BLM

United States Department of the Interior
Bureau of Land Management

Supplemental Information
For the
Roberts Mountain Complex Wild Horse Gather and Population Management Plan

Preliminary Environmental Assessment
DOI-BLM-NV-B010-2022-0019-EA

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SUPPLEMENTAL INFORMATION

Secretarial Order 3355 provides direction for the streamlining of NEPA for Agencies within the Department of Interior. The Order established page and timing limitations for preparation of Environmental Impact Statements (EISs) and EAs. The page limit for an EA (including Appendices) has been set at 75 pages. As a result of efforts to comply with the order while providing all relevant information, background and analysis, the Supplemental Information Report is used to augment the EA.

1.0 Regulatory Framework

1.1 Wild and Free-Roaming Horse and Burro Act of 1971

The Wild Free-Roaming Horses and Burros Act of 1971 (WFRHBA) (Public Law 92-195) protects wild free-roaming horses and burros from capture, branding, harassment, or death. Wild horses are to be managed to achieve and maintain a thriving natural ecological balance on public lands. Additionally, management of wild horses and burros is to be undertaken to protect the range from deterioration associated with overpopulation of wild and free-roaming horses.

1.2 Approved RMP Amendments

In 2015, the BLM released a ROD and Approved RMP Amendments (ARMPA) for the Great Basin Region, including the Greater Sage-Grouse (GRSG) Sub-Regions of Idaho and Southwestern Montana, Nevada and Northeastern California, Oregon, and Utah. Please see the objectives and management decisions listed below related to wild horse and burros.

1.2.1. Greater Sage Grouse Management Decisions (MD):

MD Wild Horse and Burros (WHB) 1: For WHB management activities (e.g., gathers), review Objective Special Status Species (SSS) 4 and apply MDs SSS 1 through SSS 4 when reviewing and analyzing projects and activities proposed in GRSG habitat.

MD WHB 2: Manage HMAs in GRSG habitat within established AML ranges to achieve and maintain GRSG habitat objectives.

MD WHB 3: Complete rangeland health assessments for HMAs containing GRSG habitat using an interdisciplinary team of specialists (e.g., range, wildlife, and riparian). The priorities for conducting assessments are:

- HMAs containing Priority Habitat Management Areas (PHMAs), which include riparian areas.
- HMAs containing only General Habitat Management Area (GHMAs).
- HMAs containing sagebrush habitat outside of PHMA and GHMA mapped habitat.
- HMAs without GRSG habitat.

MD WHB 4: Prioritize gather and population growth suppression techniques in HMAs in GRSG habitat, unless removals are necessary in other areas to address higher priority environmental issues, including herd health impacts. Place higher priority on HAs not allocated as HMAs and occupied by wild horses and burros PHMAs.

MD WHB 5: In PHMAs, assess and adjust AMLs through the National Environmental Policy Act (NEPA) process within HMAs when wild horses or burros are identified as a significant causal factor in not meeting rangeland health standards, even if current AML is not being exceeded.

MD WHB 6: In PHMAs, monitor the effects of WHB use in relation to GRSG habitat objectives on an annual basis to help determine future management actions.

MD WHB 7: Develop or amend HMA plans to incorporate GRSG habitat objectives and management considerations for all HMAs within GRSG habitat, with emphasis placed on PHMAs.

MD WHB 8: Consider removals or exclusion of WHB during or immediately following emergency situations (such as fire, floods, and drought) to facilitate meeting GRSG habitat objectives where HMAs overlap with GRSG habitat.

MD WHB 9: When conducting NEPA analysis for wild horse/burro management activities, water developments, or other rangeland improvements for wild horses, address the direct and indirect effects to GRSG populations and habitat. Implement any water developments or rangeland improvements using the criteria identified for domestic livestock.

MD WHB 10: Coordinate with professionals from other federal and state agencies, researchers at universities, and others to utilize and evaluate new management tools (e.g., population growth suppression, inventory techniques, and telemetry) for implementing the WHB program.

1.2.2. Greater Sage-Grouse Required Design Features (RDFs):

RDF Gen 1: Locate new roads outside of GRSG habitat to the extent practical.

RDF Gen 2: Avoid constructing roads within riparian areas and ephemeral drainages. Constrict low-water crossings at right angles to ephemeral drainages and stream crossings (notes that such construction may require permitting under Sections 401 and 404 of the Clean Water Act).

RDF Gen 3: Limit construction of new roads where roads are already in existence and could be used or upgraded to meet the needs of the projects or operation. Design roads to an appropriate standard, no higher than necessary, to accommodate intended purpose and level of use.

RDF Gen 4: Coordinate road construction and use with ROW holders to minimize disturbance to the extent possible.

RDF Gen 5: During project construction and operation, establish and post speed limits in GRSG habitat to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds.

RDF Gen 6: Newly constructed project roads that access valid existing rights would not be managed as public access roads. Proponents will restrict access by employing traffic control devices such as signage, gates, and fencing.

RDF Gen 7: Require dust abatement practices when authorizing use on roads.

RDF Gen 9: Upon project completion, reclaim roads developed for project access on public lands unless, based on site-specific analysis, the route provides specific benefits for public access and does not contribute to resource conflicts.

RDF Gen 10: Design or site permanent structures that create movement (e.g., pump jack/ windmill) to minimize impacts on GRSG habitat.

RDF Gen 11: Equip temporary and permanent aboveground facilities with structures or devices that discourage nesting and perching of raptors, corvids, and other predators.

RDF Gen 12: Control the spread and effects of nonnative, invasive plant species (e.g., by washing vehicles and equipment, minimize unnecessary surface disturbance; Evangelista et al. 2011). All projects would be required to have a noxious weed management plan in place prior to construction and operations.

RDF Gen 13: Implement project site-cleaning practices to preclude the accumulation of debris, solid waste, putrescible wastes, and other potential anthropogenic subsidies for predators of GRSG.

RDF Gen 14: Locate project related temporary housing sites outside of GRSG habitat.

RDF Gen 15: When interim reclamation is required, irrigate site to establish seedlings more quickly if the site requires it.

RDF Gen 16: Utilize mulching techniques to expedite reclamation and to protect soils if the site requires it.

RDF Gen 17: Restore disturbed areas at final reclamation to the pre-disturbance landforms and desired plant community.

RDF Gen 18: When authorizing ground-disturbing activities, require the use of vegetation and soil reclamation standards suitable for the site type prior to construction.

RDF Gen 19: Instruct all construction employees to avoid employees to avoid harassment and disturbance of wildlife, especially during GRSG breeding (e.g., courtship and nesting) season. In addition, pets shall not be permitted on site during construction (BLM 2005b).

RDF Gen 20: To reduce predator perching in GRSG habitat, limit the construction of vertical facilities and fences to the minimum number and amount needed and install anti-perch devices where applicable.

RDF Gen 21: Outfit all reservoirs, pits, tanks, troughs or similar features with appropriate type and number of wildlife escape ramps (BLM 1990; Taylor and Tuttle 2007).

RDF Gen 22: Load and unload all equipment on existing roads to minimize disturbance to vegetation and soil.

1.3 Northeastern Great Basin Resource Advisory Council Standards and Guidelines

The Standard for Wild Horse and Burro Management is as follows:

"Wild horses and burros exhibit characteristics of a healthy, productive, and diverse population. Age structure and sex ratios are appropriate to maintain the long term viability of the population as a distinct group. Herd management areas are able to provide suitable feed, water, cover and living space for wild horses and burros and maintain historic patterns of habitat use.

2.0 Pertinent Wild Horse & Burro Program Regulations

From Title 43, Part 4700 of the Code of Federal Regulations (CFR):

§4700.0-6 Policy. (a) Wild horses shall be managed as self-sustaining populations of healthy animals in balance with other uses and the productive capacity of their habitat (emphasis added).

§4710.4 Constraints on management. Management of wild horses and burros shall be undertaken with the objective of limiting the animals' distribution to herd areas. Management shall be at the minimum level necessary to attain the objectives identified in approved land use plans and herd management area plans.

§4720.1 Removal of excess animals from public lands. Upon examination of current information and a determination by the authorized officer that an excess of wild horses or burros exists, the authorized officer shall remove the excess animals immediately in the following order.

(a) Old, sick, or lame animals shall be destroyed in accordance with subpart 4730 of this title;

(b) Additional excess animals for which an adoption demand by qualified individuals exists shall be humanely captured and made available for private maintenance in accordance with subpart 4750 of this title; and

(c) Remaining excess animals for which no adoption demand by qualified individuals exists shall be destroyed in accordance with subpart 4730 of this title.

4720.2-1 Removal of strayed animals from private lands. Upon written request from a private landowner……the Authorized Officer shall remove stray wild horses and burros from private lands as soon as practicable.

§4730.1 Destruction. Except as an act of mercy, no wild horse or burro shall be destroyed without the authorization of the authorized officer. Old, sick, or lame animals shall be destroyed in the most humane manner possible. Excess animals for which adoption demand does not exist shall be destroyed in the most humane and cost-efficient manner possible.

§4740.1 Use of motor vehicles or aircraft.

(a) Motor vehicles and aircraft may be used by the authorized officer in all phases of the administration of the Act, except that no motor vehicle or aircraft, other than helicopters, shall be used for the purpose of herding or chasing wild horses or burros for capture or destruction. All such use shall be conducted in a humane manner.

(b) Before using helicopters or motor vehicles in the management of wild horses or burros, the authorized officer shall conduct a public hearing in the area where such use is to be made.

§4740.2 Standards for vehicles used for transport of wild horses and burros.

