SURVEYS AND MONITORING FOR BOISE SAND-VERBENA (*ABRONIA MELLIFERA VAR. PAHOVEORUM*) IN THE BOISE FOOTHILLS

By

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ABSTRACT
Boise sand-verbena (*Abronia mellifera* var. *pahoveorum*) is a perennial herb with a distribution restricted to southwestern Idaho on the north side of the western Snake River Plain. It is on the Idaho Rare Pant List due to its limited distribution, low number of known occurrences, low number of plants at the occurrences, and recognition that much of the species' native shrub-steppe habitat has been severely degraded over time by invasive weeds. Furthermore, a substantial portion of Boise sand-verbena's distribution range coincides with prime real estate for housing development in the Treasure Valley area. After being described as a new species in 2016, it quickly became clear that more information was needed to better assess the conservation status for Boise sand-verbena in the Boise foothills. In a step to address this need, the Idaho Native Pant Society's Pahove Chapter and the City of Boise Department of Parks and Recreation agreed to collaborate on a field survey and monitoring project for Boise sand-verbena in the Boise foothills. The 2022 surveys targeted City of Boise and a few other selected properties in the lower Boise foothills known or suspected to contain potential Boise sand-verbena habitat. The monitoring part of the project aimed to establish monitoring plots at previously documented Boise sand-verbena occurrences located in Camelsback Reserve and Military Reserve, and where practical, at any new Boise sand-verbena locations discovered during the 2022 survey. A total of 20 Boise sand-verbena survey sites were searched on nine properties in spring 2022. Boise sand-verbena was not found at any of the survey sites. This included two locations known to have Boise sand-verbena in the past. A total of three Boise sand-verbena plants were recorded for the monitoring plot established in Camelsback Reserve. Two plants occurred at the monitoring plot established in Military Reserve. A monitoring plot was also established in Hulls Gulch along the 8th Street extension where one Boise sand-verbena plant was found by a chance discovery in 2022. Survey and monitoring results from 2022 highlight the rarity and imperiled conservation status of Boise sand-verbena in the Boise foothills. We now need more rangewide information to make an accurate, up-to-date, and comprehensive conservation status assessment for Boise sand-verbena. The 2022 survey in the lower Boise foothills was a first step towards this objective. A systematic, rangewide field survey for Boise sand-verbena is a logical next step to build upon the 2022 survey.

ACKNOWLEDGMENTS
The authors want to thank Idaho Native Plant Society volunteers Ann DeBolt, Barbara Ertter, Don Essig, Kirsten Severud, Sandy Smith, and Jeri Wood for conducting the Boise sand-verbena field surveys. We also acknowledge all the research and extra pre- and post-field work assistance provided by Barbara Ertter.

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INTRODUCTION

Boise sand-verbena (*Abronia mellifera* var. *pahoveorum*) is a perennial herb with white to pinkish, funnel-shaped flowers in a showy, head-like arrangement (Figure 1). It was described as a new variety in 2016 based on a combination of morphological, ecogeographical, and molecular analysis (Ertter and Nosratina 2016). For many years before this, Boise sand-verbena passed as a version of fragrant white sand-verbena (*Abronia fragrans*), a species now considered absent from the Pacific Northwest (Galloway 2003). Boise sand-verbena differs from other entities in the *Abronia mellifera* complex by its lack of rhizomes, larger inflorescence bracts that are often broadly ovate or even nearly round, relatively narrow, green, flexible leaves, glandular-septate hairs in the inflorescence, and the moderately hairy fruit with relatively large wings.

The distribution of Boise sand-verbena is restricted to southwestern Idaho on the north side of the western Snake River Plain, extending in sporadic fashion along the lower foothills from Boise to the Horseshoe Bend, Emmett, and New Plymouth areas (Ertter and Nosratina 2016). It occupies hills and slopes on sand and lake bed sediments below approximately 3600 ft. (1100 m) elevation. Rangewide, Boise sand-verbena is known from approximately 20 occurrences, but fewer than half of them have been confirmed extant in recent years. Land ownership for the eight known occurrences in the Boise foothills includes the Bureau of Land Management (BLM), State of Idaho, private, and two City of Boise (COB) properties - Camelsback Reserve and Military Reserve. Known Boise foothills occurrences are highly localized in extent and often support <10 individuals (B. Ertter, pers. comm.).

Conservation concern arose immediately once it became clear Boise sand-verbena represented a new, previously overlooked species. It was quickly added to the Idaho Rare Plant List (Corbin 2016) due to its limited distribution, low number of known occurrences, low number of plants at the occurrences, and recognition that much of the species' native shrub-steppe habitat has been severely degraded over time by invasive weeds such as cheatgrass (*Bromus tectorum*), cereal rye (*Secale cereale*), and rush skeletonweed (*Chondrilla juncea*). Furthermore, a substantial portion of Boise sand-verbena's distribution range coincides with prime real estate for housing development in the Treasure Valley area. Some populations have undoubtedly already been lost due to urban development.

Conservation status information for Boise sand-verbena is limited; in part because there has never been a systematic survey for the species in the Boise foothills, or elsewhere in its range. It became clear more information was needed to better assess the conservation status of Boise sand-verbena. Early in 2022, the Idaho Native Pant Society's (INPS) Pahove Chapter and the COB Department of Parks and Recreation agreed to collaborate on a field survey and monitoring project for Boise sand-verbena in the Boise foothills to begin to address this information need. The surveys would target COB and a few other selected properties in the lower Boise foothills known or suspected to contain potential Boise sand-verbena habitat. The project also aimed to establish monitoring plots at the previously documented Boise sand-verbena occurrences located in Camelsback Reserve and Military Reserve, and where practical, at any new Boise sand-verbena locations discovered during the 2022 survey. The objective of the project is to gain a better understanding of the conservation status and needs of Boise sand-verbena in the Boise foothills, with emphasis on COB properties. Information from the project is meant to assist land resource managers sustain populations of Boise sand-verbena on lands they administer. This report summarizes results of our 2022 field survey. It also outlines the monitoring protocol and summarizes monitoring information collected at three plots.

METHODS

Field survey

We planned the field survey by first reviewing aerial imagery covering all COB properties known or suspected to contain habitat potentially suitable for Boise sand-verbena. Imagery for a few BLM, Idaho State, and private land parcels also received review. We considered relatively sparsely vegetated sandy openings as potential habitat for purposes of the survey. In addition to the authors, INPS volunteers Barbara Ertter, Ann DeBolt, Kirsten Severud, and Don Essig assisted with the identification of potential habitat areas to survey. Based on this assessment, we initially selected seven COB and three other properties for field survey in 2022. Within each property, 1 – 4 areas were identified as potential habitat for Boise sand-verbena. They represented the primary search targets for each property, but surveyors also opportunistically searched for Boise sand-verbena as they hiked to the main target areas.

Before starting a survey, surveyors pre-loaded coordinates of the pre-selected potential habitat locations into their hand-held GPS unit to facilitate navigation to the site. Surveyors less familiar with Boise sand-verbena and its habitat refreshed their memory by visiting a readily accessible known population located adjacent to Bogus Basin Road. Beginning from the start point, survey routes were documented using the GPS Track feature.

The survey protocol requires recording location, plant community, habitat condition, disturbance, and Boise sand-verbena abundance information onto a field form (Appendix 1) for all Boise sand–verbena locations discovered during the field survey. Basic vegetation and site description information is collected at target sites lacking Boise sand-verbena. The survey protocol also requires photos be taken for each target site, and for Boise sand-verbena if it is present.

Monitoring

Monitoring plots were established at previously documented Boise sand-verbena occurrences in Camelsback Reserve and Military Reserve. A monitoring plot was also established where one Boise sand-verbena plant was discovered in 2022 along the 8th Street extension in Hulls Gulch.

Data collection consists of counting the number of Boise sand-verbena plants and recording plant community, weed species, and disturbance factor information within a 1/10 acre (37 ft. radius) circular plot. A set of photographs are also taken at each plot. We hope to resample the plots at least every three years.

Plot establishment: Boise sand-verbena occurrences in Camelsback Reserve, Military Reserve, and Hulls Gulch were all very small in extent. Plot center was subjectively placed in the approximate center of the occurrence, with the location documented by GPS coordinates. Plot center was temporarily marked with a pinflag. A measuring tape was then used to delineate the plot perimeter using additional pinflags. Plots are not permanently marked using stakes or other hardware and will be relocated in the future using GPS coordinates. Data were recorded on forms designed for the project (Appendix 1).

Boise sand-verbena census: Census information is collected by counting (or estimating if too abundant to accurately count) the number of Boise sand-verbena plants in the plot and noting the relative abundance of flowering, vegetative, and seedling individuals.

Vegetation: Plant community information is acquired by recording all shrub and native bunchgrass species in the plot and noting their abundance using 1 of 5 percent canopy cover classes: <2%, 2-10%, 10-25%, 25-50%, >50%. Cover class categories are assigned for total shrub cover and total bunchgrass abundance as well. The four most common native forbs are

recorded and assigned one of the following abundance categories: Trace = only a few individuals, easy to overlook; Sparse = spotty and perhaps not seen at first glance, but unlikely to overlook in careful observation; Scattered = widespread, somewhat common, and not to be overlooked in careful observation; Common = frequent and widespread, obvious at first glance; Dominant = very abundant, a community dominant. All non-native weed species in the plot are also recorded and assigned one of the abundance categories used for the native forbs.

Ground disturbances: Ground disturbance information is collected by recording which of 10 disturbance factors occur anywhere within the plot. Each disturbance type is assigned one of the abundance categories used for native forbs. If detected, other disturbances not included in this list can also be noted on the data form.

1. Animal digging - Applies to mounds/piles of soil deposited by a digging animal, and/or burrow holes. These can be recent or old.
2. Wildlife tracks - Applies to animal tracks in the plot other than dog. In some cases, the tracks may be too ill defined to allow confident differentiation or species identification.
3. Dog tracks - Applies to dog prints in the plot.
4. Livestock Use - Applies to cattle and sheep tracks or feces in the plot, or grazing evidence.
5. Trail - Applies to pathways used by people, whether maintained or not.
6. Non-motorized recreation - Applies to footprints or bicycle tracks in the plot.
7. Motorized recreation - Applies to tracks or other disturbances caused by motorcycles or other motorized vehicle.
8. Road - Applies to a roadway with vehicle tracks.
9. Wildfire - Applies to plot areas with evidence of past wildfire such as burned shrub skeletons.
10. Weed invasion - Applies to situations where non-native weedy species are abundant and appear to be overwhelming the native vegetation.

