

Orcuttia californica
(California Orcutt grass)

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



Orcuttia californica (California Orcutt grass)
Photo credit: J. Travis Columbus (Rancho Santa Ana Botanic Garden)

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

March 11, 2011

5-YEAR REVIEW

Orcuttia californica (California Orcutt grass)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In a 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:

Orcuttia californica (California Orcutt grass) is an inconspicuous annual grass restricted to southern California and few historical occurrences in northern Baja California, Mexico. This species is closely associated with deep ephemeral vernal pools underlain by clay soils. At the time of listing, *O. californica* was considered depressed in distribution, and ensuing populations because of threats associated with loss and degradation of its vernal pool habitat. Threats included urban and agricultural development, grazing, altered hydrology, off-road vehicle use, trampling, grazing, and nonnative plants. Because of these threats and based on the consideration at the time that the species was considered extant at only four areas in Riverside and San Diego Counties, *O. californica* was federally listed as endangered on August 3, 1993 (USFWS 1993, pp. 41384–41392). The species was listed as endangered by the State in 1979.

Orcuttia californica is currently extant in Ventura, Los Angeles, Riverside, and San Diego Counties from 28 occurrences (Appendix 1). *Orcuttia californica* is variously associated with other federally listed vernal pool taxa including *Eryngium aristulatum* var. *parishii* (San Diego button celery), *Pogogyne abramsii* (San Diego mesa mint), *Pogogyne nudiuscula* (Otay mesa mint), *Navarretia fossalis* (spreading navarretia), San Diego fairy-shrimp (*Branchinecta sandiegonensis*), and Riverside fairy-shrimp (*Streptocephalus woottoni*).

Methodology Used to Complete This Review:

This review was prepared by the Carlsbad Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. We used information from the Recovery Plan, survey

information from landowners and managers, California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Game (CDFG), and Consortium of California Herbaria (CCH) online database for this project. We received no information from the public, relative to the taxon reviewed here, in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed within the next 5 years.

Contact Information:

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, Region 8; (916) 414-6464.

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

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

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the **Federal Register** on March 25, 2009 (USFWS 2009, pp. 12878-12883). No information relevant to the species reviewed here was received.

Listing History:

Federal Listing

FR Notice: 58 FR 41384

Date of Final Listing Rule: August 3, 1993

Entity Listed: *Orcuttia californica* (California Orcutt grass), a plant species

Classification: Endangered

State Listing

Orcuttia californica was listed by the State of California as endangered in September 1979.

Review History: No previous status reviews for *Orcuttia californica* have been conducted.

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

The recovery priority number for *Orcuttia californica* is 5C according to the Service's 2010 Recovery Data Call for the Carlsbad Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983a, pp. 43098-

43105; USFWS 1983b, p. 51985). This number indicates that the taxon is a species that faces a high degree of threat and has a low potential for recovery. The “C” indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline:

USFWS 1998. *Vernal Pools of Southern California Recovery Plan*. 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

Orcuttia californica (California Orcutt grass) is a tufted annual grass, 5 to 20 centimeters (cm) (2 to 8 inches (in)) tall. Its seeds germinate in the saturated and/or submerged soil of vernal pools and plants are at first nearly prostrate. The plants produce more erect glandular pubescent stems when they are exposed as the pool dries up and subsequently produce flowers and seeds. The species is restricted to vernal pools in southern California and a few occurrences in northern Baja California, Mexico.

Species Biology and Life History

Orcuttia californica is inconspicuous and prostrate at first. Plants have leaf and root anatomy and physiology adapted to conditions in the wettest, longest lasting portion of vernal pools (Munz 1974, p. 985; Reeder 1993, pp. 1276–1277). It is specifically adapted to survive in vernal wet conditions due to the presence of aerenchyma tissue for submerged gas exchange described by Keeley (1990, pp. 61–87; 1999, pp. 106–118) as Crassulacean Acid Metabolism (CAM) photosynthesis. Pool topography often includes a loamy soil surface and bottom hard/clay pan that restricts or precludes drainage from the pool site. Obligate vernal pool taxa require these ephemerally wet conditions to reproduce. Seeds of *O. californica* germinate while the pool is inundated and plants appear prostrate during this phase of their life history. The plant’s stems become more erect as the ephemeral pool dries out by evaporation at which time the plants flower, usually between April and June, and set seed. It is doubtful that any significant amount of germination occurs in the absence of the pool being inundated. This habit relates to the species’ more restricted habitat. Like most grasses, its flowers are wind pollinated; however, it relies on fungi to play a role in stimulating germination (Griggs 1976, pp. 57–63; Griggs 1981,

p. 16; Keeley 1988, pp. 1086–1089). *Orcuttia californica* is less abundant at the shallow periphery of vernal pools that are subject to more rapid changes in moisture and are generally more abundant in portions of pools that retain water for the longest period of time (longer inundation time).

Spatial Distribution

Orcuttia californica was first collected in the 1800s near San Quintin, Baja California, Mexico. Plants were first observed in the United States in 1922 near Menifée in Riverside County, and has since been found as far north as Ventura County, California. At the time of listing, *O. californica* was thought to be restricted to four general localities in California, located in Riverside and San Diego Counties. These localities were the Santa Rosa Plateau, Skunk Hollow, and Salt Creek (now identified as the Stowe Pools) in Riverside County, and Otay Mesa in San Diego County. It was thought to be extirpated from Los Angeles County at the time of listing. The species was likely never widespread, compared to other obligate plant species, because deeper pools with longer inundation times (longer seasonal ponding) are less common in southern California. Because of its small stature and lack of showy flowers to catch the eye, few collections were made in areas that probably supported the species. We know that vernal pool habitat was more extensive in southern California and has been reduced due to anthropogenic development in southern California (Mattoni and Longcore 1997, p. 88).

Vernal pools have spatial and temporal dynamics that differ from year to year and may have been captured by different surveys at different times. Some surveys are local, describing one or a few pools, their status and biota, while other surveys attempt to provide a broader view of the vernal pool landscape conditions. This latter approach was used in San Diego County. Slight topographic ridges or differences in elevation mean that at various times and in different years, smaller separate pools may be joined into larger pools and that during especially wet conditions even larger aggregations may occur.

In the 1970s, it became clear that identification of particular pools and pool areas would be useful to help conserve vernal pools in San Diego County. In an effort to describe conditions and pools in an area, vernal pools in close proximity were called pool complexes comprised of anywhere between 2 to over 100 pools and alpha-numeric references were adopted by some surveyors (e.g., Beauchamp 1979, pp. 3–12; Bauder 1986). Bauder's identification system has become the standard for San Diego County. As new pools are detected they are either considered to be part of an existing complex, or given a new alpha-numeric reference, based on Bauder's identifying system. Bauder's report included a cross reference to earlier reports such as Beauchamp's however neither of these reports included digital maps, therefore, this has led to considerable difficulty in translating information regarding local pools or complexes across various reference surveys and documents into regionally relevant views on the condition of the pools and their biota. In the discussion below, we attempt to address conditions and distributions of pools and pool complexes as we do for other biota with the broader scale system of Element Occurrences used by the CNDDDB; however we do note the Bauder identifier, where relevant, for the complexes occurring in San Diego County (Appendix 1). The transient, dynamic nature of vernal pools is reflected in the transient nature of the occurrence and temporal presence of vernal

pool biota, especially annual plants including *Orcuttia californica*. The presence and distribution of the species in a pool or perhaps even in a pool complex may change over time.

Currently the CNDDDB recognizes 37 separate element occurrences of *O. californica* (CNDDDB 2010, EOs 1 to 46) and 53 collections of *O. californica* represented by 75 specimens exist in the CCH (Appendix 1). This latter online resource includes plant-accessioned specimens housed in herbaria throughout the state (CCH 2010). The curated specimens include individual plants collected at vernal pool habitats in Los Angeles, Riverside, San Diego and Ventura counties between 1922 and 2005. All of the herbarium specimens in the CCH database are assignable to one of the recognized CNDDDB element occurrences. Some CNDDDB element occurrences have been merged after analysis by CDFG staff determined that they were coincident. All of the known occurrences of the species are described in Appendix 1 and depicted on Figure 1; those occurrences currently considered extant are distinguished from those considered extirpated.

Since listing, *Orcuttia californica* was relocated at two occurrences in Los Angeles County (EOs 29, 30), and detected for the first time at three occurrences in Ventura County (EOs 28, 33, 35). These occurrences extend the range of the species by about 140 kilometers (km) (87 miles (mi)) to the northwest. *Orcuttia californica* is still considered to be extant at the Santa Rosa Plateau, Skunk Hollow, and Upper Salt Creek (Stowe Pools) in Riverside County (CCH 2010). Since listing, four previously unknown occurrences of the species have been found in Riverside County and at least nine in San Diego County (Appendix 1). In Baja California, Mexico, *O. californica* had been found historically on Mesa de Colonet and at San Quintin; however, there is no current knowledge confirming the contemporary existence of the species in this area.

Orcuttia californica is currently considered to be extant at 28 occurrences: 3 occurrences in Ventura County, 3 occurrences in Los Angeles County, 9 occurrences in Riverside County, and 13 occurrences in San Diego County (Appendix 1).

Abundance

Historical loss of vernal pool habitat in San Diego County is estimated to be 97 percent (Oberbauer and Vanderwier 1991, p. 210), although no estimates of what portion of those pools supported *Orcuttia californica* is available. Few current data on population counts and trends are extant (Appendix 1).

Habitat or Ecosystem

Vernal pool habitat in San Diego County has been described by Bauder and McMillan (1998, pp. 56–70). These authors were identifying the soil types and historical extent of vernal pool habitat in San Diego County to estimate historical loss of habitat. They found that most vernal pool areas were on lands with at least a 9 percent slope with subsurface permeability of 0.06 inches per hour or less (Bauder and McMillan 1998, p. 57). When they examined the soil types and their distribution, they found that pools were associated with Chesterton, Huerhuero, Olivenhain, Placentia, Redding, and Stockpen soil series (Bauder and McMillan 1998, p. 61). Historically, soils supporting vernal pools were never very extensive in San Diego County, amounting to no more than 520 square km (200 square mi) (Bauder and McMillan 1998, pp. 56 and 66).

In southern California, vernal pools are topographic features in close proximity with a variety of vegetation communities, including grasslands, coastal sage scrub, maritime succulent scrub, maritime and chamise chaparral, coniferous forest, and montane wet meadow (USFWS 1998, p. 21).

Orcuttia californica is an obligate vernal pool species. Seeds of this annual grass germinate in the deepest portions of ephemeral pools. Southern California typically has a wet winter season and dry summer season weather regime indicative of a Mediterranean climate. Vernal pools are topographic features formed by the inundation and accumulation of water from rainfall and surface run-off in lower-lying areas of a relatively poor-draining clay soil layer, resulting in a temporary perched water table (Zedler 1987, pp. 1–136; Keeley and Zedler 1998, pp. 1–14). These temporary pools are formed in depressions that range in depth from 2 to 100 cm (1 to 40 in). The particular biota of a vernal pool is affected by the size and depth of the pool and its rate of desiccation as the season progresses. The deeper portion of a pool remains wetter longer. These conditions dictate the configuration and growth of the vernal pool flora species. Different taxa tend to be associated with different microhabitat conditions in this changing system. *Orcuttia californica* is one of many plant and animal taxa (e.g., *Eryngium aristulatum* var. *parishii* (San Diego button celery), *Pogogyne abramsii* (San Diego mesa mint), and San Diego fairy shrimp (*Branchinecta sandiegonensis*)) that are restricted to vernal pool topography in southern California.

