossalis* was not detected and Caltrans anticipates future potential indirect impacts in the form of edge effects to occurrences if they are discovered in the area (USDOT and Caltrans 2008, pp. 3.20-11-3.20-15). Scott Road in Riverside County was also widened, threatening but not destroying the Scott Pool occurrence (Terra Nova 2007, Exhibit 6). Since listing, the Act has provided some protection for the plant, and mitigation and avoidance measures are often included in transportation and flood control project plans. Although the plant currently has protection in some areas, proposed projects may introduce threats. The San Jacinto River Improvement Project is an ongoing proposal identified at the time of listing that is not yet complete. The proposed project will affect some sections of *N. fossalis* habitat along the San Jacinto River, and preserve other sections (Dudek and Associates 2003, pp. 7-59). State Route 79 was proposed to run through the Upper Salt Creek occurrence in Hemet prior to the listing of *N. fossalis*, but now an alternate route is being proposed. Through mitigation and avoidance measures, we believe that transportation and flood control projects are not a predominant threat to *N. fossalis* at this time.

### Grading

The grading of vernal pool habitat was identified as a threat to *Navarretia fossalis* in the listing rule (USFWS 1998b, p. 57984). Grading can change vernal pool hydrology, turn up the soil, and destroy the habitat and vegetation. Since listing, Service files indicate that three occurrences have been graded: 1) the Cruzan Mesa occurrence; 2) the Arjons area, which is along the east edge of the Carroll Canyon Preserve occurrence; and 3) the aforementioned grading at the Mesa de Burro occurrence (Table 2). Since grading continues to occur, we still consider it a threat to *N. fossalis*.

### Pipeline Construction

A pipeline project was identified as a threat to *Navarretia fossalis* in the listing rule (USFWS 1998b, p. 54984). Since that time, there have been two cases of pipeline construction through a vernal pool (Table 2). First, a pipeline was run directly through Wickerd Pool in Riverside County with no mitigation for the affects of the project (USFWS 2001b, p.1). Second, a proposed storage pond and pipeline for a recycled water storage system would destroy 200 acres (81 hectares) of land on the San Jacinto River Wildlife Area (USFWS 2008, p.1). Since listing, pipeline construction has affected the habitat of *N. fossalis* without mitigation or avoidance of vernal pools and we still consider pipeline construction a threat.

### Off-Highway Vehicles (OHV)

At the time of listing, OHV use was described as an ongoing threat to *Navarretia fossalis* in Riverside and San Diego Counties (USFWS 1998b, p. 54984). This type of activity may alter the hydrology, degrade habitat, and compromise the existence of *N. fossalis* within vernal pools (e.g., crush plants).

Currently, OHV impacts fall into three categories: recreational (often illegal) on private or public property, Border Patrol activities, and emergency response actions. Since listing, OHV activity

has impacted the majority of pools in the Otay Mesa region, and is documented in 12 pools in San Diego County and 1 pool in Los Angeles County (Table 2). Most of these accounts are from recreational vehicles trespassing on protected property, despite efforts of landowners to deter illegal trespass. However, vernal pools at Otay Mesa are threatened by OHV use associated with Border Patrol activities (City of San Diego 2006, pp. 136-140). These roads are often used and expanded by recreational OHV users. Despite attempts to deter this activity using fencing and signage, off-highway vehicle activity remains a threat to *N. fossalis*.

To a lesser degree, OHV use for emergency response (e.g., fire suppression and aviation emergencies) and law enforcement actions may impact *Navarretia fossalis* habitat. Many vernal pools occur within areas that are prone to fire, such as the vernal pools at Otay Lakes that burned in the 2003 Otay Fire. Fire suppression activities may impact vernal pools and *N. fossalis* due to vehicle and people/equipment movement through pools or creation of firebreaks. Additionally, aviation emergency response may occur at vernal pools near the Ramona, Montgomery Field, and Marine Corps Air Station (MCAS) Miramar airports.

Today, OHV use remains a threat to *Navarretia fossalis*, especially from Border Patrol and recreational activities near vernal pools on Otay Mesa. Installation and maintenance of fencing and signage are needed to help protect *N. fossalis* habitat from the impact of OHV users.

Trash dumping, described as a threat in the listing rule (USFWS 1998, 63 FR 54984), and grazing (USFWS 1998, 63 FR 54985) are discussed below under Factors E and C, respectively.

#### Summary for Factor A:

In summary, the loss and modification of vernal pool habitat continues to be the primary threat to *Navarretia fossalis*, especially where urbanization continues. Urbanization of surrounding lands results in fragmentation of *N. fossalis* habitat, including protected areas. Lands that are not preserved in perpetuity (35 percent; 17 occurrences) are subject to significant habitat modification. Habitat loss continues to occur, with 13 of the 48 known occurrences developed, impacted by development, or proposed for development. Acquisition of land and conservation easements have resulted in the preservation of vernal pool habitat for the species, but the trend of habitat loss and degradation continues. Restoration activities and associated conservation measures for *N. fossalis* habitat have been implemented and improved over time, although many areas are still subject to impacts such as OHV use, trespassing, and manure dumping and alteration of hydrology that contribute to lowering the quality of habitat for *N. fossalis*. Overall, threats to *N. fossalis* attributable to Factor A have been diminished considerably since listing (Table 2).

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

Overutilization was not known to be a factor at the time of listing (USFWS 1998b, p. 54985). Overutilization is not a threat at this time.

#### **FACTOR C: Disease or Predation**



Disease or predation was not known to be a threat at the time of listing (USFWS 1998b, p. 54985). Sheep herbivory and cattle grazing were reported at listing as threats to *Navarretia fossalis* under Factor A, but are treated under Factor C in this 5-year review. There has been only one reported incident of grazing affecting *N. fossalis* since listing. Sheep grazed on Stowe Pool and reportedly ate the flowering heads of *N. fossalis* and trampled the pool (Roberts, pers. comm. 2005). Disease and predation are not considered wide spread or rangewide threats for *N. fossalis*.

#### **FACTOR D: Inadequacy of Existing Regulatory Mechanisms**

At the time of listing, existing regulatory mechanisms that could provide some protection to *Navarretia fossalis* included: 1) conservation provisions under the Federal Clean Water Act; 2) the Endangered Species Act in cases where listed plant species occur in habitat occupied by a listed wildlife species; 3) implementation of conservation plans pursuant to the California Natural Community Conservation Plan (NCCP) program; 4) listing under the California Endangered Species Act (CESA); 5) the California Environmental Quality Act (CEQA); 6) enforcement of Mexican laws (USFWS 1998b, p. 54985); 7) land acquisition and management by Federal, State or local agencies, or by private groups and organizations; and 8) local laws and regulations. Our assessment regarding the adequacy of those regulatory mechanisms generally still applies; however, current efficacy of those regulatory mechanisms and others not identified in the listing rule are discussed below.

#### **State Protections**

The State's authority to conserve *Navarretia fossalis* is comprised from four major pieces of legislation: the California Endangered Species Act, the Native Plant Protection Act, the California Environmental Quality Act, and the Natural Community Conservation Planning Act.

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 CDFG 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 are notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify CDFG 10 days in advance of changing land use in order to allow salvage of listed plants. *Navarretia fossalis* is not State-listed, but can co-occur with other State-listed species. Therefore, *N. fossalis* may receive indirect protection under CESA and

NPPA. CESA generally requires an incidental take permit for activities that would result in take of a State-listed species. Among other requirements for a State incidental take permit, a project proponent must demonstrate that any such take will be fully mitigated.

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: The Natural Community Conservation Program is a cooperative effort to protect regional habitats and species. The program helps identify and provide for area-wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. Many NCCPs are developed in conjunction with HCPs that are prepared pursuant to the Endangered Species Act. The most relevant of these NCCPs and HCPs with regard to *Navarretia fossalis* are the North San Diego County Multiple Habitat Conservation Program (MHCP), the City of San Diego Subarea Plan under the Multiple Species Conservation Program (MSCP), and the Western Riverside County MSHCP. Each of these NCCP/HCPs is described below under *Regional Planning Efforts*.

## **Federal Protections**

National Environmental Policy Act (NEPA): This regulatory mechanism was not noted in the final listing rule. In general, NEPA provides some protection for *Navarretia fossalis*. For activities undertaken, authorized, or funded by Federal agencies (i.e., projects with a Federal nexus), NEPA requires the project be analyzed for potential impacts to the human environment prior to implementation (42 U.S.C. 4371 et seq.). For instances where that analysis reveals significant environmental effects, the Federal agency must identify appropriate mitigation to offset those effects (40 CFR 1502.16). However, NEPA is a procedural statute, and while it requires disclosure and analysis of significant impacts and mitigation alternatives, it does not require that such impacts be mitigated. Actions taken by private landowners that lack a Federal nexus are not required to comply with this law.