(a) Use of motor vehicles for transport of wild horses or burros shall be in accordance with appropriate local, State and Federal laws and regulations applicable to the humane transportation of horses and burros, and shall include, but not be limited to, the following standards:

(1) The interior of enclosures shall be free from protrusion that could injure animals;

(2) Equipment shall be in safe conditions and of sufficient strength to withstand the rigors of transportation;

(3) Enclosures shall have ample head room to allow animals to stand normally;

(4) Enclosures for transporting two or more animals shall have partitions to separate them by age and sex as deemed necessary by the authorized officer;

(5) Floors of enclosures shall be covered with nonskid material;

(6) Enclosures shall be adequately ventilated and offer sufficient protection to animals from inclement weather and temperature extremes; and

(7) Unless otherwise approved by the authorized officer, transportation shall be limited in sequence to a maximum of 24 hours followed by a minimum of 5 hours of on-the-ground rest with adequate feed and water.

(b) The authorized officer shall not load wild horses or burros if he/she determines that the vehicle to be used for transporting the wild horses or burros is not satisfactory for that purpose.

3.0. Roberts Mountain Complex Wild Horse and HMA Information and Background

3.1. Roberts Mountain HMA

AML for this HMA is 150 wild horses. Many of the horses in this HMA are distributed into the lower elevations of Kobeh Valley during both summer and winter. Several water sources appear to be key in influencing movement patterns. Wild horses also move back and forth into the Whistler Mountain HMA and outside of HMA boundaries in Kobeh Valley.

Wild horses travel throughout the Roberts Mountain HMA with little impediments to their movement. There are several pasture fences and drift fences throughout the two allotments included within the HMA, but the horses know where the fences are located and travel through open gates and around drift fences freely. During summer months, horses may move into the higher elevations and foothills that support pinyon pine and juniper and contain many springs and ponds. During winter months, wild horses often move down to the lower elevations in the southern portion of the HMA as snow accumulates in the mountains. During the winter months, wild horses from the Roberts Mountain HMA have also been documented moving south out of the HMA into the northwest portion of Kobeh Valley and joining with wild horses from the Whistler Mountain and Fish Creek HMAs.

Though there are numerous natural water sources for wild horses within the HMA, water in the southern portion of the Roberts Mountain HMA is limiting. As water availability changes due to changes in seasons or wells being used by permittees, the wild horses move throughout the HMA, north and south, and east and west. A primary water source used by horses in summer is Mud Springs, which is a water-filled depression that holds water until late summer depending upon the annual moisture, wild horse use and use by livestock.

3.2. Whistler Mountain HMA

The Whistler Mountain HMA shares a western boundary with the Roberts Mountain HMA and wild horses frequently move between the two HMAs. Additionally, no fence exists on the western boundary of the HMA in Kobeh Valley, allowing wild horse movement into the valley. The AML for this HMA has been set as 14-24 wild horses. Water sources are limited within the Whistler Mountain HMA, which is likely one of the main reasons that wild horses do not use the HMA year-round.

Prior to construction of the highway right-of-way fence on Highway 278 in the 1990's, wild horses were frequently killed by vehicles on the highway. Drought has been an issue within this HMA, as water is limited, especially on the west side of the HMA in Kobeh Valley.

The Whistler Mountain HMA was originally part of the Kobeh Valley Herd Area, which encompassed all of the northern portion of the Lucky C Allotment and the portion of the Romano Allotment west of State Route 278.

The AML for the Whistler Mountain HMA was developed with consideration of the movement patterns of the wild horses to ensure that their year-round needs are met, and that over utilization of the vegetation did not occur. AML was also set at a level to ensure that wild horses are successful in drought years when forage and water may be limited.

The west portion of the Whistler Mountain HMA has not supported large numbers of wild horses in the past, which may partially be due to limited water sources and drift into other HMAs. Wild horses within the Whistler Mountain HMA use water sources both within and outside of the HMA boundaries. Wild horses have been documented at Lone Mountain Spring and Treasure Well, located in the Lucky C Allotment outside of the HMA boundary. The wild horses move outside of the HMA to the west into Kobeh Valley and intermingle with wild horses in and around the Fish Creek HMA. It is suspected that these animals are one group of animals that move throughout Kobeh Valley, in and out of Whistler Mountain, Fish Creek, and Roberts Mountain HMAs.

Trap Corral Spring, Hash Spring, and Railroad Spring have provided limited water in the southeastern portion of the Whistler Mountain HMA. Wild horses in the northern portion of the HMA have utilized water located at the Mount Hope and Garden Spring with limited access. Stinking Spring, located in the central portion of the HMA has been developed and may provide water year around.

The wild horses using Whistler Mountain HMA and the Kobeh Valley area are strongly associated with the Roberts Mountain HMA. Fence-lines separate the Roberts Mountain, Romano, and Lucky C Allotments however, wild horses have found places to cross the fence-line, taking advantage of open gates, and are able to travel back and forth between the areas. The wild horses are well aware of the location of the gates within the HMA, as indicated by very well defined, conspicuous trails passing through them from one area to another.

Throughout the year, wild horses move back and forth into the Roberts Mountain HMA, as a result of changes in water supply, presence of livestock and changes in forage condition and climate. Field Office staff suspect movement west into the Roberts Mountain HMA to access water sources and cooler, higher elevations in the summer months. Wild horses have been known to frequent the Mt. Hope area in the early spring, and then leave the area, but may be year-round residents in certain years. In addition to the Mount Hope area, the census maps indicate that a portion of the wild horses have been observed on the east flank of Whistler Mountain.

3.3. Fish Creek HMA

The 19,300 acres of the Fish Creek HMA located north of U.S. Highway 50 was originally within the area identified as the Kobeh Valley Herd Area. This herd area was once recommended for identification as a HMA, but not carried forward into the 1986 Resource Management Plan. Instead, the present day boundaries of Fish Creek and Whistler HMAs were identified in the area that had been known as the Kobeh Valley Herd Area. There are no waters within the HMA boundary as designated, and habitat is characterized by pinyon juniper, black sage, Wyoming big sagebrush and sodic bottom vegetation types that are not highly productive.

Wild horses have historically moved through Kobeh Valley, including portions of the Fish Creek HMA, the Whistler Mountain HMA, and Roberts Mountain HMA. For these reasons, the 2004 Fish Creek Complex Rangeland Health Assessment resulted in recommendations to manage this portion of the Fish Creek HMA in conjunction with Kobeh Valley, Whistler Mountain HMA and Roberts Mountain HMA. Since U.S. Highway 50 has been fenced, movement between the remaining portion of the HMA south of the highway has been restricted.

The 2004 FMUD identified an AML for this area of 6-10 wild horses to account for incidental use that may occur within the area. The lack of reliable waters precludes the ability to manage this portion of the HMA for more than incidental use.

3.4 Wild Horse Survival and Reproduction

Generally, annual survival rates of horses are very high on average for mature animals (with average rates of 90% or more; Ransom et al. 2016) and only slightly lower for foals (84%; Ransom et al. 2016). This survivability declines again within the older age classes. In the western US, predation rates on wild horses vary regionally, but are too low to limit population growth in most cases (Andreasen et al. 2021). Death loss due to predation by Mountain Lion or coyote would have minimal impacts to the overall population, and predation rates within the Complex are not known. Human related causes of death such as vehicle collisions or shootings have not been documented within the Complex within the past 10+ years. Population increases within the Complex do not indicate high levels of predation.

According to research conducted by Joel Berger on the Granite Range of Nevada in the early 1980's, many factors affect wild horse population dynamics, reproductive success, and overall success on the range through harsh winters and drought summers (Berger 1986). Observations determined that maternal body weight/condition and band stability influenced gestation length. It was found that small and poorly conditioned mares had shorter gestation lengths, and lower foal production. The research determined that foals raised in better condition ranges suckled longer as foals, matured to puberty faster, and attained "critical body mass" sooner than those raised on poorer quality ranges. Berger states ". . . females that occupied better home-range areas produced more offspring; those offspring then suckled longer and grew faster. The data suggest that female reproductive success was affected more by access to and use of resources than it was by intra-band interactions."

Berger also determined that young horses dispersed from the natal band, finding that 97% of all females and males between the ages of 1-4 years of age moved away from their mother's band. In females, the attainment of puberty was the factor that influenced the dispersal. The result of this dispersal is dynamic movement of young horses between bands, and the prevention of daughter-father relationships or inbreeding. It was also found that males under 5 years of age generally failed to sire offspring and were successful for relatively short periods of their lives compared with females. In Berger's study, mares between the ages of 2-22 produced foals, while for most stallions, average harem tenure was less than four years. As would be expected, body size appeared to influence stallion success.

Other factors that influence reproductive success and foal production included band stability. Regardless of age, mares from unstable bands had significantly lower reproductive success than those from stable bands. Band takeovers from new stallions also influenced reproduction, often resulting in abortions in mares that were less than 6 months pregnant.

Berger states "For any female the best route to maximize reproductive success over her lifetime would be to attain a large body size, remain in a stable band, and feed in a high quality home range. The road toward maximizing individual fitness is filled with complex interwoven, behavioral trade-offs."

Berger also analyzed the inter-relationships of habitat quality, density of population and reproductive success per individual. He determined that the population expanded their range due to the effects of inter-specific competition stemming from a rapidly enlarging population. The following conclusions were derived from the research:

- Individuals from richer resource areas produced better than those from poorer regions.
- The lack of parity in reproductive success between females from good and medium to poor quality ranges indicates that substantial costs were incurred by inhabitants of lower quality ranges, despite lower densities there.
- A density dependent reduction in foal production occurred in good home ranges, yet mares from these areas were still more successful breeders than those from poorer ranges, even though densities at the former were higher.
- Within lower quality ranges, the relative parity of reproductive success over a multiple year period, suggests that individuals may be more apt to space themselves more widely to avoid competition for food resources when resources are less than the best.