Photo point photographs: Photographs provide a visual record of each monitoring site. Repeat photo monitoring can be useful to document site-specific change or lack of change to landscape features of interest (Hall 2001). The plot center point serves as the photo-point reference point to take photos. Landscape oriented photographs are taken using a digital camera set at wide-angle. Showing the horizon with some sky helps replicate the repeat photo in future monitoring years. A minimum of four photos are taken at each plot using the cardinal direction azimuths, 0°, 90°, 180°, and 270°. Additional photos to show Boise sand-verbena, plant community patterns, disturbances, or other landscape features are optional.

RESULTS

Field survey

A total of 20 Boise sand-verbena survey sites were searched on nine properties between April 28 – May 28, 2022 (Table 1; Appendix 2, Appendix 3). Boise sand-verbena was not found at any of the survey sites. All survey sites were in the lower Boise foothills, and Boise sand-verbena had never been searched for previously at most of them. The exceptions were two sites where Boise sand-verbena had been documented in the past - Camelsback Reserve (northwest corner of Reserve upslope of homes) and Military Reserve (Elephant Rock area). Although relatively sparse at a few places, introduced weed species dominated the vegetation at most survey sites. Native herbaceous species and shrubs tended to be substantially less abundant. Most survey sites had sandy substrates that appeared potentially suitable for Boise sand-verbena, at least in places. However, several survey sites lacked the proper soil type, contradicting our initial assessment based on aerial imagery. Survey sites had varying levels of ground disturbance, with wildlife tracks and pocket gopher digging being common at some of them. Many also had evidence of past wildfire. Descriptive information for each survey

Table 1. Boise sand-verbena survey sites in the Boise foothills, 2022.

Property Name	Land Ownership	Surveyors	# of survey sites
Camelsback Park	City of Boise	K. Severud	1
Highland Hackberry Subdivision	Private*	A. DeBolt, J. Wood	2
Hulls Gulch Reserve	City of Boise/private*	D. Essig, K. Severud	3
Military Reserve	City of Boise	D. Essig	4
Peace Valley Overlook	City of Boise	B. Ertter	3
Peggy's Trail	BLM	K. Severud	2
Pierce Gulch Farm	City of Boise	K. Severud	1
Table Rock/Mesa Reserve	Idaho State	A. DeBolt, S. Smith	3
Warm Springs/Mesa Reserve	City of Boise	A. DeBolt	1
Total			20

*Private land with public, open space access

site has been summarized (Appendix 4). A total of 87 labeled photographs provide visual documentation of the survey sites, with the exception is of Peace Valley Overlook Reserve, where photos were not taken (Appendix 5).

One of the Table Rock survey sites (TR1) was in the vicinity of an experimental out-planting of 30 greenhouse-grown Boise sand verbena plants in 2015 (A. DeBolt, pers. comm.). Surveyors failed to detect any of the out-planted Boise sand-verbena plants in the 2022 survey area, but noted their search was not comprehensive.

Monitoring

We established two monitoring plots at previously documented Boise sand-verbena locations on COB property (Appendix 6). A monitoring plot was also established in Hulls Gulch along the 8th Street extension where one Boise sand-verbena plant was found by a chance discovery in 2022. (Appendix 6). The plot in Camelsback Reserve (Plot ID CBMP1) had three reproductive Boise sand-verbena plants. Vegetation in the plot included 11 weed species, with cheatgrass and cereal rye being the community dominants. Native species contributed moderate shrub cover, low cover of multiple bunchgrass and forb species, including a solitary Mulford's milkvetch plant, and patches of mossy ground. The main ground disturbance was pocket gopher digging. The plot in Military Reserve (Plots ID MRMP1) contained two Boise sand-verbena plants, one of them possibly diseased, the other with an inflorescence removed by herbivory. Vegetation in the plot included six weed species, with cheatgrass being the community dominant. Native species contributed moderate shrub cover and low cover of multiple bunchgrass and forb species. Patches of moss/crust were also present. Pocket gopher digging was the main ground disturbance in the plot. The plot in Hulls Gulch (Plot ID HGMP1) had one reproductive Boise sand-verbena plant. The plot included six weed species, with bachelor buttons (*Centaurea cyanus*) and cheatgrass co-dominating the plant community. Native species contributed moderate shrub cover with low cover of perennial bunchgrasses and multiple forb species. Ground disturbance was caused by a combination of wildlife and dog tracks, as well as evidence of yard waste being dumped from homes above the plot location. The plot area was surveyed and monitoring data collected from the road to minimize disturbance on the steep, sandy slopes. The extent of Boise sand-verbena was limited to a few square meters at all three monitoring locations. None of the plots had Boise sand-verbena seedlings. Data forms detail the monitoring data collected in 2022 (Appendix 7). A total of 15 labeled photographs provide visual documentation to supplement the monitoring data (Appendix 8).

Mulford's milkvetch

Mulford's milkvetch has been a priority plant conservation concern in southwestern Idaho for many years due to its limited distribution, small size of most populations, and problems with habitat loss and degradation, especially in the Boise foothills portion of the species' range. It occurs in open, sandy foothill sites like Boise sand-verbena. The COB has taken steps to help conserve Mulford's milkvetch in the Boise foothills, including collaborating on a monitoring program (Mancuso and Brabec 2019). Considering COB's concern for the species, we planned to collect information for Mulford's milkvetch if it was encountered during the Boise sand-verbena survey. Overall, Mulford's milkvetch was found at three Boise sand-verbena survey sites, including 13 individuals at the Highland Hackberry Subdivision HH1 site, 221 individuals at the Highland Hackberry Subdivision HH2 site, and two plants at the Camelsback Reserve CB1 site. Another individual occurred within the Boise sand-verbena monitoring plot in Camelsback Reserve.

DISCUSSION

The field survey failed to discover any new Boise sand-verbena occurrences within the survey areas. However, a single Boise sand-verbena plant was opportunistically discovered adjacent to the 8th Street extension in Hulls Gulch. The field survey also failed to find Boise sand-verbena at a previously documented site in the northwest corner of Camelsback Reserve that had two plants in 2015, or at Elephant Rock in Military Reserve, a site known to have plants many years ago. Habitat that appeared potentially suitable for Boise sand-verbena was encountered at Camelsback Reserve, a sandy area in Hulls Gulch, both Highland Hackberry Subdivision survey sites, the Peggy's Trail Peg1 survey site, and the three Table Rock survey sites. Other survey sites contained marginal, or in some cases unsuitable habitat due to improper soil types (e.g. Peace Valley Overlook Reserve) or high weed density (e.g., Hulls Gulch Reserve).

Three Boise sand-verbena monitoring plots were established in 2022. This represents the first monitoring program ever undertaken for Boise sand-verbena. Having plots in Camelsback Reserve and Military Reserve will allow COB to monitor the status of Boise sand-verbena and its habitat at these locations into the future. The information collected in 2022 forms a baseline to assess the efficacy of any future conservation efforts such as habitat restoration or supplemental planting for Boise sand-verbena sites at the Reserves.

Survey and monitoring results from 2022 highlight the rarity and imperiled conservation status of Boise sand-verbena in the Boise foothills. The species also appears to be at risk rangewide, where it is known from approximately 20 occurrences (Table 2). Eleven of these occurrences are based on old collections made more than 30 years ago. These often have vague location data making their confident future relocation problematic. The historical occurrence at Elephant Rock in Military Reserve has not been observed for many years and assumed to be extirpated. Although not confirmed, four other historical occurrences are thought likely extirpated due to habitat degradation in the general area of their presumed locations. The status of six historical (pre-1990) occurrences is unknown, at least partly due location uncertainty. Boise sand-verbena plants have not been seen at the small Harrison Hollow occurrence (off Hill Road in Boise) since 2019. Whether or not the species persist in the seed bank at this site is not known. The remaining eight occurrences were verified to be extant in 2015 or a later year (Barbara Ertter, pers. comm.). None of these extant occurrences are large, all having <100 plant, and in some cases <25 individuals based on most recent site visits. The known rangewide total is estimated to be <500 Boise sand-verbena plants. This is a species whose long-term persistence and conservation appears to be in peril.

Table 2. Rangewide Boise sand-verbena occurrences. Based on plant collection records and other research conducted by Barbara Ertter (pers. comm.)

Location	Year last observed	Conservation status
Ada County		
Spring Valley Ranch, north of Eagle	1949	unknown
Old Highway 55, sandy road cut	1955	unknown but probably extirpated
Stack Rock Rd., N of Shadow Hills Golf Course	2021	extant, ca 20 plants in 2015
Harrison Hollow, off Hill Road	2019	2 plants in 2019, none seen since
Camelsback Reserve (NW corner and upslope of pond)	2022	0 plants in NW corner, 3 plants upslope of pond
Hulls Gulch Reserve, 8th Street extension	2022	1 plant
Military Reserve, Elephant Rock	1987	apparently extirpated
North of Horizon Drive, base of sandy cliff	1973	unknown but probably extirpated
Hackberry Highlands Subdivision area	2022	at least portions extant
S of Stewart Gulch, along Bogus Basin Road	1973	unknown
Bogus Basin Road, near mile marker 4	2022	extant
near Lucky Peak Dam, Highway 21 road cut	2022	extant
Hwy 21 ca 0.5 mi beyond Lucky Peak Dam	2021	11 plant observed in 2021
Boise County		
ca 3 miles SW of Horseshoe Bend	1939	unknown
Horseshoe Bend Hill (old Highway 55)	1947	unknown
Canyon County		
north of Caldwell, small sand dunes	1959	unknown but probably extirpated
Gem County		
Freezeout Hill near Emmett	2016	2 plants observed in 2016
along Payette River east of Montour Bridge	1980	unknown
2 miles S of Montour	1986	unknown
Payette County		
Big Willow, sandy slopes	1916	unknown but probably extirpated
New Plymouth, near Langley Gulch Power Plant	2015	ca 60 plants in 2015

We need more rangewide information to make an accurate, up-to-date, and comprehensive conservation status assessment for Boise sand-verbena. The 2022 survey in the lower Boise foothills was a first step towards this end. A systematic, rangewide field survey for Boise sand-verbena is a logical next step to follow up the 2022 survey. Such a survey should include attempts to relocate historical occurrences and searching other areas known or suspected to contain potential habitat for Boise sand-verbena throughout its distribution range. We also recommend establishing additional monitoring locations at extant occurrences rangewide wherever practical. Occurrences that may be suitable candidates for monitoring include four near Boise (Bogus Basin Road near mile marker 4, Stack Rock Road, Hackberry Highlands Subdivision, near Lucky Peak Dam), one near Emmett (Freezeout Hill), and one near New Plymouth (Langley Gulch Power Plant area).

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Figure 1. Photos of Boise sand-verbena. Photos by Barbara Ertter.

