

SITE MANAGEMENT PLAN FOR *MIMULUS EVANESCENS* (DISAPPEARING MONKEYFLOWER)

Submitted by
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to
Lakeview BLM District (Klamath Falls Resource Area)
(Under BLM Agreement #HLP073016)

Site name and legal description: Dog Hollow Reservoir, Klamath County, Oregon
T40S R14½E Sec. 7 NW¼



Common name: Disappearing monkeyflower

Scientific name: *Mimulus evanescens* Meinke

SUMMARY

This was a one year project (2007) designed to establish a basic site management plan for *Mimulus evanescens* at Dog Hollow Reservoir (DHR) in eastern Klamath Co., Oregon. Observations in 2007 were supplemented by previous visits to the site by the author in 2004 through 2006. The population and habitat at DHR are the highest quality known for

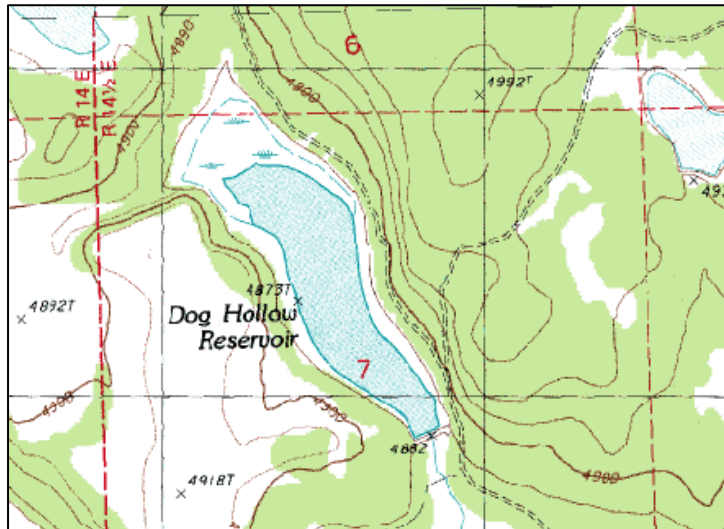
this taxon on public lands. The management goal at DHR should be to prevent changes to the environment that would impact the local *M. evanescens* population, the loss of which would increase the chances for the species to be listed under the federal ESA. A summary of the range and distribution, habitat requirements and ecological processes, and life history are provided. Recommendations are also offered for suggested management and monitoring protocols, focusing on recreation, noxious weeds, fire, grazing, and edaphic ecology (primarily soils hydrology).

INTRODUCTION AND GOAL OF THE MANAGEMENT PLAN

While never common, even by historical standards (fewer than 20 populations have ever been recorded since the first collections in the 19th century), the endangered annual species *Mimulus evanescens* is distributed widely along the northwest edge of the Great Basin, ranging from southwest Idaho through southeastern Oregon and into northeastern California. Prior to 2003, only three populations of the species were known to remain extant: one in Lassen Co., California on private land (the type locality); one comprising a series of essentially inter-connected sub-populations just south of Drews Reservoir in southern Lake Co., Oregon, and almost entirely on private land; and a small, degraded site of less than 400 individuals located in 1999 on BLM (Lakeview District) property, on the southeast edge of remote Wool Lake in Lake Co.

During field studies for another sensitive species (*Pogogyne floribunda*), a fourth population of *Mimulus evanescens* was unexpectedly located at Dog Hollow Reservoir (DHR) in Klamath Co., Oregon, in the summer of 2003. The site was located entirely on

BLM land managed by the Klamath Falls Resource Area, and was comprised of several hundred to several thousand robust plants scattered along the shoreline for 300-400 meters, suggesting a well-established population. Previous work has shown that *Mimulus evanescens* requires high soil moisture through early summer – plants at this locality typically occurred



among woody debris along the high water line, and among rock fragments and small boulders in well-drained, sandy to gravelly soils that had been inundated during the winter. At this site the species occurs in relatively undisturbed habitat with numerous annuals, with a wide range of interesting native taxa and relatively few exotics present. In terms of quality, it is probably the best known site for the species on public lands. Finally, a fifth population was subsequently located at Campbell Reservoir about 70 km to the north of DHR. A few dozen plants have been noted here, although the population is small and highly transient.

The goal of this work is to provide the necessary background and knowledge to develop management guidelines for the significant *M. evanescens* population at DHR. Considering that the site has multiple uses (with grazing and limited recreation being the most prominent), sustaining the immediate population through sound stewardship of the habitat around DHR is the primary goal of the plan. Secondary objectives include (1) managing the site to potentially increase the size of the population, and (2) evaluating whether or not there are sufficient plants at DHR to permit seed collection for use in future reintroduction at this site (if the population was somehow extirpated), or for the creation of a new population at another site on public lands.