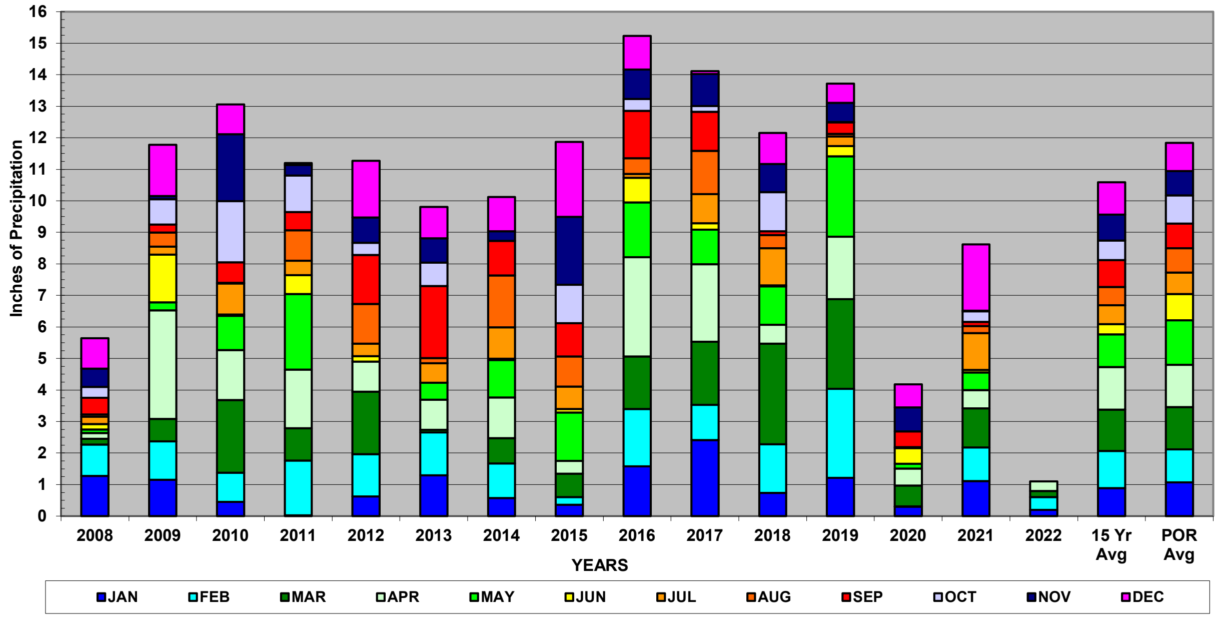
For more information regarding wild horse behavior, biology and population dynamics, the reader is referred to *Wild Horses of the Great Basin* (Berger, 1986) which describes the results of over 8,000 hours of observational data collected on the Granite Range wild horses through a five-year study.

4.0. Vegetation, Climate and Monitoring Summary

Refer also to the documents identified in the 2008 Roberts Mountain Complex Gather EA Section 1.6, particularly, Appendix D which also detailed and summarized climate, vegetation, and monitoring information. The Diamond Valley Weather Station was used in the 2008 Roberts Mountain Gather EA to display precipitation levels. The data recorded at the station since 2007 is sporadic with many months and years completely missing data. The station data recording ended in 2016, so that station will not be used in this current EA. Instead, data will be provided for the Eureka Airport and Pine Valley in addition to Eureka and Beowawe Weather Stations. Totals are highlighted where drought conditions were present (see definition below at 4.2).

4.1. Precipitation Data

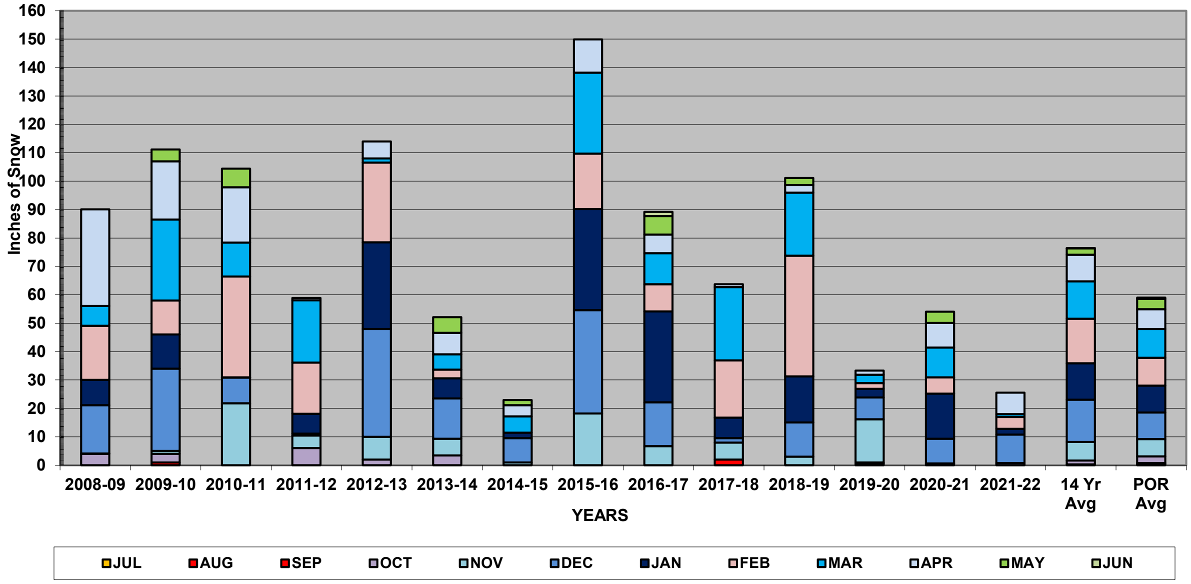
Eureka USDA Weather Monitoring Station – Precipitation Data



Year	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC		Total	
2008	1.27		1		0.18		0.18		0.12		0.17		0.23		0.07	a	0.53		0.35		0.58		0.96		5.64	
2009	1.15		1.22		0.71		3.45		0.25		1.51		0.26		0.44		0.26		0.8		0.1		1.63		11.8	
2010	0.45		0.93		2.3		1.59		1.08		0.04		0.99		0.02	a	0.65		1.94		2.12		0.95		13.1	
2011	0.02		1.74		1.03		1.86		2.39		0.6		0.46		0.97		0.58		1.15		0.34		0.06		11.2	
2012	0.62		1.34		1.99		0.95		0		0.17		0.4		1.26		1.55		0.39		0.8		1.8		11.3	
2013	1.29		1.37		0.08		0.95		0.54		0		0.62		0.16		2.29		0.74		0.77		1		9.81	
2014	0.57		1.1		0.8		1.29		1.19		0.04		1		1.64		1.1		0		0.31		1.08		10.1	
2015	0.36		0.24		0.74		0.41		1.53		0.12		0.71		0.95		1.06		1.22		2.15		2.38		11.9	
2016	1.58		1.82		1.66		3.15		1.74		0.78		0.12		0.5		1.51		0.37		0.94		1.06		15.2	
2017	2.41		1.12		2		2.46		1.1		0.2		0.92		1.38		1.24		0.18		1.01		0.1		14.1	
2018	0.74		1.54		3.19		0.6		1.22		0.03		1.18		0.41		0.13		1.23		0.9	a	0.98		12.2	
2019	1.21		2.83		2.84		1.98		2.55	a	0.33		0.3		0.08		0.37		0.01		0.61		0.61		13.7	
2020	0.3		0.01		0.66		0.54		0.15		0.5		0		0.03		0.5		0		0.76		0.73		4.18	
2021	1.11		1.07		1.24		0.58		0.55		0.09	a	1.16		0.23		0.13		0.34	b	0.02		2.1	zd	6.52	a
2022	0.2		0.4		0.2		0.3		0		0	g	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z
15 Yr Avg	0.89		1.18		1.31		1.35		1.03		0.33		0.6		0.58		0.85		0.62		0.82		1.03		10.8	
POR Avg	1.07		1.05		1.34		1.34		1.41		0.83		0.68		0.78		0.78		0.89		0.78		.89		11.83	

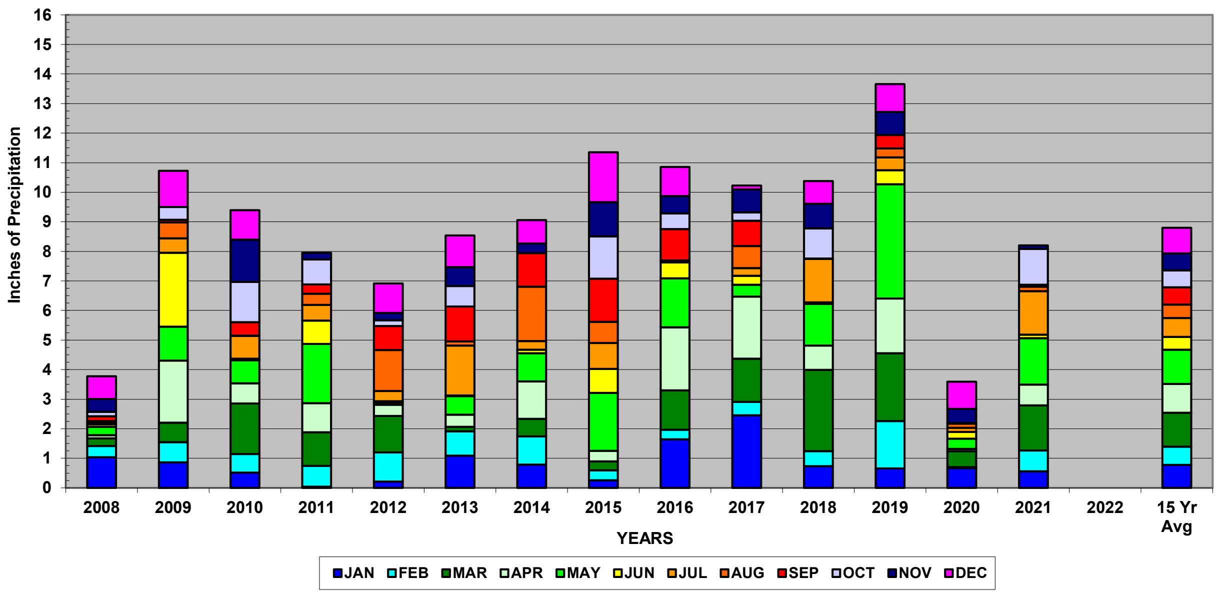
The Eureka Weather Station is located just north of Eureka at 6,538 feet elevation. For the period of record (POR) 4/1/1888– 6/10/2016, the average total annual precipitation was 11.83 inches according to Western Regional Climate Center website (wrcc@dri.edu). Data were provided through May 2022.