Prior to listing, estimations of historical and remaining vernal pool habitat in San Diego County were reported. Habitat loss was attributed primarily to development. Beauchamp estimated that 11,572 hectares (ha) (28,595 acres (ac)) of vernal pool habitat reduced to 1,009 ha (2,494 ac) by 1979, amounting to an annual rate of habitat loss of 9 percent (Beauchamp 1979, p. 3). These figures imply that 87 percent of the vernal pool habitat was lost by 1979. Oberbauer and Vanderwier (1991, p. 210) indicated that 96.5 percent of an estimated 23,840 ha (58,910 ac) (twice Beauchamp's estimate for San Diego County) of vernal pools had been lost by 1991 in San Diego County and only 838 ha (2,070 ac) remained. Neither of these reports provided maps, figures, or descriptions of criteria used to identify or quantify vernal pool habitat in San Diego County.

Changes in Taxonomic Classification or Nomenclature

Orcuttia californica was described by George Vasey (1886, p. 219) based on a collection made in April 1886 by Charles Russell Orcutt near San Quintin Bay, Baja California, Mexico. Munz collected the first specimens of *O. californica* in the United States in 1922 in Menifee Valley, Riverside County, California (Munz 1924, p. 127).

There have been no subsequent changes in the taxonomic classification of the species in systematic (e.g., Hoover 1941, pp. 149–156) or floristic (e.g., Reeder 1993, pp. 1276–1277) treatments. *Orcuttia californica* is still the accepted name for the plant. At least two other taxa at various times have been included under *O. californica*; however, they are currently recognized as separate species. The recognition of these two taxa does not alter the description or distribution of *O. californica* described in this document.

Genetics

No contemporary genetic analysis has been completed.

Persistence of a species in small populations suggest that loss of genetic variation, genetic drift, and potential inbreeding depression might occur over prolonged periods of time. See Factor E for analysis of this phenomenon.

Species-Specific Research and/or Grant-Supported Activities

In 1993, Rancho Santa Ana Botanic Garden attempted to create vernal pools; this project determined that:

“recreated pools are not self-sustaining and therefore not a viable option to replace the loss of naturally occurring vernal pools” (CPC 2009, p. 2).

Monitoring surveys conducted by the city of San Diego were supported by the Service (City of San Diego 2004). Since that time, no species-specific research or rigorous detailed adaptive monitoring, *sensu* Lindenmayer and Likens (2009, p. 482) has been completed.

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

Southern California (Ventura, Los Angeles, Orange, and San Diego Counties) and surrounding environs are considered to be among the fastest growing metropolitan areas in the United States. Loss of vernal pool habitat in San Diego County, that supports *Orcuttia californica* among other species, is attributed primarily to development (Beauchamp 1979, p. 1; Bauder 1987, p. 209). Threats to vernal pool habitat attributable to Factor A discussed in the listing rule include: urban and agricultural development, off-road vehicular traffic, habitat trampling associated with humans or cattle, mowing or plowing, highway construction, drainage or watershed alterations, and military activities (USFWS 1993, p. 41388). These were described as threats to vernal pool habitat associated with the collective distribution of the three vernal pool plants and the Riverside fairy shrimp included in the listing rule. In some instances, threats were considered to impact vernal pool habitat in general with no specific reference to *O. californica*, because plants could be present in different pools at different times. Currently, one or more of these threats continue to impact *O. californica* at most occurrences, and impacts associated with development and OHVs have the potential to be considered rangewide threats. The current threats are discussed under the headings of Urban and Agricultural Development (includes plowing), Highway Construction, Off-Highway Vehicle (OHV) use, Habitat Destruction (Trampling), Military Activities, and Drainage or Watershed Alteration.

Urbanization and Agricultural Development

Habitat loss via urban and agricultural development is the leading cause of endangerment of listed species in the United States (Wilcove *et al.* 1998, pp. 607–615; Tennant *et al.* 2001, pp. 1–3), which continues to harm native ecosystems (McKinney 2002, pp. 883–890). Hoover (1941, p. 151) suggested almost 70 years ago, that:

“Orcuttia are, generally speaking, very easily exterminated by the operations of agriculture. With the apparent exception of O. pilosa, plowing of the ground where they occur usually prevents the reappearance of these plants in following years.”

Plowing was identified as a threat to vernal pool habitat at Skunk Hollow (Appendix 1, EO 24) in Riverside County in the listing rule (USFWS 1993, p. 41387); the current status of this occurrence is unknown.

Loss of habitat has been the predominant threat to *Orcuttia californica* and has been considered a primary threat to vernal pools in southern California (Bauder 1986, p. 9-4; Bauder 1987, p. 209). When *O. californica* was listed in 1993, it was estimated that approximately 97 percent of vernal pool habitat in San Diego County had been destroyed (Oberbauer and Vanderwier 1991, p. 210); however, there is no indication of the distribution of *O. californica* among those pools. No other specific comparable data exists for other southern California counties. Similar losses of vernal pool habitat have been reported in the northern portion of its range, where historically there were seven records of *O. californica* in the area of the Western Riverside County Multiple Species Habitat Conservation Plan (Western Riverside County MSHCP); now only three sites remain for certain in the plan area (Upper Salt Creek, Skunk Hollow, and Santa Rosa Plateau) (USFWS 2004, pp. 24–29).

Habitat loss from urbanization and agricultural development continues to impact *Orcuttia californica* and will not likely be reduced as a threat until more private lands, which support the species, are conserved. There are currently 11 occurrences protected from the direct effects of urbanization: 1 occurrence in Ventura County in a local preserve (EO 28; Lennar 2003), 5 occurrences in Riverside County (EOs 16, 18, 20, 21, 24), and 5 occurrences in San Diego County (EOs 11, 34, 37, 38, 39). Currently 9 of the 28 known extant occurrences are threatened by urban or agricultural development (EOs 3, 7, 9, 10, 27, 28, 29, 46 and 31) (Appendix 1).

Highway Construction

Road development was identified as a threat to vernal pool habitat when *Orcuttia californica* was listed (USFWS 1993, p. 41387). In the listing rule the potential expansion of a road near the Stowe vernal pools (EO 27) was considered a threat (USFWS 1993, p. 41388). Since that time, a plan to change the road alignment has resulted in the elimination of this threat to the Stowe pools.

Roads are closely associated to habitat fragmentation (loss) due to urban and agricultural development. Vernal pools and associated habitat proximal to basins have been eliminated by

road and highway construction. Road development and related construction activities may still pose a threat to the species.

Off-Highway Vehicle (OHV) Use

OHV use was described as a threat to vernal pool habitat in the listing rule (USFWS 1993, p. 42387). Since listing, OHV damage continues to impact habitat occupied by *Orcuttia californica* at many locations (EOs 6, 7, 9, 10, 27, 29). Damage to vernal pool habitat can be caused by motorcycles, quads, bicycles, and four-wheel drive vehicles. Bauder (1987, p. 209) indicated that some OHV damage may also occur in the course of legitimate activities including fire-fighting, security patrols, and military maneuvers. Bauder also stated that vehicles may impact the species by creating ruts, compacting soil, burying seeds, crushing plants, and altering pool hydrology. OHV use causing fragmentation, degradation, and destruction of vernal pools has been long noted as one of the key agents impacting listed species (Hilty *et al.* 2006, p. 157; Forman *et al.* 2003, pp. 113–138; Wilcove *et al.* 1998, pp. 607–615). Vehicles used to traverse between individual pools or complexes have the potential to alter the pool hydrology, artificially spread native species, and facilitate the invasion of nonnative taxa.

To date, there are no recent clear assessments identifying or enumerating vernal pools where *Orcuttia californica* continues to be threatened by OHV use. Despite protective measures at Marine Corps Air Station (MCAS) Miramar, such as signage, regulations, and regular patrols, OHV damage to vernal pool habitat continues to impact the species (Kassebaum 2008, p. 1; Kassebaum 2009, pp. 1–8). Aerial photographs show numerous extant identified vernal pool basins with evidence of OHV tracks in or adjacent to them (City of San Diego 2004, pp. 16, 17, 22–24, 40, 54, 97).

Bauder (1988, pp. 2–21) examined methods to repair damage caused by OHVs and nonnative species and to improve the quality of vernal pools. She (Bauder 1988, p. 19) found that hand weeding, decompaction, and recontouring of pool soils increased the pool quality; yet, fencing and keeping OHV vehicles out of vernal pool habitat is the best way to maintain the delicate habitat, i.e., “*the most important element of their recovery is protection from future vehicle trespass.*”

Threats associated with OHVs are identified at six of the 28 extant occurrences and are likely at more (Appendix 1).

Habitat Destruction (Trampling)

Trampling by cattle and humans was identified as a threat to vernal pool habitat, and specifically to pools containing *Orcuttia californica* on Otay Mesa in the listing rule; however, no specific references to *O. californica* or quantification of trampling were provided (USFWS 1993, p. 41387). The inundation of vernal pools creates sticky clay surfaces that are generally avoided by humans and livestock. When the inundation dissipates, the previously submerged ecosystems are exposed, often suggesting xeric playas or otherwise open landscapes.

The incidence of cattle grazing and associated trampling of habitat supporting *Orcuttia californica* has largely been ameliorated; however, some vernal pools continue to be damaged by livestock (S. Wynn, USFWS, pers. obs. 2010).

Trampling of vernal pool habitat by human immigrant travel has not been quantified, and to date is only suspected to cause a threat to *Orcuttia californica* via direct mortality, and increasing rates of erosion. The border fence and additional staffing by the Border Patrol since 2005 has probably lessened this threat. Regardless, human access though vernal pool habitat by immigrants or Border Patrol officers has never (pre and post listing) been quantified. Habitat trampling is reported to be a threat at three occurrences (EOs 9, 10, 11).

Drainage or Watershed Alteration

Water management activities were determined to be contributing threats to vernal pool habitat when *Orcuttia californica* was listed (USFWS 1993, p. 41387). Due to urbanization, hydrologic cycles have been affected near vernal pool complexes (Bauder 1987, pp. 209–213). Many vernal pool habitat areas are flanked by roads on naturally or artificially elevated peripheries of the pool areas. Runoff from these roads or channelized flow under the roads may affect the hydrological conditions of the pool areas. This threat to *O. californica* has lessened since the time of listing due to development standards that are intended to prevent runoff from entering vernal pool basins (Wynn, pers. obs. 2010).

Military Activities

Military training activities near and adjacent to vernal pool habitat may cause site-specific impacts to vernal pool habitat and were considered to be a general threat to vernal pool habitat at the time of listing (USFWS 1993, p. 41387). Likewise, activities at MCAS Miramar ranging from construction and maintenance of installation infrastructure (roads, runways, and buildings, etc.) in correlation to increased use of training areas may adversely impact habitat occupied by *Orcuttia californica* during the development and expansion of the military mission (EOs 6, 43, 44). To minimize these impacts, activities on military installations are covered by Integrated Natural Resource Management Plans (INRMPs) that address habitat conservation and listed species protection (U.S. Marine Corps 2006, pp. 7-1–7-36). Current habitat restoration by the military of *O. californica* at MCAS Miramar has been among the best efforts with numerous acres restored; further work to note presence/absence of the species, as well as to affirm potential for long-term retention have been accomplished at MCAS Miramar (U.S. Marine Corps 2006, pp. 7-1–7-36).