Note the broad, distinct (not fused) bracts below the inflorescence

Appendix 1

Copy of field form for Boise sand-verbena survey and monitoring.

Boise sand-verbena Monitoring in the Boise Area Foothills

Location _____

Plot # _____ Date _____ Observer(s) _____

Plot Center GPS coordinates _____ GPS Datum _____

Photograph notes (0, 90, 180, 270 degrees from plot center at minimum; additional photos to show plot relocation, plant species, disturbances, and other special features as needed): _____
_____
_____

Total # of Boise sand-verbena plants in plot: _____
Comments on Abundance (distribution, reproduction, density, etc.) _____
_____
_____

Aspect _____ Slope _____ Substrate _____

Estimated canopy cover for each shrub species in plot using the following abundance categories: <2%, 2-10%, 10-25%, 25-50%, >50% _____
_____
Estimated Total Shrub Cover: <2% 2-10% 10-25% 25-50% >50% (circle one)

List all native bunchgrass species and their associated abundance (canopy cover) using the same categories as for shrubs
_____
_____
Estimated Total Native Bunchgrass Cover: <2% 2-10% 10-25% 25-50% >50% (circle one)

List of weed species and their estimated abundance: Trace = only a few individuals, easy to overlook; Sparse = spotty and perhaps not seen at first glance, but unlikely to overlook in careful observation; Scattered = widespread, somewhat common, and unlikely to overlook in careful observation; Common = frequent and widespread, obvious at first glance; Dominant = very abundant, a community dominant. Use back of page if >10 species.

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

List the 4 most common native forb species and their estimated abundance (using the weed species categories). List additional native forbs and their abundance on back of page if desired:

_____ _____
_____ _____

Circle all disturbance factors present in the plot and its estimated abundance (using the weed species categories):
Animal digging_____ Wildlife tracks_____ Dog tracks_____ Wildfire_____ Trails_____ Roads_____
Non-motorized recreation_____ Motorized recreation_____ Weed invasion_____ Other _____
Disturbance comments: _____
_____
_____

Record conservation recommendations or other comments on back of page.

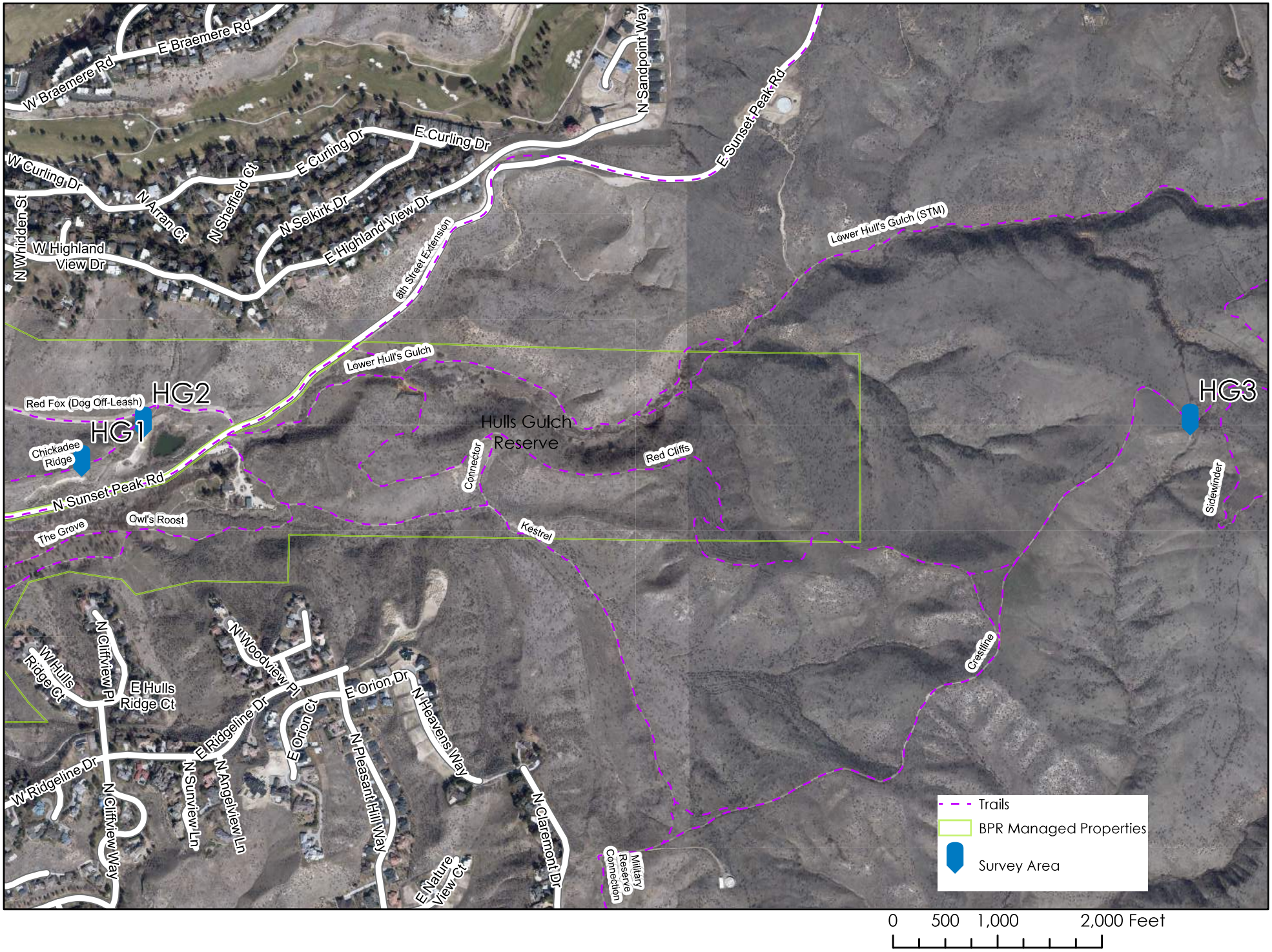
Appendix 2

Boise sand-verbena survey site locations.

