



RANCHO SANTA ANA BOTANIC GARDEN OCCASIONAL PUBLICATIONS

NUMBER 7

A CONSERVATION PLAN FOR *MIMULUS SHEVOCKII* (PHRYMACEAE)

NAOMI S. FRAGA

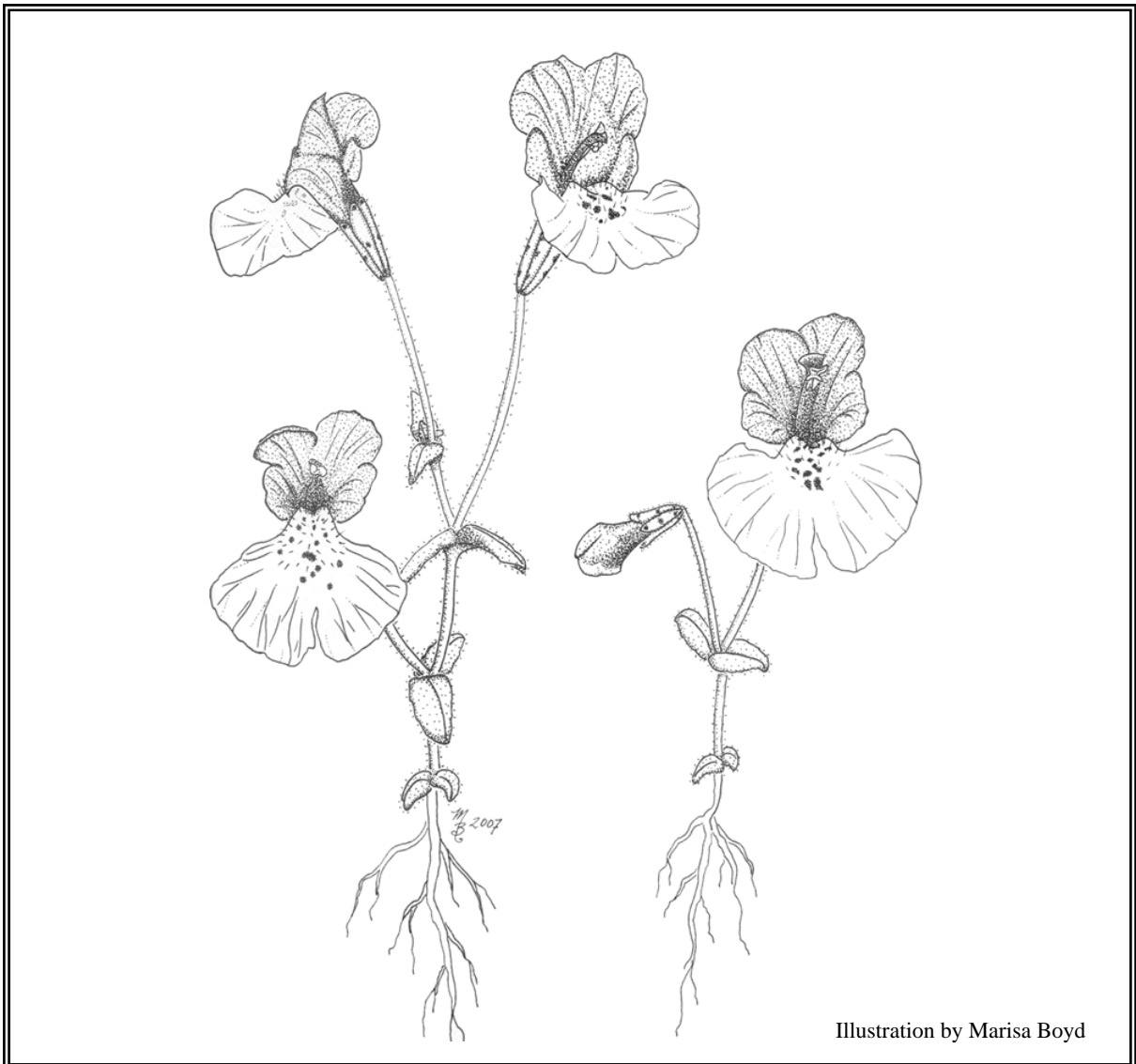


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1.0 EXECUTIVE SUMMARY

Mimulus shevockii Heckard and Bacig. (Phrymaceae, Kelso Creek monkeyflower) is an annual herb endemic to the Kern River drainage in the southern Sierra Nevada, Kern County, California. This species is currently listed as a California Native Plant Society (CNPS) list 1B.2 taxon, which designates the species as “fairly endangered” in California. *Mimulus shevockii* is a Bureau of Land Management (BLM) sensitive plant covered by the BLM West Mojave Desert Plan, and is therefore designated by the BLM for a special management consideration. There are eight extant occurrences and one extirpated occurrence of *M. shevockii*; these occur within an area of 50 km² (20 mi²). At the present time there is no official federal or state status for this species. Recommendations for this species include implementing a monitoring program with standardized protocols, surveying potential habitat for additional occurrences, and maintaining an ex situ conservation seed collection.

2.0 SCOPE AND PURPOSE

Mimulus shevockii was selected for a conservation plan due its restricted range and the limited amount of biological information that is currently available for this species. The purpose of this conservation plan is to review all available information about *M. shevockii* and compile it in a single document that is useful for land managers, conservation organizations, state and federal agencies, researchers, and plant enthusiasts. This document should also serve to determine immediate conservation needs and to identify areas where more information will be required to fully protect this species.

3.0 BACKGROUND

Mimulus shevockii Heckard and Bacig. (Phrymaceae, Kelso Creek monkeyflower) is only known from arid regions of the southern Sierra Nevada in Kern County, California. This species has been designated as a CNPS list 1B.2 taxon (CNPS 2007), and is included in the BLM West Mojave Desert Plan (BLM 2004). *Mimulus shevockii* is an annual herb that blooms from March to May. Plants of this species have a very distinctive bilabiate corolla composed of a maroon–purple upper lip, and three lower lobes that include one large bifid yellow lobe and two short maroon–purple lobes (Heckard and Bacigalupi 1986). The vegetative and pollen morphology is similar to that of other local *Mimulus* species, with *M. montioides* A.Gray (a montane meadow species) being the most similar; however morphology and coloration of the corolla lobes are quite dissimilar (BLM 2004; Heckard and Bacigalupi 1986).

Mimulus shevockii is known from nine occurrences (eight extant and one extirpated) that span an area of 50 km² (20 mi²). This relatively small geographical area lies within the Kern River drainage in the Lake Isabella region of the southern Sierra Nevada. Populations exist on both private property and land managed by the Bureau of Land Management (BLM) California Desert District (Bakersfield and Ridgecrest Office) (CNDDDB 2007). These areas have been subject to agriculture (orchards, cattle grazing), off-highway vehicle use, and home development, all of which threaten populations of this species. One or more of these threats is documented for seven of the nine occurrences (BLM 2004, CNDDDB 2007). *Mimulus shevockii* was proposed for federal listing in 1994 by the United States Fish and Wildlife Service (USFWS) due to urbanization, Off Highway Vehicle (OHV) use, and agricultural land conversion

(USFWS 1994). However, the proposal was withdrawn in 1998 because the USFWS determined that *M. shevockii* is not threatened with extinction throughout all or a significant portion of its range and does not meet the definition of a threatened or endangered species (USFWS 1998).

Mimulus shevockii was described in 1986 (Heckard and Bacigalupi 1986); specimens collected prior to that were either unidentified or identified tentatively as *M. barbatus* Greene (Heckard and Bacigalupi 1986). As a consequence of its recent discovery, very little is known about the biology and ecology of *M. shevockii*.