Summary of Factor A

Threats identified at the time of listing continue to impact habitat occupied by *Orcuttia californica*. Habitat loss and modification due to urban and agricultural development threaten 9 of the 28 known extant occurrences, especially in areas where habitat remains private and unprotected. Even where habitat is protected, urbanization of surrounding lands results in the fragmentation of habitat and damage to watersheds that support vernal pool habitat. Acquisition of land and conservation easements has resulted in the conservation of 11 of the 28 known extant

occurrences; these are protected from urbanization or agricultural development. Habitat that has been protected in small remnant parcels within urbanized or agricultural development areas may still be subject to changed hydrological conditions and invasion by nonnative plants that make habitat less suitable for *O. californica*. Threats associated with OHV use continue throughout much of the range (at least 6 of the 28 known extant occurrences), except on some preserve lands, (e.g., Santa Rosa Plateau) or on conserved lands (e.g., some sites covered by the San Diego Multiple Species Conservation Plan (MSCP)). The level of impact from threats associated with plowing, and habitat trampling are not likely to increase in frequency or severity in the foreseeable future. Road construction in urbanized southern California will likely continue to pose some level of threat to vernal pool habitat although currently no specific threats from road development are identified. Water management activities near vernal pool habitat have caused changes in the hydrological structure and function of some vernal pool habitat. While still a threat, changes in development standards have helped to decrease impacts to *O. californica* by controlling run-off and water use. Military activities have been a threat to the species because of training activities that disrupted extant vernal pools. However, conservation of the three extant occurrences on MCAS Miramar is addressed in the INRMP and military activities pose a minor threat to the remaining vernal pool habitat that supports *O. californica*. Factor A threats continue to impact *O. californica* habitat at 12 of the 28 known extant occurrences on private, commercial, and military lands throughout the range of the species in southern California.

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

Overutilization for any purpose was not considered a threat during the listing of the species, nor is any threat due to overutilization a threat to the species at this time.

FACTOR C: Disease or Predation

Cattle grazing was identified in the listing rule as a specific threat to all of the vernal pools on Otay Mesa in San Diego County that supported *Orcuttia californica* (USFWS 1993, p. 41387). Grazing impacts have been reduced since listing, but remain as a threat at four occurrences (EOs 7, 9, 10, 27).

Insect herbivory of *Orcuttia californica* was not listed as a threat when the species was listed, and though suggested, its impacts have been undocumented and remain unknown at this time.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, existing regulatory mechanisms were considered inadequate. The listing decision indicated:

“Existing regulatory mechanisms are not sufficient to reduce the losses of Orcuttia californica, Pogogyne nudiuscula, Eryngium aristulatum var. parishii, or the Riverside fairy shrimp. Vernal pools as isolated wetlands and waters of the United States, are regulated by the U.S. Army Corps of Engineers(Corps) under section 404 of the Clean Water Act” (USFWS 1993, p. 41388).

Current regulatory mechanisms and their efficacies are discussed below.

State Protections in California

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

Native Plant Protection Act (NPPA) of 1977 and California Endangered Species Act (CESA) of 1984:

Under provisions of NPPA (Division 2, chapter 10 section 1900 *et seq.* of the CDFG) and CESA (Division 3, chapter 1.5, section 2050 *et seq.* of CFG), the CDFG Commission listed *Orcuttia californica* as endangered in 1979 and 1984, respectively. Both NPPA and CESA include prohibitions forbidding the "take" of *O. californica* (Chapter 10, Section 1908 and Chapter 1.5, Section 2080, CFG code). However, sections 2081(b) and (c) of CESA allow the CDFG to issue incidental take permits for State-listed threatened and endangered species if:

- 1) The authorized take is incidental to an otherwise lawful activity;
- 2) the impacts of the authorized take are minimized and fully mitigated;
- 3) the measures required to minimize and fully mitigate the impacts of the authorized take are roughly proportional in extent to the impact of the taking on the species, maintain the applicant's objectives to the greatest extent possible, and are capable of successful implementation;
- 4) adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures; and
- 5) issuance of the permit will not jeopardize the continued existence of a State-listed species.

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

California Environmental Quality Act (CEQA)

CEQA is the principal statute mandating environmental assessment of projects in California. The purpose of CEQA is to evaluate whether a proposed project may have an adverse affect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation. CEQA applies to projects proposed to be undertaken or requiring approval by State and local public agencies (http://www.ceres.ca.gov/topic/env_law/ceqa/summary.html). CEQA requires disclosure of potential environmental impacts and a determination of "significant" if a project has the potential to reduce the number or restrict the range of a rare or endangered plants; however, projects may

move forward if there is a statement of overriding consideration. If significant effects are identified, the lead agency may require mitigation, require changes to a project, or decide that mitigation is unfeasible due to overriding considerations. Thus, while *Orcuttia californica* may be afforded some protection under CEQA, this protection is not guaranteed and is ultimately dependent upon the discretion of the lead agency.

California Porter-Cologne Act

The primary law regulating water quality in California is the California Porter-Cologne Act of 1969 (section 13000 *et seq.*, California Water Code). This Act designates authority over surface water and groundwater quality to the State Water Resources Control Board and the nine Regional Water Quality Control Boards. Additionally, this Act regulates the discharge of fill into waters of the state (section 13260 *et seq.*, California Water Code). “Waters of the state” are defined as “any surface water or groundwater, including saline waters, within the boundaries of the state,” and includes vernal pools. While this Act affords some protection to *Orcuttia californica* habitat, automatic waivers of discharge requirements are granted if the Regional Boards do not respond to applications within 120 days. The San Diego Regional Water Board has taken an active role in developing and implementing mitigation requirements.

Natural Communities Conservation Planning (NCCP) Act

In 1991, the State of California passed the NCCP Act to address the conservation needs of natural ecosystems throughout the State (CFG 28002835). The NCCP program is a cooperative effort involving the State of California and numerous private and public partners to protect regional habitats and species. The primary objective of NCCPs is to conserve natural communities at the ecosystem scale while accommodating compatible land uses. NCCPs help identify, and provide for, the regional or area-wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. The initial focus of this program was the coastal sage scrub vegetation community in southern California; although other associated vegetation communities are also being addressed in this ecosystem-based planning approach. Many NCCPs are developed in conjunction with Habitat Conservation Plans (HCPs) prepared pursuant to the Act. Regional NCCPs may provide protection to federally listed species by conserving native habitats upon which the species depend. The plans that currently provide protection to *Orcuttia californica* include the Western Riverside County Multiple Species Conservation Plan (Western Riverside County MSHCP), the San Diego Multiple Habitat Conservation Program (San Diego MHCP), and the City of San Diego Subarea plans under the San Diego County Multiple Species Conservation Program (MSCP), which are discussed below under the Act. *Orcuttia californica* has been treated as a covered species, and thus is provided some level of protection under regional NCCPs.

Local Laws and Regulations

Some local jurisdictions in San Diego County have enacted local ordinance for wetland resources, including vernal pools that may be inhabited by *Orcuttia californica*, which requires avoidance of vernal pools to the maximum extent practicable. The ordinance does not cover road pools or other unvegetated, disturbed pools and has not recognized many threats associated

with development (e.g., habitat isolation and fragmentation, indirect effects of adjacent development, alternation of hydrology). The City of San Diego continues to approve projects that surround vernal pools with development, but there have been no direct impacts to *O. californica*. Local laws and regulations have the potential to adequately protect *O. californica* and its habitat.

Federal Protections

National Environmental Policy Act (NEPA)

NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigations that could offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Clean Water Act

Under section 404, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to areas meeting the Corps’ criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the CWA, NEPA, and the Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

At the time of listing, the Corps Los Angeles District (Corps LAD) generally took jurisdiction over all vernal pool habitat, regardless of whether it consisted of road pools (ephemeral pools inhabited by San Diego fairy shrimp or other vernal pool fauna, formed inadvertently by human activities such as vehicle use) or other unvegetated pools that were found within historical vernal pool habitat. However, recent Supreme Court rulings have called into question the Corps’ regulation of vernal pools based on the definition of “waters of the United States” in the CWA: *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (531 U.S. 159) (2001) (*SWANCC*) and *Rapanos v. United States*, 126 S. Ct 2208, U.S. (2006)). In these cases, the Court adopted a more restrictive view 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 has 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) have recently 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 United States are subject to regulation under the CWA, as are non-adjacent wetlands that are 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 where the species is found. The overall effect of the new permit guidelines on vernal pool habitat is not known at this time. In light of these rulings and changes in practice since listing of the *Orcuttia californica*, the continued regulation of wetlands that contain *O. californica* habitat by the Corp’s LAD is, at best, uncertain. Should Corps regulation of wetlands that contain *O. californica* habitat be discontinued, there is the potential for loss of *O. californica* habitat; however, local jurisdictions have mitigation requirements for the taxon.

Endangered Species Act

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

Under Section 9(a)(2) of the Act, with respect to endangered plant taxa, it is unlawful to remove and reduce to possession (i.e., collect) any such taxon from areas under Federal jurisdiction; maliciously damage or destroy any such taxon on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law.

Under Section 10(a)(1)(A) of the Act, there are provisions for collection of plants or plant parts for scientific purposes or to enhance the propagation and survival of the species. Under section 10(a)(1)(B) of the Act, the Service may issue “incidental take” (take is defined in section 3(18) of the Act) permits for listed animal species to non-Federal applicants. 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. Issuance of an incidental take permit by the Service is subject to section 7 of the Act; thus, the Service is required to ensure that the actions proposed in the HCP are not likely to jeopardize the species or result in the destruction or adverse modification of critical habitat. Although section 10(a)(1)(B) allows for exemptions to take prohibitions under section 9 for animals, it does not allow for similar exemptions for plants. Many NCCPs are developed in conjunction with HCPs prepared pursuant to the Act. *Orcuttia californica* is a covered species under the Western Riverside County MSHCP, and the County of San Diego Subarea plans under the San Diego County MSCP. It is conditionally covered under the Carlsbad Habitat Management Plan.

Western Riverside County Multiple Species Conservation Plan (Western Riverside County MSHCP):

Orcuttia californica is a covered species under the Western Riverside County MSHCP (Dudek 2003; USFWS 2004). *Orcuttia californica* is fully and permanently protected on vernal pools located at the Santa Rosa Plateau Ecological Preserve, which are a protected portion of the Riverside County Parks system and Skunk Hollow. As a covered species, it is afforded two additional layers of regulatory protection; i.e., covered species status under the Western Riverside County MSHCP, and as protected species within the Santa Rosa Plateau Ecological Preserve, even if it were to be removed from the list of endangered and threatened plants:

“Because the California Orcutt grass is not widely distributed within the Plan Area, species specific conservation objectives are provided in the MSHCP (Section 9, Table 9.2, pp. 9-111) to ensure that suitable habitat and known populations of the California Orcutt grass will persist. At least three of the known locations of California Orcutt grass at the Santa Rosa Plateau, Skunk Hollow, and the upper Salt Creek drainage west of Hemet will be included within the MSHCP Conservation Area, and the hydrologic processes of the pool complexes associated with these known locations will be maintained to provide for persistence of the species. In addition, at least 6,680 acres of playas and vernal pools within the Riverside Lowlands Bioregion will be included within the MSHCP Conservation Area of which 1,550 ha (3,830 ac) are Additional Reserve Lands and 1,161 ha (2,870 ac) are existing PQP Lands.” (USFWS 2004, p. 318).