Eureka USDA Weather Monitoring Station – Snowfall Data



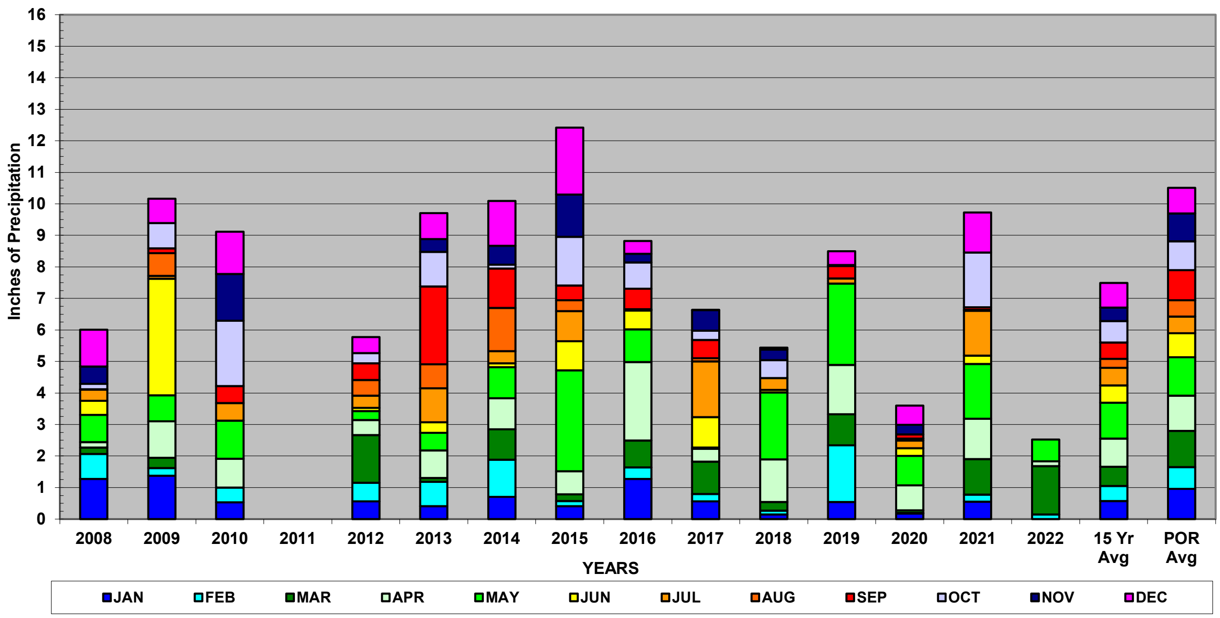
Year	JUL		AUG		SEP		OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		Total	
2008-09	0		0	a	0		4		0.1		17		9		19	a	7		34		0		0		90.1	
2009-10	0		0		1		3		1		29		12		12	a	28.5		20.5		4.2		0		111	
2010-11	0		0	a	0		0		21.8	a	9		0.1		35.5		12	a	19.5		6.5		0		104	
2011-12	0		0		0		6		4.5		0.6		7		18		22		0.8		0		0		58.9	
2012-13	0		0		0		2		8		38		30.5	a	28		1.5		6		0		0		114	
2013-14	0		0		0		3.5	a	5.8		14.2		7.1		3		5.5		7.5		5.5		0		52.1	
2014-15	0		0		0		0		1		8.5		2		0	a	5.7		4		1.8		0		23	
2015-16	0	a	0		0		0		18.2		36.4		35.6		19.5		28.5		11.7		0		0		150	
2016-17	0		0		0		0		6.7		15.5		32		9.5		11		6.5		6.5		1.5		89.2	
2017-18	0		0		2		0		6		1.5		7.2		20.2		25.8		1		0		0		63.7	
2018-19	0		0		0		0		3	a	12.1		16.2		42.5		22.2		2.7		2.5	a	0		101	
2019-20	0		0		0.5		0.5		15.2		7.7		3		2		2.9		1.5		0		0		33.3	
2020-21	0		0		0		0		0.6		8.7		15.9	c	5.8	c	10.4	b	8.7		4		0	c	54.1	
2021-22	0		0	a	0		0.8	b	0		10	f	2		4.2		1.00	c	7.5		0	z	0	g	15.5	b
14 Yr Avg	0		0		0.25		1.41		6.56		14.9		12.8		15.7		13.1		9.49		2.21		0.11		75.8	
POR Avg	.1		0		.6		2.4		6.1		9.4		9.4		9.8		10.2		7.0		3.6		.4		58.9	

Eureka Airport Weather Monitoring Station – Precipitation Data
NOWData - NOAA Online Weather Data: https://www.weather.gov/wrh/Climate?wfo=lkn



Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
2008	1.04	0.37	0.26	0.11	0.28	0.09	0.04	0.07	0.16	0.15	0.44	0.76	3.77
2009	0.86	0.68	0.67	2.1	1.14	2.5	0.49	0.54	0.09	0.43	0	1.23	10.73
2010	0.52	0.62	1.72	0.68	0.78	0.05	0.77	0.01	0.45	1.37	1.43	0.99	9.39
2011	0.04	0.7	1.14	0.99	2	0.79	0.53	0.38	0.31	0.85	0.22	0	7.95
2012	0.21	0.99	1.23	0.38	0.07	0.05	0.35	1.38	0.81	0.2	0.25	0.99	6.91
2013	1.09	0.82	0.16	0.41	0.62	0.03	1.68	0.14	1.19	0.69	0.64	1.07	8.54
2014	0.79	0.95	0.6	1.26	0.95	0.12	0.3	1.84	1.13	0	0.33	0.79	9.06
2015	0.26	0.33	0.31	0.35	1.96	0.81	0.88	0.72	1.46	1.43	1.15	1.69	11.35
2016	1.64	0.33	1.33	2.13	1.66	0.54	0.06	0	1.07	0.52	0.59	0.98	10.85
2017	2.45	0.46	1.46	2.1	0.4	0.3	0.26	0.75	0.86	0.28	0.78	0.13	10.23
2018	0.73	0.51	2.75	0.82	1.41	0.06	1.47	0	0.01	1.02	0.83	0.77	10.38
2019	0.66	1.6	2.3	1.85	3.86	0.48	0.43	0.3	0.46	0	0.78	0.94	13.66
2020	0.67	0.03	0.54	0.08	0.34	0.23	0.14	0.14	0.02	0	0.48	0.92	3.59
2021	0.56	0.7	1.53	0.7	1.57	0.12	1.48	0.15	0.06	1.21	0.12	1.92	10.12
2022	0.06	0.25	1.17	0.62	0.34	M	M	M	M	M	M	M	M
15 Yr Avg	0.77	0.62	1.14	0.97	1.16	0.44	0.63	0.46	0.58	0.58	0.57	0.87	904
Mean	0.7	0.75	1	1.07	1.03	0.37	0.6	0.55	0.51	0.61	0.63	0.85	8.76
Max	2.45	1.6	2.75	2.13	3.86	2.5	1.68	1.84	1.46	1.43	1.43	1.69	13.66
	2017	2019	2018	2016	2019	2009	2013	2014	2015	2015	2010	2015	2019
Min	0.04	0.03	0.16	0.08	0.05	0.03	0.04	0	0.01	0	0	0	3.59
	2011	2020	2013	2020	2001	2013	2008	2018	2018	2020	2009	2011	2020

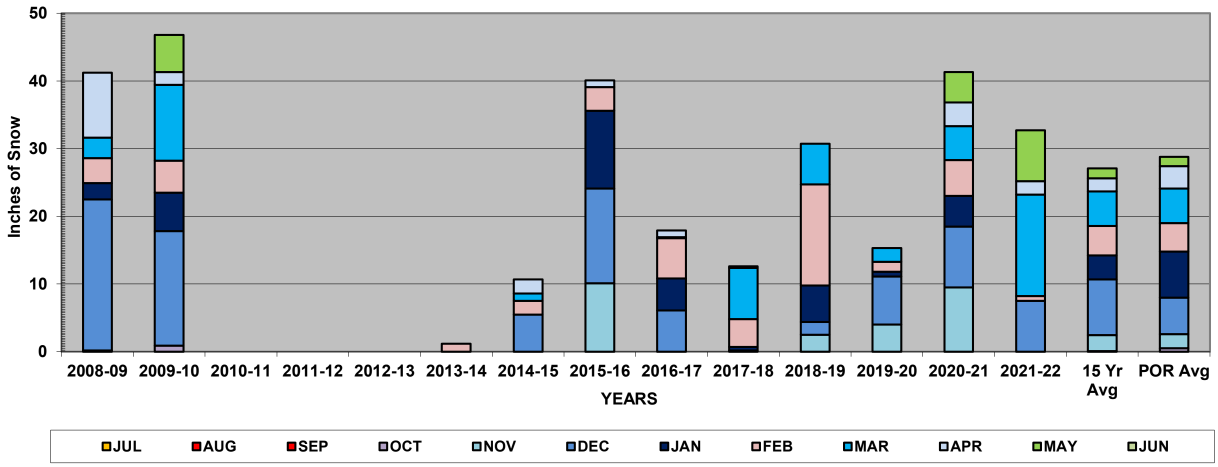
Beowawe, Univ. of Nevada Gund Ranch USDA Weather Monitoring Station – Precipitation Data