3.1 Species Description

Mimulus shevockii is a minute annual herb in the family Phrymaceae (Fig.1, 2, 4). The stems are erect, 2–12 cm long, simple or branched at the lowermost nodes. The cotyledons are persistent, round to ovate, 5–10 mm long, with clasping bases. The leaves (1–10 pairs) clasp the base of the stems, are sessile, 3–10 mm long, lanceolate to ovate, somewhat fleshy, purplish below, and have thickened entire margins. The flowers are solitary in each leaf axil beginning with the first true leaf node and continuing distally; pedicels are 10–22 mm long. The calyx is 4–7 mm long, angled, with reddish spots or entirely red, and elongating in fruit. The corolla is zygomorphic (bilabiate), the tube is 8–12 mm long; the lips are widely and unequally spreading, 10–15 mm long. The upper lip is maroon–purple and is two–lobed. The lower lip is three–lobed with one central lobe and two short, maroon–purple, lateral lobes. The central lower lobe is bifid, 5–10 mm long, 8–15 mm broad, yellow with maroon dots at the base that are bearded with trichomes. The stamens are glabrous, with dark red filaments. The anthers and stigma are exerted, with the stigma slightly exceeding the anthers. The stigma is bilobed

and closes after being touched by a pollinator. The fruit is a capsule, ellipsoid, tan, 5–6 mm long, barely included in calyx tube at maturity, dehiscent from the apex, and along both sutures. The seeds are many per fruit (more than 100), ellipsoid to ovoid in shape, tan, and ca. 0.5 mm long (Heckard and Bacigalupi 1986; Thompson 1993). The chromosome number is $n = 16$ (Heckard and Bacigalupi 1986).



Fig. 1. *Mimulus shevockii* in flower.
Photograph by Naomi Fraga.

3.2 Taxonomic History

The genus *Mimulus* (traditionally placed in Scrophulariaceae), as currently circumscribed, contains approximately 120 species. The genus is worldwide in distribution; however nearly 75% of the species occur in western North America (Beardsley et al. 2004). Thirty-three species are listed as rare in

California (CNPS 2007). Relationships within the genus *Mimulus* have been a source of considerable debate. In her monograph of *Mimulus*, Grant (1924) recognized 120 species, two subgenera, and ten sections. The taxonomy of *Mimulus* has since been reviewed by McMinn (1951), Vickery (1978), Argue (1980), and Beardsley et al. (2004). Based on section delimitation in Grant's (1924) monograph, *M. shevockii* would have been placed in section *Paradanthus*, based on chromosome number, vegetative characters, and pollen morphology (Heckard and Bacigalupi 1986). However, the placement is problematic. Section *Paradanthus* is noted for having a high number of endemic species, large variation in breeding systems and problematic species delimitations (Grant 1924; Argue 1986; Heckard and Bacigalupi 1986; Thompson 1993; Beardsley et al. 2004). In creating section *Paradanthus*, Grant noted that species placed in this section consisted of "small closely allied associations that did not seem to belong to any of the well established groups."

Recent phylogenetic studies have found the Scrophulariaceae s.l. to be polyphyletic, (Olmstead and Reeves 1995; Olmstead et al. 2001). The family has since been redefined, with *Mimulus* now placed in the segregate family Phrymaceae (Beardsley and Olmstead 2002). *Mimulus shevockii* was described in 1986 by Lawrence R. Heckard and Rimo Bacigalupi. Prior to its description, specimens collected as early as 1932 remained undefined or tentatively identified as *M. barbatus* Greene. There are no synonyms for *M. shevockii* (IPNI 2007; Tropicos 2007).

In a maximum parsimony analysis of combined *trnL-F*, nuclear ribosomal ITS and ETS data, a clade (100% bootstrap support) of *Mimulus* section *Paradanthus* species mostly from the southern Sierra Nevada was recovered (Beardsley et al. 2004). The

analysis indicates that *M. shevockii* and *M. androsaceus* Curran (Fig. 3), which occurs sympatrically with *M. shevockii*, form a well-supported clade (100% bootstrap support) (Beardsley et al. 2004). *Mimulus shevockii* is quite distinct from *M. androsaceus* in its morphology, primarily in the shape and color, of the corolla but the two species are quite similar vegetatively. Hybrids have not been observed in any of the known localities.

3.3 Biology and Ecology

Plants of *M. shevockii* flower from March to May and fruit from April to June. The effects of rainfall amount and timing on reproductive output are not yet known for this species, although plants of this species are known not to germinate in years of drought (Fraga 2007). There is no information regarding the pollinators, breeding system, or mechanisms of seed dispersal. However, in conducting surveys in 2006, there were ten observations of a soft wing flower beetle (family Melyridae, genus *Trichochrous*) visiting flowers of *M. shevockii* (Fig. 5).

Studies of seed banks have been conducted on taxa that share a similar life history with *M. shevockii* (i.e., desert annuals) and information gathered on other desert annuals is likely relevant to this particular species. Seed banks have been shown to be important in the desert annual life cycle (Went 1949). The amount and timing of rainfall affect the number of seeds that germinate, the timing of germination, and the size and longevity of plants. Studies have shown that even in wet years, when germination is high, a fraction of the viable seed will remain dormant and in the seed bank (Packe and Venable 1996). It is likely that maintaining a seed bank is important for the long term maintenance of *M. shevockii*.



Fig. 3. *Mimulus androsaceus* growing near Kelso Creek, Kern County California. *Mimulus shevockii* and *M. fremontii* (in the background) also occur at this site (CNDDDB EO03). Photo by Michael Wall.



Fig. 2. Growth habit of *Mimulus shevockii* shown with a toothpick and a finger for scale. Photograph by Naomi Fraga.