Up to 4 percent of the 17,139 ha (42,349 ac) of *Orcuttia californica* modeled habitat that is outside the Western Riverside County MSHCP Conservation Area and the Narrow Endemic Plant Species Survey Area (NEPSSA) may be lost. In the plan area, 57 percent of California Orcutt grass modeled habitat will be subject to surveys within NEPSSA 1, 2, 3, 3a, 4, and 9. Once the conservation objectives noted above for *O. californica* have been met, avoided areas, not otherwise conserved, may be impacted. We anticipate that occurrences determined to be important to the overall conservation of the species will be considered for inclusion in the Additional Reserve Lands and that some of the avoided areas may be maintained as open space habitat. In addition, this species occurs within a habitat type that is afforded protection throughout the Plan Area by the Riparian/Riverine Area and Vernal Pools policy. Vernal pools will be mapped throughout the Plan Area and avoided if feasible. If avoidance is not feasible, a determination of biologically equivalent or superior preservation must demonstrate that the proposed action will provide equal or better conservation than avoidance of the occupied habitat. *Orcuttia californica* is anticipated to persist within areas conserved through implementation of the NEPSSA surveys and Riparian/Riverine Area and Vernal Pools policy, as well as the remaining 39 percent of its modeled habitat within both the PQP Lands and the Additional Reserve Lands. The Western Riverside County MSHCP will further offset the proposed impacts to this species through management and monitoring actions within the Reserve. We anticipate that conserved areas will be monitored and managed cooperatively to benefit this species. One of the management actions proposed that may benefit the species is the enhancement of historical or vestigial vernal pools within Core Areas for the Riverside fairy shrimp, which has been observed within the Plan Area to co-occur with California Orcutt grass (USFWS 2004, p. 319).

Currently five of the nine occurrences in western Riverside County are considered conserved (Appendix 1) and protected at least from habitat loss from urban or agricultural development.

San Diego Multiple Habitat Conservation Program (San Diego MHCP)—Carlsbad Habitat Management Plan (HMP):

The San Diego MHCP is a comprehensive, multi-jurisdictional, planning program designed to create, manage, and monitor an ecosystem preserve in northwestern San Diego County. The San Diego MHCP is also a regional subarea plan under the State of California's NCCP program and was developed in cooperation with CDFG. The San Diego MHCP preserve system is intended to protect viable occurrences of native plant and animal species and their habitats in perpetuity, while accommodating continued economic development and quality of life for residents of northern San Diego County. The San Diego MHCP includes an approximately 45,324-ha (112,000-ac) study area 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). The section 10(a)(1)(B) permit for the City of Carlsbad HMP was issued on November 9, 2004 (USFWS 2004b, p. 1).

Orcuttia californica is a conditionally covered species under the Carlsbad HMP. Conditional coverage means that the City of Carlsbad will receive assurances for this species after a series of conditions is met for this species: 1) the city of Carlsbad needs to receive legal control over the protection, management, and monitoring of the Poinsettia Train station pools, and 2) demonstrate that have adequate funds to carry out these activities. There is currently one area within the City of Carlsbad that supports an occurrence of *O. californica*. This occurrence is on land that is conserved and some management is currently occurring under the Carlsbad HMP. Any new occurrences of *O. californica* that are discovered will be conserved under the Narrow Endemics Policy that provides special protection to rare species such as *O. californica*. Under this Policy of the San Diego MHCP, any new occurrences found within Focused Planning Areas (FPA) (i.e., core areas and linkages deemed important for conservation of sensitive species) will be conserved at levels of 95 to 100 percent. The Narrow Endemics Policy requires the conservation of new occurrences of narrow endemic species (80 percent outside of FPAs), mitigation for unavoidable impacts, and implementation of management practices designed to achieve no net loss of these narrow endemic species. Additionally, cities cannot permit more than 5 percent gross cumulative loss of narrow endemic species or occupied area within the FPAs and no more than 20 percent cumulative loss of a narrow endemic's locations, population numbers, or occupied acreage outside of FPAs (AMEC Earth and Environmental, Inc. 2003).

The Carlsbad HMP currently provides conservation for the *Orcuttia californica* habitat at the Poinsettia Lane Commuter Station (Appendix 1 EO 34) at the 100 percent level (City of Carlsbad 1999, p. Appendix C-24). The land is conserved with conservation easements, and funds have been designated for the management of this area to benefit vernal pool species, including *O. californica* (USFWS 2004b, p. 320).

City of San Diego and County of San Diego Subarea Plans under the San Diego County Multiple Species Conservation Program (MSCP):

In southwestern San Diego County, the MSCP planning area encompasses more than 235,535 ha (582,000 ac) and includes lands under the jurisdiction of the County of San Diego, City of San Diego, 10 other city jurisdictions, and several independent special districts. Under the broad umbrella of the MSCP, each participating jurisdiction prepares a subarea plan that implements the goals of the MSCP within that jurisdiction. The MSCP provides for the assembly and establishment of approximately 69,204 ha (171,000 ac) of preserve areas to provide conservation benefits for 85 federally listed and sensitive species, including the *Orcuttia californica*, over the permit term. The MSCP anticipates the conservation of at least 88 percent of vernal pool habitat, requires avoidance of impacts to *O. californica* and its habitat to the maximum extent practicable, mitigation for impacts deemed unavoidable, and management to protect habitat against edge effects to *O. californica*.

As discussed above under “Clean Water Act,” the Corps LAD generally took jurisdiction over *Orcuttia californica* 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 *O. californica* habitat under section 404 of the CWA and section 7 of the Act to insure compliance with the USEPA’s CWA, 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 *O. californica* and six other vernal pool species. The court held that the City’s Subarea Plan does not provide adequate protection for *O. californica* as a result of Plan deficiencies and in light of *SWANCC*. As a result, the City surrendered permit coverage for seven vernal pool species on April 20, 2010. The City is currently revising its subarea plan to restore coverage for those species. The Service accepted the City’s relinquishment of coverage for vernal pool species in the MSCP and on May 14, 2010, issued a revised permit covering 78 listed and unlisted species. *Orcuttia californica* is no longer a covered species under the City of San Diego’s Subarea Plan under the MSCP; however, with the relinquishment of coverage, the San Diego City Council authorized the preparation of a new HCP that addresses the District Court’s concerns regarding conservation of the seven vernal pool species and the acceptance of the grant funds for preparation of the new HCP. The City is currently working with the Service to revise and improve the management plan for *O. californica* under the MSCP and is updating their wetland ordinance. Despite the City’s relinquishment of their permit, 54 percent, or 1,369 pools of all currently identified vernal pool habitat within the boundaries of the City’s subarea plan were conserved by covenant of easement, conservation easement, or dedication in fee title to the City (City of San Diego 1997, 2006). The Service is working with the City to conserve more suitable habitat for future restoration and potential reestablishment of *O. californica* populations, which is necessary if the species’ range is to expand. The City continues to monitor and manage vernal pools in support of the MSCP.

Habitat managers have been identified, management plans have been put in place, and management activities (e.g., restoration, maintenance, monitoring) have been carried out at many conserved sites. However, according to Service files, many conserved sites lack long-term management and most sites are in need of additional management to address threats. The City received funds from a 2007 TransNet grant to carry out restoration activities at conserved vernal pool sites. However, these restored sites still need long-term management to maintain the conservation benefit. The City's draft Vernal Pool Management Plan details additional management needed to address ongoing or potential impacts in conserved areas (City of San Diego 2006). The City has identified additional funding sources to carry out long-term management at conserved sites and is working with several landowners to place additional sites into conservation. The Service continues to work closely with the City to finalize and implement the Vernal Pool Management Plan and project specific plans; recent restoration activities demonstrate the City's commitment to conserve *Orcuttia californica*.

Of the 28 extant *Orcuttia californica* occurrences, 11 are conserved by regional plans. In Riverside County, five of the nine occurrences are considered conserved and protected from habitat loss by urban or agricultural development. A total of seven occurrences are covered by the County of San Diego's subarea plan; two are conserved, and development has been proposed on at least two others. A total of eight extant occurrences of *Orcuttia californica* are within the MSCP plan area, four are conserved, three are in the Multi-Habitat Planning Area but not yet conserved, and one is neither conserved nor in the Multi-Habitat Planning Area.

The Sikes Act

The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans for conservation and rehabilitation programs, and to establish outdoor recreation facilities on military installations. The Sikes Act also provides for the Secretaries of Agriculture and the Interior to develop cooperative plans for conservation and rehabilitation programs on public lands under their jurisdiction. While the Sikes Act of 1960 was in effect at the time *Orcuttia californica* was listed, it was not until 1997 when the Sikes Act Improvement Act was enacted that Department of Defense (DOD) installations were required to prepare Integrated Natural Resource Management Plans (INRMP). An INRMP provides for the management of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. Management under an INRMP may include surveying, monitoring, and restoration of natural resources. Implementation of an INRMP is subject to funding availability and does not preserve any military lands in perpetuity, as ultimately those lands may be necessary for National Security. Several INRMPs have been adopted since the listing of the *O. californica*. The most significant for *O. californica* is the INRMP for MCAS Miramar (U.S. Marine Corps 2006, p. 7-1-7-36). On MCAS Miramar vernal pool conservation and management is guided by an INRMP initially developed in 2000 and updated in 2006 (U.S. Marine Corps 2006). The MCAS Miramar's strategy for conservation and management of *O. californica* is to limit activities, minimize development, and mitigate actions in areas supporting high densities of vernal pool habitat. *Orcuttia californica* is known from only three vernal pool areas on MCAS Miramar.

United Mexican States Law

The Service is not aware of any existing regulatory mechanisms that would protect *Orcuttia californica* or its occupied habitat in Baja California, Mexico.

Summary of Factor D

In summary, the Act provides the greatest regulatory protection to *Orcuttia californica*. HCPs, and the related conservation actions arising from the Act have contributed to short and long-term conservation of *O. californica*. In Western Riverside County, five of the nine occurrences are conserved and protected from further loss by development. Seven occurrences are covered by the San Diego MHCP and two are conserved. Eight occurrences fall within the MSCP plan area and three of these are fully conserved. Additionally, the INRMP at MCAS Miramar has created policy mechanisms and partnerships that have restored and conserved vernal pool habitat; three *O. californica* occurrences are located at MCAS Miramar and are provided protection. Additional potential protection provided by other Federal, State, and local laws and ordinances is discretionary, incomplete, subject to funding availability and changing missions, and/or largely dependent on the federally listed status of the *O. californica*. However, in absence of the Act, other Federal, State, and local laws and ordinances do not independently or collectively provide adequate regulatory protection to the species. Inadequacies in provisions or implementation of regulatory mechanisms are not considered a threat to the species, although inadequacies may permit or precipitate actual threats that are attributable to and described under Factors A, B, C, and E.

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

In the listing rule, nonnative plant species, competition with invading species, trash dumping, fire, fire suppression activities, and drought were considered Factor E threats to the existence of four vernal pool species: *Pogogyne nudiuscula* (Otay mesa mint), *Eryngium aristulatum* var. *parishii* (San Diego button celery), Riverside fairy shrimp (*Streptocephalus woottoni*), and *Orcuttia californica* (USFWS 1993, p. 41389). The vernal pool species in the listing rule were also considered vulnerable to extinction due to stochastic events because of the limited numbers of pools and distribution of habitat. This threat is discussed below in the section on small population size. Trash dumping has continued (Wynn, pers. obs. 2011), though little information has been reported since the species was listed. Drought noted in the listing rule as a threat is discussed in this review in conjunction with climate change. Threats identified since listing include: small population size, loss of pollinators, and climate change. These threats as well as conditions of those known at the time of listing are discussed below under the headings: Nonnative Plant Species, Loss of Pollinators, Fire and Fire Suppression Activities, Small Population Size, and Drought/Climate Change.