Conserving the DHR site has high biological significance due to (1) the extreme rarity of *Mimulus evanescens*, which is in the process of being listed as Endangered by the State of Oregon (and may be listed by the federal government in the foreseeable future); (2) the fact that this is the only known site for the species on public land (of just two total) where the site has not been seriously degraded due to grazing and exotic weeds; (3) this being only *one of five* extant populations known for the species globally; and (4) the strong potential for this location to represent the highest quality site, in terms of plant numbers and habitat quality, known to exist for the species.

SPECIES RANGE, DISTRIBUTION, ABUNDANCE, AND TRENDS OVERVIEW

Mimulus evanescens is distributed widely along the northwestern edge of the Great Basin at elevations from ca. 1200-1700 m, ranging from southwest Idaho west through eastern Oregon and south into northeastern California (Meinke, 1995: *Mimulus evanescens* (Scrophulariaceae): a new annual species from the northern Great Basin. Great Bas. Nat. 55:249-257). Subpopulations of the species are characteristically scattered and patchy – they rarely exceed 10 square meters and range in size from a few plants to (in years with exceptional precipitation) potentially several thousand individuals. Today only five populations (or population complexes) are known to be extant for the species, although a number of historical sites have been recorded via herbarium collections. The following list provides an overview of the historic distribution of the species, as represented by herbarium specimen label data:

California, Lassen Co., 10 miles south of Ravendale, 9 June 1940, *Pennell* 25763 (P); 4.8 miles south of Madeline, 17 June 1958, *Raven and Solbrig* 13298 (JEPS). **Modoc Co.**, along Willow Creek, June 1894, *Austin s.n.* (UC). **Idaho, Owhyee Co.**, meadow, 3 miles south of Riddle, 1 July 1949, *Holmgren and Holmgren* 7973 (CAS, UC, WS, WTU). **Oregon, Crook Co.**, Grizzly Butte, 18 June 1894, *Leiberg* 275 (NY, ORE, US). **Gilliam Co.**, forks of Cottonwood Canyon, 6 June 1894, *Leiberg* 156 (NY, ORE, P, US). **Grant Co.**, Ochoco National Forest, Graylock Butte, 6 July 1912, *Ingram s.n.* (RM). **Harney Co.**, dry watercourse near Frenchglen, 26 June 1942, *Peck* 21389 (CAS, NY, P, UC, WILLU) – probably on Burns BLM. **Lake Co.**, along Dog Creek, west of Drews Reservoir, T. 40. S., R. 17. E., Sec. 11 (NE ¼), 3 July 1999, *Meinke s.n.* (donated to Lakeview BLM herbarium; OSC); Sagehen Creek bed, just north of Road 4017 (west of Drews Reservoir), T. 40. S., R. 17. E., Sec. 1 (SE ¼), 4 July 1999, *Meinke s.n.* (donated to Lakeview BLM herbarium; OSC); Whiskey Creek bed, above and below Road 4017 (just west of Drews Reservoir dam and picnic area), T. 40. S., R. 18. E., Sec.

8 (NE ¼), 4 July 1999, *Meinke s.n.* (donated to Lakeview BLM herbarium; OSC); along Wool Lake drainage, southeast margin of lake, along drying edges and banks of seasonal stream (mixed population with *M. latidens*), T. 38. S., R. 25. E., Sec. 12 (NW ¼), 26 June 1999, *Meinke s.n.* (donated to Lakeview BLM herbarium; OSC). **Klamath Co.**, along the east banks of Dog Hollow Reservoir, 12 June 2003, *Meinke s.n.* (OSC); shallow, stony drainage at southeast edge of Campbell Reservoir, near culvert, *Meinke s.n.* (OSC) (both sites on Lakeview BLM).

Meinke (1995) commented on the conservation status and abundance of the species at the time of its description:

“It is not encouraging that only (a few) extant or historical populations of *Mimulus evanescens* are known, with only two sites recorded since 1958. This contrasts with hundreds of collections at dozens of localities for the much less conspicuous (and closely related) *M. breviplorus*. As with *M. breviplorus*, the distribution of *M. evanescens* is apparently limited to damp or wet sites at moderate elevations within open rangeland. Virtually all such sites in the Great Basin are associated with a long history of grazing by domestic livestock. The broad geographic range and relatively unremarkable habitat of *Mimulus evanescens* imply that the comparative rarity of the species may be the result of habitat loss or disturbance. However, the paucity of herbarium records, especially when contrasted with similar species, suggest that *M. evanescens* may have never been common, even under pristine, pre-grazing conditions. If this is true, the combination of natural scarcity with contemporary grazing or other disturbances may now be jeopardizing the species.”