Year	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC		Total	
2008	1.27		0.8		0.2		0.17		0.87		0.44		0.36		0.01		0		0.17		0.55		1.17		6.01	
2009	1.38		0.24		0.32		1.16		0.83		3.69		0.09		0.73		0.15		0.8		0		0.77		10.2	
2010	0.53		0.47		0	e	0.91		1.21		0		0.56		0		0.54		2.07		1.49		1.34		9.12	
2011	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	0		0	k
2012	0.56		0.59		1.52		0.47		0.29		0.1		0.39		0.49		0.53		0.33		-----	z	0.5	o	5.27	b
2013	0.41		0.77		0.12		0.88		0.56		0.33		1.08		0.76		2.47		1.1		0.4		0.83		9.71	
2014	0.7		1.18		0.97		0.98		0.99		0.12		0.39		1.37		1.25		0.12		0.6		1.42		10.1	
2015	0.41		0.16		0.22		0.73		3.2		0.92		0.96		0.34		0.47		1.54		1.35		2.12		12.4	
2016	1.27		0.37		0.85		2.49		1.04		0.6		0.02		0.02		0.65		0.83		0.28		0.4		8.82	
2017	0.56		0.24		1.02		0.41		0.04		0.96	f	1.77		0.1		0.58		0.3		0.65		0.01		5.68	a
2018	0.15		0.12		0.27		1.35		2.13		0.08		0.37		0		0		0.57		0.34		0.06		5.44	
2019	0.54		1.8	a	0.99		1.56		2.58		0		0.16		0		0.4		0.01		0.02		0.44		8.5	
2020	0.18		0.02		0.08		0.79		0.93		0.25		0.24		0.06		0.14		0		0.3		0.61		3.6	
2021	0.55		0.23		1.12		1.28		1.74		0.26		1.43		0.03		0.08		1.74		0		1.27	z	9.73	a
2022	0		0.15		1.53		0.15		0.69		0	p	--		--		--		--		--		--			
15 Yr Avg	0.57	0	0.48	0	0.61	0	0.89	0	1.14	0	0.55	0	0.56	0	0.28	0	0.52	0	0.68	0	0.43	0	0.78	0	7.47	
POR Avg	0.96		0.69		1.15		1.12		1.21		0.77		0.52		0.52		0.69		0.91		0.89		0.81		10.2	

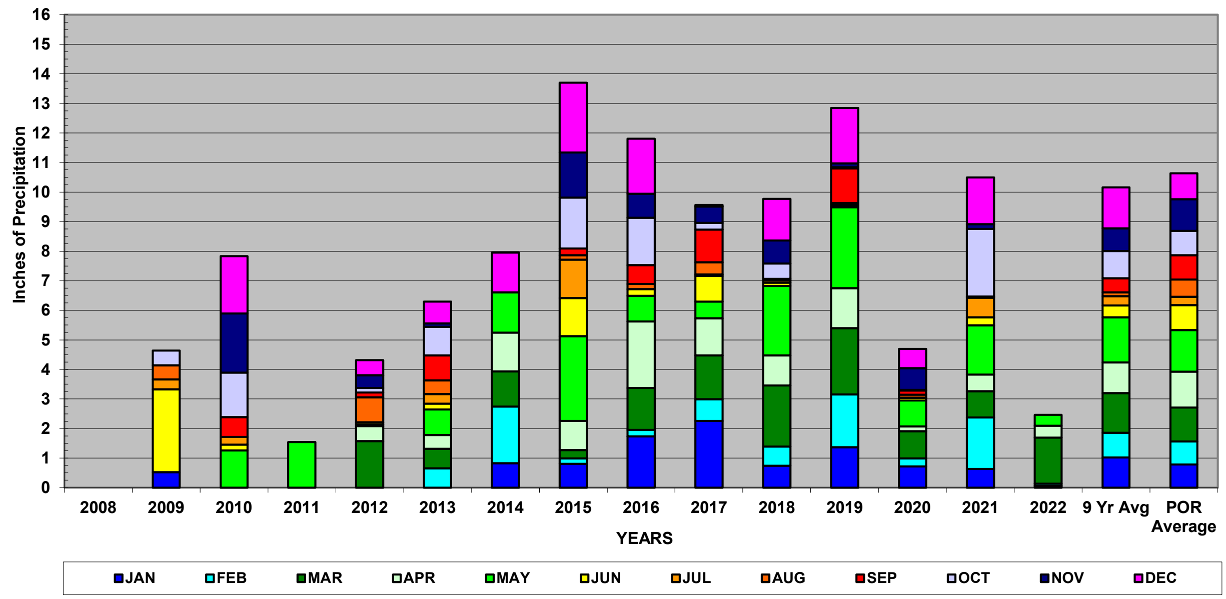
The Beowawe U of N Ranch weather station is at 5,740 ft. elevation and is located less than 20 miles west of the RMC. The period of record from this weather station was from January 1972 to June 2016, though data is provided through May 2022. The average annual precipitation received at this weather station was 10.23” through the period of record according to the Western Regional Climate Center website (wrcc@dri.edu).

Beowawe, Univ. of Nevada Ranch USDA Weather Monitoring Station – Snowfall Data



Year	JUL		AUG		SEP		OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		Total	
2008-09	0		0		0		0	a	0.2		22.3		2.4		3.7		3		9.6		0		0		41.2	
2009-10	0		0		0	a	0.9	b	0		16.9		5.7		4.7		11.2		1.9		5.5		0		46.8	
2010-11	0		0		0		0		0		0	i	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	0	g
2011-12	---	z	---	z	---	z	-----	z	-----	z	0		0	e	-----	z	-----	z	-----	z	0		0		0	h
2012-13	0		0		0		-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	0	i
2013-14	---	z	---	z	0		-----	z	-----	z	-----	z	-----	z	1.2		0		0		0		0		1.2	f
2014-15	0		0		0		0		0		5.5		0		2		1.1		2.1		0		0		10.7	
2015-16	0		0		0		0		10.1		14		11.5		3.5		0		1		0		0		40.1	
2016-17	0		0		0		0		0		6.1		4.7		6		0.1		1		0		0	g	17.9	a
2017-18	0		0		0		0		0		0.2		0.5		4.1		7.6		0.2		0		0		12.6	
2018-19	0		0		0		0		2.5		1.9		5.4		14.9	a	6		0		0		0		30.7	
2019-20	0		0		0		0		4		7.1		0.7		1.5		2		0		0		0		15.3	
2020-21	0		0		0		0		9.5		9	a	4.5		5.3		5		3.5		4.5		0		41.3	
2021-22	0		0		0		0		0		7.5		0		0.7		15		2		7.5		0	p	32.7	a
15 Yr Avg	0		0		0		0.08		2.39		7.55		4.29		4.26		3.67		3.12		1		0.63	7.55	25.8	
POR	0		0		0		.5		2.1		5.4		6.8		4.2		5.1		3.3		1.4		0		28.7	

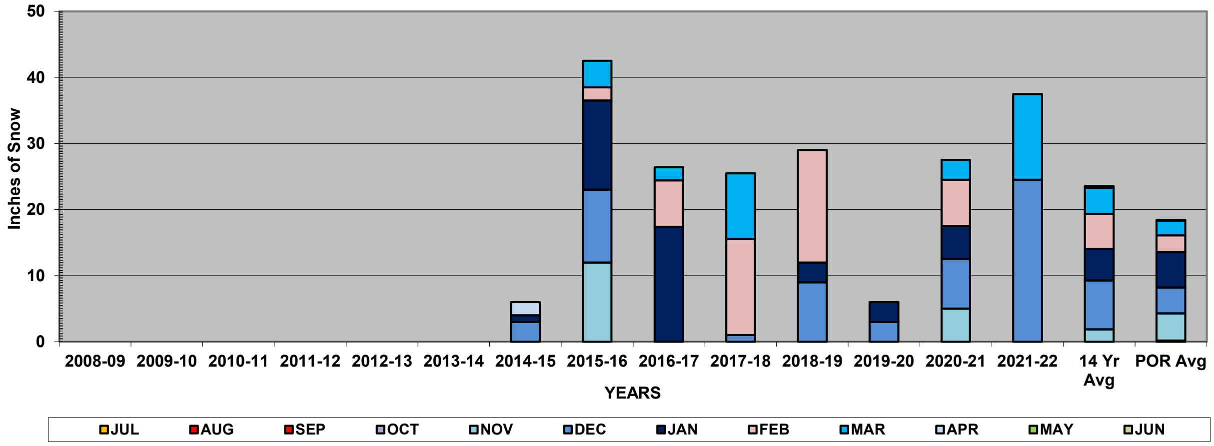
Pine Valley/Bailey Ranch Weather Monitoring Station – Precipitation Data



Year	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC		Total	
2008	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	0	l
2009	0.52		0		-----	z	-----	z	-----	z	2.81		0.34	h	0.47		-----	z	0.5	c	-----	z	-----	z	4.3	g
2010	-----	z	-----	z	-----	z	-----	z	1.26	s	0.2		0.26		0		0.67	c	1.5	c	2	c	1.94	g	4.63	f
2011	-----	z	-----	z	-----	z	-----	z	1.54		-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	1.54	k
2012	-----	z	-----	z	1.57	m	0.51		0.06	d	0.07	l	0		0.85	c	0.16		0.15	j	0.43	e	0.51	k	2.01	f
2013	-----	z	0.65	d	0.67	g	0.46	d	0.87	c	0.19	b	0.33	b	0.46	d	0.85		0.96	b	0.12		0.73	t	4.89	c
2014	0.83		1.91		1.19	o	1.32		1.36		-----	z	-----	z	-----	z	-----	z	-----	z	0	x	1.34	a	6.76	g
2015	0.81		0.18		0.28		0.99		2.87		1.28		1.3		0.16		0.22		1.72		1.53		2.36	c	13.7	
2016	1.74		0.21		1.42		2.25		0.87		0.23		0		0.17		0.64		1.6		0.81		1.87		11.8	
2017	2.26		0.73		1.49		1.25		0.56		0.87		0.06		0.41		1.1		0.23		0.55		0.05		9.56	
2018	0.74		0.65		2.07		1.02		2.35		0.1		0.08		0		0.05		0.52		0.78		1.41		9.77	
2019	1.37		1.79		2.24		1.35		2.74		0.02		0.05		0.07		1.17		0.04		0.13		1.87		12.8	
2020	0.72		0.27		0.92		0.16		0.88		0.09		0.01		0.09		0.15		0.02		0.73		0.65		4.69	
2021	0.63		1.75		0.88		0.57		1.66		0.27		0.66		0		0.05		2.28		0.17		1.57		10.5	
2022	0.06		0.08		1.55		0.41		0.36		-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	2.46	g
9 Year Average	1.02		0.84		1.34		1.04		1.52		0.41		0.31		0.13		0.48		0.92		0.76		1.39		10.4	
Period of Record Avg	0.78		0.78		1.15		1.21		1.41		0.85		0.28		0.58		0.83		0.82		1.07		0.88		10.6	

The Pine Valley Weather Station is located north of Eureka at the Bailey Ranch at an elevation of 5,450 feet, approximately 45 miles north of the RMC. The period of record is 7/1/82 through 6/1/2016 according to the wrcc.dri.edu website. However, monthly precipitation totals are provided through May 2022. The Period of record average annual precipitation is 10.6".