Nonnative Plant Species

At listing, introduction of nonnative species and competition with invading species were considered to impact *Orcuttia californica* (USFWS 1993, p. 41389) and was delineated in the recovery plan as a threat (USFWS 1998, p. 9). The California Native Plant Society also

considered invasive plants to be a threat to *O. californica* (CNPS 2009 p. 2). Bauder (1997, p. 54) indicated that:

“extensive stands of exotics may be altering many of the relationships among animals and the vernal pool biota by providing an abundant food supply for fossorial rodents, ants, and rabbits.”

Roadways and trails facilitate nonnative species incursion (Hilty *et al.* 2006, pp. 157–158) into patches of remaining vernal pool habitat. Meyers and Bazely (2003, pp. 34–50) highlight species area relationships in noting the number, diversity, and success of invasive plants in most ecosystems. They also indicated that frequency of use by visitors increased the number of nonnative plants present (Meyers and Bazely 2003, pp. 34–50).

Nonnative plant taxa currently within San Diego County are altering natural landscapes and available habitat (Bauder 1987, pp. 209–213). Invasive nonnative plants have been considered a concern in vernal pool habitat (Appendix 1). Potential impacts include competition with *Orcuttia californica* for water, soil nutrients, and space above and below ground. Invasive plants have potential for lowering extant water tables and altering rates of sedimentation and erosion by altering soil chemistry, nutrient levels, and physical structure of soil. As such, they can often out-compete native species such as *O. californica*. Bauder (2005, p. 2133) indicated that *Agrostis avenacea* (Pacific bentgrass) and *Polypogon monspeliensis* (annual beard grass) invaded vernal pools in San Diego County since listing, and it was shown that they negatively impacted the survivorship and reproductive success of native species. Prevention of plant invasions and immediate removal of invasive plants has been noted as important to address and control nonnative species introduction and competition (Vitousek *et al.* 1997, pp. 1–16; Batten 2008, pp. 1–8). The four occurrences on the Santa Rosa Plateau in Riverside County are reportedly threatened by thatch buildup presumably from invasive nonnative plants. Because of the lack of site management, and ubiquitous nonnative plants in and near vernal pool ecosystems, invasive nonnative plants may constitute a rangewide threat to *O. californica*.

Loss of Pollinators

Orcuttia californica is believed to be wind pollinated. To date, we are not aware of any studies on wind pollination or vector assisted pollination in *O. californica*. Changes in regional wind patterns per the Walker Circulation, and transition to a more arid climate are believed to be occurring due to climate change, with increases in aridity and decreased wind speeds noted for both modeled and empirically derived data for California (Zack *et al.* 2005, pp. 1–3; Vecchi *et al.* 2006; Seager *et al.* 2007, pp. 73–76; Pryor and Barthelmie 2010, pp. 430–437). Urbanization is believed to also contribute to decreased wind speeds (Zack *et al.* 2005, pp. 1–3), which may also contribute to an effect on pollination of *O. californica*. The relationship of any of these potential impacts to wind regimes and the wind regime at ground level that affects pollination of *O. californica* is unknown. Some ground nesting bees that are specialists on vernal pool plant taxa nest in vernal pool margins (Thorp 2007, p. 52). Loss of invertebrate pollinators may affect other vernal pool species, which combine to create a functional ecosystem that supports *O. californica* as a component. Diversity of insects, and insect pollinator presence and diversity in and near California vernal pools within the range of *O. californica* is virtually unknown.

Fire and Fire Suppression Activities

Fire was considered a threat to *Orcuttia californica* in the listing rule in the context of a random event impacting a species restricted to a few sites (USFWS 1993, p. 41390); however, our understanding of fire in meadow and grassland habitat has changed since the listing of the species in 1998 (Dyer 2002, pp. 107–111). Fire is a natural component of most of the vegetation communities that surround vernal pools, including those that support *O. californica*, in southern California. During the dry season, *O. californica* faces two seemingly diametrically opposed forces: lack of natural fire regime (exclusion), and introduction of fire (accidentally and purposefully) into a natural or altered landscape. The San Diego County wildfires of 2003 and 2007 exemplify these dual threats.

The ecological effects of fire exclusion in the habitat of southern California has not been specifically detailed for vernal pool habitat; however, the processes and structure of fire ecology is likely comparable to other ecosystems (Keane *et al.* 2002, pp. 3–11; D’Antonio and Vitousek 1992, pp. 63–87) including those that typically surround vernal pool habitat such as chaparral and coastal sage scrub. Fire exclusion from fire adapted vegetation in southern California habitat may affect: 1) nutrient recycling, 2) natural regulation of succession via selecting and regenerating plants, 3) biological diversity, 4) biomass, 5) insect and disease populations, 6) interactions between plants and animals, and 7) biological and biogeochemical processes (i.e., soil property alteration) (Keane *et al.* 2002, pp. 3–11). Fire in areas where *Orcuttia californica* exists can cause erosion post fire which can disrupt vernal pool ecology. Species that are adapted to light fire (such as *O. californica* during the dry season) are replaced by species that are able to out compete for growing resources in the absence of fire (Keane *et al.* 2002, pp. 3–11). Nonnative plant species incursion have exacerbated fire danger to vernal pool habitat by creating micro-climates that are at risk to conflagrations and subsequent intense fire during more times of the year (see MALGBC 2007, p. 7). Bauder (1997, p. 54) indicated that fires may negatively impact vernal pool habitat, because of the increased fuel loads by nonnative plants.

Fires at critical times could impact populations of *Orcuttia californica* by killing individual standing plants, overheating of soil to create hydrophobic conditions, or by killing the seed bank (Agee 1993, pp. 1–493; Keeley 2001, pp. 81–94; Keane *et al.* 2002, pp. 3–11; Arno and Fiedler 2005, pp. 7–38). Historically, this would not have been a problem because there were undoubtedly other adjacent populations that could recolonize depopulated sites.

The threat of catastrophic wildfire is heightened in southern California every year during seasonal Santa Ana adiabatic winds. Miller and Schlegel (2006) suggest that a shift in the frequency of Santa Ana conditions, coupled with increased vegetative drying, may increase during fire season under global warming scenarios. Wildfire in southern California can cause effects over large areas of habitat. In 2003, three fires within San Diego County burned 111,292 ha (275,000 ac) including areas in and near *Orcuttia californica* habitat.

Fires have exposed and cleared habitat where old vernal pools were overgrown by chaparral (e.g., the Copp parcel is now “covered with *Eryngium aristulatum* var. *parishii*” following a recent fire that reduced chaparral (Wynn, pers. obs. 2010)). *Eryngium aristulatum* var. *parishii*

is also a vernal pool dependent species that is listed as endangered by the Service. This suggests that in some instances, fire may be used to reclaim vernal pools overgrown with chaparral.

Conflagrations pose the largest single stochastic/single event risk to the remaining occurrences of *Orcuttia californica* in southern California. In the current context of global climate change (McKenzie and Peterson 2005, pp. 8–12; Flannigan *et al.* 2009, pp. 483–507), small escaped fires (size class B-D) in the San Diego area will most likely turn into large conflagrations (size class E-G) due to wind, weather, lack of natural or managed fire regimes, invasive vegetation, and wildfire control/prevention response.

To the extent that vernal pools that support *Orcuttia californica* are vulnerable to the altered fire regimes of the surrounding vegetation, fire may be considered a rangewide non-imminent threat.

Small Population Size

Small population size was not identified as a threat to *Orcuttia californica* at the time of listing. A more refined understanding of small and declining population biology and genetics than was available at the time of listing suggests that repeated reduction of extant numbers of individuals through stochastic processes may result in local extinction of a species. Small populations are more vulnerable to natural catastrophes and stochastic demographic, genetic, and environmental events. *Orcuttia californica* is limited by its ecological tolerances, as well as past and current anthropogenic activities at, and proximal to, vernal pool complexes. Stochastic events outside the range of natural occurrence, such as floods, fires, contamination, or drought, can substantially reduce, impair, or eliminate small populations and thus increase the likelihood of their local extinction (Lande 1993, p. 912).

Small populations are highly vulnerable to demographic, genetic, and environmental stochastic events, and natural catastrophes (Caughley 1994, pp. 217–227; Asquith 2001, pp. 345–352). Genetic effects may further influence population demography via inbreeding depression and genetic drift (Lande 1988, pp. 1455–1460; Elam 1998, pp. 180–189; Whitlock and Bürger 2004, pp. 155–170; Barrett and Kohn 1991, pp. 3–30; Menges 1991, pp. 58–61). Allee (1931, pp. 17–50) suggested small, single populations are vulnerable to extirpation when opportunities for reproduction diminish because of reduced opportunity of individuals to reproduce (Allee effect or depensation) (Courchamp *et al.* 2008, pp. vi–216). Stephens *et al.* (1999, pp. 185–190), Dennis (2002, pp. 389–401), and Courchamp *et al.* (2008, pp. vi–216) suggest that the Allee effect is a density-dependent event that is inversely related to population size. Because of the distance between populations of *Orcuttia californica*, inbreeding depression and genetic drift may become a quandary for the species.

The current small population size of *Orcuttia californica* may already be demographically or genetically limited where it may be difficult for the plant to persist long-term (Elam 1998, pp. 180–189; Whitlock and Bürger 2004, pp. 161, 167–170) without intensive site management, and potentially *ex situ* propagation and population augmentation, as allele adaptation *in situ* may be too long of a process for *O. californica* with small populations (Orr and Unckless 2008, pp. 163, 168; Bell and Gonzalez 2009, pp. 942–948).

Forming and analyzing innovative conservation approaches using outside experts (Meffe *et al.* 1998, p. 268) will be necessary for the Service to continue to benefit the species, and move the species towards recovery. Addressing *Orcuttia californica* population demography and long-term population viability whether it is via small or declining population, paradigms will require careful analysis to balance short and long-term conservation strategies. Because of the spatial, ecological, and temporal distribution of *O. californica*, small population size is considered a rangewide non-imminent threat (Appendix 1).

Drought/Climate Change

Drought was noted as an unpredictable naturally occurring threat to *Orcuttia californica* at the time of listing (USFWS 1993, p. 41390). Climate change has been identified as a threat to natural environments since the species was listed (Karl *et al.* 2009, pp. 13–152; Alder *et al.* 2009, pp. 1–6). Periodic and successive droughts are considered an underestimated ecological stress and selection factor that impact biological diversity, shaped by species-specific ability to withstand these effects (Gutschick and BrassiriRad 2003, p. 37; Archaux and Wolters 2006, p. 645). The current extended drought effecting southern California may be having deleterious effects on *O. californica*, comparable to other aquatic species (Rahel *et al.* 2008, pp. 551–561).

Climate change is expected to affect plants and wildlife in southern California, as well as throughout the world, by altering natural conditions under which the biota evolved, and thereby potentially creating conditions where invasive species out-compete the endemics (Field *et al.* 1999, pp. 17–42; CEPA 2006, p. 33; IPCC 2007, pp. 2–18). Climate change also makes conserving endangered species cumulatively more difficult (Kostyack and Rohlf 2008, pp. 10203–10213).

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, unpredictable precipitation timing and amounts, and increased summer continental drying (Field *et al.* 1999, pp. 17–42; Cayan *et al.* 2005, pp. 3–7; IPCC 2007, pp. 2–18; Karl *et al.* 2009; Rockström *et al.* 2009, pp. 472–475). Predictions of short and long-term climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or more frequent El Niño or La Niña events (Pierce 2004, p. 31; Vecchi and Wittenberg, in press, pp. 1–16). Climate change related effects have not yet been studied for vernal pool ecosystems. From an ecological context, current models and scientific thought suggest that southern California vernal pools likely will be adversely affected by global climate change through prolonged seasonal droughts, and rainfall coming at unusual periods and different amounts (Pierce 2004, pp. 1–33; Cayan *et al.* 2005, pp. 3–7; CEPA 2006, p. 33). The effects of an unpredictable precipitation regime on vernal pools, and on vernal pool species will have consequential effects on short and long-term persistence of most if not all pools within basins (Bauder 2005, pp. 2129–2135). Bauder (2005, p. 2134) indicated:

“Climate changes would be expected to alter pool hydrology and in turn the distributions, population dynamics and interactions of these vernal pool plants and animals. Less obvious threats are related to the loss of structural habitat diversity and

the concomitant impacts of such losses on hydrological diversity and in turn species responses.”