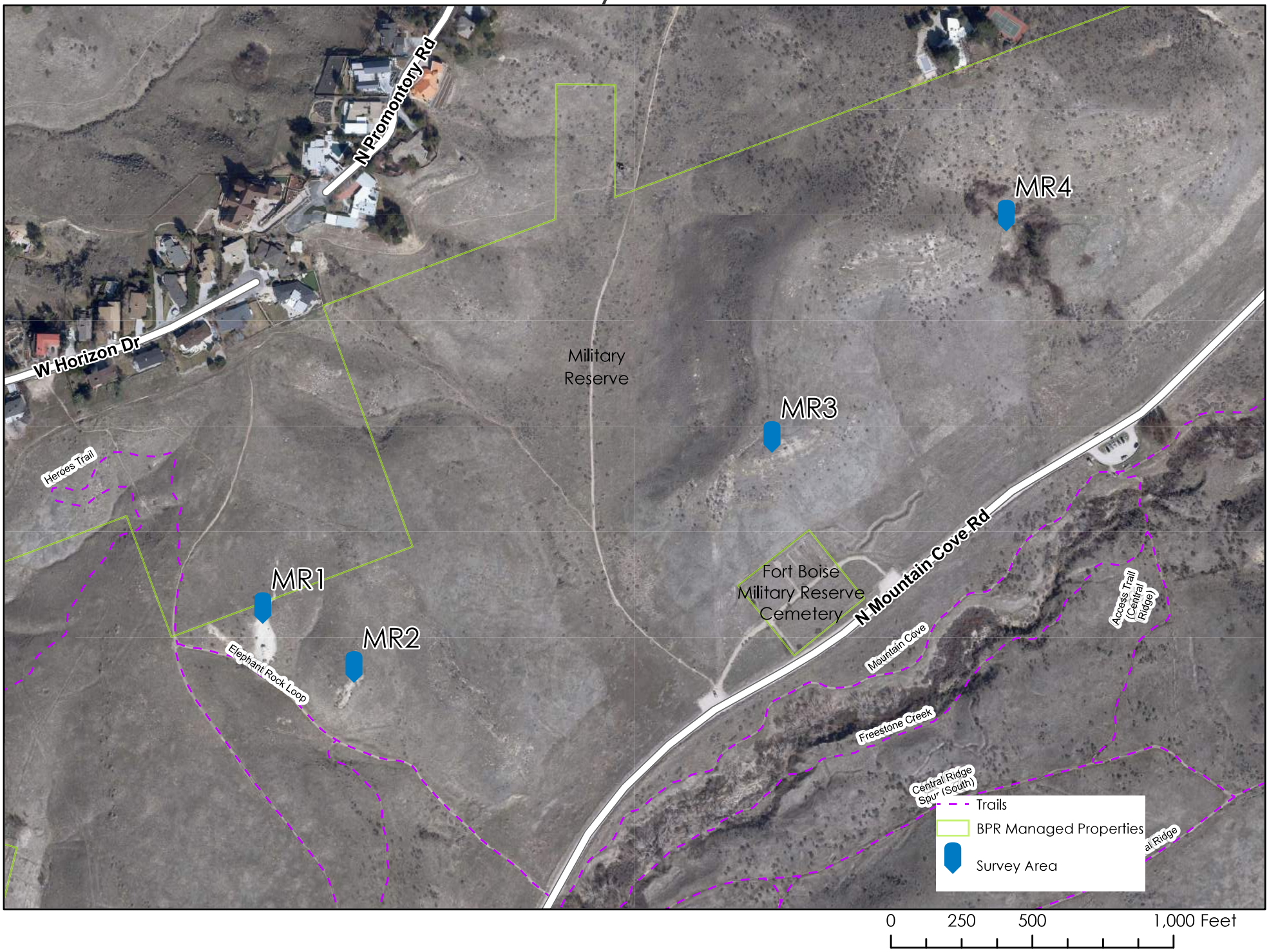
Camelsback Reserve

Highland Hackberry Subdivision

Hulls Gulch Reserve

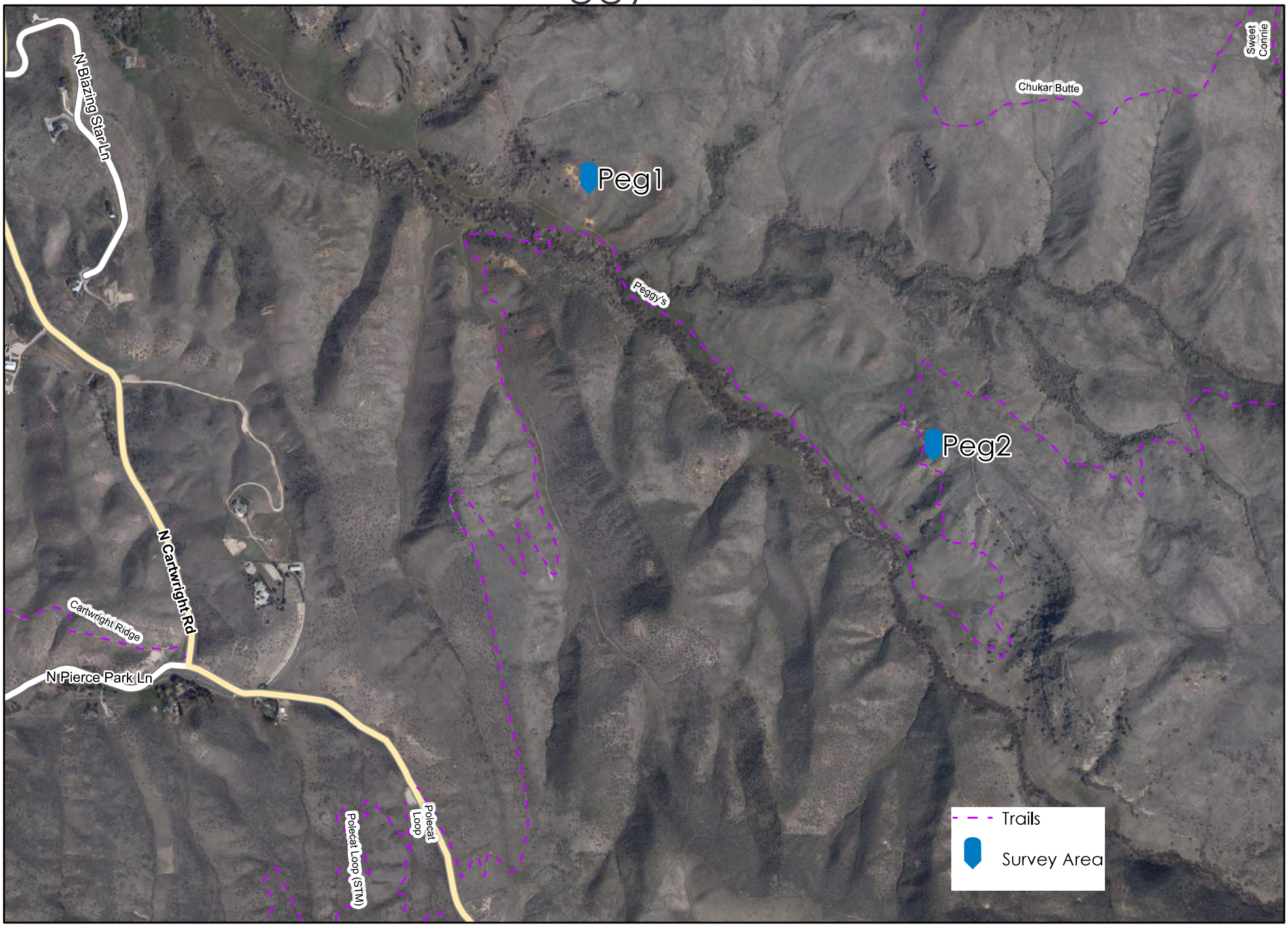


Military Reserve

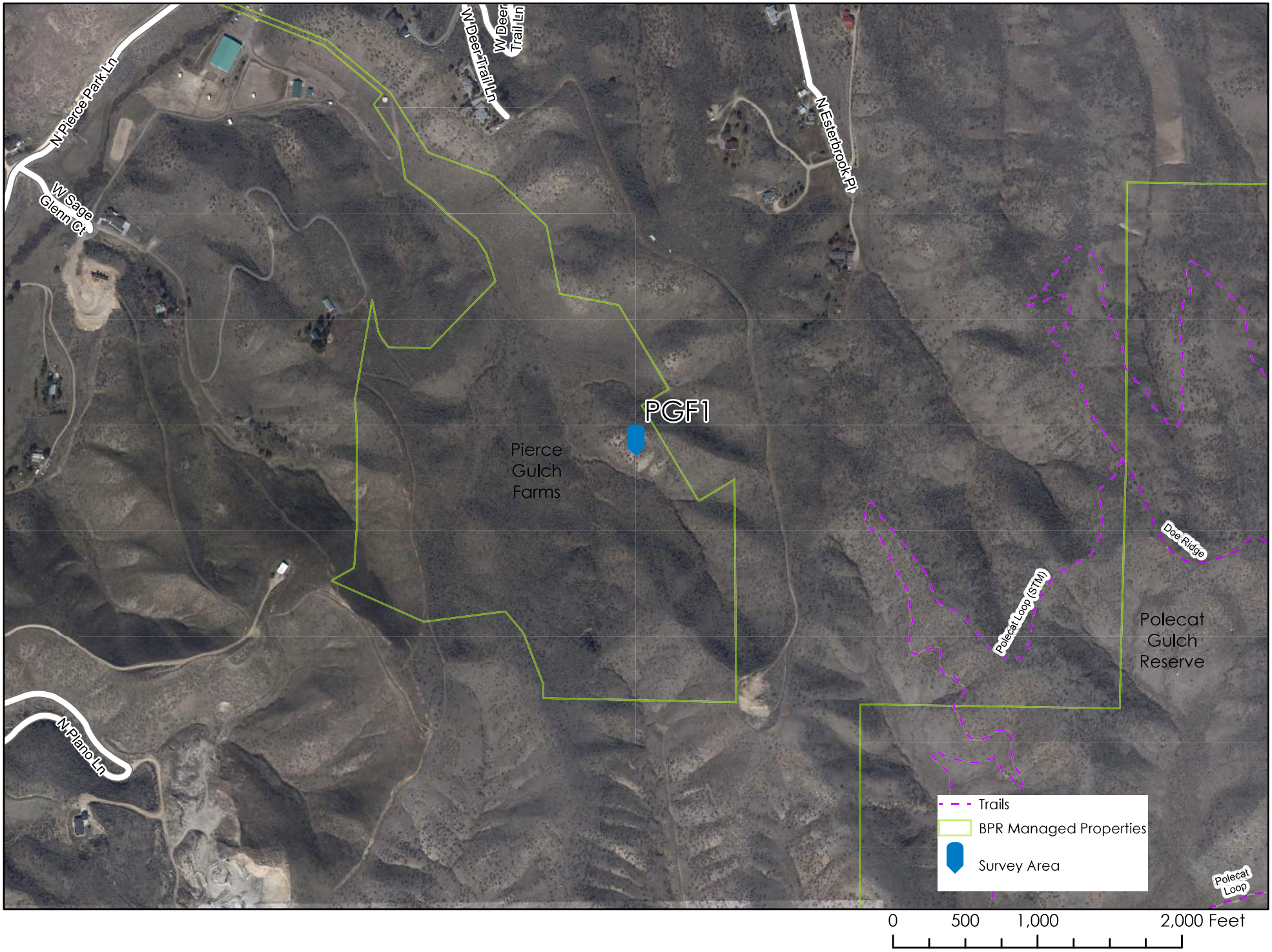


Peace Valley Overlook Reserve

Peggy's Trail



Pierce Gulch Farms



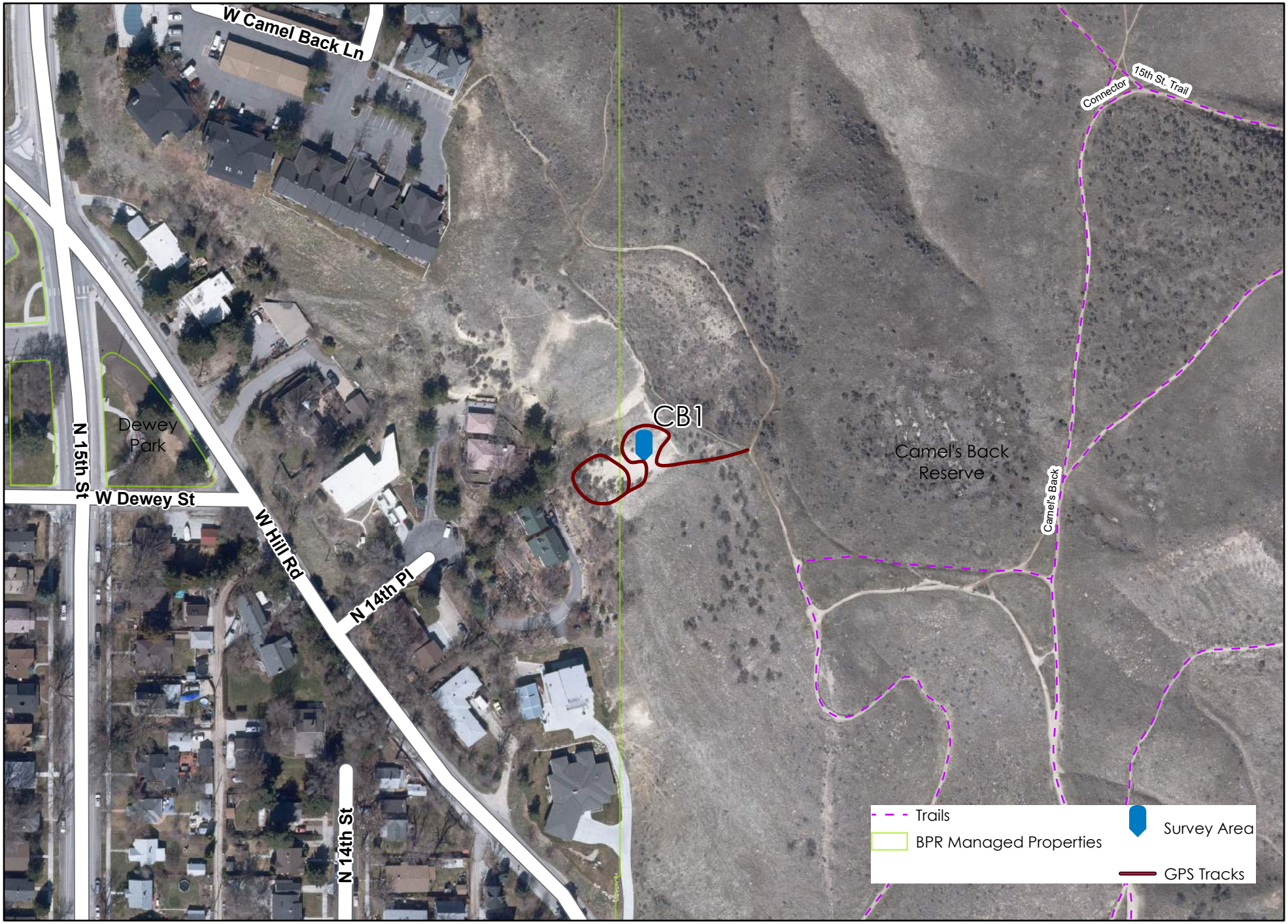
Mesa Reserve/Table Rock

Mesa Reserve/Warm Springs

Appendix 3