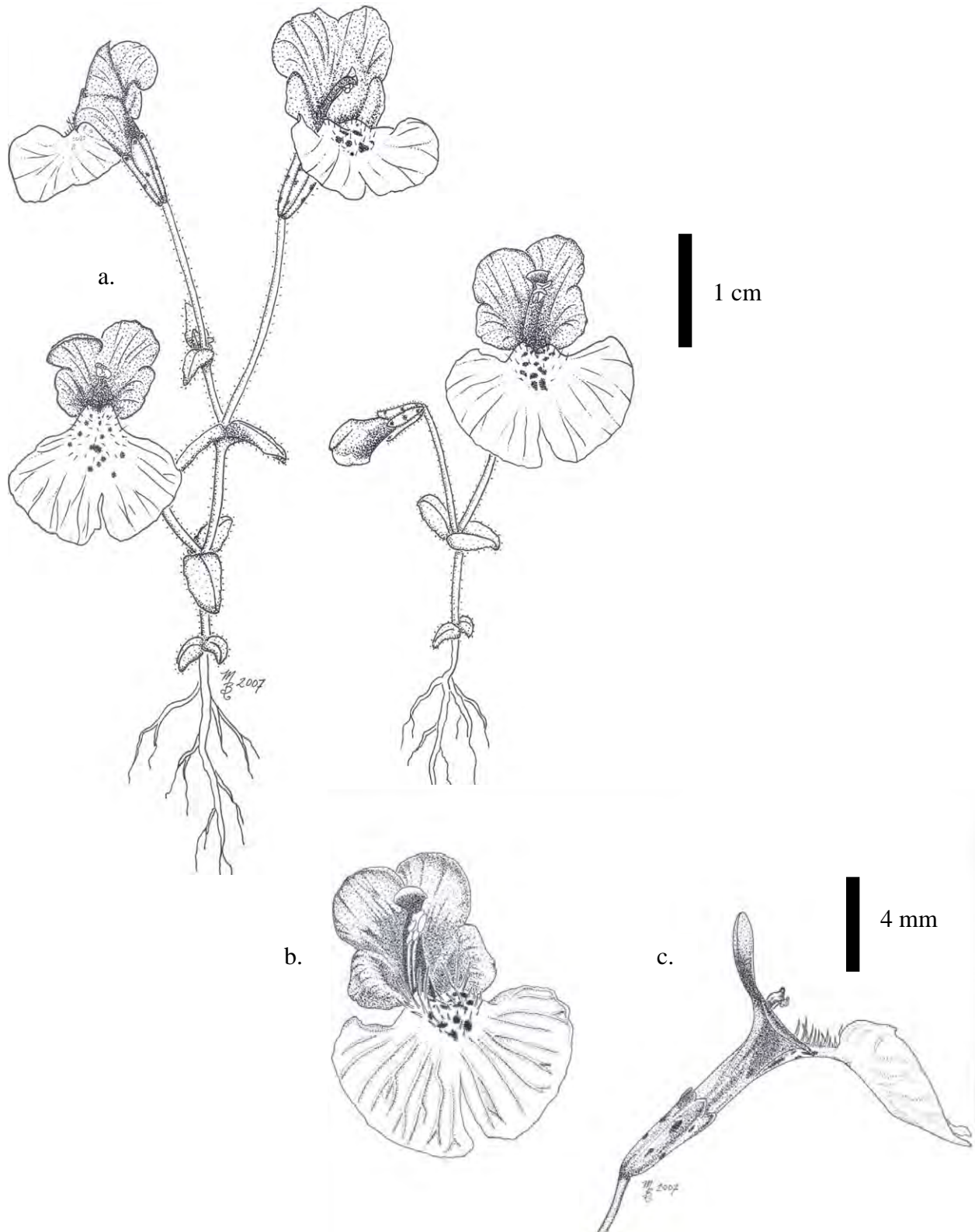


Fig. 4. Illustration of *Mimulus shevockii*. a. Habit. b. Flower (adaxial view). c. Flower (side view). Illustration by Marisa Boyd.

3.4 Habitat

Mimulus shevockii is a winter annual with a highly restricted distribution. However, the habitat requirements of *M. shevockii* do not appear to be stringent. Populations occur in Joshua tree or California juniper woodland habitats (Fig. 6), ranging from 2700 to 4400 ft (825–1340 m) in elevation (CNDDDB 2007). The mean annual precipitation in this region is 20 cm (8 in) (Heckard and Bacigalupi 1986). The substrate is typically loamy, coarse sands of granitic origin on alluvial fans of dry streamlets (BLM 2004; Heckard and Bacigalupi 1986). However, the Cyrus Canyon population grows on finer soils developed from metasedimentary rocks (Heckard and Bacigalupi 1986).

Associated species summarized from all localities include: *Anisocoma acaulis* Torr. and A.Gray (scalebud), *Camissonia graciliflora* (Hook. and Arn.) P.H.Raven (hill suncup), *Canbya candida* Parry ex. A.Gray (white pygmy poppy), *Chrysothamnus nauseosus* (Pall. ex. Pursh) Britton (rabbitbrush), *Cylindropuntia echinocarpa* (Engelm. and J.M.Bigelow) F.M. Knuth (golden cholla), *Ephedra nevadensis* S.Watson (Nevada jointfir), *Ericameria linearifolia* (DC.) Urbatsch and Wussow (narrowleaf goldenbush), *Eriogonum fasciculatum* Benth. var. *polifolium* Benth. S.Stokes. (Mojave buckwheat), *Eriophyllum pringlei* A.Gray (Pringle's woolly sunflower), *Hymenoclea salsola* Torr. and A.Gray (cheesebush), *Linanthus aureus* (Nutt.) Greene (golden linanthus), *L. parryae*

(A.Gray) Greene (sandblossoms), *Lupinus concinnus* J.Agardh (bajada lupin), *Mimulus androsaceus* Curran ex. Greene (rockjasmine monkeyflower), *M. fremontii* (Benth.) A.Gray (Fremont's monkeyflower), *Pectocarya penicillata* (Hook. and Arn.) A.DC. (sleeping combseed), *P. setosa* A.Gray (moth combseed), and *Salvia dorrii* (Kellogg) Abrams (purple sage) (Heckard and Bacigalupi 1986).

3.5 Distribution and Abundance

Mimulus shevockii is endemic to the Kern River drainage in the southern Sierra Nevada, Kern County, California. All but one of the eight extant populations occur in a 31 km² (12 mi²) area (USFWS 2004), with one occurrence in Cyrus Canyon that is disjunct by 22 km (14 mi) northwest of the rest of the occurrences (Fig. 7). Three of the known occurrences were documented after this species was described in 1986, for a total of nine documented occurrences. In the notice of withdrawal of the proposal to list *M. shevockii* in 1988, it was noted that the range of the species may be more extensive than understood at the time the proposed rule was published and that surveys of potential habitat were required (USFWS 1998). Surveys of potential habitat were conducted in 2005–2007, with no new occurrences found as of the spring of 2007 (Fraga 2007). The rarity of *M. shevockii* is evidenced by its highly limited distribution; however it appears to be common where it occurs.



Fig. 5. *Trichochrous* sp. observed visiting a *Mimulus shevockii* flower in 2006. Photograph by Naomi Fraga.



Fig. 6. Habitat of *Mimulus shevockii*. Joshua tree woodland with *Chrysothamnus nauseosus* near Kelso Creek, Kern County, California. Photograph by Naomi Fraga.