Considering that most, if not all, known locations for *M. evanescens* are located in seasonally moist or wet rangeland areas subject to cattle grazing, it is likely that the trend for the species is not an upward one. Several of the historic sites listed above have been re-visited in recent years, and no sign of the species was observed in Owyhee (Idaho), Crook, Gilliam, Grant, or Harney counties. No monitoring plots or other quantitative means of evaluating “population trend” have been established for any population. Considered the ephemeral nature of the species and its dormant seeds, such methods would have minimal value since populations would be expected to ebb and flow over the years in relation to seasonal and climatic fluctuations. Accordingly, the absence of a previously known population in a particular year, in and of itself, would not necessarily reflect a downward demographic trend. A better population and conservation indicator would be some measure of habitat degradation, particularly impacts to site hydrology.

SPECIES LIFE HISTORY, IDENTIFICATION, AND COMPARISON WITH SIMILAR TAXA

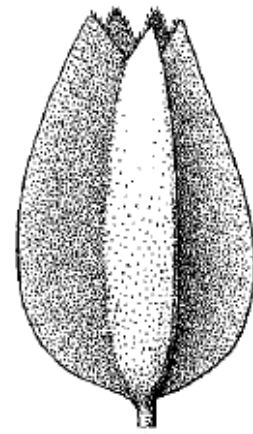
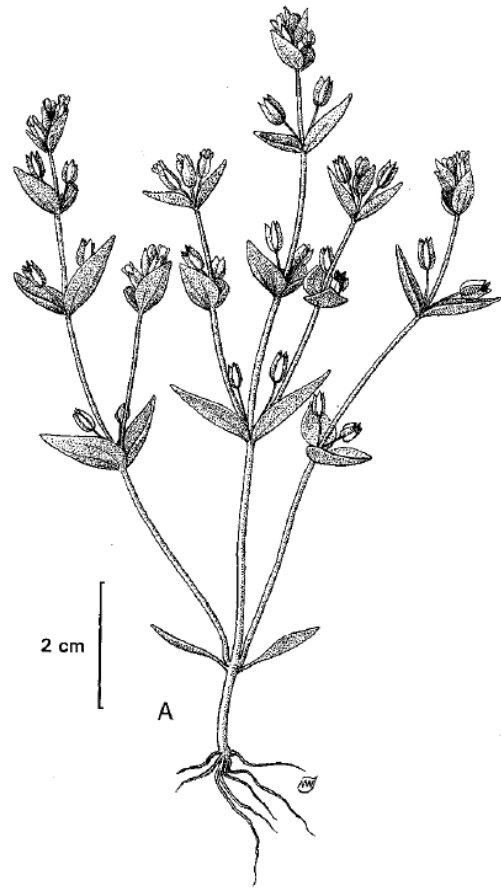
Life history. *Mimulus evanescens* plants have a spring annual life history, germinating in late winter or early spring (probably in March or April) due to seed dormancy-breaking requirements (see discussion below). Corolla size in the species is small for the genus, and is consistent with taxa that rely on self-pollination for seed production. Greenhouse studies confirm the species is an extremely efficient self-pollinator, and probably only rarely, if ever, outcrosses – insect visitors have very seldom been recorded on the

flowers. Seed set in the field exceeded 90% for 15 plants that were randomly selected for evaluation. The species blooms and sheds seeds from late May into July, with the phenology for any given year or site highly dependant on soil moisture and local spring and summer temperatures.

Reproductive plants (right) are characterized by stiffly ascending fruiting pedicels ranging from two to fifteen times the length of the calyx, extending the erect capsules away from the glandular-sticky foliage. No evidence of animal-mediated seed dispersal has been observed for the species. Hundreds or even thousands of tiny seeds are produced per plant, which lay quiescent until exposed to many weeks of cold, damp winter conditions. These are typically spilled from the capsules and calyx tubes by wind, with dispersal from the vicinity of parent plants via wind or flowing water. Attempts to germinate seed of *M. evanescens* without a cold-wet treatment result in germination of less than 5%. After eight weeks exposure to artificially induced stratification, seeds can be germinated to medium to high percentages, confirming dormancy in the species (which is probably critical in the harsh summer xeric environment the species inhabits).

Identification. The easiest time to identify *M. evanescens* is when it is in fruit and late flower (ranging from late May into early July, again depending on seasonal soil moisture levels). The species is often small, however, and it can potentially be confused with other small annual monkey-flowers in the area. *Mimulus evanescens* appears most similar to *M. breviflorus*, and the two species do co-occur in Klamath Co. The yellow, virtually regular corollas, mostly non-stipitate capsules, and short-puberulent foliage and stems are traits that are essentially identical in the two species. Since *M. evanescens* also develops a papery, plicate-inflated fruiting calyx (right), which is the most prominent character in most specimens of *M. breviflorus*, the potential for confusion is understandable. The oversized habit of *M. evanescens* is striking, however, and all of the floral and vegetative characteristics are larger, on average, than in *M. breviflorus* (Meinke, 1995).