Direct and indirect impacts from changes in climate are potentially rangewide to *Orcuttia californica* and its habitat rangewide (Appendix 1).

Summary of Factor E

Threats to *Orcuttia californica* and its habitat described under Factor E in the listing rule are still present. Threats associated with nonnative plants impact the species at five occurrences. Fire and fire suppression activities are possibly rangewide in their scope, though are non-imminent. Threats identified since listing, including small population and climate change, are rangewide. The indirect threat from loss of pollinators is not immediate for this wind pollinated species.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, states, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The recovery strategy for *Orcuttia californica* and vernal pool species concentrated on:

“eliminating and reducing the primary existing threats to their habitats. Specifically, these threats are, habitat destruction and modification, alteration of wetland hydrology, off-road vehicle activity, cattle grazing and competition from nonnative species”
(USFWS 1998, p. 58).

Recovery criteria cooperatively prepared for the Service by Dr. E. Bauder (San Diego State University), A. Kreager (USFWS), and S. McMillan in 1998 were developed for four plant species (including *Orcuttia californica*) and two animal species (USFWS 1998, p. iii). Recovery criteria developed in recovery plans at the time were not threat-based. Recovery

criteria for allowing consideration of reclassifying *O. californica* as threatened include (citing only those that apply to occurrences of *O. californica*):

- 1) *“In order to maintain genetic diversity and population stability of the listed species and other sensitive species.”*
 - *“Existing vernal pools currently occupied by *Orcuttia californica*, *Pogogyne nudiuscula*, and Riverside fairy shrimp and their associated watersheds should be secured from further loss and degradation in a configuration that maintains habitat function and species viability.”*
 - *“Existing vernal pools and their associated watersheds within the Transverse and Los Angeles Basin-Orange Management Areas should be secured from further loss and degradation in a configuration that maintains habitat function and species viability.”*
 - *“Existing alkali pools and alkali playas, and their associated watersheds within the Hemet complexes, that contain San Diego fairy shrimp, *Navarretia fossalis*, and *Orcuttia californica*, or any other vernal pool species, should be secured from further loss and degradation in a configuration that maintains habitat function and species viability.”*
 - *“Existing vernal pools and associated watersheds located on Stockpen soils (Otay Mesa) should be secured from further loss and degradation in a configuration that maintains habitat function and species viability, to provide for the recovery of species restricted to this soil type...”*
 - *“Remaining vernal pools and their associated watersheds contained within complexes identified in Appendix F must be secured in a configuration that maintains habitat function and species viability (as determined by prescribed research tasks).”*
- 2) *“The existing vernal pools and their associated watersheds contained within the complexes identified in Appendix G are secured in a configuration that maintains habitat function and species viability (as determined by recommended research);*
- 3) *Secured vernal pools are enhanced or restored such that population levels of existing species are stabilized or increased;*
- 4) *Population trends must be shown to be stable or increasing for a minimum of 10 consecutive years prior to consideration for reclassification. Monitoring should continue for a period of at least 10 years following reclassification to ensure population stability.” (USFWS 1998, pp. 62–63).*

Further protection and management of habitat occupied by *Orcuttia californica* is necessary to prevent extinction and promote persistence of this vernal pool species. Though there are still

several threats impacting the species throughout its range, regional habitat conservation plans have successfully conserved 11 of the 28 extant occurrences; these are functionally protected from further development pressures. However, a better estimate of the population size in each pool complex is still needed to ensure the long-term persistence of the species. *Orcuttia californica* has persisted throughout its range since listing, though many of the occurrences are presumed extant and their status needs to be verified. Population trends also need to be monitored and must be stable or increasing for a minimum of 10 years prior to reclassification. None of the criteria above, for reclassification of *O. californica*, have been completely met at this time and many threats continue to impact the species. Therefore, we consider that *O. californica* is not recovered to the point that protection under the Act is no longer necessary.

IV. SYNTHESIS

At the time of listing, all sites occupied by *Orcuttia californica* were considered to be under imminent threat of development or other impacts associated with habitat loss and degradation. Threats at listing included habitat loss and degradation of habitat through urbanization and agricultural development, damage and destruction caused by OHVs, human trampling associated with immigrant travel, livestock grazing and trampling, road development and highway construction, military activities, water management activities, mowing and plowing of extant habitat, lack of regulatory control, fire and suppression, and nonnative species introduction and competition. Overall, *O. californica* has persisted (maintained its low population size and distribution) and has only negligibly declined since the time of listing. Some vernal pool complexes have been lost and other complexes have been newly detected, protected, or enhanced/created. All remaining *O. californica* habitat is threatened, to varying degrees, by many of the original threats. However, trampling associated with immigrant travel, military activities, and mowing and plowing of extant habitat have nearly been eliminated as threats to *O. californica*. All other delineated threats remain, including rangewide threats associated with small population size and climate change, and may disrupt the *in situ* presence and population dynamics of the species. Threats impacting habitat and individuals of *O. californica* have been documented at 16 of the 28 extant occurrences. Twelve occurrences face threats to the habitat, especially those associated with urban or agricultural development and OHV traffic. Grazing remains as a threat to four of the occurrences and nonnative plants threaten five occurrences. Outside of continued urbanization and direct/indirect effects associated with this threat, climate change may have the longest lasting potential for degrading the species long-term persistence, setting back potential recovery, or causing extinction. Protections afforded by the Act and corresponding cooperative endeavors with private landowners, universities, and local and State governments, have reduced or ameliorated several of these threats since listing. As a result, conservation efforts afford protection to 11 of the 28 (39 percent) extant occurrences of *O. californica* from direct habitat loss due to development.

Many of the occurrences of this species have not been surveyed in recent years. Occurrences of the species are frequently recorded to consist of few individuals and the microsite preferences for *Orcuttia californica* are not well documented. All of these factors contribute to the possible condition that the species may in fact only occur in very low numbers and at far fewer localities than considered extant here. We recommend the status of *O. californica* remain as endangered due to the low number of extant occurrences and status of current threats.

V. RESULTS**Recommended Listing Action:**

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

New Recovery Priority Number and Brief Rationale: 11C.

We recommend a change in the recovery priority number for *Orcuttia californica* from 5C to 11C. This taxon is a species that faces a moderate degree of threat with a low recovery potential. *Orcuttia californica* is distributed over four counties and over a third of the extant occurrences are now conserved through regional HCPs. Many of the threats have been ameliorated and few are rangewide. However, due to the amount of vernal pool habitat historically destroyed within the range of *O. californica*, the species may be conservation-dependent with a low recovery potential.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

- 1) Work with partners, such as the Service's Partners for Fish and Wildlife Program to identify opportunities for conservation or preservation for *Orcuttia californica* occurrences on private lands. Survey all known locations where *O. californica* is presumed extant, to determine persistence, habitat quality, and threats.
- 2) Determine those specific vernal pool attributes associated with occurrence of *Orcuttia californica*.
- 3) Coordinate with partners to develop a nonnative species prevention and eradication program for all vernal pool habitat where *Orcuttia californica* is extant.
- 4) Develop hydrological monitoring and modeling to determine characteristics and identification of pools and complexes likely to be impacted by prolonged drought, and lack of seasonal rainfall caused by climate change effects to El Niño/Southern Oscillation (ENSO).
- 5) Develop a dynamic species-specific recovery outline or recovery plan for *Orcuttia californica*, based on analysis of current knowledge of the species, and a thorough threats analysis.

VII. REFERENCES CITED

- Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington D.C.
- Alder, P.B., J. Leiker, and J.M. Levine. 2009. Direct and indirect effects of climate change on a prairie plant community. PLoS One 4:e6887-1-6.
- Allee, W.C. 1931. Animal aggregations: a study in general sociology. University of Chicago Press, Chicago, Illinois.
- AMEC Earth and Environmental Inc. and Conservation Biology Institute. 2003. Final MHCP Plan, Volume 2: Biological Analysis and Permitting Conditions. Prepared for San Diego Association of Governments Multiple Habitat Conservation Program, San Diego, California.
- Archaux, F. and V. Wolters. 2006. Impact of summer drought on forest biodiversity: What do we know? Annals of Forest Science 63:645-652.
- Arno, S.F. and C.E. Fiedler. 2005. Mimicking nature's fire; restoring fire-prone forests in the west. Island Press, Washington DC.
- Asquith, N.M. 2001. Misdirections in conservation biology. Conservation Biology 15:345-352.
- Barrett, S.C.H. and J.R. Kohn. 1991. Genetic and evolutionary consequences of small population size in plants: implications for conservation. Pages 1-30, in Falk, D.A.I. and K.E. Holsinger (editors.). Genetics and conservation of rare plants. Oxford University Press, New York, New York.
- Batten, K. 2008. Invasive species management recommendations; DOI transition. Obama-Biden transition project.
- Bauder, E.T. 1986. San Diego vernal pools: Recent and projected losses; their condition; and threats to their existence, 1979-1990. Report prepared for Endangered Plant Project, California Department of Fish and Game, Sacramento, California.
- Bauder, E.T. 1987. Threats to San Diego vernal pools and a case study in altered pool hydrology. Pages 209-213, in Elias, T.S. (editor). Conservation and management of rare and endangered plants. California Native Plant Society, Sacramento, California.
- Bauder, E.T. 1988. Vernal pool enhancement. Department of Biology, San Diego State University, California Department of Fish and Game, and California State University Interagency agreement # C-1483.7.

- Bauder, E.T. 1997. Exotics in the southern California vernal pool ecosystem. Pages 52-55, in Lovich, J., J. Randall, and M. Kelly (editors). Proceedings: California Exotic Pest Plant Council Symposium. Volume 2: 1996. California Exotic Pest Plant Council, Trabuco Canyon, California.
- Bauder, E.T. 2000. Inundation effects on small scale plant distributions in San Diego, California vernal pools. *Aquatic Ecology* 34:43-61.
- Bauder, E.T. 2005. The effects of an unpredictable precipitation regime on vernal pool hydrology. *Freshwater Biol.* 50:2129-2135.
- Bauder, E. T., and S. McMillan. 1998. Current distribution and historical extent of vernal pools in southern California and northern Baja California, Mexico. Pages 56-70, in Witham, C.W., E. T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (editors.). Ecology, conservation, and management of vernal pool ecosystems: Proceedings from a 1996 conference. California Native Plant Society, Sacramento, California.
- Beauchamp, R.M. 1979. San Diego Vernal Pool Study, 1978. Nongame Wildlife Investigations, California Department of Fish and Game, Job I-1.0. Job Final Report.
- Bell, G. and A. Gonzalez. 2009. Evolutionary rescue can prevent extinction following environmental change. *Ecology Letters* 12:942-948.
- [CCH] Consortium of California Herbaria. 2010. Herbarium specimen records for *Orcuttia californica*. Data provided by the participants of the Consortium of California Herbaria (ucjeps.berkeley.edu/consortium/).
- [CEPA] California Environmental Protection Agency. 2006. Climate Action Team Report to Governor Schwarzenegger and the Legislature. California Environmental Protection Agency, Sacramento, California.
- [CNDDDB] California Department of Fish and Game, Natural Diversity Database. 2010. Element Occurrence Reports for *Orcuttia californica* EOs 1-46. Unpublished cumulative data.
- CNPS [California Native Plant Society]. 2009. Inventory of rare and endangered plants (online edition, v7-09c). California Native Plant Soc. Sacramento, California. Accessed on Sept. 8, 2009 from <http://www.cnps.org/inventory>.
- Caughley, G. 1994. Directions in conservation biology. *J. Animal Ecol.* 63:215-244.
- Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America? U.S. Geological Survey, WMC Networker; Scripps Institution of Oceanography, La Jolla, California.