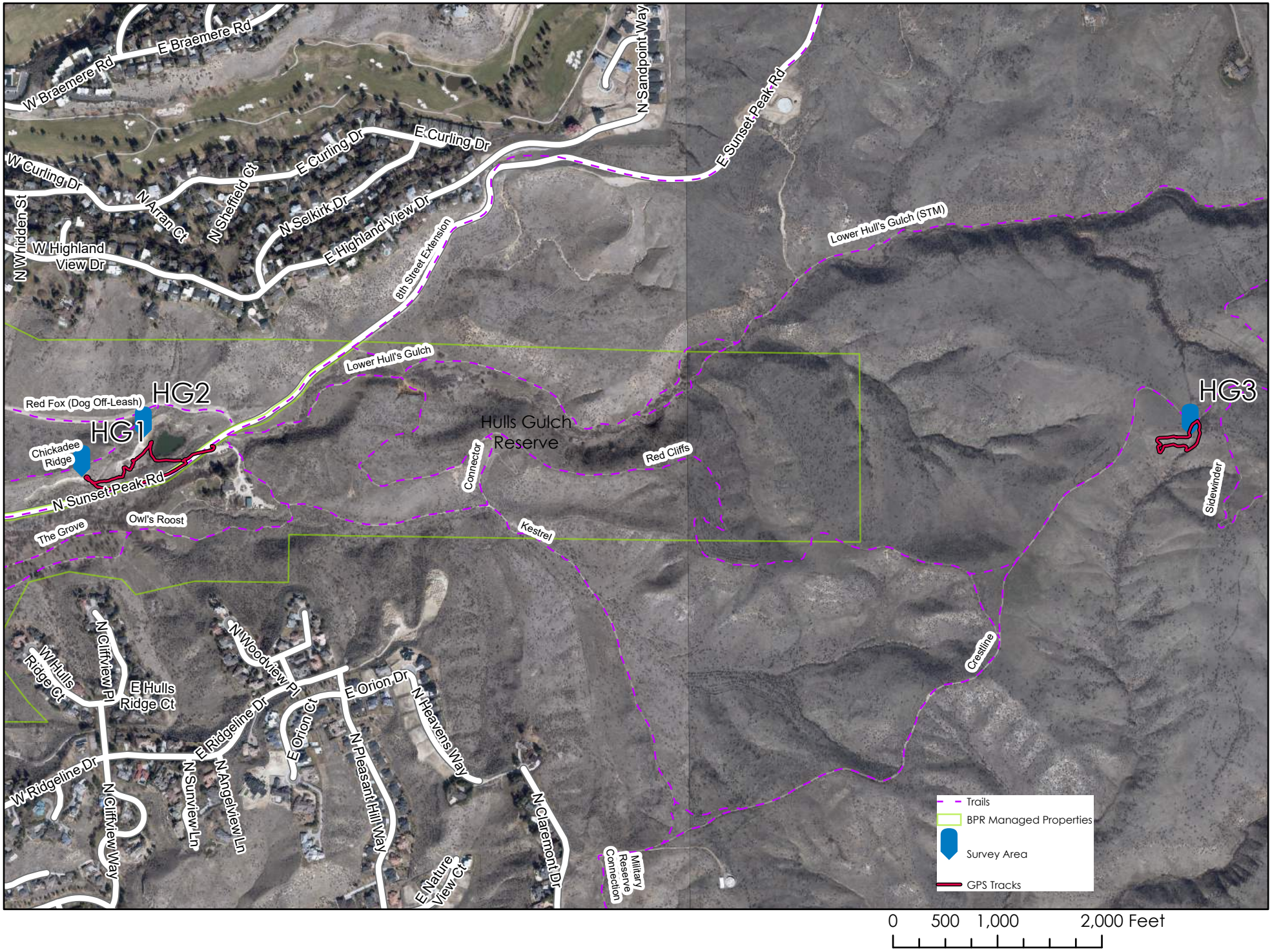
Boise sand-verbena survey routes for each survey site property.

Camelsback Reserve

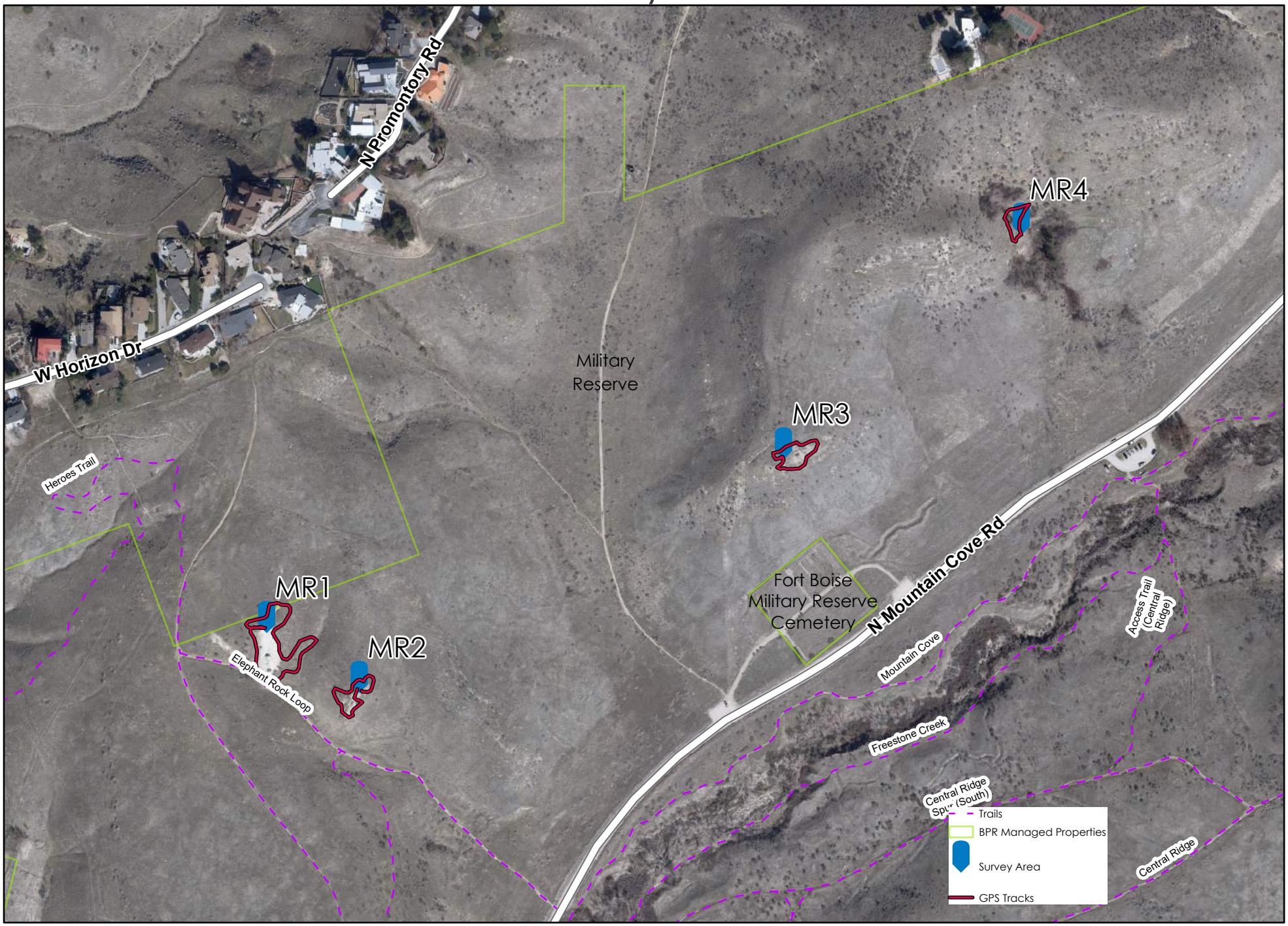


Highland Hackberry Subdivision

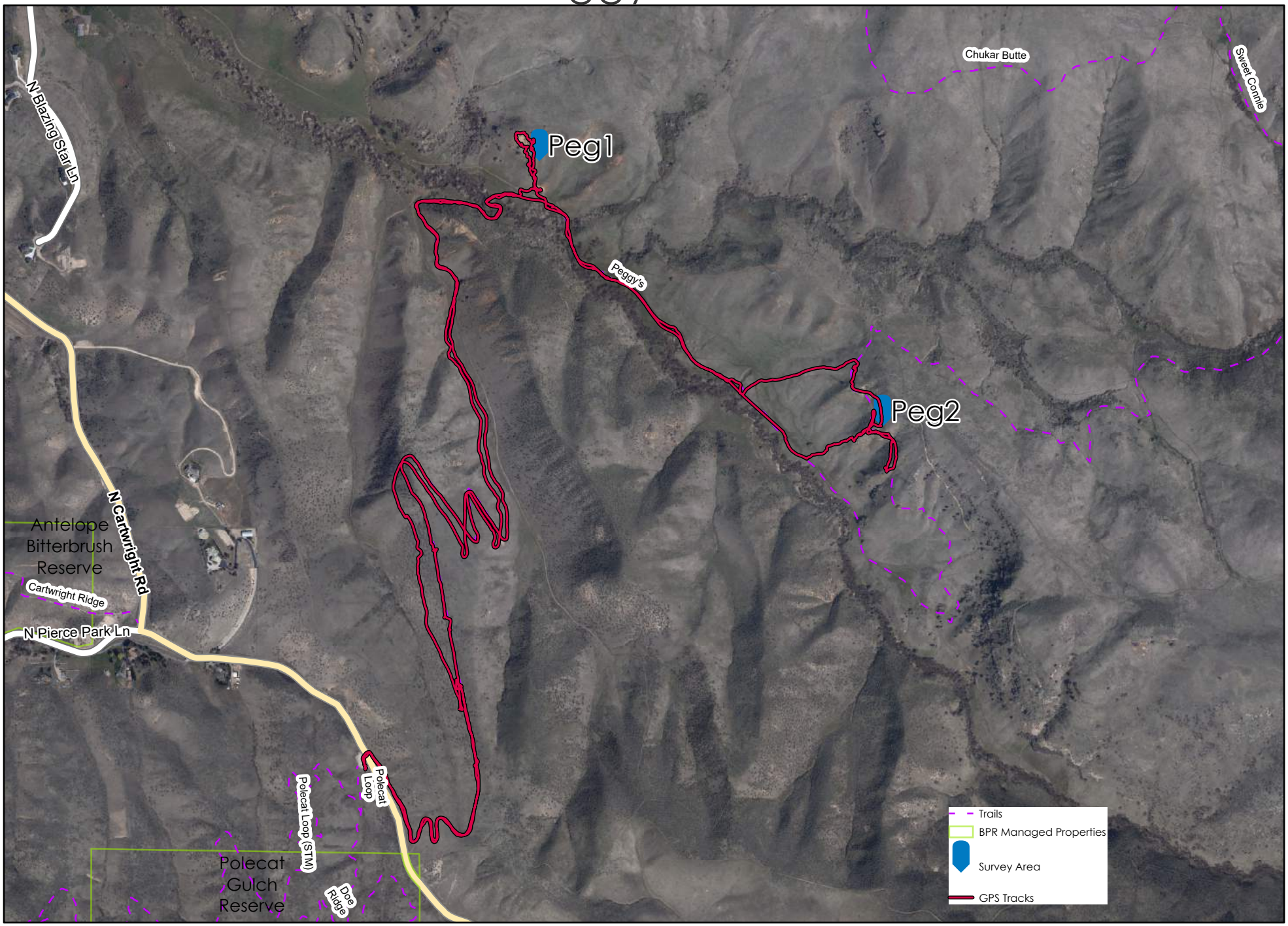
Hulls Gulch Reserve



Military Reserve



Peggy's Trail



Pierce Gulch Farms

Mesa Reserve/Table Rock

Mesa Reserve/Warm Springs

Appendix 4

Survey sites description information.