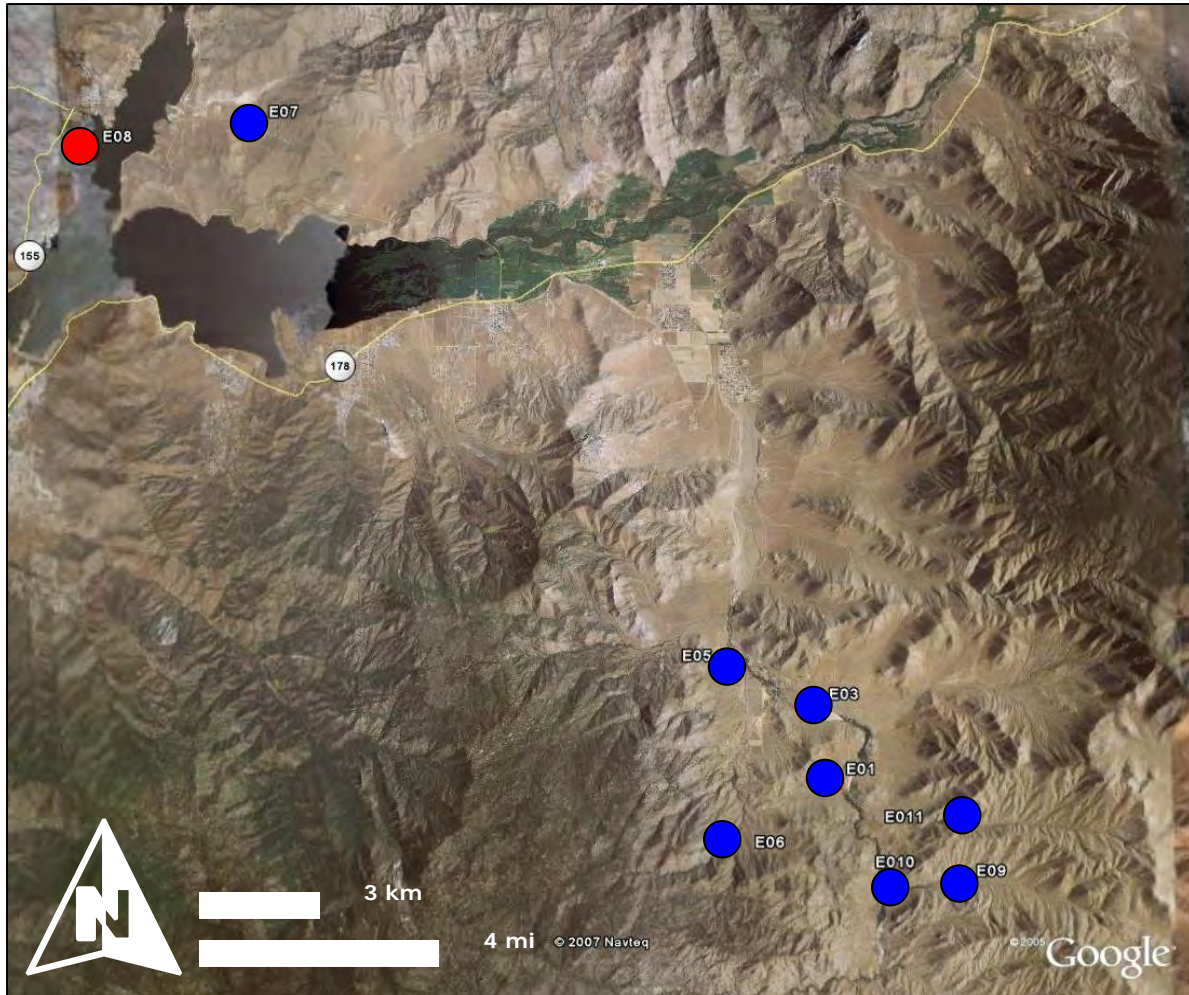


Fig. 7. Distribution map for *Mimulus shevockii*, Kern County, California. Extant occurrences are indicated with blue dots and the probable locality of the extirpated “Kernville” occurrence is indicated with a red dot. Satellite image © 2005 Google Earth.



Fig. 8. Cattle observed grazing during the flowering period of *Mimulus shevockii* in Apr 2005 at EO03 off Kelso Creek Road, Kern County, California. Photograph by Michael Wall.

3.6 Population Trends

Population trends for *M. shevockii* are not well characterized. California Natural Diversity Database element occurrences are listed in Table 2 along with number of plants estimated at each locality, and the date of observation (CNDDDB 2007; Fraga 2007). The available data set is not complete, with census counts available for only one year at most populations. There are no discernable population trends given the current data; however, it appears that populations vary widely from year to year and that *M. shevockii* may be abundant or locally common at most localities at least during years of adequate winter rains.

3.7 Threats and Limiting Factors

At more than half of the known occurrences of *M. shevockii*, the plants have

documented threats (Table 1). This species is known from nine historical occurrences (as noted above and indicated in Fig. 7, one of these is thought to be extirpated [EO08]), and one or more threats have been documented for seven of the remaining eight occurrences. These threats include residential development, OHV use, road maintenance, cattle grazing (Fig. 8), and agricultural conversion to orchards (CNDDDB 2007; BLM 2004). Other potential threats include competition from non-natives, apiculture, and a nearby landfill site (CNDDDB 2007). These threats limit the area and habitat available for the species to spread in its natural range. Cattle grazing, OHV use and road maintenance all result in habitat degradation. Trampling and removal of individuals might also affect the viability and success of populations subject to these threats. Tracks from OHV use have been observed in two populations, while roads are known to bisect several populations.

Table 1. Summary of potential threats for *Mimulus shevockii*.

EO#	Locality	Notes	Potential Threats
01	Cane Canyon	Includes former EO's 2 & 4. On private and BLM land.	Agriculture, development, road maintenance, OHV use
03	Kelso Creek	On private land	Cattle grazing, development, road maintenance
05	Bob Rabbit Canyon	On private and BLM land	Residential development, road maintenance
06	Cortez Canyon	On BLM Wilderness Area	Road maintenance
07	Cyrus Flat	On private and BLM land	Development, road maintenance, OHV use
08	Kernville	Extirpated (inundated by Lake Isabella).	Habitat loss due to water inundation
09	Frog Creek	On BLM land	Cattle grazing, OHV use
10	Frog Springs	On BLM land	Cattle grazing, development, OHV use
11	Mustang Springs	On BLM land	Cattle grazing, OHV use

EO#	Locality	1983	1986	1993	1995	2000	2003	2004	2005	2006	2007
01	Cane Canyon	Several thousand	—	—	—	—	—	—	—	ca. 385	None observed
03	Kelso Creek	Several thousand	—	—	—	—	ca. 204	ca. 25	> 3000	ca. 100	None observed
05	Bob Rabbit Canyon	—	Several hundred	—	—	—	—	—	—	—	—
06	Cortez Canyon	Several hundred	—	ca. 7000	Several thousand	—	—	—	—	None observed	None observed
07	Cyrus Flat	Several hundred	Several hundred	—	Several thousand	Dozens	—	—	ca. 20	ca. 100	None observed
08	Kernville	Extirpated	—	—	—	—	—	—	—	—	—
09	Frog Creek	—	—	—	ca. 150	—	—	—	None observed	None observed	None observed
10	Frog Springs	—	—	—	Discovered in 1995	—	—	—	None observed	ca. 4	None observed
11	Mustang Springs	—	—	—	ca. 5000	—	ca. 2345	ca. 300	None observed	None observed	None observed

Table 2. Census counts for *Mimulus shevockii*, taken from the California Natural Diversity Database (CNDDB). Yellow boxes indicate years for which no data is available, red boxes indicate an extirpated occurrence, and blue boxes indicate time prior to the discovery of an occurrence.

3.8 Conservation Status

Mimulus shevockii is currently listed as a CNPS list 1B.2 taxon; this means the species is “fairly endangered” in California and meets the requirements for being listed by the state of California (CNPS 2007).

Mimulus shevockii was proposed as endangered under the Federal Endangered Species Act of 1973 as amended (Act)(USFWS 1994). Threats to this species were identified as urbanization, OHV use, and agricultural land conversion (USFWS 1994). Subsequent to the proposal an additional three occurrences and 1600 acres of unsurveyed potential habitat were identified. The Service noted that urbanization, OHV use, agricultural land conversion, and the restricted range of the species continue to put *Mimulus shevockii* at risk (USFWS 1998: 49075). However they concluded that current threats that warranted listing had not been identified and determined that, therefore, *M. shevockii* is not threatened with extinction throughout all or a significant portion of its range and does not meet the definition of a threatened or endangered species (USFWS 1998). In the federal ruling to withdraw the species, it was noted that the range of *M. shevockii* may be greater than understood at the time of the proposed rule and that potential habitat requires surveying (USFWS 1998).

Although the species was not listed in 1994, the proposed rule focused attention on the need to gather more information about the status of the species. The species is a BLM sensitive plant, which means it is designated by the BLM for special management consideration. In 2005, the BLM completed the West Mojave Desert Plan (WMDP), a habitat conservation plan that covers the western portion of the Mojave Desert in southern California (BLM 2005). In that plan, *M. shevockii* is a covered species. Prescriptions for management of the populations that occur within the Jawbone-

Butterbrecht Area of Critical Environmental Concern (ACEC) include (BLM 2005):

1. Maintain regional rangeland health standards. Direct grazing away from occupied habitat.
2. Designate vehicle routes of travel. The existing routes designated for the Jawbone Butterbrecht ACEC will be used unless monitoring reveals the need for change in areas of occupied habitat.
3. Require botanical surveys for projects on public lands. Require avoidance of Kelso Creek monkeyflower occurrences.

4.0 CONSERVATION

4.1 Conservation Objectives

The primary objectives for conserving *M. shevockii* in the Kern River drainage are as follows.