Clean Water Act: Until 2001, the U.S. Army Corps of Engineers (Corps) regularly took jurisdiction over vernal pools. At the time of listing, the Corps Los Angeles District (Corps LAD) generally took jurisdiction over all *Navarretia fossalis* habitat, regardless of whether it consisted of road pools (i.e., road ruts that pool water and support vernal pool organisms) or other degraded pools that were found within historical vernal pool habitat. However, recent Supreme Court rulings, such as the *Solid Waste Agency of Northern Cook County v. United States Army Corp of Engineers (SWANCC)* decision, called into question the Corps' regulation of vernal pools based on the definition of "waters of the United States." Following these rulings, Corps regulatory oversight of vernal pools is in doubt because of their "isolated" nature, and the Corps made determinations regarding regulation of such wetland areas (including vernal pools) on a case-by-case basis. In response to the Supreme Court decisions, the Corps and the U.S. Environmental Protection Agency (USEPA) released a memorandum providing guidelines for determining jurisdiction under the CWA. Recent Corps guidance indicates that wetlands

adjacent to navigable-in-fact waters of the U.S. are subject to regulation under the Clean Water Act, as are non-adjacent wetlands shown to have a significant nexus to navigable waters. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, vernal pool habitat (USEPA and USACE 2007). The overall effect of the new permit guidelines on vernal pool habitat is not known at this time. In the face of these Supreme Court decisions, the Corps LAD has not regulated road pools or other pools that lack vernal pool indicator plants, regardless of whether they contain *N. fossalis* or other vernal pool flora and fauna, and the Corps LAD’s continued regulation of wetlands that contain *N. fossalis* habitat is uncertain. Should Corps regulation of wetlands that contain *N. fossalis* habitat be discontinued, unmitigated destruction of potential habitat for *N. fossalis* is likely to occur.

Sikes Act: The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans with the Secretaries of Agriculture and the Interior for natural resources on public lands. The Sikes Act Improvement Act of 1997 requires Department of Defense installations to prepare INRMPs that provide for the conservation and rehabilitation of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. The INRMPs incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. Additionally, INRMPs are subject to Service and state review. While INRMPs are not technically regulatory mechanisms because their implementation is subject to funding availability, they can be an added conservation tool in promoting the recovery of endangered and threatened species on military lands.

Two military bases, MCAS Miramar and Marine Corps Base (MCB) Camp Pendleton, have adopted INRMPs that include management provisions for *Navarretia fossalis*. Vernal pool conservation and management on MCAS Miramar is guided by an INRMP that was initially developed in 2000 and updated in 2006 (Gene Stout and Associates 2006). The MCAS Miramar strategy is to limit activities, minimize development, and mitigate actions in areas supporting high densities of vernal pool habitat. Land on MCAS Miramar is divided into five Management Areas, each with different guidelines for conservation and varying degrees of permitted impacts to vernal pool habitat. The majority of vernal pool habitat is located in Level 1 Management Areas and receives the highest priority for conservation. Management actions in these areas include protective fencing and signage, debris and trash removal, nonnative plant removal, research, and periodic surveys. The INRMP on MCAS Miramar is anticipated to provide adequate management and conservation for *N. fossalis* on the base.

Marine Corps Base Camp Pendleton adopted an INRMP in 2001 that was revised in 2007 (MCB Camp Pendleton 2007). It is largely ecosystem-based except where biological opinions (under section 7 of the Act) direct species-specific actions. The strategy for conservation and management of *Navarretia fossalis* is to avoid disturbing vernal pools, minimize actions in areas with vernal pools, monitor the occurrences, provide education and resource awareness training, and to conduct research on vernal pools (MCB Camp Pendleton 2007, F-54). The strategy also provides for some management of nonnative invasive species and erosion. The Service and Marine Corps are currently consulting under section 7 of the Act on the Marine Corps’ programmatic plan to avoid and minimize the effects of their activities on federally listed upland plant and animal species, including *N. fossalis*. 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 *N. fossalis* management and conservation.

We consider that measures implemented under the MCAS Miramar and MCB Camp Pendleton INRMPs will provide considerable conservation benefit to *N. fossalis*.

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for *Navarretia fossalis*. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Section 9(a)(1) of the Act prohibits the "take" of any federally listed wildlife. The Act provides for civil and criminal penalties for the unlawful taking of listed wildlife species. Since listing, the Service 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 determination may include reasonable and prudent measures (for a listed animal species) that minimize the effects of incidental take of listed wildlife species associated with a project. The Service works with Federal, State, and local agencies, and with private project proponents, to minimize project effects to listed vernal pool species, and to compensate for the loss of habitat through preservation or restoration of vernal pool habitat on site or elsewhere.

Non-Federal project proponents may obtain incidental take permits for animal species that may be issued pursuant to section 10(a)(1)(B) of the Act and include authorized take of listed animal species resulting from projects without a Federal nexus. Take and therefore incidental take protections are not extended to plants. "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 HCP that details measures to [avoid] minimize and mitigate the project's adverse impacts to listed species, including listed plants. Section 10 of the Act provides protection for *N. fossalis* through the implementation of Service-approved HCPs that detail measures to minimize and mitigate the potential impacts of a project to the maximum extent practicable. *Navarretia fossalis* is a "covered species" under most existing and planned regional HCPs in southern California, including those in San Diego and Riverside Counties, which cover most of the species' current range. As a covered species in these HCPs, *N. fossalis* is afforded an additional layer of regulatory protection.

With regard to federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to insure any project they fund, authorize, or carry is not likely to jeopardize the continued existence of any endangered species or threatened species (including plants) or result in the destruction or adverse modification of critical habitat of such 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. In the final listing rule (USFWS 1998b, p. 54987), we noted that *Navarretia fossalis* would be afforded some incidental protections under the Act to the extent that it co-occurred with a federally listed animal species. We provided examples of listed vernal pool taxa whose ranges overlap that of *N. fossalis* to some extent. Overall, the Act provides the primary protection for *N. fossalis* and is necessary for the survival and recovery of the species at this time.

### *Regional Planning Efforts*

Most occurrences of *Navarretia fossalis* are covered in a regional habitat conservation or management plan (e.g., area-specific management plan, HCP, or NCCP), although these plans do not cover incidental take of listed plants as they do for listed animals on private property (Table 2; see also discussion of the Western Riverside County MSHCP and the MSCP below). Although lands are not guaranteed protection under a management plan that does not include a mechanism for protection in perpetuity (e.g., conservation easement), management plans are intended to obligate a landowner to consider impacts to covered species when developing a project.

Avoidance of occupied vernal pools is stressed when analyzing development projects with a Federal nexus (i.e., implemented, funded, or permitted by the Federal Government) during Endangered Species Act section 7 consultations. Impacts to *Navarretia fossalis* habitat are typically minimized through preservation and enhancement of existing pools, or restoration of basins in areas that once supported vernal pools. These efforts are often addressed as conservation measures contained in the project description or otherwise included as terms and conditions to minimize the effects of development to pools. Vernal pool restoration projects are then maintained and monitored to ensure that efforts were successful. This maintenance and monitoring typically includes quantitative and qualitative assessments of progress toward specific project goals (e.g., number of vernal pools, pool area, acceptable percent coverage of desired species and nonnative plant species, presence of *N. fossalis*, duration of ponding, water quality, etc.). Although long-term monitoring and maintenance of these pools for other impacts (e.g., trash, damaged or removed fencing, trespassing) can be uncertain, preserved and restored vernal pools are presumably protected from future development activities (Table 1).

At the time of listing, *Navarretia fossalis* was a covered species in the City and County of San Diego Subarea Plans under the MSCP. As discussed above under “Clean Water Act,” the Corps LAD generally took jurisdiction over all *N. fossalis* habitat (including road pools) both prior to SWANCC and at the time the City’s permit was issued. Therefore, the Service anticipated individualized review of projects impacting *N. fossalis* habitat under section 404 of the Clean Water Act and section 7 of the Act to insure compliance with the Environmental Protection Agency’s Clean Water Act, 404(b)(1) guidelines, and the Federal policy of “no net loss of wetland function and values”. However, the SWANCC decision has rendered future CWA jurisdiction over vernal pools uncertain. Additionally, a 2006 Federal district court ruling in *Center for Biological Diversity v. Bartel*, 98-CV-2234 (S.D.Cal.) enjoined the incidental take permit issued to the City of San Diego as applied to *N. fossalis* and six other vernal pool species.

The court held that the City's Subarea Plan does not provide adequate protection for *N. fossalis* as a result of Plan deficiencies and in light of SWANCC. By extension, this finding also applies to the City of Chula Vista Subarea Plan. This decision is currently on appeal. The City's State NCCP authorization and commitment under the MSCP remains in place notwithstanding the Federal injunction.

The City is currently working with the Service to revise and improve the management plan for *N. fossalis* under the MSCP. The City continues to monitor and manage vernal pools in support of the MSCP and is pursuing a new HCP to address vernal pool species, including *N. fossalis*. Since *N. fossalis* was listed, the Western Riverside County MSHCP was enacted in 2003 and covers the occurrences of *N. fossalis* in Riverside County. On June 22, 2004, we issued an incidental take permit for the Western Riverside County MSHCP under section 10(a)(1)(B) of the Act. The MSHCP is a large-scale, multi-jurisdictional NCCP/HCP that addresses 146 listed and unlisted "Covered Species," including *N. fossalis*, within a 1,260,000-acre (510,000-hectare) Plan Area in western Riverside County. Participants in the MSHCP include 14 cities in western Riverside County, the County of Riverside, the California Department of Parks and Recreation, and the California Department of Transportation (Caltrans). We granted the participating jurisdictions take authorization of listed species in exchange for their contribution to the assembly and management of the "MSHCP Conservation Area." Approximately 347,000 acres (140,426 hectares) of existing natural and open space areas (e.g., State Parks, USFS, and County Park lands known as Public/Quasi-Public Lands) and an additional 153,000 acres (61,916 hectares) of new conservation lands (Additional Reserve Lands) will form the 500,000-acre (202,343-hectare) MSHCP Conservation Area.