Camelsback Park – site CB1 (N 43.638196 W 116.203191): This small survey site occupied a steep west-facing, sandy slope. Part of the slope lacked vegetation, but otherwise had a scattered mix of native and introduced herbaceous species, plus a few antelope bitterbrush (*Purshia tridentata*) along the edges. Two Mulford's milkvetch plants were observed. An occasionally used trail passes through the site. Two Boise sand-verbena plants were observed at this site in 2015, but none were found in 2022. Survey conducted by Kirsten Severud on May 6, 2022.

Highland Hackberry Subdivision - site HH1 (N 43.657247 W 116.185841): This survey site occupied a steep, southeast-facing slope with coarse sand. Cheatgrass dominated the vegetation. A few other weed species, including rush skeletonweed were less abundant. Woody species occurred at low cover, with antelope bitterbrush being the most common one. Each of the five bunchgrass species had low cover. Several forb species were present, but all at low cover. The native forb component included 13 Mulford's milkvetch plants. In addition to weed invasion, disturbances included gopher digging, wildlife tracks, dog tracks, and evidence of past wildfire. Boise sand-verbena not found. Survey conducted by Ann DeBolt and Jeri Wood on May 6, 2022.

Highland Hackberry Subdivision - site HH2 (N 43.660306 W 116.186476): This survey site consisted of moderately steep, southeast to southwest-facing slopes having a mix of course sand and silty sand varying by aspect. Cheatgrass and storksbill (*Erodium cicutarium*) dominated the vegetation. A few other weed species, including rush skeletonweed were less abundant. Several native shrub, bunchgrass, and forb species were present. All occurred at low cover, except for antelope bitterbrush with moderate cover. The native forb component included 221 Mulford's milkvetch plants. At least 20 additional Mulford's milkvetch plants were observed in a separate colony on an old roadbed across from house number 4057. In addition to weed invasion, gopher digging and wildlife tracks were common disturbances within the site. Boise sand-verbena not found. Survey conducted by Ann DeBolt and Jeri Wood on May 6, 2022.

Hulls Gulch Reserve – site HG1 (N 43.64166 W 116.188721): This survey site located a short distance west of the Foothills Learning Center, immediately north of the 8th Street Extension road. It consisted of a large, south-facing sandy cliff and the slope extending from its base towards the road. The high weed cover likely makes the area unsuitable for Boise sand-verbena, which was not found during the survey. Survey conducted by Kirsten Severud on May 28, 2022.

Hulls Gulch Reserve – site HG2 (N 43.642394 W 116.187106): This survey site located a short distance east of Hulls Gulch Reserve – site HG1. It consisted of southeast-facing sandy cliff and the slope extending from its base towards the road. A dense cover of annual grasses, especially cereal rye dominated most of the area beneath the cliff. The high weed cover likely makes the area unsuitable for Boise sand-verbena, which was not found during the survey. Survey conducted by Kirsten Severud on May 28, 2022. The survey route for Hulls Gulch Reserve sites 1 and 2 totaled 0.4 mile.

Hulls Gulch Reserve – site HG3 (N 43.642444 W 116.159652): This survey site was located immediately south of Crestline Trail, west of the intersection with Sidewinder Trail. It occupied an open, easterly slope near a gully. The gravelly loam soil not good habitat for Boise sand-verbena. The native bunchgrass species, threeawn (*Aristida purpurea* var. *longiseta*), dominated the vegetation, with cheatgrass and rush skeletonweed co-occurring. Boise sand-verbena not found. Survey conducted by Don Essig on May 18, 2022.

Military Reserve – site MR1 (N 43.6233384 W 116.184237): This survey sites overlaps the Elephant Rock area. It consists of a small sandstone outcrop and surrounding open sandy zone largely devoid of vegetation. It abruptly grades into vegetation dominated by the weedy species cheatgrass, bulbous bluegrass (*Poa bulbosa*), and cereal rye. Scattered shrubs and low to moderate cover of native herbaceous species also present in the vicinity. The general area is very disturbed by people and dogs. Boise sand-verbena was documented from this location in the past but has not been seen for many years. Boise sand-verbena not found. Survey conducted by Don Essig on May 13, 2022.

Military Reserve – site MR2 (N 43.622971 W 116.183353): This survey site occupied a steep southerly slope with a rocky outcrop surrounded by much less open sandy ground compared to Elephant Rock. Vegetation with high cheatgrass cover, lesser amounts of several other weed species, scattered shrubs, and low cover of native bunchgrass and native forb species. Very limited amount of potential Boise sand-verbena habitat. Boise sand-verbena not found. Survey conducted by Don Essig on May 13, 2022.

Military Reserve – site MR3 (N 43.624584 W 116.179305): This survey site occupied a steep southerly-facing slope with a fair amount of bare/open area. The soils somewhat sandy, but with a substantial clay content. Marginal habitat at best for Boise sand-verbena. Cheatgrass dominated the vegetation. Lesser amounts of several other weed species, moderate shrub cover, and low cover of native bunchgrass and forb species also occurred. Evidence of past wildfire present. Boise sand-verbena not found. Survey conducted by Don Essig on May 13, 2022.

Military Reserve – site MR4 (N 43.626136 W 116.177036): This survey site was a moderately steep southwest slope. The vegetation dominated by dense cover of cheatgrass and cereal rye. A large thistle species (*Cirsium* sp.?) and pampas grass (*Cortaderia* sp.?) were also present. Bare ground was limited to gopher digging piles. Soils not sandy and this site lacked potential habitat for Boise sand-verbena. Boise sand-verbena not found. Survey conducted by Don Essig on May 13, 2022.

Peace Valley Overlook – sites PV1, PV2, and PV3 (N 43.564472 W 116.105413); N 43.56579 W 116.106064; N 43.567032 W 116.107303). The survey for this site followed the Peace Valley Overlook trail. Shrub-steppe vegetation in somewhat decent condition dominated the site, with threeawn being the primary bunchgrass species. Arrowleaf balsamroot (*Balsamorhiza sagittata*) a common native forb. The site devoid of lake sediments, consisting instead of jumbled rocks of batholith origin mixed with finer grained soils. The area lacked the sandy habitat typical of Boise sand-verbena habitat. Boise sand-verbena not found. Survey conducted by Barbara Ertter on April 18, 2022.

Peggy's Trail – site Peg1 (N 43.703114 W116.214439): This survey site consisted of an open, gentle southwest facing slope. It had a mix of shallow coarse grain sand atop bedrock, slightly deeper sands, and large freestanding sandstone features. Substantial portions lacked vegetation, or nearly so. Vegetated areas had scattered sagebrush and gray rabbitbrush (*Ericameria nauseosa*), native bunchgrasses, plenty of cheatgrass, and several native and non-native forb species. Disturbances included footprints from people likely visiting the interesting rock features and cattle tracks throughout the area. Boise sand-verbena not found. Survey conducted by Kirsten Severud on May 24, 2022.

Peggy's Trail – site Peg2 (N 43.697222 W 116.203917): This survey site occurred on a steep slope with south to west aspects and loose, sandy soil. Part of the sand exposure formed by an

old road cut likely for a nearby power transmission line, but now a popular hiking and biking trail. Vegetation within the old road cut included cheatgrass, rush skeletonweed, and scattered native forb species. Cheatgrass dominated the vegetation upslope and downslope of the road cut, which also included scattered big sagebrush and antelope bitterbrush, bunchgrasses, and the occasional native forb. Boise sand-verbena not found. Survey conducted by Kirsten Severud on May 24, 2022. The survey route for Peggy's Trail sites Peg1 and Peg2 totaled 6.8 miles.

Pierce Gulch Farms – Site PGF1 (N 43.6841 W 116.237488): This survey site occupied a moderately steep, south to southwest facing slope with pebbly, uneven ground. The vegetation consisted of regularly spaced bunchgrasses with interspersed cheatgrass, along with scattered big sagebrush and antelope bitterbrush, scattered rush skeletonweed, and several other native and non-native herbaceous species. Animal-related ground soil disturbance was minor. Boise sand-verbena not found. Survey conducted by Kirsten Severud on May 19, 2022. The survey route for Pierce Gulch Farm totaled 3.4 miles.

Table Rock - site TR1 (N 43.600699 W 116.156482): This survey area occupied a steep, southwest-facing slope with a mix of sand and silty-clay substrate. Cheatgrass and desert alyssum (*Alyssum desertorum*) dominated the vegetation. Several other weed species, including rush skeletonweed were less abundant. Woody species included antelope bitterbrush and lesser amounts of gray rabbitbrush and hackberry (*Celtis reticulata*). A few bunchgrass species occurred at low cover. A few native forb species were relatively common, others less so. Aside from weed invasion, main disturbances included heavy wildlife use and past wildfire. Boise sand-verbena not found. Survey conducted by Ann DeBolt and Sandy Smith on May 21, 2022.

Note: approximately 30 greenhouse-grown Boise sand-verbena plants were out-planted in the general vicinity of this survey site in 2015 (A. DeBolt, pers. comm.). Surveyors failed to detect any of the out-planted sand-verbena plants in the area they searched in 2022, but noted their search was not comprehensive.