In addition to the overall size disparity, there are other features that readily separate *Mimulus evanescens* from *M. breviflorus*. Most evident are the leaves, which are ovate to broadly lanceolate in *M. evanescens* as compared to rhombic-ovate or narrowly lanceolate in *M. breviflorus*. Moreover, only the lowest leaves of *M. evanescens* are petiolate, and these abruptly so, while leaf blades of *M. breviflorus* narrow gradually into slender, evident petioles at even the uppermost nodes.



In fruit, the pedicels of *M. breviplorus* generally exceed or at least equal the leaf blades. Those of *M. evanescens* are virtually always shorter, and in most instances the leaf blade exceeds the calyx as well. Finally, the fruiting calyx of *M. evanescens* is much more plicate, and typically exceeds the length of the mature capsule by 1.5-3.0 mm. In *M. breviplorus* ripe capsules are approximately the same length as the calyx.

Other small-flowered annuals that might be confused with *Mimulus evanescens* include *M. floribundus*, *M. patulus* (out of range for Klamath Co.), and *M. pulsiferae*. Of these, only *M. floribundus* is characterized as having an inflated fruiting calyx, which can be distinguished by its multicellular pubescence and narrow, lanceolate teeth. These three species are further differentiated from *M. evanescens* by distinctly petiolate upper leaves and more or less bilabiate (if often rather small) corollas. Depauperate, annual forms of *M. guttatus* are also to be expected in moist sites within the range of *M. evanescens*, such as along DHR. However, this common, yellow-flowered species can be separated by its red-speckled petals, petiolate leaves and usually zygomorphic corollas. Although the calyces of *M. guttatus* are also markedly inflated, they are oriented horizontally in fruit and are distinctly irregular (although this may take some close inspection in very tiny, drought-stricken plants). *Mimulus suksdorfii* is the only other yellow-flowered annual monkeyflower in the Pacific Northwest with features comparable to *M. evanescens*. Rarely exceeding six cm in height, this compact, freely branched species is further recognized by obtuse, linear-oblong leaves, a narrowly cylindrical fruiting calyx, and distinctively emarginate corolla lobes with prominent red spots.

SITE HABITAT DESCRIPTION AND ECOLOGICAL PROCESSES

The habitat at DHR is typical for other extant locations for the species (i.e., the known populations all occur along summer dry watercourses, or near the drying edges of small lakes or impoundments). At DHR, *Mimulus evanescens* plants are scattered in well-drained, often somewhat sandy-loamy (or loosely gravelly) microsites, often among shoreline detritus, such as woody debris and small boulders, or occasionally in moist protected areas beneath low shrubs (generally *Artemisia tridentata*). The species has a narrow ecological amplitude, and appears to be restricted to the ecotone between the upslope edge of the sagebrush-juniper dominated shrub zone, and the semi-aquatic graminoids (Cyperaceae) occurring near the waters edge. Together these, along with the intermediate area in between, comprise the roughly 3 to 12 meter wide littoral belt that encircles most of DHR (and similar bodies of water throughout the northern Great Basin).

Mimulus evanescens seeds are probably subject to local dispersal by water, much the same as a number of other annual species that occur in vernal moist areas near streambeds and reservoir margins in the area. Seeds of the mostly annual flora that characterize such sites are presumably inundated for all or much of the winter (their dormancy typically enforced by cold winter temperatures), and then are washed up along the shoreline as waters recede in the spring. Those that are deposited too high (for example, up along the edge of the *Artemisia* zone in high water years) are frequently marooned in soils subject to rapid drying out once warmer weather ensues, while those that are left too near the waters edge (in heavier soils, among species of *Scirpus* or *Eleocharis*, for example) often remain too saturated for germination and survival.

The result is that few *M. evanescens* plants manage to grow and reproduce up in the juniper-sagebrush areas, and even fewer survive in the soils near the waters edge that remain soaked well into the late spring or even summer. As with most ephemerals that characterize these “in-between areas” (including species of *Polygonum*, *Navarretia*, *Boisduvalia*, *Collinsia*, *Mimetanthe*, *Plagiobothrys*, *Trichostema*, *Psilocarphus*, etc.), the nature of the shoreline slope is important in maintaining soil moisture at appropriate levels (i.e., not so perpetually saturated as to encourage the growth of rushes and sedges, but wet enough to support a moist root zone for several weeks as ambient temperatures rise in late spring and the growing season commences). Accordingly, the band of suitable habitat for such species may be narrow (perhaps just a few feet) or up to several meters wide, depending on the perimeter morphology of the reservoir basin. In streamside habitats for the species (not seen at DHR, but found in Lake Co., near Drews Reservoir – see below), the zone of acceptable habitat can be much narrower, sometimes measured in inches!