- [CPC] Center for Plant Conservation. 2009. CPC National Collection plant profile; *Orcuttia californica*. http://www.centerforplantconservation.org/collection/CPC_ViewProfile.asp?CPCNum=3038 accessed November 24, 2009.
- City of Carlsbad. 1999. Habitat Management Plan for Natural Communities in the City of Carlsbad. December 1999, as amended.
- City of San Diego. 1997. City of San Diego MSCP subarea plan. City of San Diego, Community and Econom. Develop. Dept.
- City of San Diego. 2004. City of San Diego vernal pool inventory. Planning Department, San Diego, CA.
- City of San Diego. 2006. City of San Diego vernal pool management plan. Planning Department, San Diego, California.
- CCH [Consortium of California Herbaria]. 2009. Accession results; *Orcuttia californica*. Accessed September 4, 2009 from http://ucjeps.berkeley.edu/cgi-bin/get_consort.pl?county=&source=All&taxon_name=eryngium.
- Courchamp, F., L. Berec, and J. Gascoigne. 2008. Allee effects in ecology and conservation. Oxford University Press.
- Dennis, B. 2002. Allee effects in stochastic populations. *Oikos* 96:389-401.
- DiGregoria, J., E. Luciani, and S. Wynn. 2005. Integrating transportation conservation with regional conservation planning. IN C.L. Irwin, P. Garrett, and K.P. McDermott. Proceedings of the 2005 International Conference on Ecology and Transportation. Center for Transportation and the Env, North Carolina State University, Raleigh, North Carolina.
- D'Antonio, C.M. and P.M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. *Ann. Rev. Ecol. and Syst.* 23:63-87.
- [Dudek] Dudek and Associates, Inc. 2003. Western Riverside County Final Multiple Species Habitat Conservation Plan, Volumes I -V. Dudek and Associates, Inc., Encinitas, California.
- Dyer, A.R. 2002. Burning and grazing management in a California grassland; effect on bunchgrass seed viability. *Rest. Ecol.* 10:107-111.
- Elam, D.R. 1998. Population genetics of vernal pool plants: theory, data and conservation implications. IN C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Eds.). Ecology, conservation and management of vernal pool ecosystems-Proceedings from a 1996 conference. California Native Plant Soc., Sacramento.

- Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.
- Flannigan, M.D., M.A. Krawchuk, W.J. de Groot, B.M. Wotton, and L.M. Gowman. 2009. Implications of changing climate for global wildland fire. *Int. J. of Wildland Fire* 18:483-507.
- Flannigan, M.D., D. Sperling, J.A. Bissonette, A.P. Clewenger, C.D. Cutshall, V.H. Dale, L. Fahrig, R. France, C.R. Goldman, K. Heanue, J.A. Jones, F.J. Swanson, T. Turrentine, T.C. Winter. 2003. *Road Ecology*. Island Press.
- Griggs, T. 1976. Life history strategies of the genus *Orcuttia* (Gramineae), pp. 57-63. IN S. Jain (ed.). *Vernal pools, their ecology and conservation*. Inst. of Ecol. Publ. # 9. University of California, Davis.
- Griggs, T. 1981. Life histories of vernal pool annual grasses. *Fremontia* 9:14-17.
- Gutschick, V.P. and H. BassiriRad. 2003. Extreme events as shaping physiology, ecology, and evolution of plants: Toward a unified definition and evaluation of their consequences. *New Phytologist* 160:21-42
- Hilty, J.A., W. Z. Lidicker Jr., and A.M. Merenlender. 2006. *Corridor ecology*. Island Press.
- Hoover, R.F. 1941. The genus *Orcuttia*. *Bull. Torrey Bot. Club* 68:149-156.
- [IPCC], Intergovernmental Panel on Climate Change. 2007. *Climate change 2007: the physical science basis. Summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC Secretariat, World Meteorological Organization and United Nations Environment Programme, Geneva, Switzerland.*
- Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). 2009. *Global climate change impacts in the U.S.* Cambridge University Press.
- Kassebaum, J. 2008. 29 December 2008 Email to K. Brubaker, USFWS. Marine Corps Air Station Miramar.
- Kassebaum, J. 2009. Final report for damage repair to the HH1+ Vernal pool group (western portion) on Marine Corps Air Station Miramar. Marine Corps Air Station Miramar.
- Keane, R.W., K.C. Ryan, T.T. Beblen, C.D. Allen, J. Logan and B. Hawkes. 2002. Cascading effects of fire exclusion in Rocky Mountain ecosystems: A literature review. GT Report. RMRS-GTR-91.

- Keeley, J.E. 1988. Anaerobiosis as a stimulus to germination in two vernal pool grasses. *Am. J. of Botany* 75:1086-1089.
- Keeley, J.E. 1990. Photosynthesis in vernal pool macrophytes: relation of structure and function, pp. 61-87. IN D.H. Ikeda and R.A. Schlising (eds.). *Vernal pool plants-their habitat and biology. Studies from the Herbarium # 8, California State University, Chico.*
- Keeley, J.E. 1999. Photosynthetic pathway diversity in a seasonal pool community. *Ecol.* 13:106-118.
- Keeley, J.E. 2001. Fire and invasive species in Mediterranean-climate ecosystems of California. IN K.E.M. Galley and T.P. Wilson (eds.). *Proceedings of the invasive species workshop; the role of fire in the control and spread of invasive species. Fire Conf. 2000: First Nat. Cong. On Fire Ecol., Prevention, and Manage. Misc. Pub. No. 11, Tall Timbers Res. Stat. Tallahassee, Florida.*
- Keeley, J.E. and P.H. Zedler. 1998. Characterization and global distribution of vernal pools. IN C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Eds.). *Ecology, conservation and management of vernal pool ecosystems-Proceedings from a 1996 conference. California Native Plant Society, Sacramento.*
- Kostyack, J. and D. Rohlf. 2008. Conserving endangered species in an era of global warming. 38 *ELR* 10203-10213.
- Lande, R. 1988. Genetics and demography in biological conservation. *Science* 241:1455-1460.
- Lande, R. 1993. Risks of population extinction from demographic and environmental stochasticity and random catastrophes. *Am. Nat.* 142:911-927.
- [Lennar] Lennar-Moorpark LLC. 2003. *Tierra Rejada Vernal Pool Preserve Management and monitoring plan and guidelines. August 2001, revised July 2003.*
- Lindenmayer, D.B. and G.E. Likens. 2009. Adaptive monitoring: a new paradigm for long-term research and monitoring. *TREE* 24:482-486.
- Mattoni, R. and T. Longcore. 1997. The Los Angeles coastal prairie, a vanished community. *Crossosoma* 23(2):71-102.
- McKenzie, D. and D.L. Peterson. 2005. *Wildfire in the west: a look into a greenhouse world. U.S. Geological Survey, WMC Networker; Scripps Institution of Oceanography, La Jolla, California.*
- McKinney, M.L. 2002. Urbanization, biodiversity, and conservation. *Bioscience* 52:883-890.

- Meffe, G.K., P.D. Boersma, D.D. Murphy, B.R. Noon, S.H.R. Pulliam, M.E. Soule, and D.M. Waller. 1998. Independent scientific review in natural resource management. *Consv. Bio.* 12:268-270.
- Menges, E.S. 1991. The application of minimum viable population theory to plants. IN D.A.I. Falk and K.E. Holsinger (eds.). *Genetics and conservation of rare plants*. Oxford Univ. Press.
- Meyers, J.H., and D.R. Bazely. 2003. *Ecology and control of introduced plants*. Cambridge University Press.
- MALGBC, [Ministry of Agriculture and Lands, Government of British Columbia]. 2007. Fire effects on grasses and forbs. <http://www.agf.gov.bc.ca/range/publications/documents/fire3.htm>. Accessed March 2009.
- Miller, N.L. and N.J. Schlegel. 2006. Climate change-projected Santa Ana fire weather occurrence. California Climate Change Center CEC-500-2005-204-SF.
- [MRCA] Mountains Recreation and Conservation Authority. 2005. Fourth Annual Monitoring Report – Tierra Rejada Vernal Pool Preserve. Malibu, California. 16 pp.
- Munz, P.A. 1924. Southern California plant notes II. Vol. XXIII *Bull S. Calif. Acad. Sciences*, Los Angeles.
- Munz, P.A. 1974. *A flora of Southern California*. University of California Press, Berkeley.
- NOAA [National Oceanographic and Atmospheric Administration]. 2009. Multivariate ENSO index. <http://www.cdc.noaa.gov/people/klaus.wolter/MEI/#LaNina>. Last accessed June 2009.
- Oberbauer, T.A. and J.M. Vanderwier. 1991. The vegetation and geologic substrate association and its effect on development in southern California. IN P.L. Abbott and W.J. Elliott (Eds.). *Environmental perils San Diego Region*. San Diego Assoc. of Geologists.
- Orr, H.A. and R.L. Unckless. 2008. Population extinction and the genetics of adaptation. *The Am. Nat.* 172:160-169.
- Pierce, D.W. 2004. Effects of North Pacific oscillation and ENSO on seasonally averaged temperatures in California. Climate Research Division, Scripps Inst. of Oceanography. Cal. Energy Comm., PIER Energy-related Env. Res.. CEC-500-2005-002.
- Pryor, S.C., and R.J. Barthelmie. 2010. Climate change impacts on wind energy: a review. *Renewable and sustainable energy reviews* 14:430-437.

- Rahel, F.J., B. Bierwagen, and Y. Taniguchi. 2008. Managing aquatic species of conservation concern in the face of climate change and invasive species. *Conserv. Biol.* 22:551-561.
- Reeder, J.R. 1982. Systematics of the tribe Orcuttieae (Gramineae) and the description of a new segregate genus, *Tuctoria*. *Am. J. of Bot.* 69:1082-1095.
- Reeder, J.R. 1993. *Orcuttia* pp. 1276-1277. IN J.M. Hickman (ed). *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley.
- Reiser, C.H. 1994. Rare plants of San Diego County. Unpublished. Aquafir Press, San Diego, California. (<http://sandiego.sierraclub.org/rareplants/>, accessed August 27, 2009).
- Rockström, J., W. Steffen, K. Noone, Å. Persson, F.S. Chapin III, E.F. Lambin, T.M. Lenton, M. Scheffer, C. Folke, H.J. Schellnhuber, B. Nykvist, C.A. de Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P.K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R.W. Corell, V.J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, J.A. Foley. 2009. A safe operating space for humanity. *Nature* 461:472-475.
- Seager, R., M. Ting, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H-P Huang, N. Harnik, A. Leetmaa, N-C Lau, C. Li, J. Velez, and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. *Science* 316:1181-1184.
- Stephens, P.A., W.J. Sutherland, and R.P. Freckleton. 1999. What is the Allee effect? *Oikos* 87:185-190.
- Tamasi, J. 2011. 2010 Annual Report – Recovery Permit TE-136973-1. Mountains Recreation and Conservation Authority, Malibu, California. 14 pp.
- Tennant, T., M.F. Allen, and F. Edwards. 2001. Perspectives in conservation biology in southern California: I current extinction rates and causes. Center for Conserv. Biol., Univ. California/Riverside.
- Thorp, R.W. 2007. Biology of specialist bees and conservation of showy vernal pool flowers. A review. IN R.A. Schlising and D.G. Alexander (Eds.). *Vernal pool landscapes. Studies from the Herbarium, # 14*. California State University, Chico, California.
- [USFWS] U.S. Fish and Wildlife Service. 1983a. Endangered and threatened species listing and recovery priority guidelines. 48 FR 43098-43105.
- [USFWS] U.S. Fish and Wildlife Service. 1983b. Endangered and threatened species listing and recovery priority guidelines. 48 FR 51985.
- [USFWS] U.S. Fish and Wildlife Service. 1993. Determination of endangered status for three vernal pool plants and the Riverside fairy shrimp. *Federal Register* 58: 41384-41392.