Table Rock - site TR2 (N 43.598663 W 116.155932): This survey area consisted of a steep, south-facing slope, sandy. Cereal rye dominated the vegetation. Several native shrub species collectively had <2% cover. Native herbaceous species were sparse overall. In addition to weed invasion, disturbances included numerous wildlife tracks and scattered animal dig piles. The area burned in the past. Boise sand-verbena not found. Survey conducted by Ann DeBolt and Sandy Smith on May 21, 2022.

Table Rock - site TR3 (N 43.599704 W 116.158111): This survey area consisted of a moderately steep, southwest-facing, sandy slope. The vegetation contained low cover of several woody species. Threeawn had relatively high cover, but cheatgrass, bulbous bluegrass and several other weed species were more abundant than the native grasses and forbs. In addition to weed invasion, disturbances included numerous wildlife tracks and scattered animal dig piles. The area burned in the past. Boise sand-verbena not found. Survey conducted by Ann DeBolt and Sandy Smith on May 21, 2022.

Warm Springs – WS1 site (N 43.583169 W 116.139539): This survey area was a very steep southwestern-facing slope having silty clay and coarse decomposed granite on the surface. The vegetation contained low cover of several native and introduced woody species along with a mix of introduced and native herbaceous species. The area burned in the past. The soil type probably not suitable for Boise sand-verbena. Boise sand-verbena not found. Survey conducted by Ann DeBolt on May 6, 2022.

Appendix 5

Survey sites photographs.

Boise sand-verbena Survey Project, Boise Foothills, Camelsback Park. Photos by Kirsten Severud.

Photo 1 Survey Area CB1 05/06/2022
View of survey area from NW edge due to steep slopes.

Boise sand-verbena Survey Project, Boise Foothills, Highland Hackberry Subdivision. Photos by Ann Debolt.

Photo 2 Survey Area HH1 05/06/2022

Photo 3 Survey Area HH1 05/06/2022

Photo 4 Survey Area HH1 05/06/2022
Mulford's milkvetch (*Astragalus mulfordiae*) plants near the survey area.

Photo 5 Survey Area HH1 05/06/2022

Boise sand-verbena Survey Project, Boise Foothills, Highland Hackberry Subdivision. Photos by Ann Debolt.

Photo 6 Survey Area HH1 05/06/2022

Photo 7 Survey Area HH1 05/06/2022
Hairy wild cabbage (*Caulanthus pilosus)* found at the site.

Photo 8 Survey Area HH1 05/06/2022

Photo 9 Survey Area HH1 05/06/2022

Boise sand-verbena Survey Project, Boise Foothills, Highland Hackberry Subdivision. Photos by Ann Debolt.

Photo 10 Survey Area HH1 05/06/2022

Photo 11 Survey Area HH1 05/06/2022

Photo 12 Survey Area HH1 05/06/2022

Photo 13 Survey Area HH1 05/06/2022

Boise sand-verbena Survey Project, Boise Foothills, Highland Hackberry Subdivision. Photos by Ann Debolt.

Photo 14 Survey Area HH2 05/06/2022

Photo 15 Survey Area HH2 05/06/2022
Social trail with human and animal prints.

Photo 16 Survey Area HH2 05/06/2022

Photo 17 Survey Area HH2 05/06/2022
Pen indicates small Mulford's milkvetch individuals on trail.

Photo 18 Survey Area HH2 05/06/2022
Reproductive Mulford's milkvetch in previous year's rush skeletonweed (*Chondrilla juncea*) thatch.

Photo 19 Survey Area HH2 05/06/2022
Antelope bitterbrush (*Purshia tridentata*) flowering at site with Mulford's milkvetch.

Photo 20 Survey Area HH2 05/06/2022

Photo 21 Survey Area HH2 05/06/2022
Mulford's milkvetch and tufted evening primrose (*Oenothera caespitosa*).

Boise sand-verbena Survey Project, Boise Foothills, Hulls Gulch Reserve. Photos by Kirsten Severud.

Photo 22 Survey Area HG1 05/28/2022
Surveyed with binoculars.

Boise sand-verbena Survey Project, Boise Foothills, Hulls Gulch Reserve. Photos by Kirsten Severud.

Photo 23 Survey Area HG2 05/28/2022

Photo 24 Survey Area HG2 05/28/2022

Photo 25 Survey Area HG2 05/28/2022

Photo 26 Survey Area HG2 05/28/2022

Boise sand-verbena Survey Project, Boise Foothills, Hulls Gulch Reserve. Photos by Don Essig.

Photo 27 Plot HG3 05/18/2022
View East from center of survey area.

Photo 28 Plot HG3 05/18/2022
View South from center of survey area.

Photo 29 Plot HG3 05/18/2022
View North from center of survey area.

Photo 30 Plot HG3 05/18/2022
View West from center of survey area.

Boise sand-verbena Survey Project, Boise Foothills, Military Reserve. Photos by Don Essig.

Photo 31 Plot MR1 05/13/2022
View East from center of survey area.

Photo 32 Plot MR1 05/13/2022
View South from center of survey area.

Photo 33 Plot MR1 05/13/2022
View North from center of survey area.

Photo 34 Plot MR1 05/13/2022
View West from center of survey area.

Boise sand-verbena Survey Project, Boise Foothills, Military Reserve. Photos by Don Essig.

Photo 35 Plot MR2 05/13/2022
View East from center of survey area.

Photo 36 Plot MR2 05/13/2022
View South from center of survey area.

Photo 37 Plot MR2 05/13/2022
View North from center of survey area.

Photo 38 Plot MR2 05/13/2022
View West from center of survey area.

Boise sand-verbena Survey Project, Boise Foothills, Military Reserve. Photos by Don Essig.

Photo 39 Plot MR3 05/13/2022
View East from center of survey area.

Photo 40 Plot MR3 05/13/2022
View South from center of survey area.

Photo 41 Plot MR3 05/13/2022
View North from center of survey area.

Photo 42 Plot MR3 05/13/2022
View West from center of survey area.

Boise sand-verbena Survey Project, Boise Foothills, Military Reserve. Photos by Don Essig.

Photo 43 Plot MR4 05/13/2022
View East from center of survey area.

Photo 44 Plot MR4 05/13/2022
View South from center of survey area.

Photo 45 Plot MR4 05/13/2022
View North from center of survey area.

Photo 46 Plot MR4 05/13/2022
View West from center of survey area.

Boise sand-verbena Survey Project, Boise Foothills, Peggy's Trail. Photos by Kirsten Severud.

Photo 47 Survey Area Peg1 05/24/2022

Photo 48 Survey Area Peg1 05/24/2022

Photo 49 Survey Area Peg1 05/24/2022

Photo 50 Survey Area Peg1 05/24/2022

Boise sand-verbena Survey Project, Boise Foothills, Peggy's Trail. Photos by Kirsten Severud.

Photo 51 Survey Area Peg1 05/24/2022

Photo 52 Survey Area Peg1 05/24/2022

Photo 53 Survey Area Peg1 05/24/2022

Photo 54 Survey Area Peg1 05/24/2022
Close up of coarse grain sands at survey area.

Boise sand-verbena Survey Project, Boise Foothills, Peggy's Trail. Photos by Kirsten Severud.

Photo 55 Survey Area Peg2 05/24/2022

Photo 56 Survey Area Peg2 05/24/2022

Photo 57 Survey Area Peg2 05/24/2022

Photo 58 Survey Area Peg2 05/24/2022

Boise sand-verbena Survey Project, Boise Foothills, Pierce Gulch Farms. Photos by Kirsten Severud.

Photo 59 Survey Area PGF1 05/19/2022

Photo 60 Survey Area PGF1 05/19/2022

Photo 61 Survey Area PGF1 05/19/2022

Photo 62 Survey Area PGF1 05/19/2022

Boise sand-verbena Survey Project, Boise Foothills, Pierce Gulch Farms. Photos by Kirsten Severud.

Photo 63 Survey Area PGF1 05/19/2022
Sandy slope near center of survey area.

Photo 64 Survey Area PGF1 05/19/2022
Close-up of sand particles at site.

Boise sand-verbena Survey Project, Boise Foothills, Table Rock. Photos by Ann Debolt.

Photo 65 Survey Area TR1 05/21/2022

Photo 66 Survey Area TR1 05/21/2022

Photo 67 Survey Area TR1 05/21/2022

Photo 68 Survey Area TR1 05/21/2022

Boise sand-verbena Survey Project, Boise Foothills, Table Rock. Photos by Ann Debolt.

Photo 69 Survey Area TR2 05/21/2022

Photo 70 Survey Area TR2 05/21/2022

Photo 71 Survey Area TR2 05/21/2022

Photo 72 Survey Area TR2 05/21/2022

Photo 73 Survey Area TR2 05/21/2022
Close-up of sandy soils at survey area.

Boise sand-verbena Survey Project, Boise Foothills, Table Rock. Photos by Ann Debolt.

Photo 74 Survey Area TR3 05/21/2022

Photo 75 Survey Area TR3 05/21/2022

Photo 76 Survey Area TR3 05/21/2022

Photo 77 Survey Area TR3 05/21/2022

Boise sand-verbena Survey Project, Boise Foothills, Table Rock. Photos by Ann Debolt.

Photo 78 Survey Area TR3 05/21/2022
Whitetop (*Lepidium draba)* infestation encroaching survey area.

Photo 79 Survey Area TR3 05/21/2022
Close-up of sandy soils and cobble at site.

Boise sand-verbena Survey Project, Boise Foothills, Warm Springs/Mesa Reserve. Photos by Ann Debolt.

Photo 80 Survey Area WS1 05/06/2022

Photo 81 Survey Area WS1 05/06/2022

Photo 82 Survey Area WS1 05/06/2022

Photo 83 Survey Area WS1 05/06/2022

Boise sand-verbena Survey Project, Boise Foothills, Warm Springs/Mesa Reserve. Photos by Ann Debolt.

Photo 84 Survey Area WS1 05/06/2022
Native bunchgrasses and forbs on sandy slope.

Photo 85 Survey Area WS1 05/06/2022
Large Russian olive (*Eleagnus anguistfolia)* at site.

Photo 86 Survey Area WS1 05/06/2022
Native *Cryptantha* sp. found on-site.

Photo 87 Survey Area WS1 05/06/2022
Close-up of soil surface and associated weed species.

Appendix 6

Boise sand-verbena monitoring plot locations.

Camelsback Reserve - CBMP1

Hulls Gulch Reserve - HGMP1

Military Reserve - MRMP1

Appendix 7

Copy of forms with 2022 monitoring data.