The Western Riverside County MSHCP includes 7.3 acres (3 hectares) of playa/vernal pool habitat (Dudek and Associates 2003, Section 2.1.4) and requires surveying for *Navarretia fossalis* for all projects proposed on appropriate habitat (Dudek and Associates 2003, Sections 2.1.4, 6.1.3). Of this vernal pool or alkali playa habitat, 85 percent will be precluded from development. Although this plan provides considerable protection for *N. fossalis*, it does not provide protection from manure dumping or soil amendments.

The MHCP was developed after listing and includes the occurrences of *Navarretia fossalis* in the cities of Carlsbad and San Marcos. The MHCP is a large-scale multi-jurisdictional NCCP/HCP that addresses 61 listed and unlisted covered and conditionally-covered species, including *N. fossalis*. The Plan area encompasses 112,000 acres (43,324-hectare) in northern San Diego County within the cities of Carlsbad, Encinitas, Escondido, San Marcos, Oceanside, Vista, and Solana Beach. At this time, only the City of Carlsbad has completed its Subarea Plan, which is called the Carlsbad Habitat Management Plan (Carlsbad HMP). Under the MHCP, the major populations of *N. fossalis* in north San Diego County will be 93 percent conserved by the MHCP (AMEC 2003, p. 4-142). The *N. fossalis* occurrence at Poinsettia Station in Carlsbad is 100 percent preserved under the Carlsbad HMP (City of Carlsbad 1999, p. D-9) as a result of mitigation for the North County Transit District Coaster Station (Dudek 2004). The MHCP and Carlsbad HMP afford *N. fossalis* protection under the Act.

## **Mexican Law**

The Service is not aware of any existing regulatory mechanisms that would protect *Navarretia fossalis* or its habitat where it occurs in northwestern Baja California, Mexico. *Navarretia fossalis* is not protected or listed under Mexican endangered species law (NOM-059-ECOL-2001) and we know of no laws that protect vernal pool habitat.

Summary for Factor D:

In summary, all regulatory mechanisms in place at listing are still operating today. Since listing, the Act is the primary law that provides protection for *Navarretia fossalis* on Federal lands or in instances where there is a Federal nexus. 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 its status under the Act. Significant regional protections include the City and County Subarea Plans under the MSCP (protections of which are currently being revised and improved through negotiations with the Service as a result of litigation), the Carlsbad HMP under MHCP, and Western Riverside County MSHCP. These plans provide long-term protections, management, and monitoring of *N. fossalis* occurrences. Additionally, MCB Camp Pendleton and MCAS Miramar have enacted INRMPs that benefit the species by providing protection, avoidance measures, and some management for *N. fossalis*. These plans do not provide preservation for the species in perpetuity. Therefore, we believe that the Act still provides the most extensive protection for *N. fossalis*.

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

At the time of listing, competition with nonnative grasses and drier conditions were listed as threats to *Navarretia fossalis* (USFWS 1998b, pp. 54988-54989). These threats still impact the status of the species (Table 2).

Competition with Invasive Nonnative Plants

The listing rule stated that nonnative species of grasses and forbs invade many plant communities often as an indirect result of habitat disturbance (USFWS 1998b, p. 54988). At listing, many vernal pools on Otay Mesa or in the City of San Marcos were dominated by the nonnative *Lolium perenne* (perennial ryegrass). The ryegrass displaced *Navarretia fossalis* in many vernal pools because ryegrass is more tolerant of inundation. The listing rule cited another nonnative grass, *Crypsis schoenoides* (swamp pricklegass), as replacing *N. fossalis* in the San Jacinto River Wildlife Area in Riverside County (USFWS 1998b, pp. 54988-54989). Approximately 60 percent (29 of 48) of the existing *N. fossalis* occurrences are threatened by invasive nonnative plants (Table 2 and included references).

Invasive nonnative plants that may impact *Navarretia fossalis* are divided into three groups: (1) upland species with less tolerance for inundation, (2) plants with inundation tolerance comparable to native vernal pool species, and (3) marsh or wetland species that require a long inundation period (Bauder 1996, p. 2). Altered hydrology can change the inundation period of an area and indirectly affects species that are less or more water tolerant than native vernal pool species, resulting in elimination from or invasion into vernal pool habitat (Bauder 1986b, p. 210). Alternatively, if natural hydrology persists, the number of nonnatives able to invade may be



limited by the inundation period (Bauder 1996, p. 2). Development and OHV use (both discussed under Factor A), human access, and disturbance effects (see below) typically alter the hydrology of vernal pools. Additionally, manure dumping can change soil chemistry and facilitate invasives in normally unfavorable areas. These alterations lead to a higher disturbance level and therefore a greater likelihood of invasion by nonnative species (Bauder 2005, p. 2134).

Depending upon conditions, certain invasive nonnative plants, such as the grasses discussed above, may replace *Navarretia fossalis*. Therefore, we consider invasive nonnative plants to be a continuing threat to *N. fossalis*.

#### Human Access and Disturbance Effects

Trash dumping was identified in the listing rule as a threat to vernal pools in San Diego County supporting *Navarretia fossalis* (USFWS 1998b, p. 54984). We are including this topic under the umbrella term “human access and disturbance effects” in the paragraph below.

Separation of *Navarretia fossalis* occurrences through habitat loss and fragmentation is often accompanied by the introduction or exacerbation of indirect effects associated with human access, or disturbance associated with adjacent development. Examples include trash dumping, trampling, and nonnative plant invasions. In the listing rule for *N. fossalis*, trash dumping, trampling, and invasive nonnative plant species were cited as threats to the species (USFWS 1998b, p. 54988).

All known occurrences of *Navarretia fossalis* may potentially be affected by human access and disturbance impacts from surrounding development (Table 2). Since listing, impacts associated with adjacent development have been documented to occur at 35 (71 percent) of the *N. fossalis* occurrences (Table 2). For example, asphalt was dumped at the Upham occurrence in San Marcos during road repairs in 2001 (J. Upham, owner, pers. comm. 2001). This small property is completely surrounded by development and is highly impacted by human-related disturbance. Pedestrians can introduce invasive nonnative plants that result in altered hydrology and competition with native plants. Protective fencing is used in many conserved occurrences to protect vernal pool complexes. Though implementing this protective measure has lessened the impacts of human access and disturbance, such effects still pose a predominant threat to *N. fossalis*.

#### Climate Change

The listing rule stated that drier conditions and drought are threats to *Navarretia fossalis*, which relies on seasonal rainfall and the pooling of water. Drier conditions physiologically stress the species and reduce its germination and survival rates (USFWS 1998b, p. 54989). Additionally, other threats may have an increased impact when combined with impacts from climate change. Data from 1986 to 1992 indicate drought was related to a decrease in the abundance of *N. fossalis* (USFWS 1998b, p. 54989; Table 1). However, there is no evidence to suggest that this was caused by climate change rather than normal climatic cycles.

Currently, drier conditions and drought remain a threat to all occurrences of *Navarretia fossalis*

(Table 2). There is a broad consensus among scientists that the earth is in a warming trend caused by anthropogenic greenhouse gases such as carbon dioxide (IPCC 2007). Models are not yet powerful enough to predict what will happen in localized regions such as southern California, but many scientists believe warmer, wetter winters and warmer, drier summers will occur within the next century (Field et al. 1999, pp. 2-3, 20).

Climate-related changes in California have been documented (Croke et al. 1998, pp. 2128, 2130; Breshears et al. 2005, p. 15144). Predictions for California indicate prolonged drought and other climate-related changes will continue in the future (e.g., Field et al. 1999, pp. 8–10; Lenihen et al. 2003, p. 1667; Hayhoe et al. 2004, p.12422; Breshears et al. 2005, p. 15144; Seager et al. 2007, p. 1181; IPCC 2007, p. 9). In habitat such as vernal pools that is isolated and dependent on certain hydrological regimes, these climatic changes are expected to become even more dramatic and intense (Graham 1997). It is expected that climate change will alter the hydrology of the region, and therefore threaten the existence of vernal pool habitat and associated species such as *Navarretia fossalis* (Bauder 2005, pp. 2133-2134). 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 particular species (including *N. fossalis*) or sites at this time. However, it is possible that drying could be expected to adversely affect the long-term viability of *N. fossalis* in its habitat.

#### Summary for Factor E:

In summary, impacts associated with competition from invasive nonnative plants, trash dumping, trampling, and climate change (drier conditions and drought) were identified at the time of listing and continue to threaten *Navarretia fossalis* today. Since listing, human access and disturbance effects associated with adjacent development have been documented to occur at 35 (71 percent) of the *N. fossalis* occurrences, while certain invasive nonnative plants may replace *Navarretia fossalis* if conditions are appropriate. Climate change impacts to habitat, such as vernal pools are expected to intensify. Although climate change data specific to *N. fossalis* is currently unavailable, adverse impacts to *N. fossalis* and its habitat are probable. Therefore, we believe that these natural and man-made factors continue to threaten *N. fossalis* and its habitat.