By way of comparison, plants of *M. evanescens* at the type locality in Lassen Co., California, were scattered among large rock fragments and alongside small boulders, in well-drained, gravelly soil (along a small reservoir) that had apparently been inundated earlier in the spring. In many ways this location is comparable to DHR, although the reservoir is much smaller. Associate species at this site (occurring directly with *M. evanescens*, or growing nearby) included *Mimulus floribundus*, *Porterella carnosula*, *Collinsia grandiflora*, *Downingia* sp., *Mimetanthe pilosa*, *Heterocodon rariflorum*, *Poa bulbosa*, *Marsilea vestita*, and *Machaerocarpus californicus*. In Lake Co., Oregon, populations occur in somewhat similar sites, i.e., along the edges or steep cutbanks of drying creek beds, and near the shore of Drews Reservoir below the high water line. Common associate species here included *Trichostema oblongum*, *T. simulatum*, *Phacelia lutea*, *Plagiobothrys scouleri*, *P. mollis*, *Navarretia breweri*, and *Perideridia oregana*, as well as several other annual monkeyflowers, including *M. breviflorus*, *M. breweri*, *M. floribundus*, and depauperate annual forms of *M. guttatus*.

Habitat at historical sites for *M. evanescens* is known primarily from herbarium labels, most of which provide little, if any, significant information. Indications are that these sites generally resembled the extant localities, consisting mostly of rocky, well-

drained stream banks or drying watercourses. There is nothing to suggest that the species has been found at any locations that are dramatically different than the habitat described in the preceding paragraphs.

The ecological processes that preserve the habitat for *M. evanescens* at DHR are directly related to the maintenance of the vernal soil moisture ecotone, as discussed above. The timing of the rising and lowering of the water level in the reservoir is critical to the continued existence of the annual plant community that *M. evanescens* is a member of. Fire may play a secondary role in maintaining habitat, by discouraging the build-up of thatch, or the possible encroachment along the banks by perennial (especially woody) species. Currently, significant suitable habitat (particularly on the north and east side of the reservoir) is available for the species, and BLM management actions at DHR (at least as observed over the last four years) does not appear to constitute a negative influence. This is not to say that current management practices could not at some point reduce habitat quality. It simply appears that there is minimal impact, based on four years of observation without the benefit of any quantitative monitoring of the species or the local surroundings. Environmental changes likely to have the most negative impact on the site are permanent shifts in hydrology, and establishment of invasive noxious weeds within the preferred habitat of *M. evanescens*.

SITE THREATS

Observed, on-going threats to *Mimulus evanescens* habitat at DHR include ATV traffic along the shoreline (very minimal), as well as cattle congregating and trailing at various points near the reservoir (occasional, especially at the north end). Recreational uses of the reservoir, including fishing, camping, and hiking, is limited due to the isolation of the site, but these also pose existing (if generally inconsequential) threats, and may result in limited trampling and soil compaction within *M. evanescens* habitat. Threats of a much greater potential magnitude include anything that would change the spring hydrologic regime at the site that favors the growth of native annuals (see additional details under Desired Site Conditions, below), or anything that would facilitate the introduction and spread of noxious weed infestations in the DHR basin. Nearby rangeland improvements by BLM since FY2005 have opened up adjacent sagebrush-juniper habitats, often via methods resulting in harsh substrate disturbance, increasing the potential for noxious weeds to become established in *M. evanescens* habitat.

CURRENT LAND ALLOCATIONS AND MANAGEMENT

BLM administers DHR and adjacent public lands, and current management at the site is multiple use. Water is impounded in DHR to support grazing in the area and to facilitate limited recreational opportunities. The entire reservoir area appears open to recreation and grazing, based on observations in 2007 and earlier years. Camping, fishing, and hunting are encouraged, although DHR is not a regularly visited area and impacts from these activities are relatively light anywhere around the reservoir margin. Cattle trail near or adjacent to much of the reservoir (as observed from 2004 through

2007), and when present, cattle tend to congregate at the north end of the reservoir. They have been observed at DHR when *M. evanescens* is in flower and fruit, although there is no evidence they eat the *Mimulus* plants or spend much time in their preferred habitat. There is little desirable forage for cattle immediately adjoining the waterline, particularly within habitat for *M. evanescens* along the east shore, and they have mostly been observed grazing in nearby uplands or along a seasonal drainage feeding DHR from its north end.