Boise sand-verbena Monitoring in the Boise Area Foothills

Location Military Reserve

Plot # _____ Date 6/6/2022 Observer(s) M. BRABEC

Plot Center GPS coordinates _____ GPS Datum _____

Photograph notes (0, 90, 180, 270 degrees from plot center at minimum; additional photos to show plot relocation, plant species, disturbances, and other special features as needed): Pics - S, W, N, E

Total # of Boise sand-verbena plants in plot: 2

Comments on Abundance (distribution, reproduction, density, etc.) → Leaves partially buried in sand.

Two individuals - one appears diseased. Flowers brown, rotted, no seed set. Other plant in flowerbed appears herbivorized by deer/rabbit. One inflorescence has been removed.

Aspect S Slope 10° Substrate SANDY w/ some crusts/moss

Estimated canopy cover for each shrub species in plot using the following abundance categories: <2%, 2-10%, 10-25%, 25-50%, >50% PUTR2 - 2-10%, ERC16 - 2-10%, CHVI8 <2%

Estimated Total Shrub Cover: <2% 2-10% (10-25%) 25-50% >50% (circle one)

List all native bunchgrass species and their associated abundance (canopy cover) using the same categories as for shrubs
HECO - 2-10% / ARPU9 - <2%

Estimated Total Native Bunchgrass Cover: <2% (2-10%) 10-25% 25-50% >50% (circle one)

List of weed species and their estimated abundance: Trace = only a few individuals, easy to overlook; Sparse = spotty and perhaps not seen at first glance, but unlikely to overlook in careful observation; Scattered = widespread, somewhat common, and unlikely to overlook in careful observation; Common = frequent and widespread, obvious at first glance; Dominant = very abundant, a community dominant. Use back of page if >10 species.

BRTE - Dominant
CHTH - SPOTTY
SECE - TRACE
Salsola tragus - Sparse (last years plants)
Centaurea agenus - trace
POBU - trace

List the 4 most common native forb species and their estimated abundance (using the weed species categories). List additional native forbs and their abundance on back of page if desired:

Commandra umbellatum - Trace
Phacelia hastata - Trace
Achillea millefolium - trace
Orobanche sp. Trace

Circle all disturbance factors present in the plot and its estimated abundance (using the weed species categories):
Animal digging X Wildlife tracks_____ Dog tracks_____ Wildfire_____ Trails_____ Roads_____
Non-motorized recreation_____ Motorized recreation_____ Weed invasion X Other _____
Disturbance comments: BRTE seems to be rapidly colonizing the site. The presence of Salsola tragus is new. Two large ant mounds are located within 2 ft of the the two ABMEL plants - perhaps the ant mound is cause of poor health in 1 of the individuals? Deer prints visible around the site.
Record conservation recommendations or other comments on back of page.

Boise sand-verbena Monitoring in the Boise Area Foothills

Location HULLS GULCH - 8th STREET

Plot # _____ Date 5/16/2022 Observer(s) M. BRABEC

Plot Center GPS coordinates 43.646617°, -116.178543° GPS Datum WGS84 Decimal Degrees

Photograph notes (0, 90, 180, 270 degrees from plot center at minimum. Additional photos to show plot relocation, plant species, disturbances, and other special features as needed): * DID NOT HIKE TO PLOT CENTER DUE TO EXTREMELY STEEP, FRAGILE SLOPE. ALL OBSERVATIONS OCCURED FROM THE SHOULDER OF 8th STREET.

Total # of Boise sand-verbena plants in plot: 1

Comments on Abundance (distribution, reproduction, density, etc.) one large flowering individual under a bitterbrush plant. No other plants observed

Aspect S Slope 20° Substrate Sandy

Estimated canopy cover for shrub species in plot: Bitterbrush >50% (25-50%) 10-25% <10% 0%; Sagebrush >50% 25-50% 10-25% <10% (0%); Gray rabbitbrush >50% 25-50% 10-25% (<10%) 0%

Estimated Total Shrub Cover: >50% (25-50%) 10-25% <10% 0% (circle one)

List the 3 most common native bunchgrass species and their associated abundance (canopy cover) using the same categories as for shrubs (note that some plots may have <3 bunchgrass species): ~~ELEL~~, THIN <10%, ACTH7 <10%, ARPU <10%

Estimated Total Native Bunchgrass Cover: >50% 25-50% 10-25% <10% 0% (circle one)

List of weed species and their estimated abundance: Trace = only a few individuals, easy to overlook; Sparse = spotty and perhaps not seen at first glance, but unlikely to overlook in careful observation; Scattered = widespread, somewhat common, and unlikely to overlook in careful observation; Common = frequent and widespread, obvious at first glance; Dominant = very abundant, a community dominant. If >8 weed species, list the 8 most common.

CECY - Scattered
BRTE - SPARSE
SECE - SCATTERED
POBU - TRACE
~~ACMI~~ TRACE
ALAL - TRACE
CHIV - TRACE

List the 4 most common native forb species and their estimated abundance (using the above weed species categories):

MACA - SPARSE
PHHA - SPARSE
ACMI - TRACE
CHDO - SPARSE
GRSQ - SPARSE

Disturbance factor checklist (circle all that apply): Animal digging Wildlife tracks (Dog tracks) Livestock use Trails Roads Non-motorized recreation Motorized recreation Wildfire (Weed invasion) Other _____

Disturbance details (magnitude, extent, etc.) Myrtle Spurge observed below homes adjacent to the ABNE2 plant.

Record conservation recommendations or other comments on back of page.

Slopes steep and area surveyed from roadside. Homeowners have dumped yardwaste from top of hill downslope. Perhaps education to homeowners is required?

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Boise sand-verbena Monitoring in the Boise Area Foothills

Location Camelsback Reserve

Plot # _____ Date June 2, 2022 Observer(s) Mike Mancuso

Plot Center GPS coordinates N 43.63630° W 116.19998° GPS Datum WGS 84

Photograph notes (0, 90, 180, 270 degrees from plot center at minimum; additional photos to show plot relocation, plant species, disturbances, and other special features as needed):
photo notes on back of page

Total # of Boise sand-verbena plants in plot: 3
Comments on Abundance (distribution, reproduction, density, etc.) 3 reproductive plants, each separated by 2-3 meters; total area <10m²; no seedlings observed

Aspect east Slope ~5% Substrate Sandy

Estimated canopy cover for each shrub species in plot using the following abundance categories: <2%, 2-10%, 10-25%, 25-50%, >50% Ericameria nauseosa 10-25% Chrysothamnus viscidiflorus ~2%

Estimated Total Shrub Cover: <2% 2-10% (10-25%) 25-50% >50% (circle one)

List all native bunchgrass species and their associated abundance (canopy cover) using the same categories as for shrubs
Hesperostipa comata <2% Pseudoroegneria spicata <2% Poa secunda <2%
Festuca idahoensis <2% Koeleria macrantha <2% Sporobolus cryptandrus <2%
Estimated Total Native Bunchgrass Cover: <2% (2-10%) 10-25% 25-50% >50% (circle one)

List of weed species and their estimated abundance: Trace = only a few individuals, easy to overlook; Sparse = spotty and perhaps not seen at first glance, but unlikely to overlook in careful observation; Scattered = widespread, somewhat common, and unlikely to overlook in careful observation; Common = frequent and widespread, obvious at first glance; Dominant = very abundant, a community dominant. Use back of page if >10 species.

Secale cereale - common (see below note)
Poa bulbosa - common
Bromus tectorum - dominant
Sisymbrium altissimum - scattered
Chondrilla juncea - sparse
↳ hard to see where Secale so tall
Erodium cicutarium - scattered
Salsola tragus - scattered
Anthriscus scandacina - sparse (1 patch)
Alyssum desertorum - sparse
Bromus hordeaceus - sparse
Centaurea cyanus - sparse

List the 4 most common native forb species and their estimated abundance (using the weed species categories). List additional native forbs and their abundance on back of page if desired:
Plantago patagonica <2%
Grindelia squarrosa <2%
Machaeranthera canescens <2%
Achillea millefolium <2%
Astragalus miser ridius - 1 plant
Moss fairly common in plot

Circle all disturbance factors present in the plot and its estimated abundance (using the weed species categories):
Animal digging ~25-50%, Wildlife tracks_____ Dog tracks_____ Wildfire_____ Trails_____ Roads_____
Non-motorized recreation_____ Motorized recreation_____ Weed invasion >50% Other _____
Disturbance comments: Animal digging disturbance much closer to 25% than 50%

Record conservation recommendations or other comments on back of page.
Secale cereale = dominant in upslope (west) half of plot but scattered in downslope (east) half.
More notes on back.

Plot located ca 50 meters upslope (west) of main trail; mostly gentle lower slope but slope steepens towards upslope end of plot. Weed density substantially higher in north $\frac{2}{3}$rds of plot compared to southern $\frac{1}{3}$rd. Native forbs + grasses substantially more common (and most restricted to) in the southern $\frac{1}{3}^{rd}$ of plot.

Plot center = NE-most Abronia plant; 2 of the 3 plants previously marked with pink pinflag

photos: 3869: 0° 3871: 180°
3870: 90° 3872: 270° > from plot center

3873 = 360° from SE corner of plot ~ overview of southern $\frac{1}{3}$ of plot - lower weed density, with several native species in what looks to be remnant bladed pathway

3874-76 = 3 Abronia plants

Appendix 8

Monitoring plots photographs.

Photo 1 Plot CBMP1 06/02/2022
0° from Plot Center.

Photo 2 Plot CBMP1 06/02/2022
180° from Plot Center.

Photo 3 Plot CBMP1 06/02/2022
90° from Plot Center.

Photo 4 Plot CBMP1 06/02/2022
270° from Plot Center.

Photo 5 Plot HGMP1 05/16/2022
Observations taken from road due to steep, sandy slopes.

Photo 6 Plot HGMP1 05/16/2022
Boise sand-verbena (*Abronia mellifera* var. *pahoveorum*) plant.

Photo 7 Plot HGMP1 05/16/2022
Close-up of single plant.

Photo 8 Plot HGMP1 05/16/2022
Looking NW from 8th Street extension towards plant.

Photo 9 Plot MRMP1 06/06/2022
0° from Plot Center.

Photo 10 Plot MRMP1 06/06/2022
180° from Plot Center.

Photo 11 Plot MRMP1 06/06/2022
90° from Plot Center.

Photo 12 Plot MRMP1 06/06/2022
270° from Plot Center.

Photo 13 Plot MRMP1 06/06/2022
Flowering Boise sand-verbena at site.

Photo 14 Plot MRMP1 06/06/2022
Potential herbivory on one of the two Boise sand-verbena individuals.

Photo 15 Plot MRMP1 06/06/2022
Needle and thread (*Stipa comata*) near plot center.