1. To maintain all existing occurrences. Currently four of the nine populations are threatened by development.
2. To preserve existing habitat of *M. shevockii*.
3. To limit impacts from disturbances (e.g., residential development, OHV use, and cattle grazing).
4. Establish an ex-situ maternal line seed collection(s) to be housed at RSABG’s seed storage facility. These collections are to be used for future research or recovery efforts.
5. Assess the genetic diversity of the species to identify meta–population dynamics.
6. Identify more specific research needs at each occurrence

4.2 General Conservation Actions

Land ownership at some occurrences is ambiguous; for each occurrence land

ownership should be determined. If possible, private landowners should be contacted for discussion regarding easements for maintaining occurrences. The extent of area occupied and abundance of the species at each occurrence has not been well characterized, and should be documented in both years of plentiful and sparse winter rains.

The number of individuals at each occurrence appears to fluctuate from year to year; varying physical factors may account for the disparity in population size each year (Table 1). Seed viability tests and germination trials may be conducted to investigate the reproductive potential of the species and determine optimal conditions for *M. shevockii*. Additionally, the establishment of weather stations at each occurrence to gather data on rainfall, temperature, wind speed, and other physical factors may aid in understanding differences in microclimate at each site that may account for the fluctuating population sizes.

The lack of information on pollinators, seed dispersal mechanisms, seed set, and population trends indicate a need to monitor and document these at each occurrence. The biological and ecological information may provide insight into why this species has such a narrow distribution.

Annual monitoring for *M. shevockii* should be conducted using a standardized method so that comparisons can be made from year to year. Recommendations for monitoring protocols are outlined here. Shape files (polygons) for each occurrence should be created with an accurate (sub-meter accuracy) GPS unit. To create polygons, each population should be mapped by flagging the perimeter of the population, and walking to each flag with the GPS unit. In the interest of understanding population dynamics, meta-populations should be mapped along with each subpopulation. This nested approach will give more accurate and detailed

information for viewing population changes over time.

A temporary sample plot (1 m²) should be constructed and placed randomly within each population. Attributes documented for each occurrence should include number of plants, plant height, number of flowers and fruits, size of flowers and fruits, slope, aspect and percent cover of non-natives. The total number of *M. shevockii* individuals should be counted within each 1 m² sample plot, however a maximum of 30 individuals, randomly selected in the plot, will be used for measurements of height, flowers, and fruits (if fewer than 30 individuals are found within a plot, then total number of individuals will be measured). The total number of individuals within each population will be extrapolated from the total number of individuals counted within each plot, along with the estimated percent cover of the species, and the total area of the polygon. If pollinators are observed they will be collected and sent to an expert for identification.

Seeds should be collected from each population in May–June to establish a conservation seed bank. Population size permitting, seeds should be collected from at least 30 maternal lines. In smaller populations, seed from no more than 10% of the population should be collected. *Mimulus androsaceus*, a related taxon, is very similar in vegetative form and grows sympatrically with *M. shevockii* at most occurrences. Therefore *M. shevockii* plants should be flagged for seed collection during the flowering period when the two species are discernable.

The broad habitat requirements of *M. shevockii* also warrant surveys of potential habitat in the Kern River drainage and surrounding areas. The outlined habitat includes sandy washes and alluvial plains with soil of granite origin in Joshua tree or California juniper woodland on gentle slopes (0–10%) facing east–southeast.

4.3 Site-Specific Actions

EO01 (includes former occurrences 2 & 4; area ca. 400 acres).— This population is on or near private property and is also partly on BLM land managed by the Ridgecrest Office. The extent of the population on private land needs to be determined.

EO03 (area ca. 82.7 acres).— This population is on private property and occurs on land zoned for residential development. Development of this land would likely cause extirpation. The extent of land to be developed in this area should be determined. A portion of the habitat for this occurrence was cleared for development in early 2006, and cattle were observed grazing at this occurrence during the flowering period (Fraga 2007). Seeds should be collected at this population while the remaining habitat is still intact. In addition, monitoring should be conducted in order to determine the impacts of these disturbances. Mitigation measures should be established.

EO05 (area ca. 15 acres).— This population occurs on BLM land managed by the Ridgecrest office near private property. The extent of the population that might occur on private land needs to be determined. An easement should be established for access to the occurrence.

EO06 (area ca. 15 acres).— This population is within the BLM Bright Star Wilderness area managed by the Ridgecrest Office. A road bisects this occurrence at the eastern end. Surveys should be conducted in order to determine the impacts of the road on plants at this occurrence.

EO07 (area ca. 88 acres).— This occurrence is on BLM land managed by the Bakersfield

office and near private property. The extent of this occurrence on private land needs to be determined.

EO08 (extirpated).—This occurrence from “Kernville” is based on a herbarium specimen collected by R.C. Bangsberg in 1932 (JEPS 3906) and is thought to be extirpated due to the creation of Lake Isabella (the original site of the town of Kernville was inundated). The information given on the label data of the herbarium specimens is vague, however, and this may actually be the same population as *EO7* (Jim Shevock, personal communication). Further surveys at this occurrence are not warranted since the “Kernville” of 1932 is now underwater and, absent more detailed locality data, searching for plants at sites proximate to the original Kernvilles is not warranted.

EO09 (area ca. 58 acres).—This population is on BLM land managed by the Ridgecrest Office and is located near OHV trails. Surveys should be conducted at this occurrence in order to determine if recreational use in the area impacts this population.

EO10 (radius 80 meters).— This population is on BLM land managed by the Ridgecrest Office, and is located near OHV trails. Surveys should be conducted at this occurrence in order to determine if recreation use in the area impacts this population.

EO11 (area ca. 64 acres).— This population is on BLM land managed by the Ridgecrest Office, and is located near OHV trails and private land that has been graded. Surveys should be conducted at this occurrence to determine if recreation use in the area and nearby habitat degradation impacts this population.

Table 3. Recommended conservation tasks for *Mimulus shevockii*. Conservation tasks delegated to RSABG will be conducted by Naomi Fraga.

Task	Description	Participants	Priority
Survey known occurrences	Monitor, and map populations	RSABG BLM NFWF	High
Survey potential habitat	Survey potential habitat for additional populations	RSABG BLM	Medium
Determine land ownership	If possible, obtain easements for surveying occurrences	RSABG BLM	High
Life history assessment	Study breeding systems, pollinators, and genetic diversity	RSABG	Medium
Ex situ conservation	Collect seeds for long term storage; conduct seed viability tests and germination trials	RSABG	High

4.4 Conservation Tasks

A list of conservation tasks are recommended and outlined for *M. shevockii*. These are summarized in Table 3.

4.5 Out-of-State Considerations

Mimulus shevockii and its closest relatives are endemic to California. There are no out-of-state considerations for this species.

4.6 List of Likely Participants

- BLM Bakersfield Office
- BLM Ridgecrest Office
- California Native Plant Society
- Kern County Planning Department
- National Fish and Wildlife Foundation
- Private Land Owners
- Rancho Santa Ana Botanic Garden
- United States Fish and Wildlife Foundation

5.0 IMPLEMENTATION

5.1 Action Assessment

Mimulus shevockii is a species with a limited distribution. Habitat loss and degradation due to development, recreation, and cattle grazing pose threats to the existence of this species. Preservation of known occurrences and habitat is important to the conservation of *M. shevockii*.

5.2 Federal Listings

This species may warrant state or federal listing and petitioning of *M. shevockii* for listing should be considered after further investigation.

5.3 Other Actions

Currently, *M. shevockii* has monitoring and adaptive management prescriptions that are outlined in the West Mojave Plan (BLM 2005). Monitoring prescriptions are:

1. Continue surveys on public land identified as potential habitat. Document any spillover impacts to public lands from private lands.