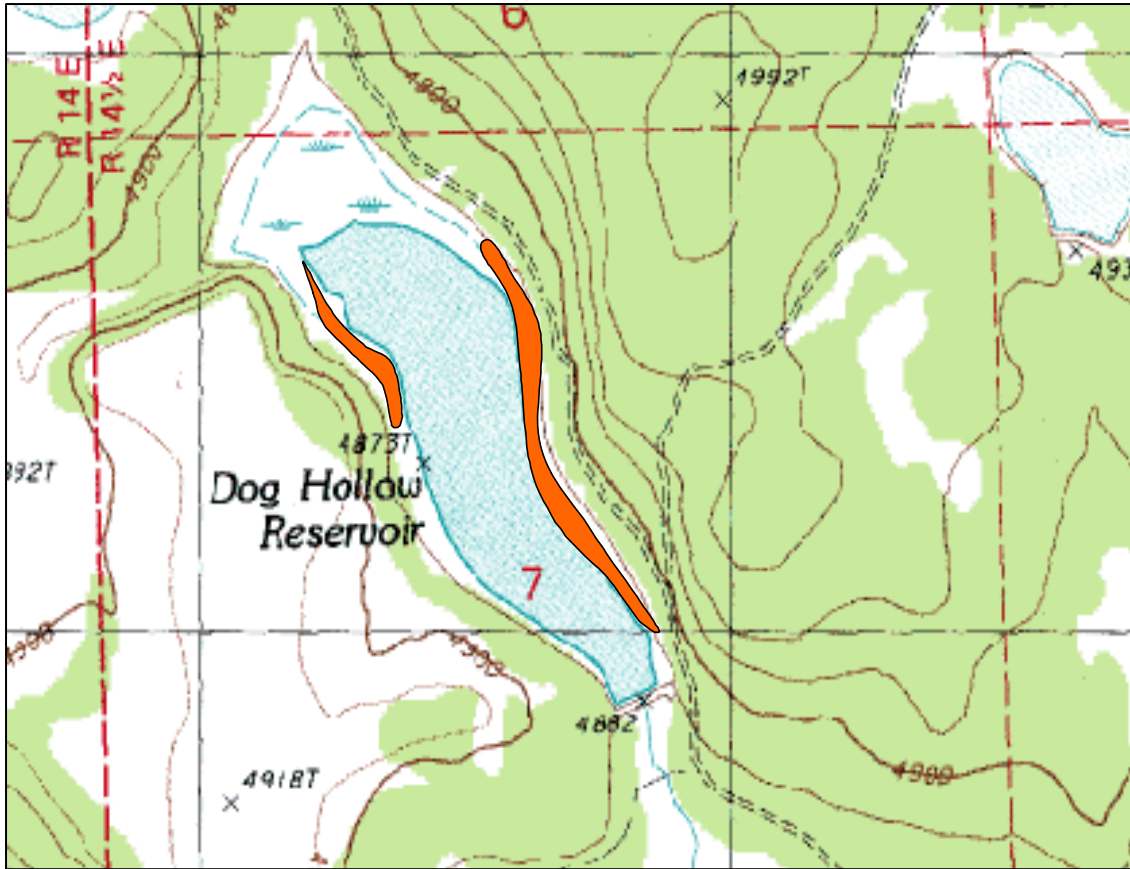
Administration of adjacent upland sites is primarily for cattle grazing and wildlife management. Cattle utilize pastures within the vicinity of DHR where they graze on nearby slopes and flats, accessing the reservoir area mainly for drinking water.

Considerable habitat modification (by BLM) has taken place in nearby upland areas over the last three years, to improve grazing opportunities and reduce fire risk, including hazardous fuels reduction, and various wildlife-related habitat treatments. This has largely consisted of the removal of woody species (chiefly western juniper), to reduce canopy coverage while encouraging the growth of native forb and grass species (although a side effect has been an increase in the cover and distribution of exotic species in many treated areas). Much of the area leading into DHR has been extensively disturbed by the rangeland improvement process.

Unfettered access to all areas of the reservoir by cattle has the potential to limit effective management *M. evanescens* habitat. Any habitat modification or improvement projects on adjoining upland areas that promote the spread of noxious weeds into shoreline environments will also make it potentially difficult to maintain quality habitat for native annuals. Most importantly, any modification of reservoir levels that would result in a significantly higher or lower waterline for more than a year carries with it the possibility of extirpating *M. evanescens* at this site. This could happen via sudden drawdowns, allowing water levels to rise into the juniper-sage zone in the spring and summer, or physical changes to the slope along the shoreline through development.