- [USFWS] U.S. Fish and Wildlife Service. 1997. Determination of endangered status for the San Diego Fairy Shrimp. Federal Register 62:4925-4939.
- [USFWS] U.S. Fish and Wildlife Service. 1998. Vernal Pools of Southern California, Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR.
- [USFWS] U.S. Fish and Wildlife Service. 2004a. Intra-Service Formal Section 7 Consultation/Conference for Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit (TE-088609-0) for the Western Riverside County Multiple Species Habitat Conservation Plan, Riverside County, California. Dated June 22, 2004.
- [USFWS] U.S. Fish and Wildlife Service. 2004b. Subregional Multiple Habitat Conservation Plan and the City of Carlsbad Subarea Plan/Habitat Management Plan, San Diego County, California (1-6-00-F-847.4). Dated November 9, 2004.
- [USFWS] U.S. Fish and Wildlife Service. 2009. Notice of initiation of 5-year reviews; availability of completed 5-year reviews. 74 FR 12878-12883.
- U.S. Marine Corps. 2006. Integrated Natural Resources Management Plan, MCAS Mirimar, California.
- Vasey, G. 1886. A new genus of grasses. Bull. Torrey bot. Club 13:219.
- Vecchi, G.A., B.J. Soden, A.T. Wittenberg, I.M. Held, A. Leetmaa, and M.J. Harrison. 2006. Weakening of tropical Pacific atmospheric circulation due to anthropogenic forcing. Nature 441:73-76.
- Vecchi, G.A. and A. T. Wittenberg. In Press. El Nino and our future climate: where do we stand? Wiley interdisciplinary reviews: Climate change.
- Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejmanek, and R. Westbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand J. of Ecol. 21:1-16.
- Whitlock, M.C. and R. Bürger. 2004. Fixation of new mutations in small populations. IN Ferrière, R. U. Dieckmann, and D. Couvet (Eds.). Evolutionary conservation biology. Cambridge University Press.
- Wilcove, D.S., D. Roghstein, J. Dubow, A. Phillips and E. Losos. 1998. Quantifying threats to imperiled species in the United States. Bioscience 48:607-615.
- Zack, J.W., G.E. Van Knowe, and K.T. Waight. 2005. Examination of regional wind trends due to global climate change to improve wind resource assessments. From 15th Conf. on App. Climatology.

Zedler, P.H. 1987. The ecology of southern California vernal pools: a community profile. Biol. Rept. 85(7.11), U.S. Fish and Wildlife Service.

Personal Observations

Susan Wynn. 2010. USFWS, Carlsbad Fish and Wildlife Office. Subject: discussion of factor A threats and their impacts to vernal pools and associated habitat occupied by *Orcuttia californica*.

Susan Wynn. 2011. USFWS, Carlsbad Fish and Wildlife Office. Subject: discussion of factor E threats and their impacts to *Orcuttia californica*.

Appendix 1: Occurrences of <i>Orcuttia californica</i> prepared for the FY 2010 5-year review.						
Regional Location	Location	CNDDDB Element Occurrence # and pool complex	Status at Listing	Current Threats	Current Status and Conservation	Owner
VENTURA COUNTY						
Southeast of Moorpark	Tierra Rejada Vernal Pool Preserve	EO 28	Unknown	A. Development, Altered hydrology E. Nonnatives	Presumed extant. Conserved. 10,000 plants in 1992, negative surveys 2000, 2003, 2004, 2010 (Tamasi 2011); ca. 26,125 plants in 2005 (MRCA 2005)	Mountains Recreation and Conservation Authority; Public
	Thousand Oaks	EO 33	Unknown	vague locality	Presumed extant	Private
Southeast of Moorpark	E of Tierra Rejada Valley and SR 23	EO 35	Unknown	A: Altered hydrology	Presumed extant. 23 plants in 2003	Private
LOS ANGELES COUNTY						
	Los Angeles, Rosecrand and Western	EO 12	extirpated			Unknown
	Near Lakewood	EO 13	extirpated	vague locality		Unknown
	Near Downey	EO 14	extirpated	vague locality		Unknown
	Cruzan Mesa	EO 29	unknown	A: Development, OHVs	Extant	Private
	Plum Canyon	EO 30	unknown		Presumed extant. 100 plants in 1996, unknown number in 2003	Unknown
	Near Newhall	EO 32	unknown	Vague locality	Presumed extant	Unknown

RIVERSIDE COUNTY						
	Stowe Pools, E of Homeland	EO 27	Extant at listing	A: Development, Highway Expansion, OHV activity. C: Grazing	Presumed extant. 1992: 350,000 plants, 2000 no plants, 2005 4266 plants	Private
	Menifee Valley	EO 2	Extirpated		Considered extirpated	Unknown
Paloma Valley	S of Bell Mtn., E of Menifee Rd.	EO 40	Unknown		Possibly extirpated based on 2008 aerial imagery (CNDDDB 2010, EO 40)	Private
Paloma Valley	SSW of Bell Mtn, W side Lindenberger Rd.	EO 46	Unknown	A: Development (farming)	Presumed extant. 2009: Three plants, probably more.	Private
Paloma Valley	NE of intersection Menifee and Scott Rds.	EO 31	Unknown	A: Development (farming)	Presumed extant. 2001: 10-100 plants	Private
	Elsinore Trough	EO 42	Unknown		Presumed extant.	Unknown
	Murietta Hot Springs	EO 1	Extirpated		Extirpated	Unknown
	Skunk Hollow	EO 24	Extant at listing		Presumed extant. Conserved	Private

Santa Rosa Plateau Preserve	Mesa de Burro, E and W sides	EO 16 (includes EOs 15, 17, 19, and 26)	Extant on Santa Rosa Plateau at listing no specific location cited	E: Nonnatives (thatch build-up), Climate Change	Presumed extant. Conserved. 1982: thousands of plants, 1986 and 1988 unknown number of plants seen and declining according to TNC monitors, 2005 uncommon in western polygon	TNC-Santa Rosa Nature Preserve
	Mesa de Burro, N end	EO 18	Extant on Santa Rosa Plateau at listing no specific location cited	E: Nonnatives (thatch build-up), Climate Change	Presumed extant. Conserved. 1982: In 2 pools each with about 10,000 plants, 1986 and 1988 unknown number but declining according to TNC monitors	TNC-Santa Rosa Nature Preserve
	Mesa de Colorado, S side	EO 21	Extant on Santa Rosa Plateau at listing no specific location cited	E: Nonnatives (thatch build-up), Climate Change	Presumed extant. Conserved. 1982: 100 plants, 1986 and 1988 unknown number but declining according to TNC monitors	TNC-Santa Rosa Nature Preserve
	Mesa de Colorado, W side	EO 20 (includes EO 22)	Extant on Santa Rosa Plateau at listing no specific location cited	E: Nonnatives (thatch build-up), Climate Change	Presumed extant. Conserved. 1982: About 10,000 plants seen, 1986 and 1988 unknown number of plants but declining according to TNC monitors.	TNC-Santa Rosa Nature Preserve

SAN DIEGO COUNTY						
	Warner Valley	EO 41	Unknown		Presumed extant. Unknown number of plants seen in 1998	Unknown
	Carlsbad, Poinsettia Train Station	EO 34	Unknown		Presumed extant. Conserved.	Unknown
MCAS Miramar	N of runways, S of Rose Canyon	EO 43 (pools referenced do not match GIS plot)	Unknown		Presumed extant.	MCAS Miramar
MCAS Miramar	W end of runways	EO 44 Pools HH HH1+	Unknown		Presumed extant	MCAS Miramar
MCAS Miramar	W side Hwy 163, 1mi N of Clairmont Mesa Blvd.	EO 6 Pool Complex U2	Unknown	A: Highway maintenance, OHVs	Presumed extant	MCAS Miramar
	NE of Brown Field	EO 3 Pool complex J29		A: Urban and Agricultural development	Presumed extant. In MHPA but not yet conserved	Private
	Headwaters Dennery Canyon	EO 39 Pool complex J2S and J2W Otay Mesa Road Helix and Recon	Unknown		Presumed extant. Conserved	City of San Diego

2011 5-Year Review For *Orcuttia californica*

	SW of Brown Field	EO 38 Pool complex J14	Unknown		Presumed extant. Conserved	Unknown
	Otay Mesa W of Finger Canyon	EO 7. Pool complex 13S	Extant	A: Development, OHVs, C: Grazing	Presumed extant. Not in MHPA (not conserved)	Private
	N of Wruck Canyon	EO 11 Pool complex J16-18	Extant	A: Habitat Destruction (trampling)	Presumed extant. Conserved	Private
	Spring Canyon	EO 10. Pool complex J12	Extant	A: Development, altered fire regime, OHVs, Habitat Destruction (trampling) C: Grazing	Presumed extant. In MHPA but not yet conserved.	Private
	W. of Spring Canyon	EO 9. Pool complex J11	Extant	A: Development, altered fire regime, OHVs, Habitat Destruction (trampling) C: Grazing	Presumed extant. In MHPA but not yet conserved	Private
	Arnie's Point SE on mouth Wruck Canyon	EO 37	Unknown		Presumed extant. Conserved	Unknown
	SE of Brown's Field	EO 4 Pool complex J28	Extant		Possibly extirpated.	Private
	S of Siempre Viva Rd.	EO 5 Pool complex J19	Extant		Possibly extirpated.	Private
	Penasquitos Substation	EO 45 (created pools)	N/A	N/A	N/A	Private PG&E

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

Orcuttia californica (California Orcutt grass)

Current Classification: Endangered

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

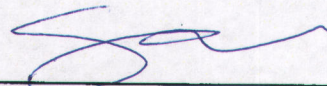
New Recovery Priority Number and Brief Rationale: 11C.

We recommend a change in the recovery priority number for *Orcuttia californica* from 5C to 11C. This taxon is a species that faces a moderate degree of threat with a low recovery potential. *Orcuttia californica* is distributed over four counties and over a third of the extant occurrences are now conserved through regional HCPs. Many of the threats have been ameliorated and few are rangewide. However, due to the amount of vernal pool habitat historically destroyed within the range of *O. californica*, the species may be conservation-dependent with a low recovery potential.

FIELD OFFICE APPROVAL:

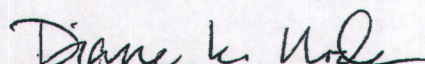
Lead Field Supervisor, U.S. Fish and Wildlife Service

ACTING

Approve  Date MAR 11 2011
Scott A. Sobiech

Ventura Fish and Wildlife Office, Field Supervisor

Concur Do Not Concur

Signature  Date 3/9/11