### **III. RECOVERY CRITERIA**

Pursuant to section 4(f) of the Act, recovery plans are developed to 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. Recovery plans are required to contain objective, measurable criteria, which, when met, would result in a determination that the species be delisted. Conservation (i.e., recovery) is defined in section 3 of the Act as the “use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary.” In accordance with section 4(a)(1) of the Act, we determine if any species is an endangered or threatened species because of any of the five threat factors identified in the Act and evaluated in this 5-year review. Therefore, we may recommend revision of the listing status of a species based on the outcome of an analysis of these five factors.

Although recovery plans are not regulatory documents, they provide a guide on how to achieve recovery based on information available at the time the recovery plan is finalized. Recovery criteria describe measurable projected outcomes or an estimated species response to a reduction or removal of the threats to a species as described in a five-factor analysis. However, reduction or removal of threats may occur without meeting all recovery criteria contained in a recovery plan, as there are many paths to accomplishing 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 other cases, recovery opportunities may have been recognized that were not known at the time the recovery plan was finalized. Likewise, we may learn information about the species or threats that was not known at the time the recovery plan was finalized. 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.

Consistent with section 4 of the Act, determinations whether any federally listed species should be: (i) removed from the list; (ii) changed in status from endangered to threatened; or (iii) changed in status from threatened to endangered will be made in accordance with an analysis of the five factors. Therefore, although we expect at the time a recovery plan is published that recovery criteria will be met, the actual determination of appropriate listing status is not based solely on whether recovery criteria have been met. Rather, progress towards fulfilling recovery criteria serves to indicate the extent to which threats have been reduced or eliminated. In absence of meeting recovery plan criteria, the Service may judge in some cases that overall the threats have been reduced sufficiently and the species is sufficiently robust to either reclassify the species from endangered to threatened, or delist 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. We focus our evaluation of species status in this 5-year review on progress made toward recovery since the species was listed 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 are reduced or eliminated. 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 by eliminating or reducing the threats discussed in the five-factor analysis section, above.

A recovery plan that included *Navarretia fossalis* was published in 1998 prior to the formal listing of the species (USFWS 1998a). The criteria to assess recovery of *N. fossalis* provided in the 1998 Recovery Plan do not reflect the most current information available. Additional *N. fossalis* occurrences were identified since completion of the Recovery Plan, and the status of several vernal pool complexes identified in Appendices F and G of the Recovery Plan have changed.

Despite the lack of current information, the 1998 Recovery Plan provides guidance for recovering *Navarretia fossalis*. The recovery criteria are not threats-based, which is current policy for Recovery Plan development, but the criteria speak indirectly to the threats outlined in the five-factor analysis section of this review and the final listing rule. Overall, progress is being

made toward satisfying the recovery criteria, although none can be fully achieved as written in the 1998 Recovery Plan. The Recovery Plan should be revised and updated to provide threats-based recovery criteria and address the other shortcomings of the Plan discussed within this review.

The Recovery Plan for Vernal Pools of Southern California outlines four criteria for the recovery of *Navarretia fossalis* (USFWS 1998b, pp. v-vi). The recovery criteria for stabilizing and delisting *N. fossalis* are as follows:

***Criteria 1-2:*** *All the existing vernal pools and their watersheds identified in Appendix F and G of the Recovery Plan should be secured from further loss and degradation in a configuration that maintains habitat function and viability (as determined by prescribed research tasks).*

This recovery criterion does not explicitly address any of the threat factors identified in the five-factor analysis in the listing rule or in the above discussion. Moreover, achievement of this criterion as written is complicated by the fact that some pools within the complexes identified in Appendices F and G have been developed or preserved in accordance with provisions of regional HCPs since the completion of the recovery plan. However, working toward the goals in this criterion will reduce the threats discussed above in Factor A. Securing vernal pool complexes physically, legally, and ecologically would reduce threats posed by development (e.g., habitat loss and alterations of hydrology) and discussed under Factor A above.

Securing vernal pool complexes legally ensures they are preserved even in the event of a change in ownership, and sets out the conservation measures necessary to maintain the habitat through time. Securing vernal pool complexes ecologically, via restoration of preserved vernal pools (if needed) and regular maintenance and monitoring in perpetuity, will ensure complexes are not allowed to degrade over time due to vandalism, trash accumulation, invasive nonnative plants, or hydrological alterations.

As discussed in Factor A, 63 percent of the *Navarretia fossalis* occurrences are secured in the foreseeable future (Table 2). These protections generally extend to direct loss and not necessarily indirect loss of habitat through degradation. The 63 percent includes lands that are under conservation easements or protected in perpetuity, lands that are conserved through mitigation, areas that are included in military INRMPs and lands that have some sort of protection from development (Table 2). Pools within these areas meet the criterion in the Recovery Plan as “secured legally” from further habitat loss. In the Recovery Plan, Appendix F lists the vernal pool occurrences that are necessary to stabilize the proposed and listed vernal pool species. Of the 16 occurrences on this list that contain *N. fossalis*, eight occurrences are currently considered conserved. Additionally, four occurrences are considered partially conserved and four are considered not conserved. Appendix G of the Recovery Plan lists vernal pool occurrences identified as necessary to secure in order to reclassify the proposed and listed vernal pool species. Of the four occurrences on this list that contain *N. fossalis*, one is conserved, one is partially conserved, and two are not conserved. Although some of these occurrences are considered secure from development, they are not all guaranteed monitoring or maintenance.

In addition to the difficulties mentioned above, implementation of criteria 1 and 2 listed in the Recovery Plan is further complicated because the Recovery Plan does not define the term “complex” nor provide information on how Appendices F and G were derived (the Recovery Plan refers to groupings of occurrences as complexes (please see above discussion in Spatial Distribution section.) The Recovery Plan does not contain maps or figures identifying complex locations, nor does it cite an identification system. Additionally, several complexes identified in Appendices F and G are combined in an unclear fashion (e.g., East Miramar; J2, 5, 7, 11-21, 23-30) and there is no information regarding: (1) the size of complexes, (2) amount of extant or potential *Navarretia fossalis* habitat, (3) *N. fossalis* abundance, and (4) relative importance for each complex. Therefore, it is difficult to determine how to utilize the appendices to achieve recovery (i.e., prioritizing preservation and restoration efforts). Criteria 1 and 2 should be revised and clarified as described above to delineate the location of all identified complexes and prioritize preservation and restoration activities necessary to achieve recovery.

Although it is not possible to specifically identify every complex in Appendices F and G of the Recovery Plan, the Service recommends avoiding development and impacts on complexes listed in Appendices F and G. Additionally, the Service is working towards conserving these complexes.

***Criterion 3: Secured vernal pools must be enhanced or restored such that population levels of existing species are stabilized or increased.***

This criterion does not directly address any of the threats discussed above in the five-factor analysis. Rather, this criterion uses a measure of stability that is not easily assessed for *Navarretia fossalis*. As discussed in the Abundance section of this 5-year review, the population numbers for *N. fossalis* are not easily measured. Because methods of measurement are not standardized and *N. fossalis* does not germinate every year, population abundance is not a good indicator for the species. However, restoration and management do provide a measure of protection against threats to the species. In Factor A, we stated that 11 occurrences are partially restored. These occurrences meet the criteria of secured ecologically, but do not necessarily have population levels that are stable or increasing.

Additionally, the CFWO issues biological opinions associated with consultations under section 7 of the Act for *Navarretia fossalis*. These opinions detail avoidance and minimization measures to prevent jeopardizing the species’ continued existence and can include restoration of *N. fossalis* habitat. Many of these opinions lead to successful restoration and protected populations of *N. fossalis*. Some pools are being restored and therefore meet the outlined goals of Criterion 3 in the Recovery Plan.

***Criterion 4: Population trends must be shown to be stable or increasing for a minimum of 10 consecutive years prior to consideration for reclassification.***

This criterion does not directly address any threats outlined in the five-factor analysis. Reducing the threats discussed above in Factors A and E would help us provide the conditions needed to work toward the goal in this criterion, but vernal pool habitat has been lost to urbanization (Bauder and McMillan 1998, p. 66). It is difficult to assess the abundance of *Navarretia fossalis*

in the absence of standardized sampling methods. Therefore, we are unable to address this criterion.

#### IV. SYNTHESIS

At the time of listing in 1998, there were 34 occurrences of *Navarretia fossalis* in Los Angeles, Riverside, and San Diego Counties, California. Since the listing of *N. fossalis* as a threatened species, 17 new occurrences have been detected (Table 1). These occurrences were likely in existence at the time of listing, although they had not been identified in the listing rule. These additional occurrences contribute to the viability and conservation of *N. fossalis* but did not expand the range of the species. Through conservation, 31 occurrences (63 percent) are considered protected from development, while 14 occurrences have been impacted by development, extirpated, or proposed for development since listing. Further, the largest populations along the San Jacinto River and at the Stowe Road Pool are not conserved

At listing, *Navarretia fossalis* was threatened by development and degradation of vernal pool habitat due to agricultural practices, invasive nonnative plants, and drought conditions. These are still threats to *N. fossalis*. Agricultural activities, such as manure dumping (not identified in the listing rule) and discing, are currently affecting some occurrences in Riverside County. The degree to which drier conditions (considered a threat in the listing rule) have caused a rangewide decrease in the abundance of *N. fossalis* is unknown. As development surrounds and fragments the remaining habitat, associated effects of human access and disturbance (including OHV use, trash and debris dumping, and trespassing) will continue to impact many of the occurrences (Table 2). These threats continue to affect the existence of *N. fossalis* and compromise its potential for recovery.