2. BLM will make a determination of regional rangeland health standards on public lands in the Rudnick Common Allotment within five years of Plan approval.

Adaptive management prescriptions are:

1. Adjust boundaries of conservation area based on survey results
2. Change route designation as necessary to protect occupied habitat
3. Adjustments in grazing practices and Allotment Management Plans in Kelso Valley will be made as necessary based on results of the rangeland health determinations.
4. Pursue land purchase or exchange
5. Fence BLM/private property boundaries if spillover impacts are evident

Lands trusts such as the Kern River Preserve, Kern Valley Heritage Foundation, or the Mojave Desert Land Trust may also look into acquiring land that is currently

zoned for development on which *M. shevockii* occurs.

5.4 Implementation Schedule

An implementation schedule for the outlined conservation tasks (Table 3) is presented in Table. 4

5.5 Potential Difficulties in Implementation

Funding availability for the study of *M. shevockii* may serve as an impediment, although RSABG has acquired funding from the National Fish and Wildlife Foundation to monitor and seed bank this species for one year. Difficulties may be encountered with access to populations that occur on private property if easement rights are not granted. Severe weather such as drought may have impacts on collecting seeds for long term storage because few to no plants may germinate in years of drought.

Table 4. Implementation Schedule. The following are recommendations for implementing conservation tasks.

Action	Description	Timeframe	Completion
Monitoring surveys	Locate, census, and map all populations	Mar / 2005– May / 2010	May 2010
Field surveys	Search potential habitat for additional populations	Mar / 2005– May / 2010	May 2010
Life history assessment	Study breeding systems, pollinators, and investigate germination requirements by conducting germination trials.	Mar / 2006 – June / 2010	Jun 2010
Genetic study	Investigate the genetic structure of the species	Mar / 2008– Dec / 2010	Dec 2010
Ex situ conservation	Collect seed for long-term storage	Apr / 2008– Dec / 2010	Dec 2010

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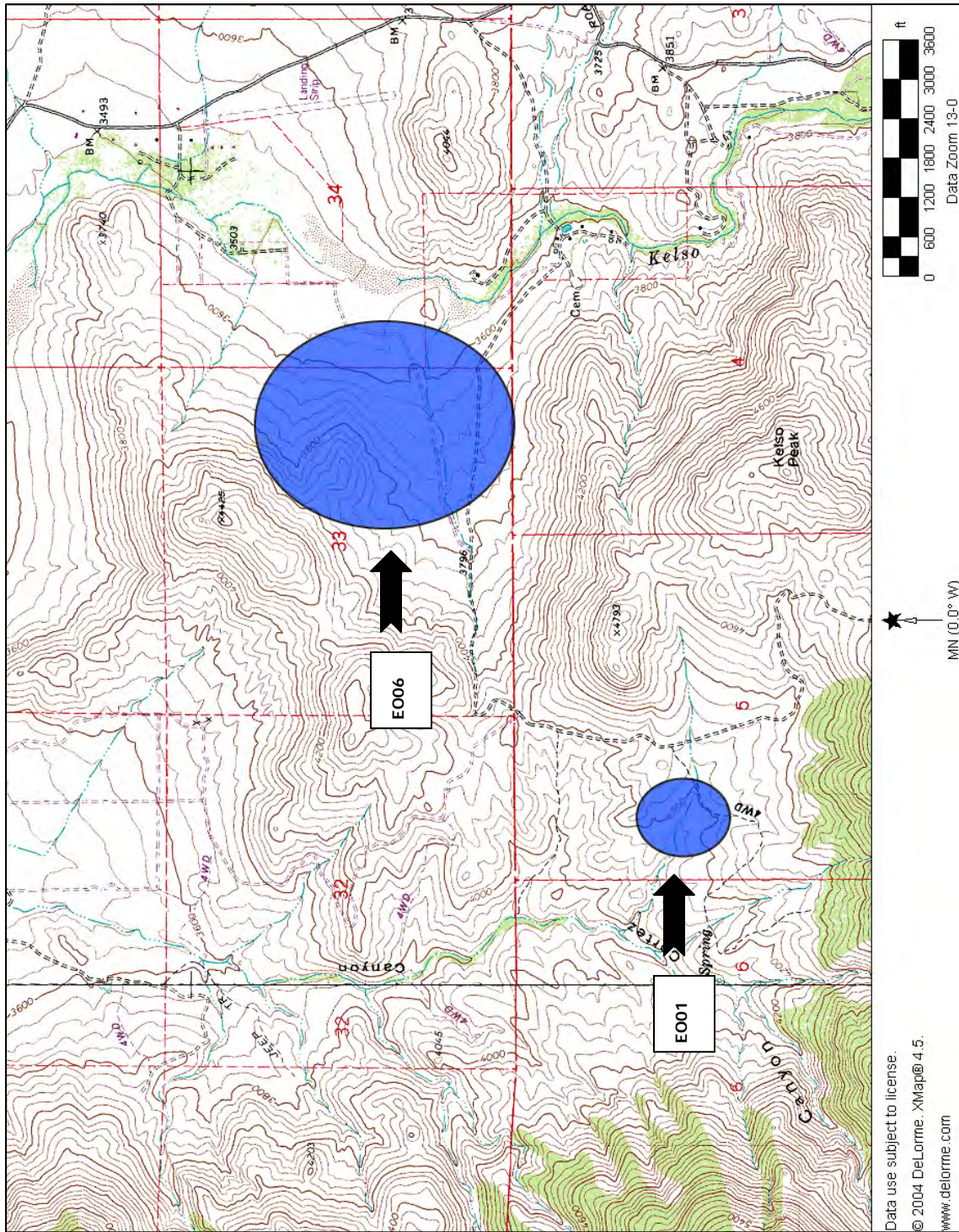
The development of this document is owed to Gary Wallace and Elizabeth Friar who initiated a course for students to write conservation plans for rare species of California. Funding for this project was provided by National Fish and Wildlife Foundation and Southern California Botanists. Connie Rutherford was helpful in reviewing a draft of this document and providing some necessary references. Jonathan Mawdsley identified the beetle. Shelley Ellis provided information on surveys she conducted in 2006. Elizabeth Friar, Lucinda McDade, and Gary Wallace provided useful comments in an early draft of this document. Special thanks are given to Theodore Anderson, Daniel Brock, LeRoy Gross, Krista Coquia, Amber Maurice, and Michael Wall for assisting with field surveys and to Marisa Boyd for providing the line drawing.