Pine Valley Weather Monitoring Station – Snowfall Data



Year	JUL		AUG		SEP		OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		Total	
2008-09	---	z	---	z	---	z	---	z	-----	z	-----	z	0		0	a	-----	z	-----	z	---	z	0		0	i
2009-10	0	h	0		---	z	0	c	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	0	e	0		0	h
2010-11	0		0		0	c	0	c	0	g	0	k	-----	z	-----	z	-----	z	-----	z	0	b	----	z	0	g
2011-12	---	z	---	z	---	z	---	z	-----	z	-----	z	-----	z	-----	z	-----	z	0		0	d	0	l	0	j
2012-13	0		0	c	0		0	j	-----	z	-----	z	-----	z	-----	z	-----	z	-----	z	0	a	----	z	0	h
2013-14	---	z	--	z	---	z	---	z	--	z	-----	z	-----	z	-----	z	-----	z	-----	z	---	z	----	z	0	l
2014-15	---	z	---	z	--	z	---	z	0	x	3	a	1	a	0	a	0		2		0		0		6	e
2015-16	0		0		0		0		12	a	11	b	13.5		2		4		0		0		0		42.5	
2016-17	0		0		0		0		0		-----	z	17.4		7		2		0		0		0		26.4	a
2017-18	0		0		0		0		0		1		0		14.5		10		0		0		0		25.5	
2018-19	0		0		0		0		0		9		3		17		0		0		0		0		29	
2019-20	0		0		0		0		0		3		3		0		0		0		0		0		6	
2020-21	0		0		0		0		5		7.5		5		7		3		0		0		0		27.5	
2021-22	0		0	a	0		0		0	z	24.5		0		0		13		0		0		----	z	37.5	a
9 Yr Avg	0		0		0		0		1.89		7.38		4.77		5284		4		0.22		0		0		23.5.3	0
POR AVG	0		0		0		.2		4.1		3.9		5.4		2.5		2.2		0		.1		0		18.3	

a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.
MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5
Individual Months not used for annual or monthly statistics if more than 5 days are missing.
Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

4.2 Precipitation Data Analysis

Eureka

The Eureka weather station provides consistent data with few periods of missing data after 1965 though the period of record begins in 1888. For the period of 1965-2022 (58 years), 15 years had annual precipitation that fell below 75% of normal and met the qualification of drought[1]. In recent past, this occurred in 2008, 2020 and 2021. Further analysis of precipitation during key spring months (March-June) reflected periods

[1] Drought is defined by the Society for Range Management as "…prolonged dry weather when precipitation is less than 75% of the average amount" (SRM 1989).

with much reduced precipitation and levels below 75% of average which would impact spring growth and overall health of perennial vegetation. These periods occurred in 2008, 2012-2015 and 2020-2021. Summer precipitation levels (July-September) was below 75% of average 2008-2010 and 2019-2021. Snow data has been included which shows snow levels varying widely from year to year. Many of the past 14 years showed snow levels above average with only three years (2014-15, 2019-20 and 2021-22) showing levels below 75% of average.

Eureka Airport
The data for the Eureka Airport was obtained from the website indicated with the precipitation tables. No Period of Record was provided. The 15-year average indicates 8.79 inches of precipitation. The Airport is located at approximately 5,988 feet in elevation and is representative of valley locations in the area. 2008 and 2020 precipitation levels fall below 75% of average with the remaining years with several years reflecting higher than 120% of normal. 2008, 2012-2013, 2020 and 2022 reflect spring moisture levels below 75% of the 15 year average. Snow data was not available for this location.

Beowawe, University of Reno Gund Ranch
This weather station is often utilized for analysis in Central Nevada as it is one of few available and generally has consistent data. With the exception of 2011, this data set appears complete since the most recent gather in 2008. For the period of record (1972-2022, 51 years) 16 years had precipitation which met the definition of drought (75% of average). Most recently, these periods occurred in 2008, 2012, 2017-2018 and 2020.

Snow data for Beowawe reflects great variation since the most recent wild horse gather. Four of the past eight years reflect snow levels less than 75% of the period of record average and the remaining four reflect levels higher than that average.

Pine Valley
The Pine Valley weather station provides data from 1982 through May 2022. There are numerous gaps in the data and therefor it is difficult to assess the various years for drought. The past 9 years have the most consistent data, with only one of those years (2020) showing precipitation less than 75% of the period of record average. 2015 reflected 129% of normal precipitation. Snow data is variable, with a 14-year average of 23.5 inches. 2015-2016 reached 42.5 inches with 2019-2020 only showing 6 inches of snow.

Summary and Drought Discussion
The precipitation tables and graphs show that precipitation received in the region associated with the Roberts Mountain Complex is highly variable and often meets the definition of drought. Even if the entire year did not meet that definition, variable precipitation levels in spring months have a direct correlation to growth and health of forage species. The growing period for perennial grasses is a critical time for moisture to be received. Depending upon elevation, aspect and specific site conditions, perennial grasses will begin to green-up in March-April and continue to grow and set seed until May-June. April and May would typically be the most important for growth of perennial grasses and forbs in central Nevada. Precipitation levels and timing is critical to rangeland health and vegetation availability. Obviously, precipitation and snow levels also directly affect the availability of waters whether from springs, or the flow in creeks, a well as the health of the riparian systems.

Information obtained from the U.S. Drought Monitor (www.drought.unl.edu) an the Climate Prediction Center indicates Persistent Drought for the season Nevada wide. As of June 21, 2022, the U.S. Drought Monitor indicates 99.52% of the state of Nevada in Severe Drought, with 58.54% Extreme (which overlaps the Roberts Mountain Complex), and 21.32% of the state in Exceptional Drought. The long-term Objective Drought Blend Equivalent indicates Central Nevada to continue in the Severe and Extreme Drought categories. Additionally, the Vegetation Drought response Index (VegDRI) and Palmer Drought Severity

Index both show the majority of Nevada in Moderate to Severe drought with central Nevada and specifically the region surrounding the Roberts Mountain Complex showing the most severe conditions. Reviewing data over the past 5 years, Central Nevada was in Severe to Extreme Drought since 2020 for the Mid-late June time frame.

During periods of drought, it becomes even more important to prevent overgrazing of perennial plants. A significant impact of drought on rangelands is a severe reduction in herbage production. Not only is less production of forage available for animals, but heavy use can harm or kill the plants.

The effect of drought on range plants is a function of both the intensity and duration of drought and the general health or vigor of the vegetation before the drought. Plants with healthy root systems and adequate carbohydrate reserves will fare much better during and after drought than plants that have been struggling to maintain themselves all along. During a drought year, these plants might have to rely on stored carbohydrates for as long as 9 to 10 months and have as little as 2 to 3 months to recharge reserves for the coming year (PNW 200, March 1980).

During drought, plant growth can be arrested before carbohydrates are replaced, or the replenishment period may be shorter than normal. Carbohydrates may not be fully restored, and grasses enter a longer than normal dormant period with less than their full complement of energy. Heavy grazing, especially during the latter part of the growing season, hinders the accumulation of carbohydrates (PNW 200, March 1980).

Standard recommendations grazing management during drought periods include allowing grasses as much opportunity as possible to grow before the full impact of the drought arrives and keeping use as light as feasible in order for plants to make maximum use of soil moisture.

Low annual precipitation levels and drought are issues throughout the Roberts Mountain Complex. Low precipitation and drought have affected current health and recovery of the rangeland vegetation from past overuse by wild horses and livestock. This has resulted in reduced availability of forage to livestock, wildlife, and wild horses.

4.3 Vegetation

The vegetation resources within and outside the Roberts Mountain Complex are dictated by geologic and climatologic factors within the Great Basin, which determine what type of plant communities can be sustained.

The Roberts Mountain Complex is dominated by sagebrush and pinyon/juniper plant communities. As shown in the tables below, sagebrush communities consist of about 80% of the Complex, with Pinyon Juniper 15-18% of the landscape. In general, wild horses do not prefer heavily timbered areas, but would frequently use open Pinyon-Juniper and individual trees for shade in summer or shelter in winter. Because of the position on the landscape, these upper elevations would sometimes be used throughout the year by wildlife, livestock, and wild horses. Lower elevations provide important winter habitat where snow depth would not deter use.

Table 1: Roberts Mountain Complex Vegetation Communities

Description	Acres	Percent
Inter-Mountain Basins Big Sagebrush Shrubland	133,854	70.3%
Great Basin Pinyon-Juniper Woodland	27,036	14.2%
Great Basin Xeric Mixed Sagebrush Shrubland	10,437	5.5%
Inter-Mountain Basins Montane Sagebrush Steppe	9,569	5.0%

Description	Acres	Percent
Inter-Mountain Basins Greasewood Flat	6,064	3.2%
Inter-Mountain Basins Mixed Salt Desert Scrub	3,600	2%
Invasive Perennial Grassland		
Inter-Mountain Basins Semi-Desert Grassland		
Inter-Mountain Basins Semi-Desert Shrub Steppe		
Inter-Mountain Basins Cliff and Canyon		
Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland		
Invasive Annual Grassland		
Inter-Mountain Basins Big Sagebrush Steppe		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland		
Invasive Annual and Biennial Forbland		
Inter-Mountain Basins Playa		
Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Complex		
Total Acres	190,548	

The ecological sites within an area are a function of soils and precipitation that support vegetation can be sustained. As seen in the table below, the Loamy 8-10" precipitation zone comprises 51% of the Complex. This ecological site should produce Wyoming big sagebrush with an understory of perennial grasses such as Indian Ricegrass. Also note that Pinyon Juniper ecological sites total approximately 19% of the land area within the Complex.