Significant progress has been made in protecting habitat for *Navarretia fossalis* since listing. However, based on the lack of protections for about 35 percent (17 occurrences) of this species' occurrences, and the persistence of rangewide threats including all of those identified in the listing rule, we conclude that *Navarretia fossalis* still meets the definition of threatened 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

**Listing and Reclassification Priority Number and Brief Rationale:** We recommend the recovery priority number should be changed from “2”, a high degree of threat and a high

probability of recovery, to “8”, a moderate degree of threat and a high probability of recovery. The high degree of threat from development has been reduced through conservation efforts to protect 63 percent of extant occurrences from development. Currently, *Navarretia fossalis* experiences a moderate degree of threat from a combination of urbanization, agricultural activities, invasive nonnative plants, and drought conditions.

## **VI. RECOMMENDED ACTIONS FOR THE NEXT FIVE YEARS**

1. Coordinate with Riverside County and city governments to enact ordinances banning manure dumping in areas containing sensitive species, such as the San Jacinto River flood plain. Such a measure could reduce threats and meets Criteria 1 and 2 for the Recovery Plan.
2. Determine the breeding system, distribution of genetic diversity of *Navarretia fossalis*, and best management practices to maintain genetic diversity within the species. This would allow a better understanding of the methodology needed to meet Criterion 4.
3. Consider revising the Recovery Plan by incorporating new information and addressing issues discussed in Recovery Criteria section of this review. Consider revising recovery criteria to be threats-based and to include quantifiable thresholds to down list and delist. Additionally, areas of high value to the species should be identified and preserved.
4. In order to analyze trends in abundance, standardize methods for sampling abundance of *Navarretia fossalis*. Use quantitative indices in data collection protocol. Any empirical approach in methodology will prove a more reliable method to analyze population data required in Criteria 3 and 4.
5. Work with partners to help conserve *Navarretia fossalis*, by conducting surveys of all occurrences within the next 5 years to have more information (abundance, spatial distribution, and threats) about the status of the species. Recovery Plan Criteria 3 and 4 require that populations are monitored and stabilized.



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- Brown, Sally. November 9, 2006 (b). Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Electronic mail correspondence with Adam Fisher, California Water Resources Control Board. Subject: manure spreading in Wickerd pool.
- Brown, Sally. April 17, 2008. Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Personal communication with Anna Braswell, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: Riverside County occurrences of *Navarretia fossalis*.
- Dellith, Chris. April 29, 2008. Biologist, Ventura Fish and Wildlife Office, Ventura, California. Electronic mail correspondence to Anna Braswell, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: Cruzan Mesa occurrence of *Navarretia fossalis*.



- Gower, Patrick. September 11, 2007. Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Electronic mail correspondence to David Acuff, Consulting Planner. Subject: dumping on the Universal Boot vernal pool.
- Huffman, Tom. July 26, 2005. Consultant, Helix Environmental Planning, Inc, La Mesa, California. Facsimile correspondence to Janet Stuckrath, Biologists, Carlsbad Fish and Wildlife Office, Carlsbad, California and Nancy Frost, California Department of Fish and Game, San Diego, California. Subject: construction of batch plants in San Marcos, California.
- Kashac, Ed. May, 15, 2008. Santa Ana Regional Water Quality Control Board, Riverside, California. Personal Communication with Anna Braswell, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: wastewater dumping into the San Jacinto River on April 25, 2005.
- Lieberman, Carolyn. June 11, 2007. Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Personal observations from site visit to *Navarretia fossalis* occurrences in San Marcos, California.
- Maher Hasselquist, Eliza. May 1, 2008. Western Riverside County Preserve Manager, Center for Natural Lands Management. Electronic mail message to Jonathan Snapp-Cook, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: Confirmation of the existence of an occurrence of *Navarretia fossalis* at Johnson's Ranch.
- Martin, John. June 19, 2007. Refuge Biologist, San Diego National Wildlife Refuge Complex, Jamul, California. Electronic mail correspondence to Carolyn Lieberman, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: Status of *Navarretia fossalis* on the San Diego National Wildlife Refuge.
- Roberts, Fred. May 6, 2005. Field Biologist, San Luis Rey, California. Electronic mail correspondence to Gary Wallace, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: sheep grazing at the Stowe pool *Navarretia fossalis* occurrence.
- Roberts, Fred. April 10, 2008. Botanist, San Luis Rey, California. Electronic mail correspondence to Anna Braswell, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: occurrences of *Navarretia fossalis* in Riverside County.
- Stadlander, Doreen. November 21, 2003. Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Electronic mail correspondence to Karen Goebel, Assistant Field Supervisor, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: Mesa de Burro occurrence of *Navarretia fossalis*.
- Upham, Jonathan. May 31, 2001. Property owner, San Marcos, California. Facsimile correspondence to Susan Wynn, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: edge effects on the Upham property in San Marcos, California.

Zoutendyk, David. August, 13 2007. Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Electronic mail correspondence to Carolyn Lieberman, Biologist, Carlsbad Fish and Wildlife Office, Carlsbad, California. Subject: Sweetwater High School.

**Table 1: Occurrences of *Navarretia fossalis*; prepared for the 2009 5-Year Review.**

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sup>2</sup>	Last Post-listing Surveys <sup>3</sup>	Occurrence Considered Currently Extant	Notes
<b>Los Angeles County</b>										
1	Cruzan Mesa	31, 32, 41	Plum Creek, Mint Canyon	Yes*	Yes	Present	Not Surveyed Since Listing		Yes	Directly impacted by development
<b>Riverside County</b>										
2	San Jacinto River	27, 33, 36, 37, 38	Upstream of Ramona Expressway including the San Jacinto Wildlife Area	Yes*	Yes	100,000 plants	Not Surveyed Since Listing	2005	Yes	Development proposed on two sections; The San Jacinto Wildlife Area is preserved.
		22, 23, 28	From Ramona Expressway to Nuevo Road			12,075 plants			Yes	
		39, 47	From Nuevo Road to Interstate 215			50,000 plants	361,000 plants		Yes	
		17	From Interstate 215 to Railroad Canyon			1425 plants			Yes	

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sup>2</sup>	Last Post-listing Surveys <sup>3</sup>	Occurrence Considered Currently Extant	Notes
3	Stowe Pool	24	Upper Salt Creek	Yes*	Yes	375,500 plants	10,000	2005	Yes	Considered one occurrence; MWD preserve is conserved.
	MWD Preserve	N/A				5,600 plants	489 plants	2001	Yes	
4	Stetson - Warren/Hemet	48	Benchmark Pacific or Pulte Homes	No	No	Not Detected at Listing	1000 plants	2004	Yes	Development and mitigation proposed
5	Menifee Pool	46	Menifee Valley	No	No	Not Detected at Listing	50 plants	2003	Yes	Western Riverside County MSHCP; Development proposed
6	Wickerd Pool	N/A	None	No	No	Not Detected at Listing	Present	2001	Yes	Direct development impacts
7	Scott Pool	42	None	No	No	Not Detected at Listing	Present	2001	Yes	Proposed for development
8	Clayton Ranch	N/A	None	No	No	Not Detected at Listing	450 plants	2004	No	Extirpated
9	Date Street	N/A	Old School House II/ Tentative Tract 29863	No	No	Not Detected at Listing	7 plants	2001	Yes	Proposed for development

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
10	Madison Pool	N/A	None	No	No	Not Detected at Listing	Present	2003	No	Extirpated by development
11	Skunk Hollow	43	None	No	No	Present	Present	2001	Yes	Western Riverside County MSHCP; Preserved by Center for Natural Lands Management
12	Johnson Ranch	N/A	Field Pool	No	No	Not Detected at Listing	1 plant	2008	Yes	Western Riverside County MSHCP; Preserved by Center for Natural Lands Management
13	Mesa de Burro	44	Santa Rosa Plateau	Yes	Yes	Present	Not Surveyed Since Listing		Yes	Conserved by Nature Conservancy
14	Los Caballos Road	45	Vail Lake	No	No	Not Detected at Listing	Present	2001	Yes	Western Riverside County MSHCP; Development proposed
<b>San Diego County</b>										

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
15	Stuart Mesa	21	Oscar One Training Area, Mass 3, MCB Camp Pendleton	Yes*	Yes	Present in 2 pools	Present in 4 pools	2004-2005	Yes	
16	Wire Mountain	N/A	Y 1-6, MCB Camp Pendleton	Yes*	Yes	Present in 7 pools	Present in 7 natural pools and 5 restored pools	2001	Yes	Restored in 2004
17	Camp Del Mar	N/A	MCB Camp Pendleton	Yes- in 1996 survey for CP	No	Present	Not Surveyed Since Listing		Yes	
18	Poinsettia Commuter Station	35	JJ 1, JJ 3	Yes	Yes	Present in 6 pools	Present	2005	Yes	Preserved as mitigation for disturbance.
19	Pacific Street	14	L 9-10, Superior Ready Mix and Universal Boot	Yes*- old EO	No	Present	Present	2003	Yes	Development proposed
20	Upham	14	L 1-6	Yes*- old EO	No	Present	Present	2003	Yes	

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
21	Bent Avenue	29	L 11-13, Fry's, Linda Vista-Bent	Yes*- old EO	No	500 plants	Not Found	2000	Yes	Preserved as mitigation for disturbance.
22	Santa Fe Valley Vernal Pool Preserve	N/A	Starwood, Crosby Estates, D6++4S	No	No	Not Detected at Listing	Present	2004	Yes	Restored 5 and created 1 pool as mitigation for disturbance for 3 other vernal pools.
23	DD 1	13	Santa Fe Valley	Yes - old EO	No	Present in 3 pools	Possibly Extirpated		Yes	Possibly extirpated by direct development impacts.
24	Ramona T		Ramona Airport,	Yes*	Yes	Present in 1 pool	Not Found	2001-2003	Yes	Preserved as mitigation for disturbance.
25	Cummings Ranch	12	Ramona Grasslands	Yes	No	Present in 1 pool		2003	Yes	
26	Carroll Canyon Preserve	N/A	D 5-6	No	No	Not Detected at Listing	Present	2003	Yes	Preserved as mitigation for disturbance.