LITERATURE CITED

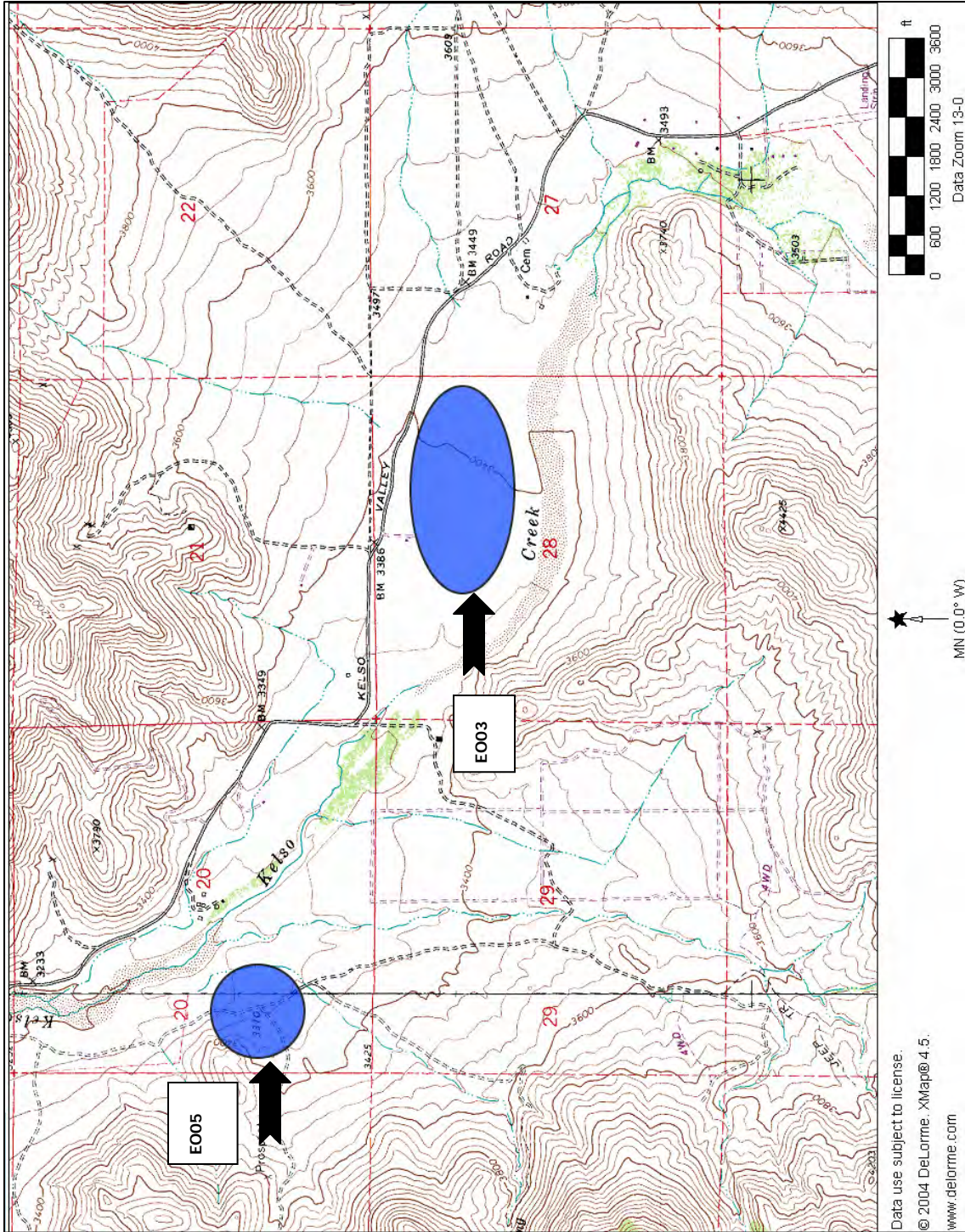
- ARGUE, C. L. 1980. Pollen morphology in the genus *Mimulus* (Scrophulariaceae) and its taxonomic significance. *Amer. J. Bot.* **67**: 68–87.
- BEARDSLEY, P. M. AND R. G. OLMSTEAD. 2002. Redefining Phrymaceae: the placement of *Mimulus*, tribe Mimuleae, and *Phryma*. *Amer. J. Bot.* **89**: 1093–1102.
- , S. E. SCHOENIG, J. B. WHITEHALL, AND R. G. OLMSTEAD. 2004. Patterns of evolution in western North American *Mimulus* (Phrymaceae). *Amer. J. Bot.* **91**: 474–489.
- BLM (BUREAU OF LAND MANAGEMENT). 2004. Kelso Creek monkeyflower www.blm.gov/ca/pdfs/cdd_pdfs/kelso1.PDF (accessed 9/29/2004)
- BLM (BUREAU OF LAND MANAGEMENT). 2005. Final environmental impact report and statement for the West Mojave Plan: A habitat conservation plan and California Desert Conservation Area plan amendment. Vol. 2. CALIFORNIA NATURAL DIVERSITY DATABASE (CNDDDB). 2007. Vers. 3.1.1 (03/03/2007). California Department of Fish and Game.
- CALIFORNIA NATIVE PLANT SOCIETY (CNPS). 2007. Inventory of rare and endangered plants. <http://www.cnps.org/inventory> (accessed 3/1/2007).
- FRAGA, N. S. 2007. Botanical surveys of Kelso Creek monkeyflower (Phrymaceae). Submitted to Glenn Harris, Bureau of Land Management, Ridgecrest, California.
- GRANT, A. L. 1924. A monograph of the genus *Mimulus*. *Ann. Missouri Bot. Gard.* **11**: 99–389.
- HECKARD, L. R. AND R. BACIGALUPI. 1986. *Mimulus shevockii* (Scrophulariaceae), a new species from desert habitat in the southern Sierra Nevada of California. *Madroño* **33**: 271–277.
- INTERNATIONAL PLANT NAMES INDEX (IPNI). 2007. <http://www.ipni.org/> (accessed 3/1/2007).
- MCMINN, H. E. 1951. Studies in the genus *Diplacus* (Scrophulariaceae). *Madroño* **11**: 1–32.
- OLMSTEAD, R. G. AND R. R. REEVES. 1995. Evidence for the polyphyly of the Scrophulariaceae based on chloroplast *rbcL* and *ndhF* sequences. *Ann. Missouri Bot. Gard.* **82**: 176–193.
- , C. W. DEPAMPHILIS, A. D. WOLFE, N. D. YOUNG, W. J. ELISONS, AND P. A. REEVES. 2001. Disintegration of the Scrophulariaceae. *Amer. J. Bot.* **88**: 348–361
- PACKE, C. E. AND D. L. VENABLE. 1996. Seed banks in desert annuals: Implications for persistence and coexistence in variable environments. *Ecology* **77**: 1427–1435
- THOMPSON, D. M. 1993. *Mimulus*, pp. 1037–1051. In J. C. Hickman [ed.], *The Jepson Manual*. University of California Press, Berkeley, California, USA.
- TROPICOS. 2007. MBG: W3TROPICOS. <http://mobot.mobot.org/W3T/Search/vast.html>. (accessed 3/1/2007).
- USFWS (UNITED STATES FISH AND WILDLIFE SERVICE). 1994. Endangered and threatened wildlife and plants; proposed endangered or

- threatened status for 10 plants from the foothills of the Sierra Nevada Mountains in California. Federal Register **659**: 191.
- USFWS (UNITED STATES FISH AND WILDLIFE SERVICE). 1998. Endangered and threatened wildlife and plants; withdrawal of proposed listing of two plants as endangered, and four plants as threatened from the foothills of the Sierra Nevada Mountains in California. Federal Register **63**: 177.
- VICKERY R. K. 1978. Case studies in the evolution of species complexes in *Mimulus*. *Evol. Biol.* **11**: 404–506.
- WENT, F. W. 1949. Ecology of desert plants. II. The effects of rain and temperature on germination and growth. *Ecology* **30**: 1–13.