DESIRED SITE CONDITIONS

The situation at DHR is not so much one of site restoration as much as it is a maintenance and prevention issue. Quality habitat currently exists at DHR for *Mimulus evanescens*, and the goal of this plan is reduce the prospect for habitat loss or degradation. Most of the eastern shoreline of the reservoir has slope and substrate compatible with vigorous populations of the species, as does a limited segment of the northwest margin (see map on page 10). The highlighted acreage in orange indicate areas where *M. evanescens* plants were observed in 2004, 2005, 2006, or 2007. The favorable physical and hydrologic conditions described previously (under Site Habitat Description) exist in these sites – it is important to maintain these shoreline stretches without significant disturbance to ensure the perpetuation of *M. evanescens* at DHR. Shoreline not highlighted may support pockets of the species, but in general have less suitable habitat, either due to longer periods of inundation or poor soil moisture holding capacity at times when the species needs to be germinating and growing. Due to the ephemeral character of the plants, and the transient nature of the dormant seed bank, *M. evanescens* populations were spatially and temporally dynamic in these areas over the four year period – in other words, they seldom reoccurred in the same precise spot in successive seasons.



The desired site conditions for *M. evanescens* at DHR are compatible with current land use patterns, providing these do not change appreciably in the future. They can best be achieved and maintained in the long term by (1) ensuring that competitive noxious weed populations do not gain a foothold in the intermediate shoreline areas favored by native annuals; (2) evaluating the pattern of livestock usage at DHR (both current and expected), and determining where, when, and to what extent cattle presently impact (or may impact) the sensitive near-shore areas of the reservoir; and (3) not permitting development of the shoreline in the vicinity of the highlighted areas, above, to prevent measurable changes in shoreline slope and substrate hydrology that could alter the distribution and composition of plant communities in the littoral zone.

ACTIONS NEEDED

Recreation-related

1. The present pattern of low key, mainly summer visitation is compatible with the preservation of sensitive habitat on the east shore. These current low levels of recreational usage at DHR should be maintained, by continuing to limit on-site facilities and minimizing upkeep of the access road.

2. Camping and ATV use should be discouraged in shoreline areas known to have *M. evanescens* habitat, to avoid repeated and focused substrate disturbance.
3. Boat launching should be limited to near the dam at the south end of DHR. This is probably not a serious problem, but restricting boat access to the dam area would further ensure the integrity of the eastern shoreline, where most subpopulations and habitat for *M. evanescens* exist.

Wildfire-related

1. If feasible, allow any wildfires that occur in the immediate vicinity of DHR to burn to the perimeter of the reservoir. This isn't critical if management or safety issues dictate otherwise. However, allowing fires to burn to the waterline would help in maintaining an open shoreline, and would probably reduce competing woody vegetation that could in time encroach into *M. evanescens* habitat.
2. If possible, avoid disturbance to the east and northwest shoreline during any firefighting operations.

Weed control

1. Public lands around DHR have been subject to range and habitat improvement work (i.e., removal of woody vegetation) in the last few years. To reduce the potential for weed infestations in *M. evanescens* habitat, it is recommended that such activities in the immediate vicinity of DHR be avoided where possible.
2. Currently, sensitive habitat at DHR is not seriously compromised by noxious weeds. However, the potential exists for this to change. Annual inspections in June or July of the reservoir perimeter (within 100 meters of the shoreline), should be undertaken to inspect for weed establishment, with a particular focus on *M. evanescens* habitat.
3. An aggressive weed control policy should be adopted for DHR, considering its status as habitat for a species that has the potential to become federally listed as endangered. Hand-pulling is preferred. Chemical applications should be applied in the area following EPA guidelines for listed species.

Habitat improvement

1. Yearly evaluations to determine if woody species are encroaching into *M. evanescens* habitat (along the east shore in particular) are recommended (also see #3, below, under Hydrology-related).
2. If encroachment is considered a problem, spot removal of juniper, sagebrush, or other species may be necessary to maintain the open nature of current habitat. Care should be taken to minimize substrate disturbance – follow-up monitoring of the sites for weed introductions would be necessary.
3. Microsites for *M. evanescens* may be created at DHR by placing scattered chunks of woody debris between the edge of the juniper-sagebrush community and the sedge-rush dominated wet shoreline.

Grazing

1. Excessive grazing at the north end of the reservoir may need to be evaluated. However, although cattle have been frequently observed congregating in this area, habitat for *M. evanescens* is not present there.
2. Livestock do trail along other areas of the reservoir, and in some years may compact soils or cause other (mostly minor) damage in *M. evanescens* habitat. A review of the presence of cattle in such areas over the years was beyond the scope of this project. BLM may wish to consider the degree to which cattle can impact sensitive areas, especially on the east side of DHR, and whether remedial action (such as fencing or restriction of cattle in the area during the growing season of *M. evanescens*) may be appropriate.