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
27	X 1-4	N/A	MCAS Miramar	Yes - old EO	No	Present in 52 pools	Not found	2005	No	Extirpated by development according to 2008 imagery
28	HH1+	N/A	MCAS Miramar	Yes*	Yes	700 plants	Present	2001, 2005	Yes	
29	EE1	58	MCAS Miramar	Yes*	Yes	Present	Not Found	2005	Yes	Recent surveys were negative but habitat is still present so occurrence considered extant
30	EE2	N/A	MCAS Miramar	Yes*	Yes	Present	Not Found	1999-2005	Yes	
31	U North	N/A	MCAS Miramar	No	No	Not Detected at Listing	3 plants	2006	Yes	Preserved in Miramar Mounds National Natural Landmark and restored in 2003



Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
32	F North	(3)	MCAS Miramar	No	No	Not Detected at Listing	2 plants	2001	Yes	
33	Nobel Drive	N/A	X 5	No	No	Not Detected at Listing	Present	2003	Yes	Preserved as mitigation for disturbance.
34	New Century	N/A	New Century, Spectrum, BB2	Yes	Yes	60 plants	Not found	2001, 2002-2003, 2005	Yes	Restored, created new pools, and preserved as mitigation for disturbance.
35	Montgomery Field	4	N 6	Yes*- old EO	No	Present	Not found	2002-2003	Yes	Development proposed.
36	Sweetwater Reservoir	11	S 1-3	Yes	Yes	Present in 3 pools	Not Found	2000-2001	Yes	Direct impacts to three pools from SR 125 work
37	Proctor Valley	N/A	R 1	Yes	Yes	Present	Not Found	2002-2003	Yes	Part of MSCP Cornerstone Lands
38	M 2	2	None	Yes - old EO	No	Present in 2 pools	Not Surveyed Since Listing		Yes	

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
39	M 4	N/A	Bellavista	Yes - old EO	No	49 plants	Not Surveyed Since Listing		Yes	County Landfill – part of MSCP County subarea plan
40	West Otay Mesa A & B	N/A	J 32	No	No	Not Detected at Listing	Present in 3 pools	2003-2004	Yes	Restored and conserved as mitigation for disturbances to the J3 occurrences.
41	Sweetwater High School	1	J 3	Yes*	Yes	Present in 1 pool	Present in 3 pools	2002-2003	Yes	Restored, new pools created, and preserved as mitigation for disturbance.
42	Otay Lakes	10	K 2	Yes - old EO	No	Present	Not Surveyed Since Listing		Yes	Part of MSCP Cornerstone Lands
		N/A	K 5, 11	No	No	Not Detected at Listing	Present	2003, 2005	Yes	
		N/A	K 3-4	Yes	Yes	Extirpated	Present	2002-2003	Yes	
43	J 2 S	20	Cal Terraces, Otay Mesa Road Helix, Otay Mesa Road RECON	Yes*	Yes	Present in 14 pools	Present in 79 pools	2002-2003	Yes	Partially restored and preserved as mitigation for disturbance.

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
44	J 13 N	N/A	None	Yes*	Yes	Present	Present	2002-2003	Yes	Partially restored and preserved as mitigation for disturbance.
45	J 13 S	19	None	Yes*	Yes	Present	Not found	2002-2003	Yes	
46	J 14	34	Otay Mesa Road, Heritage Road	Yes*	Yes	Present	Present	2002-2003	Yes	Caltrans plans to restore and preserve as mitigation for disturbance.
47	J 16-17	N/A	Goat Mesa or Wruck Canyon	Yes*	Yes	Present in 7 pools	Not Found	2002-2003	Yes	Conserved and enhanced
48	J 29-30	N/A	Otay Ranch, Lonestar, New Millennium	Yes*	Yes	Present	Not Found	2002-2003	Yes	Partially restored as mitigation for SR 125 construction impacts; Development proposed on private land.
49	Robinhood Ridge	N/A	J 4-7	Yes*	Yes	Present in 1 pool	Present in 4 pools	2002-2003	Yes	Restored, new pools created, and preserved as mitigation for disturbance.

Occurrence Group	Occurrence Group Name	Included CNDDDB Element Occurrence (EO)	Occurrence Aliases	Occurrence Known at Listing?	Occurrence in the Recovery Plan?	Abundance at Listing <sup>1</sup>	Peak abundance Post-listing <sub>2</sub>	Last Post-listing Surveys <sub>3</sub>	Occurrence Considered Currently Extant	Notes
50	Arnie's Point	N/A	J 15	No	No	Not Detected at Listing	Present	2005-2006	Yes	Restored, new pools created, and preserved as mitigation for border fence
51	Sunroad	8	J 22, Sunroad Centrum	Yes*	Yes	12 plants	Not Surveyed Since Listing		Yes	Portion preserved as mitigation for disturbance.
<sup>1</sup> Estimated number of plants at the occurrence at the time of listing.										
<sup>2</sup> Highest number of plants reported for the occurrence; For some occurrences EO numbers are combined in the estimate.										
<sup>3</sup> Year(s) in which surveys were conducted since listing.										
* occurrence listed in Federal Register listing rule of <i>Navarretia fossalis</i> , USFWS, 1998b.										
All references for plant estimates are listed in the References Cited section.										
Does not include occurrences extirpated before listing.										

**Table 2 – Occurrences of *Navarretia fossalis*: Current threats and Conservation; prepared for the 2009 5-Year Review.**

OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<b>Los Angeles County</b>			
<b>Cruzan Mesa</b>  EO 31, 32, 41	<u>Factor A</u>  <u>Factor E</u>	<u>Factor A:</u> OHV activity, trampling, altered hydrology - filling of a pool, disturbance impacts from movie filming, grading, discing (USFWS 2005, pp. 60669-60671) (C. Dellith, U. S. Fish and Wildlife Service, pers. comm. 2008)  <u>Factor E:</u> Invasive nonnative plants (Dellith, pers. com, 2008), Climate change (Bauder 2005, p. 2134)	None
<b>Riverside County</b>			
<b>San Jacinto River</b>  EO 17, 22, 23, 27, 28 33, 36, 37, 38, 39, 47	<u>Factor A</u> <u>Factor D</u> <u>Factor E</u>	<u>Factor A:</u> Manure dumping, artificial flooding of habitat, discing, proposed residential development, alteration of hydrology, dry-land farming, pipeline project (Glenn Lukos Associates, Inc., 2000; Roberts 2005, Attachment A; Brown, pers. obs. 2008; F. Roberts, Field biologist, pers. comm. 2008; D. Bramlet, Field biologist, pers. comm. 2008; USFWS 2002a, pp.1-6; USFWS 2008, pp.1-3; E. Kashac, Santa Ana Regional Water Quality Control Board, pers. comm. 2008)  <u>Factor E:</u> Invasive nonnative plants (F. Roberts, pers. comm. 2008)) Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP

OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<b>Stowe Pool/ MWD Preserve (Salt Creek)</b>  EO 24	<u>Factor A</u> <u>Factor D</u> <u>Factor E</u>	<u>Factor A:</u> Discing, fuel modification (Brown, pers. obs. 2006a) (Roberts, pers. comm. 2008)  <u>Factor E:</u> Invasive nonnative plants (A. Braswell, Service, pers. obs. 2008) Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP MWD preserve is conserved
<b>Stetson – Warren/Hemet/Benchmark Pacific/Pulte Homes</b>  EO none	Not known at listing	<u>Factor A:</u> Proposed for development (Glenn Lukos Associates 2005a, p.1)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP
<b>Menifee Pool</b>  EO 46	Not known at listing	<u>Factor A:</u> Discing, dry land farming (Chambers Group 2004, Attachment A), Development proposed (USFWS 2006b, p.1)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP
<b>Wickerd Pool</b>  EO none	Not known at listing	<u>Factor A:</u> Manure spreading, direct impacts from pipeline built through pool (Brown, pers. obs. 2006b)(USFWS 2001b, p.1)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP
<b>Scott Pool</b>  EO 42	Not known at listing	<u>Factor A:</u> Development proposed on property (AMEC Earth and Environmental, Inc. 2006, p. 5) alteration of hydrology -telephone pole installed in pool (USFWS 2002a, pp.1-3) Widening of Scott Road (Terra Nova 2007, Exhibit 6)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP

OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<b>Clayton Ranch</b> EO none	Not known at listing	Extirpated	Extirpated
<b>Date Street</b> EO none	Not known at listing	<u>Factor A:</u> Development proposed on property (PCR Services Corporation 2001, p.13, figure 5), OHV use (Google Earth 2008)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP
<b>Madison Pool</b> EO none	Not known at listing	Extirpated	Extirpated
<b>Skunk Hollow</b> EO 43	Not known at listing	<u>Factor A:</u> Habitat isolation and fragmentation from development (USFWS 2000, p. 40)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP Preserved by Center for Natural Lands Management
<b>Johnson Ranch (Field Pool)</b> EO none	Not known at listing	<u>Factor A:</u> Discing (E. Maher, Center for Natural Lands Management, pers. comm. 2008)  <u>Factor E:</u> Invasive nonnative plants (Maher, pers. comm. 2008) Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP Preserved by Center for Natural Lands Management
<b>Mesa de Burro</b> EO 44	<u>Factor A*</u> <u>Factor E*</u>	<u>Factor A:</u> Altered hydrology from grading (Stadtlander, pers. comm. 2003)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP Owned by The Nature Conservancy
<b>Los Caballos Road (Vail Lake)</b> EO 45	Not known at listing	<u>Factor A:</u> Development proposed (USFWS 2001b)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	Western Riverside County MSHCP

OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<b>San Diego County</b>			
<b>Stuart Mesa</b>  EO 21	<u>Factor A</u> <u>Factor E*</u>	<u>Factor A:</u> Incidental impact from military training (EDAW, Inc. 2006, p. 6)  <u>Factor E:</u> Invasive nonnative plants (EDAW, Inc. 2006, p. 57) Climate change (Bauder 2005, p. 2134)	MCB Camp Pendleton INRMP
<b>Wire Mountain</b>  EO none	<u>Factor A</u> <u>Factor E*</u>	<u>Factor A:</u> Incidental impact from military training (P. Beck, U. S. Fish and Wildlife Service, pers. obs. 2008) Unauthorized discing (Beck, pers. obs. 2007)  <u>Factor E:</u> Invasive nonnative plants (EDAW, Inc. 2006, p. 57) Climate change (Bauder 2005, p. 2134)	MCB Camp Pendleton INRMP
<b>Camp Del Mar</b>  EO none	<u>Factor A</u> <u>Factor E*</u>	<u>Factor A:</u> Incidental impact from military training (Beck, pers. obs. 2008)  <u>Factor E:</u> Invasive nonnative plants (EDAW, Inc. 2006, p. 57) Climate change (Bauder 2005, p. 2134)	MCB Camp Pendleton INRMP
<b>Poinsettia Commuter Station</b>  EO 35	<u>Factor A*</u> <u>Factor E*</u>	<u>Factor A:</u> Edge effects, litter (AMEC 2003, p. 4-142)  <u>Factor E:</u> Invasive nonnative plants (AMEC 2003, p. 4-142) Climate change (Bauder 2005, p. 2134)	Carlsbad HMP North County MHCP Conserved as mitigation for disturbance.
<b>Pacific Street</b>  EO 14	<u>Factor A*</u> <u>Factor E</u>	<u>Factor A:</u> Dumping (P. Gower, Service, pers. obs. 2007) altered hydrology, trespassing on property, OHV use (Helix 2000, p.1) Proposed development (T. Huffman, Helix, pers. comm. 2005)  <u>Factor E:</u> Invasive nonnative plants (Lieberman, pers. obs. 2007) Climate change (Bauder 2005, p. 2134)	None



OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<b>Upham</b>  EO 14	<u>Factor A*</u> <u>Factor E</u>	<u>Factor A:</u> Discing for fuel modification (J. Upham, pers. comm. 2001), trespassing on property (USFWS 2005, p. 60671)  <u>Factor E:</u> Asphalt dumping on property (J. Upham, pers. comm. 2001) Invasive nonnative plants (Lieberman, pers. obs. 2007) Climate change (Bauder 2005, p. 2134)	None
<b>Bent Avenue</b>  EO 29	<u>Factor A*</u> <u>Factor E</u>	<u>Factor A:</u> Edge effects from surrounding development (C. Lieberman, U. S. Fish and Wildlife Service, pers. obs. 2007)  <u>Factor E:</u> Invasive nonnative plants (Lieberman, pers. obs. 2007) Climate change (Bauder 2005, p. 2134)	Conserved as mitigation for other impacts on the site.
<b>Santa Fe Valley Vernal Pool Preserve</b>  EO none	Not known at listing	<u>Factor A:</u> Edge effects (Helix 2004, p. 9)  <u>Factor E:</u> Invasive nonnative plants, Drought (Helix 2004, p.1) Climate change (Bauder 2005, p. 2134)	Restored and preserved as mitigation for disturbance.
<b>DD1</b>  EO 13	<u>Factor A</u> <u>Factor E</u>	<u>Factor A:</u> Possibly extirpated by development impacts (Google Earth 2008)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	San Diego County MSCP
<b>Ramona T</b>  EO 12	<u>Factor A</u> <u>Factor E</u>	<u>Factor A:</u> Grazing (TAIC 2005, p. 15)  <u>Factor E:</u> Invasive nonnative plants (TAIC 2005, p. 15) Climate change (Bauder 2005, p. 2134)	North County MSCP as mitigation for airport improvement project.
<b>Cummings Ranch</b>  EO 12	<u>Factor A</u> <u>Factor E</u>	<u>Factor A:</u> Grazing (TAIC 2005, p. 15)  <u>Factor E:</u> Invasive nonnative plants (TAIC 2005, p. 15) Climate change (Bauder 2005, p. 2134)	North County MSCP

<b>OCCURRENCE <sup>1</sup></b>	<b>THREATS AT LISTING <sup>2</sup></b>	<b>CURRENT THREATS <sup>3</sup></b>	<b>CURRENT CONSERVATION<sup>4</sup></b>
<b>Carroll Canyon Preserve</b> EO none	Not known at listing	<u>Factor A:</u> Debris and trash dumping, unauthorized grading (City of San Diego 2004, pp. 35-37)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	City of San Diego MSCP MHPA Preserved as mitigation for disturbance.
<b>X 1-4</b> EO none	<u>Factor A</u> <u>Factor E*</u>	Extirpated	Extirpated
<b>HH1</b> EO none	<u>Factor A</u> <u>Factor E*</u>	<u>Factor A:</u> Indirect impacts from development, air operations, air crashes, training (Gene Stout and Associates 2006, pp. 2-6, 2-9)  <u>Factor E:</u> Invasive nonnative plants (Gene Stout and Associates 2006, p. 7-22) Climate change (Bauder 2005, p. 2134)	MCAS Miramar INRMP
<b>EEI</b> EO none	<u>Factor A</u> <u>Factor E*</u>	<u>Factor A:</u> Indirect impacts from development, air operations, air crashes, training (Gene Stout and Associates 2006, pp. 2-6, 2-9)  <u>Factor E:</u> Invasive nonnative plants (Gene Stout and Associates 2006, p. 7-22) Climate change (Bauder 2005, p. 2134)	MCAS Miramar INRMP
<b>EE2</b> EO none	<u>Factor A</u> <u>Factor E*</u>	<u>Factor A:</u> Indirect impacts from development, air operations, air crashes, training, explosive detonation (Gene Stout and Associates 2006, pp. 2-6, 2-9, figure 2.2)  <u>Factor E:</u> Invasive nonnative plants (Gene Stout and Associates 2006, p. 7-22) Climate change (Bauder 2005, p. 2134)	MCAS Miramar INRMP

OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<b>U North</b> EO none	Not known at listing	<u>Factor A:</u> Indirect impacts from development, air crashes, training (Gene Stout and Associates 2006, pp. 2-6, 2-9)  <u>Factor E:</u> Invasive nonnative plants (Gene Stout and Associates 2006, p. 7-22) Climate change (Bauder 2005, p. 2134)	MCAS Miramar INRMP Restored and conserved in the Miramar Mounds National Landmark
<b>F North</b> EO none	Not known at listing	<u>Factor A:</u> Indirect impacts from development, air crashes, training (Gene Stout and Associates 2006, pp. 2-6, 2-9)  <u>Factor E:</u> Invasive nonnative plants (Gene Stout and Associates 2006, p. 7-22) Climate change (Bauder 2005, p. 2134)	MCAS Miramar INRMP
<b>Nobel Drive</b> EO none	Not known at listing	<u>Factor A:</u> OHV use (EDAW, Inc. 2007, p. 7)  <u>Factor E:</u> Invasive nonnative plants (EDAW, Inc. 2007, p. 8), (City of San Diego 2006, pp. 219- 220) Climate change (Bauder 2005, p. 2134)	City of San Diego MSCP MHPA Preserved and restored as mitigation for disturbance.
<b>New Century</b> EO none	<u>Factor A</u> <u>Factor E</u>	<u>Factor A:</u> Edge effects from surrounding development (USFWS 1998c, p. 1)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	City of San Diego MSCP MHPA Preserved as mitigation for disturbance.
<b>Montgomery Field</b> EO 4	<u>Factor A*</u> <u>Factor E*</u>	<u>Factor A:</u> Proposed development, incidental impacts from on-going maintenance to the airport, (City of San Diego 2006, pp. 213-216)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	City of San Diego MSCP Partially within MHPA