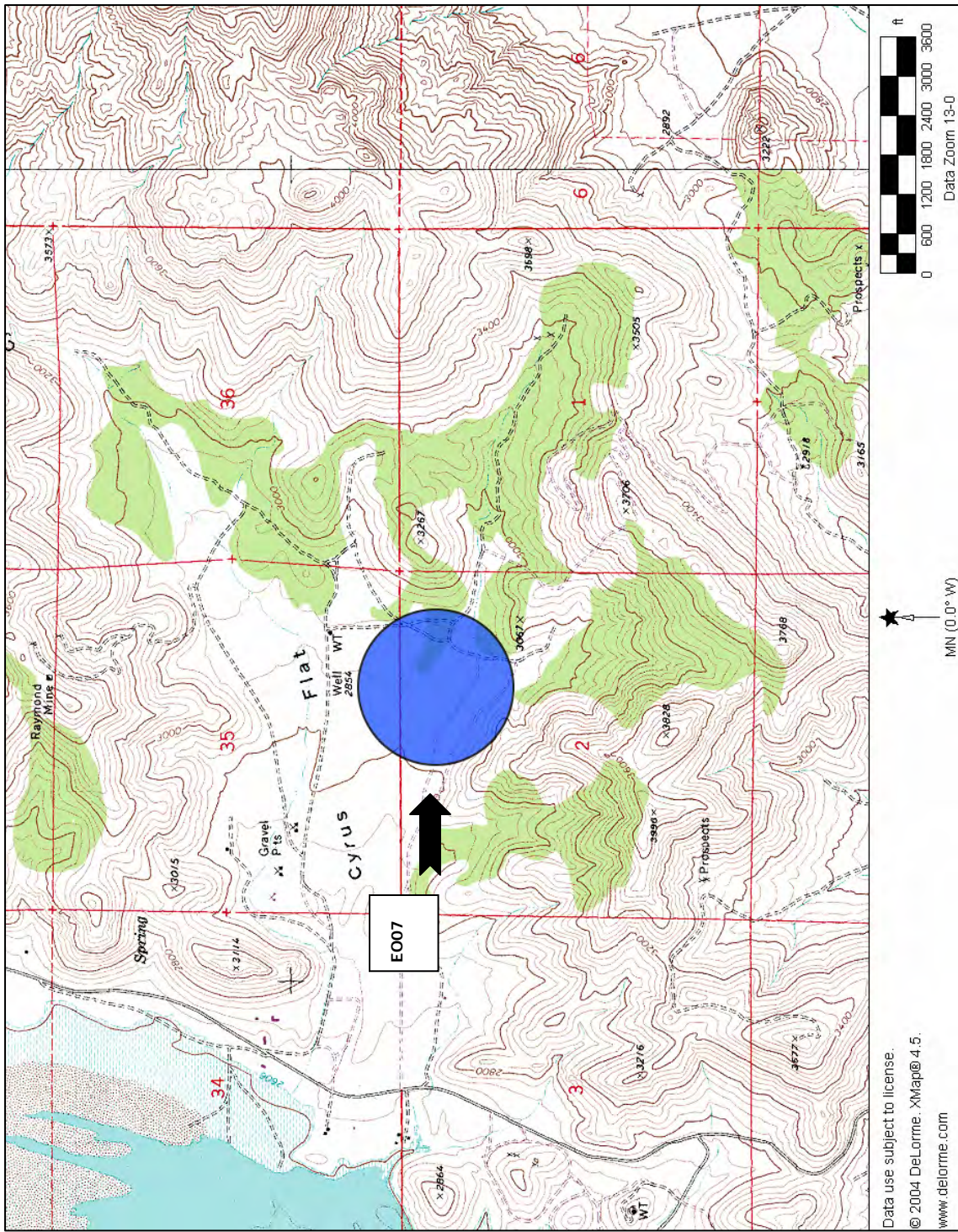
APPENDIX
OCCURRENCE MAPS



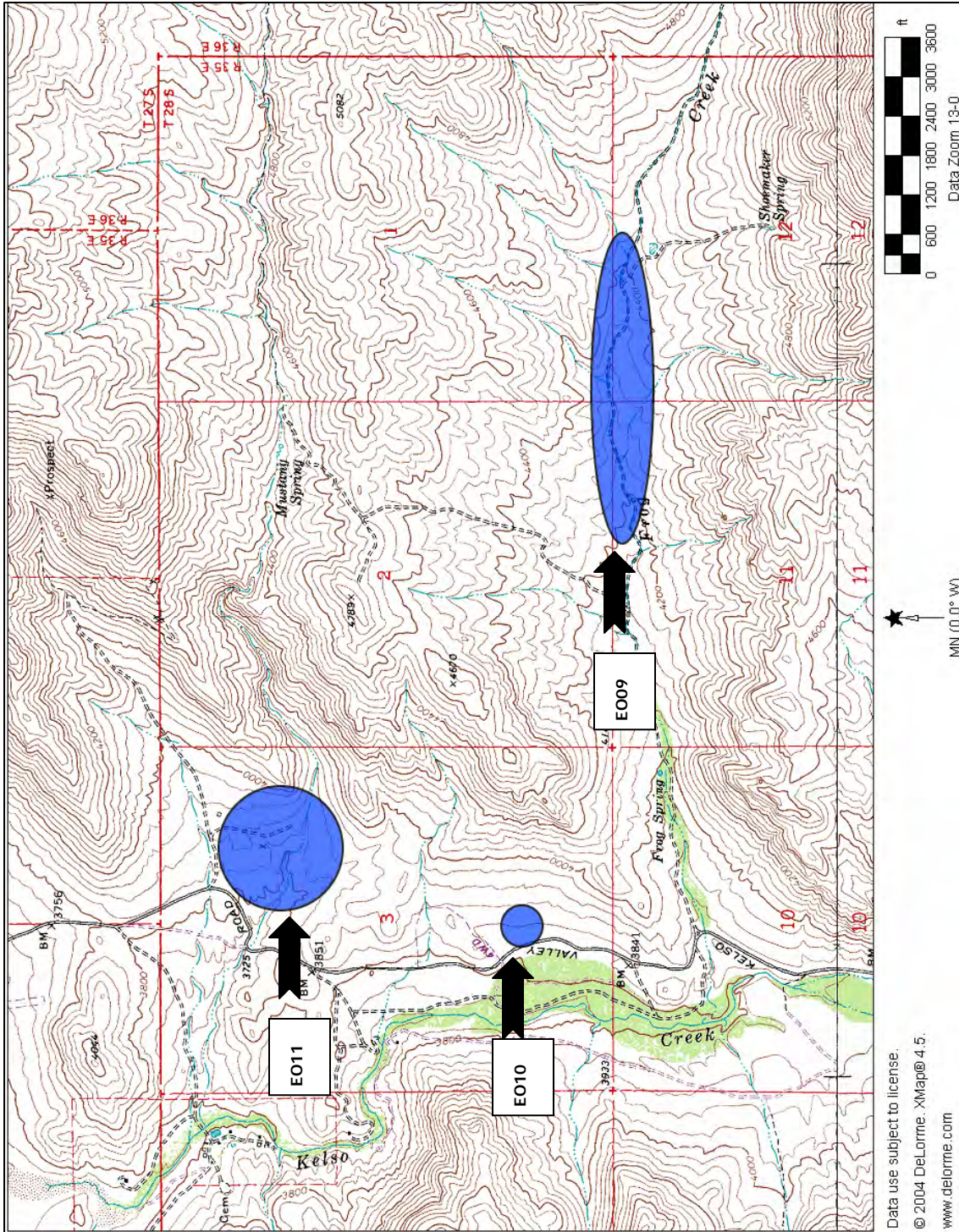
Map 1. EO01 and EO06 near Cortez Canyon on the Cane Canyon 7.5' USGS Topographic Quadrangle with the location and approximate area occupied shaded in blue.



Map 2. E003 and E005 near Kelso Creek Road on the Cane Canyon and Wolfstalf Creek 7.5' USGS Topographic Quadrangle with the location and approximate area occupied shaded in blue.



Map 3. E007 near Cyrus Canyon on the Isabella Lake North 7.5' USGS Topographic Quadrangle with the location and approximate area occupied shaded in blue.



Map 4. EO9, EO10, and EO11 west of Kelso Creek Road on the Cane Canyon 7.5' USGS Topographic Quadrangle with the location and approximate area occupied shaded in blue.