Hydrology-related

1. Although not an aquatic species, *M. evanescens* is highly dependent on vernal wet soils to germinate and maintain reproductive populations. Dramatic reductions in water levels at DHR, due to drawdowns, can reduce or eliminate populations and should be avoided where possible. The species was scarce here in 2007, probably due to the fact that summer dry regional conditions resulted in a lower than average water level at DHR.
2. On the other hand, try and avoid maintaining extremely high water levels (that extend into sagebrush-juniper habitat) during winter and (especially) spring months. Continuous high water into the sagebrush will reduce population vigor for *M. evanescens* by stranding seeds in unsuitable upland habitat. Successive high water years will probably extirpate the species at DHR.
3. Monitoring plots within *M. evanescens* habitat should be established. These would not be aimed at monitoring *M. evanescens* populations themselves (which are transitory), but would focus on habitat change and composition. One way to evaluate risk for ephemeral species such as *M. evanescens* is to assess their habitat for changes. In this case, the littoral zone at DHR would be monitored, focusing on the distribution of any hydric species along the shoreline (e.g., rushes, etc.) as well as the more xeric species characterizing the edge of the nearby sagebrush community. A series of simple one-meter square photoplots, set perpendicular to the shoreline gradient, could be set up to accomplish this. Percent soil moisture should also be taken in each plot. If areas that support *M. evanescens* are encroached upon or overtaken by perennial wetland species or upland plants, then it is likely that hydrologic conditions required by the species have shifted. It is important to note that most vernal annuals like *M. evanescens* can adjust to gradual changes along a soil-moisture gradient, which are by definition dynamic environments. However, abrupt changes in associate species or soil moisture content from year to year, possibly reflecting sudden, long-term or permanent hydrologic shifts, are likely to be much more critical.
4. Inlets or springs that feed DHR are critical to maintaining water levels, and should be protected and maintained.

5. Avoid activities within *M. evanescens* habitat that would alter the slope of the littoral zone. Any development along the shoreline (particularly along the east side of DHR) that would change the slope (i.e., flattening it out, or creating a steep cutbank) would impact local soil hydrology, potentially affecting site suitability for the species.

Ex-situ conservation

1. In years when conditions are right, and many *M. evanescens* plants are growing at DHR, seed collection is recommended. Only a few plants were seen in 2007, but many (up to a few thousand) were observed in previous years. Even smaller plants can produce several hundred seeds, and large ones up to three or four thousand – collecting just 10% of the available seed from as few as 40 individuals can result in up to twelve thousand seeds or more per year. Prior to collection, plants should be flagged when green to facilitate re-location (when seeds are ripe the fruiting plants are often difficult to see). The tiny, dormant seeds can be shaken out of recently ripened calyces into vials or small envelopes and stored dry. These can be sent to Berry Botanic Garden (BBG) for long-term storage, as a hedge against local extirpation at DHR at some future date. Seeds from plants collected on-site could then be reacquired from BBG and re-introduced if necessary.

MONITORING AND ADAPTIVE MANAGEMENT

Recreation-related

1. Conduct annual monitoring at DHR to determine if campsites are being established within *M. evanescens* habitat. This can be accomplished concurrently with #1 under General Census, below. If discovered, consider methods to reduce recreation-related disturbance and discourage camping in these areas.

Weed control

1. Visit DHR annually (in June or July) to conduct single day weed census in and near DHR (within 100 meter of reservoir). Identify major weed species and assess these as potential threats to *M. evanescens*.
2. If weeds are discovered, implement annual control program. Hand-pulling is preferred within *M. evanescens* habitat.
3. Monitor the vicinity annually in mid-summer (with timing appropriate to the species) after any weed control actions, to evaluate effectiveness.

Hydrology-related

1. Establish series of vegetation monitoring plots across soil moisture gradient, with annual data collection (a single visit at the peak of growing season, in late June or

July) to be conducted. Photoplots are recommended (discussed above under Actions Needed).

General Census

1. A site census should be undertaken for *M. evanescens* at least every other year, but preferably each year if possible. Using permanent plots for this is not appropriate, since the species is annual and patches are apt to move from year to year. Fortunately, the belt of suitable habitat paralleling the shoreline at DHR is seldom more than 5 meters wide, so carefully walking and scrutinizing this strip of land shouldn't take more than a day at most.
2. The best time to conduct a census is when the species is approximately 80% in fruit (see photo on page 1) – plants are about as large as they are going to get at this point, have typically developed an anthocyanic (reddish) hue on the stems and prominent fruiting calyces, yet still retain a few yellow flowers. They are easiest to see at this stage. However, timing the census work to coincide with this point in the life history of populations is not easy, and may not always be practical. Spring precipitation, reservoir levels, and spring temperatures all factor in when estimating the best time to visit the sites. Usually, early to mid-June provides the best opportunity to see plants at the best stage for surveying. If possible, an initial visit in May can often help pinpoint the best time for a full-scale survey later in the spring or early summer.