<b>OCCURRENCE <sup>1</sup></b>	<b>THREATS AT LISTING <sup>2</sup></b>	<b>CURRENT THREATS <sup>3</sup></b>	<b>CURRENT CONSERVATION<sup>4</sup></b>
<p><b>Sweetwater Reservoir</b></p> <p>EO 11</p>	<p><u>Factor A*</u></p> <p><u>Factor E</u></p>	<p><u>Factor A:</u> Direct impacts from development of State Route 125 (USFWS 1999, p. 18) Trespassing (McMillian Biological Consulting 2000, pp. 3-10)</p> <p><u>Factor E:</u> Invasive nonnative plants (J. Martin, U. S. Fish and Wildlife Service, pers. comm. 2007) (USFWS 2005, p. 60658) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP</p> <p>Partially in MHPA</p> <p>Conserved by NWR and Sweetwater Authority</p>
<p><b>Proctor Valley</b></p> <p>EO none</p>	<p><u>Factor A*</u></p> <p><u>Factor E*</u></p>	<p><u>Factor A:</u> Trespassing, OHV use, trash dumping (EDAW, Inc. 2007, pp. 28-29) (City of San Diego 2006, 248-252)</p> <p><u>Factor E:</u> Invasive nonnative plants (EDAW, Inc. 2007, p. 28) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP</p> <p>Cornerstone Bank</p> <p>MHPA</p>
<p><b>M 2</b></p> <p>EO 2</p>	<p><u>Factor A</u></p> <p><u>Factor E</u></p>	<p><u>Factor A:</u> OHV use (Google Earth 2008)</p> <p><u>Factor E:</u> Climate change (Bauder 2005, p. 2134)</p>	<p>San Diego County MSCP</p>
<p><b>M 4</b></p> <p>EO none</p>	<p><u>Factor A</u></p> <p><u>Factor E</u></p>	<p><u>Factor A:</u> Edge effects - adjacent to landfill (SANDAG 1989-2002, GIS data), OHV use (Google Earth 2008)</p> <p><u>Factor E:</u> Climate change (Bauder 2005, p. 2134)</p>	<p>San Diego County MSCP</p>
<p><b>West Otay Mesa A &amp; B</b></p> <p>EO none</p>	<p>Not known at listing</p>	<p><u>Factor A:</u> OHV use, trespassing on property, border activities, illegal dumping (EDAW, Inc. 2007, p. 44) (City of San Diego 2006, pp. 295-299)</p> <p><u>Factor E:</u> Invasive nonnative plants (City of San Diego 2006, pp. 295-299) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP</p> <p>Restored as mitigation for disturbance.</p>

OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<p><b>Sweetwater High School</b></p> <p>EO 1</p>	<p><u>Factor A</u></p> <p><u>Factor E</u></p>	<p><u>Factor A:</u> Altered hydrology (Zoutendyk, pers. obs. 2007), Trespassing on property (City of San Diego 2006, pp. 283-287)</p> <p><u>Factor E:</u> Invasive nonnative species (City of San Diego 2006, pp. 283-287), Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP Restored and conserved by Sweetwater Union High School</p>
<p><b>Otay Lakes</b></p> <p>EO 2</p>	<p><u>Factor A*</u></p> <p><u>Factor E*</u></p>	<p><u>Factor A:</u> OHV use (EDAW, Inc. 2007, p. 20) Grazing (City of San Diego 2004, p. 65)</p> <p><u>Factor E:</u> Invasive nonnative species (City of San Diego 2006, pp. 225-228), Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP Cornerstone Bank MHPA</p>
<p><b>J 2S</b></p> <p>EO 20</p>	<p><u>Factor A</u></p> <p><u>Factor E</u></p>	<p><u>Factor A:</u> Dumping and trespassing on property (City of San Diego 2006, pp. 47-51, 229-233, 238-241)</p> <p><u>Factor E:</u> Invasive nonnative plants (City of San Diego 2006, pp. 47-51, 229-233, 238-241) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP Partially within MHPA Partially preserved and restored as mitigation for disturbance.</p>
<p><b>J 13 N</b></p> <p>EO none</p>	<p><u>Factor A</u></p> <p><u>Factor E</u></p>	<p><u>Factor A:</u> OHV use, trespassing on property, border activity (City of San Diego 2006, pp.132-135)</p> <p><u>Factor E:</u> Invasive nonnative plants (City of San Diego 2006, pp.132-135) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP</p>

<b>OCCURRENCE <sup>1</sup></b>	<b>THREATS AT LISTING <sup>2</sup></b>	<b>CURRENT THREATS <sup>3</sup></b>	<b>CURRENT CONSERVATION<sup>4</sup></b>
<p><b>J 13 S</b>  EO 19</p>	<p><u>Factor A</u> <u>Factor E</u></p>	<p><u>Factor A:</u> OHV use, trespassing on property, border activity, dumping, litter and itinerant encampments (City of San Diego 2006, pp.136-140)</p> <p><u>Factor E:</u> Invasive nonnative plants (City of San Diego 2006, pp. 136-140) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP</p>
<p><b>J 14</b>  EO 34</p>	<p><u>Factor A</u> <u>Factor E</u></p>	<p><u>Factor A:</u> OHV use, trespassing on property, border activity, dumping (City of San Diego 2006, 141-145)</p> <p><u>Factor E:</u> Invasive nonnative plants (City of San Diego 2006, pp. 141-145) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP Partially within MHPA Conserved by Caltrans with plans to restore</p>
<p><b>J 16-17</b>  EO none</p>	<p><u>Factor A</u> <u>Factor E</u></p>	<p><u>Factor A:</u> OHV use, trespassing on property, grazing, border activity (City of San Diego 2006, pp. 146-149, 305-308)</p> <p><u>Factor E:</u> Invasive nonnative plants (City of San Diego 2006, pp. 146-149, 305-308) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP MHPA Conserved by City of San Diego.</p>
<p><b>J 29-30</b>  EO none</p>	<p><u>Factor A</u> <u>Factor E</u></p>	<p><u>Factor A:</u> Development proposed (City of San Diego 2006, pp. 162-166)</p> <p><u>Factor E:</u> Invasive nonnative plants (City of San Diego 2006, pp. 162-166) Climate change (Bauder 2005, p. 2134)</p>	<p>City of San Diego MSCP Partially within MHPA Partially restored and conserved as mitigation for disturbance.</p>

OCCURRENCE <sup>1</sup>	THREATS AT LISTING <sup>2</sup>	CURRENT THREATS <sup>3</sup>	CURRENT CONSERVATION <sup>4</sup>
<b>Robinhood Ridge</b>  EO none	<u>Factor A</u> <u>Factor E</u>	<u>Factor A:</u> OHV use, (City of San Diego 2004, p. 68) Trespassing on property (City of San Diego 2006, pp. 261-266)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	City of San Diego MSCP Restored and preserved areas impacted at this site
<b>Arnie’s Point</b>  EO none	Not known at listing	<u>Factor A:</u> Trespassing on property, border activity (City of San Diego 2006, pp. 38-42) border fence was constructed on this land (Ecological Restoration Services 2006, p. 1)  <u>Factor E:</u> Climate change (Bauder 2005, p. 2134)	City of San Diego MSCP MHPA Restoration and conservation as mitigation for border fence project.
<b>Sunroad</b>  EO 8	<u>Factor A</u> <u>Factor E</u>	<u>Factor E:</u> Invasive nonnative plants (CNDDDB 2008, EO 8) Climate change (Bauder 2005, p. 2134)	City of San Diego MSCP Conserved as mitigation for disturbance.

Abbreviations: EO = CNDDDB Element Occurrence. MSCP = Multiple Species Conservation Program. MHPA = MSCP Multiple Habitat Planning Area. MHCP= Multiple Habitat Conservation Program INRMP = Integrated Natural Resources Management Plan
* = not specifically mentioned as a threat in the listing rule, but a known threat to the occurrence at the time of listing.
Identifications are based on CNDDDB names, previous USFWS determinations, location information, and ownership boundaries.
1. Name of occurrence and CNDDDB EO number if assigned.
2. Threat factors to the occurrence at the time of listing.
3. Current threats to the occurrence segregated by listing threat factor.
4. Current conservation and protection measures for each occurrence.



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

*Navarretia fossalis* (Spreading Navarretia)

**Current Classification:** Threatened

**Recommendation Resulting from the 5-Year Review:**

- Downlist to Threatened  
 Uplist to Endangered  
 Delist  
 No change needed

**Review Conducted By:** Carlsbad Fish and Wildlife Office

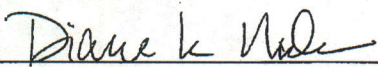
**FIELD OFFICE APPROVAL:**

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

Approve  Date AUG 10 2009

**Ventura Fish and Wildlife Field Supervisor, U.S. Fish and Wildlife Service**

Concur  Do Not Concur

Signature  Date 8/10/09