Table 2: Ecological Sites within the Roberts Mountain Complex

Ecological Site	Acres	Percent
CALCAREOUS MAHOGANY SAVANNA	0	0.0%
LOAMY 5-8 P.Z.	62	0.0%
SODIC FLAT 5-8 P.Z.	82	0.0%
SILTY 8-10 P.Z.	225	0.1%
Pinus monophylla-Juniperus osteosperma/Artemisia nova/Pseudoroegneria spicata ssp. spicata-Achnatherum hymenoides	233	0.1%
LOAMY BOTTOM 14+ P.Z.	262	0.1%
LOAMY 12-16 P.Z.	782	0.4%
SHALLOW CALCAREOUS SLOPE 14+ P.Z.	2,396	1.3%
SHALLOW CALCAREOUS SLOPE 8-10 P.Z.	2,644	1.4%
Pinus monophylla-Juniperus osteosperma/Artemisia nova/Achnatherum thurberianum-Pseudoroegneria spicata ssp. spicata	3,220	1.7%
SODIC TERRACE 6-8 P.Z.	3,244	1.7%
Pinus monophylla-Juniperus osteosperma/Artemisia tridentata ssp. vaseyana/Pseudoroegneria spicata ssp. spicata	4,574	2.4%
LOAMY BOTTOM 10-14 P.Z.	4,645	2.4%
SHALLOW CALCAREOUS LOAM 8-10 P.Z.	7,448	3.9%
(blank)	8,785	4.6%
SALINE BOTTOM	10,521	5.5%

Ecological Site	Acres	Percent
Pinus monophylla-Juniperus osteosperma/Artemisia tridentata ssp. vaseyana/Pseudoroegneria spicata ssp. spicata-Achnatherum thurberianum	13,407	7.0%
Pinus monophylla-Juniperus osteosperma/Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata ssp. spicata-Achnatherum hymenoides	14,508	7.6%
LOAMY 10-12 P.Z.	16,099	8.4%
LOAMY 8-10 P.Z.	97,406	51.1%
Grand Total	**190543**	100.0%

4.4 Roberts Mountain Complex Monitoring Summary

Refer also to the 2007 RMC Gather EA Appendix D for previous climate, monitoring, and trend data. Monitoring in the RMC since the 2008 gather has included utilization transects, drought monitoring, documentation of forage and water availability, Riparian Proper Functioning Condition (PFC), plant composition, general rangeland health indicators, apparent trend and photo documentation. The most recent monitoring conducted 2018-2020 included documentation of upland and riparian conditions throughout the RMC, including outside of the HMA, as well as animal condition and distribution. Additional information regarding animal distribution and condition was also documented during inventory flights.

A total of sixteen key management areas (KMAs) were visited within the boundaries of the Whistler Mountain, Fish Creek (north) and Roberts Mountain HMAs. Sign of wild horses (tracks, droppings or stud piles) was noted at all but three of the KMAs. Cattle sign was also noted as well as the age of the sign to provide additional information as to the use of the area. Fresh cattle sign was noted at several sites with many others noted for old cattle sign and a limited number documented as no cattle sign present at all.

Additionally, more than sixteen riparian or water locations were documented including range improvements (developed water sources such as pipelines or troughs), springs (lentic) and creeks (lotic) throughout the Complex within and outside of the boundaries of the HMAs. Similar to the upland sites, cattle and horse sign was noted if present or absent with descriptors provided as to the age of the sign.

Upland sites were primarily ecological sites that included sagebrush with an understory of perennial grasses and forbs. The majority of the sites were in the Major Land Resource Area 28B and identified as the Loamy 8-10 precipitation zone, supporting Wyoming Big Sagebrush and Indian ricegrass. It was noted throughout the KMAs that the sites were not only drought affected but had experienced downward trends since monitoring prior to the previous gather. Apparent trend was noted to be downward at 7 of the 16 KMAs. Only one site was noted to potentially be a stable to upward trend with the remaining noted as not apparent or static. Most sites reflected limited perennial grasses compared to the potential for the ecological site, with small size of grasses, grasses caged in shrubs and notable to severe pedestalling of plants. Plant death was noted at several sites. Many sites also had notable erosion pavement and bare ground beyond what would be expected for the site. Several KMAs were noted to potentially having crossed a threshold with a few others noted as having good potential for improvement. Nearly all KMAs were documented as being at risk of further degradation or complete loss of perennial grasses. The lack or absence of the key perennial grass species, and soil loss due to pedestaling and erosion are serious issues for rangeland health and the future ability of the range to sustain grazing animals and provide healthy habitat.

Of the sixteen water sources visited, only three were noted as having incidental use by wild horses with the remaining sites regularly or heavily used. Current or fresh cattle sign was noted at only a few sites with old sign noted at most locations. In the case of one region, no cattle sign was noted, not even very old sign. The sites included developed springs, ponds, troughs and creeks. Use and impacts varied by site depending on the accessibility of the area, soil types, water availability and level of use. Waters within the HMA boundaries is relatively limited to several small springs and Roberts Creek. Mud Springs is an important source in the Roberts Mountain HMA located in Kobeh Valley. It sustains heavy use by wild horses year-round. The Nebraska sedge is being trampled out and over utilized by wild horses and the riparian influence is shrinking. The water availability has decreased markedly over the past 4-5 years. Concentrated use by wild horses is being made of the Henderson Creek area with no sign of any recent or past cattle use. This area is outside of the HMA boundaries. Issues noted include channeling of the meadow, head cuts, heavy and severe use of riparian species, loss of diversity, hummocking, damage to shrubs, trailing, and digging by horses to access water. The activities of wild horses is contributing to the shrinking and drying of the riparian systems, erosion and overall degradation of the riparian system.

The following tables reflect the status of the riparian sources within the boundaries of the Roberts Mountain Complex proposed gather area which may be influenced by wild horses both inside and outside of HMA boundaries. Ratings include Proper Functioning Condition (PFC), Functioning-at Risk (FAR), and Nonfunctional (NF). Trends are also provided.

Table 3. Lotic Proper Functioning Condition (PFC) monitoring performed since 2008 in the Roberts Mountain Complex gather area

Rating Date	Stream name	Reach ID	Reach Length (miles)	Rating	Trend
Sep 2021	Birch Creek	-	3.09	FAR	Static
Oct 2020	Pete Hanson	South Fork	2.28	PFC	
Sep 2020	Pete Hanson	4	1.90	PFC	
Sep 2020	Pete Hanson	1	2.00	PFC	
Sep 2020	Pete Hanson	2	0.67	PFC	
Sep 2020	Pete Hanson	3	1.45	PFC	
Aug 2019	Willow Creek	10	0.70	FAR	Upward
Jul 2019	Pete Hanson	3	1.30	PFC	
Jul 2019	Pete Hanson	4	1.50	FAR	Upward
Nov 2017	Henderson Creek	4	3.15	PFC	
Nov 2017	Roberts Creek	Lower	1.73	PFC	
Nov 2017	Henderson Creek	2	0.56	FAR	Downward
Nov 2017	Henderson Creek	3	0.86	PFC	
Nov 2017	Vinini Creek 62	4	0.61	FAR	Upward
Oct 2017	Roberts Creek Tributary	1	1.49	PFC	
Oct 2017	Vinini Creek 62	1	0.66	PFC	
Oct 2017	Vinini Creek 62	2	1.38	PFC	
Oct 2017	Vinini Creek 62	3	0.95	PFC	
Oct 2017	Roberts Creek Tributary	2	0.43	FAR	Not Apparent
Oct 2017	Pete Hanson	2	0.47	PFC	
Oct 2017	Pete Hanson	3	1.20	PFC	
Oct 2017	Henderson Creek	1	0.56	FAR	Not Apparent
Nov 2016	Santa Fe 32	-	0.58	FAR	Not Apparent
Sep 2016	Ferguson Creek 3	3	0.48	PFC	
Sep 2016	Santa Fe 40	2	0.34	PFC	
Sep 2016	Sante Fe 40	1	0.11	PFC	

Rating Date	Stream name	Reach ID	Reach Length (miles)	Rating	Trend
Sep 2016	Ferguson Creek 3	1	0.14	FAR	Downward
Sep 2016	Ferguson Creek 3	2	0.57	FAR	Downward
Sep 2016	Santa Fe 22 Lotic R01	1	0.11	FAR	Not Apparent
Sep 2016	Santa Fe 40	4	0.16	FAR	Not Apparent
Sep 2016	Santa Fe 40	3	0.08	FAR	Upward
Sep 2016	Santa Fe 13	1	0.13	PFC	
Sep 2016	Santa Fe 13	5	0.14	PFC	
Sep 2016	Santa Fe 16	-	1.03	PFC	
Sep 2016	Santa Fe	1, 3, 4	0.53	PFC	
Sep 2016	Santa Fe	5	0.09	PFC	
Sep 2016	Santa Fe 22 Lotic R02	2	1.45	PFC	
Sep 2016	Santa Fe 76	1 & 2	0.34	PFC	
Sep 2016	Santa Fe 13	3	0.23	FAR	Downward
Sep 2016	Ferguson Creek 2	1 & 3	0.42	PFC	
Sep 2016	Ferguson Creek	2	0.14	PFC	
Sep 2016	Ferguson Creek	1	0.28	NF	
Sep 2016	Santa Fe 63	-	0.58	FAR	Not Apparent
Jul 2013	Vinini Creek 62	3	1.12	FAR	Downward
Jul 2013	Vinini Creek 62	1	0.64	FAR	Not Apparent
Jul 2013	Vinini Creek 62	4	0.66	FAR	Not Apparent
Jul 2013	Roberts Creek 59	2	0.36	PFC	
Jul 2013	Roberts Creek 59	4	0.53	PFC	
Jul 2013	Roberts Creek 59	1	0.14	FAR	Downward
Jul 2013	Vinini Creek 62	2	1.49	FAR	Not Apparent
Jul 2013	Roberts Creek 59	3	0.36	FAR	Upward
Jul 2013	Roberts Creek 59	5	1.23	PFC	
Jul 2013	Henderson Creek 50	3	0.14	NF	
Jul 2013	Henderson Creek 50	4	0.64	NF	
Jul 2013	Henderson Creek 50	5	0.14	NF	
Jul 2013	Henderson Creek 50	7	0.29	NF	
Jun 2013	Three Bars 29	1	0.34	NF	
Jun 2013	Three Bars 29	3	0.51	NF	
Jun 2013	Three Bars 20	-	0.09	NF	
Jun 2013	Three Bars 29	2	0.24	FAR	Downward
Jun 2013	Three Bars 29	5	0.33	FAR	Downward
Jun 2013	Three Bars 29	4	0.11	FAR	Upward
Jun 2013	Cottonwood Canyon 31	1	0.25	PFC	
Jun 2013	Cottonwood Canyon 31	3	0.08	PFC	
Jun 2013	Cottonwood Canyon 31	2	0.05	FAR	Downward

Rating Date	Stream name	Reach ID	Reach Length (miles)	Rating	Trend
Jun 2013	Three Bars Spring 9	1	0.30	NF	
Jun 2013	Three Bars Spring 10	2	0.62	NF	
Jun 2013	Jackass Creek	-	0.25	FAR	Downward
Jun 2013	West Cottonwood Canyon	-	0.10	NF	
Sep 2009	Pete Hanson	-	0.18	PFC	
Sep 2009	Roberts Creek 03	3 (Upper)	0.51	NF	
Sep 2009	Roberts Creek	1 & 2	0.30	FAR	Downward
Sep 2009	Vinini Creek	-	0.25	PFC	

Table 4. Lentic Proper Functioning Condition (PFC) monitoring performed since 2008 in the Roberts Mountain Complex gather area.

Rating Date	Riparian Name/Identifier	Acres	Rating	Trend
Aug 2018	Warm Springs	11.900	FAR	Not apparent
Nov 2017	Roberts Creek	-	FAR	Downward
Nov 2017	Rabbit Spring	0.340	PFC	
Oct 2017	Little Summer Camp	-	PFC	
Nov 2016	Grubb Flat Spring 6	2.024	PFC	
Nov 2016	Santa Fe 49 & 50	1.499	PFC	
Nov 2016	Santa Fe 1	0.896	FAR	Downward
Nov 2016	Santa Fe 29	0.038	FAR	Not apparent
Nov 2016	Santa Fe 31	0.039	PFC	
Nov 2016	Santa Fe 53	0.165	FAR	Not apparent
Nov 2016	Santa Fe 54	0.007	PFC	
Nov 2016	Santa Fe 2: Spring 56 & 57	1.478	NF	
Nov 2016	Santa Fe 26	<00.1	FAR	Upward
Nov 2016	Santa Fe 27	<00.1	PFC	
Nov 2016	Santa Fe 28	0.015	PFC	
Nov 2016	Santa Fe 3: Spring 58 & 59	0.286	NF	
Nov 2016	Santa Fe 46	0.023	FAR	Upward
Nov 2016	Santa Fe 47	0.019	FAR	Upward
Nov 2016	Santa Fe 55	0.013	FAR	Not apparent
Sep 2016	Santa Fe 16	0.074	FAR	Upward
Sep 2016	Santa Fe 19	0.011	PFC	
Sep 2016	Santa Fe 20	0.034	PFC	
Sep 2016	Santa Fe 40 Meadow A	0.270	PFC	
Sep 2016	Santa Fe 40 Meadow B	0.151	PFC	
Sep 2016	Santa Fe 44	0.004	FAR	Upward
Sep 2016	Santa Fe 45	0.041	NF	
Jul 2013	Roberts Mountain 28	-		
Jul 2013	Roberts Mountain 31	-	FAR	Downward
Jul 2013	Roberts Mountain 52	0.410	NF	

Rating Date	Riparian Name/Identifier	Acres	Rating	Trend
Jul 2013	Roberts Mountain 53	0.156	FAR	Downward
Jul 2013	Roberts Mountain 54	0.061	PFC	
Jul 2013	Roberts Mountain 55	0.102	FAR	Not apparent
Jul 2013	Roberts Mountain 56	0.061	PFC	
Jul 2013	Roberts Mountain 57	0.331	PFC	
Jul 2013	Roberts Mountain 58	<00.1	FAR	Upward
Jul 2013	Roberts Mountain 60	<00.1	PFC	
Jul 2013	Roberts Mountain 61	0.556	FAR	Downward
Jun 2013	Three Bars 1	<00.1	NF	
Jun 2013	Three Bars 2	<00.1	NF	
Jun 2013	Three Bars 3	<00.1	NF	
Jun 2013	Three Bars 4	0.013	NF	
Jun 2013	Three Bars 5	0.035	NF	
Jun 2013	Three Bars 6	5.942	NF	
Jun 2013	Three Bars 9	0.102	PFC	
Jun 2013	Three Bars 10	2.981	FAR	Upward
Jun 2013	Three Bars 11	1.872	FAR	Not apparent
Jun 2013	Three Bars 12	<00.1	FAR	Downward
Jun 2013	Three Bars 14	<00.1	NF	
Jun 2013	Three Bars 16	<00.1	NF	
Jun 2013	Three Bars 19	0.002	NF	
Jun 2013	Three Bars 22	0.208	NF	
Jun 2013	Three Bars 30	0.029	FAR	Downward
Jun 2013	Meadow Canyon Spring 9	-	FAR	Not apparent
Jun 2013	Meadow Canyon Spring 10	-	FAR	Not apparent
Sep 2009	Horse Spring 1 & 4	0.805	FAR	Downward
Sep 2009	Horse Spring 2	0.083	NF	
Sep 2009	Horse Spring 3	0.126	PFC	
Sep 2009	Pete Hanson Meadow 1, 2 & 4	0.829	PFC	
Sep 2009	Pete Hanson Spring 1	<00.1	FAR	Upward
Sep 2009	Roberts Spring 2	0.209	FAR	Downward
Sep 2009	Roberts Spring 3	0.050	FAR	Downward
Sep 2009	Upper Roberts Meadow 1	0.659	FAR	Upward
Sep 2009	Upper Roberts Seep 2 & 4	0.448	PFC	
Sep 2009	Upper Roberts Spring 3	-	FAR	Downward
Sep 2009	Henderson Stock Pond	3.156	FAR	Upward
Sep 2009	Vinini Meadow	0.068	FAR	Downward
Sep 2009	Vinini Spring 1 & 2	0.002	PFC	

4.5. Conclusions

In general, much of the lower elevations of the Roberts Mountain Complex are degraded and at risk of further loss of perennial forage species. It appears that trends in rangeland health have decreased further from the conditions documented prior to the 2008 Roberts Mountain Gather. Ongoing drought conditions and a population of wild horses in excess of the AML have contributed to the rangeland issues within the

Complex. Throughout the valley, vegetation communities are characterized by a lack of perennial key grass species in the understory. In many locations, extensive amounts of bare ground exist between shrubs, and perennial grasses are sparse or caged in shrubs. Pedestalling of grasses was noted at the majority of the locations and noted to be severe and extreme in many cases. Erosion pavement and other signs of erosion were also present. Apparent trend was rated as downward at more than half of the key areas monitored. Several sites were noted as being so degraded that an ecological threshold may have been crossed which could prevent improvement without manipulation of the range through seeding or other procedures.

The AMLs for RMC were carefully determined to ensure that utilization objectives would not be exceeded. In order to maintain utilization levels below objectives and prevent rangeland degradation it is important that AML be achieved, maintained. Based on the review of climate, actual use, vegetation condition, wild horse distribution, and evaluation of limiting factors, it has been determined that the current Appropriate Management Levels for the Roberts Mountain Complex HMAs are valid and should not be adjusted at this time. The following summarizes the rationale for this determination.

- Drought currently exists has been ongoing and is expected to persist.
- Vegetation communities within the Complex are degraded and not reflective of the Potential Natural Communities for the Ecological Sites.
- Vegetation communities are at risk of further loss of soil, ecological function and perennial forage species.
- Water sources are generally limiting and are especially limited following several years of ongoing drought conditions.
- Wild horses use the low and mid elevations year-round and can use higher elevations if lack of snow fall allows.
- 63% of the wild horses observed during the most recent inventory flight are located outside of HMA boundaries where use by wild horses is not allocated.
- Impacts to vegetation and water sources are occurring outside of the HMA boundaries where wild horse use is not allocated.
- Over 90% of the Complex is Greater Sage grouse habitat, with 62% of the RMC considered Priority habitat.

Monitoring of wild horse use throughout the HMA will continue into the future, and data assessed in conjunction with wildlife and livestock use and the RAC Standards for Rangeland Health.

As with any region of rangeland in Nevada, balance of rangeland users is imperative to maintain rangeland health and adequate habitat, water and forage. With rangeland conditions already degraded, and persistent drought conditions, achieving the established AML is vital to fostering range improvement and balance among wild horses, sage grouse, pronghorn, other wildlife and livestock.

4.6. Monitoring Photos

Wild horse use outside of HMA boundaries. May 2018.

Wild horses located outside of the Roberts Mountain HMA boundaries. May 2018.

Key Area LC-5. October 2019. Note pedestaling.

Upper elevations of Three Bars Allotment, Outside of HMA. May 2020.

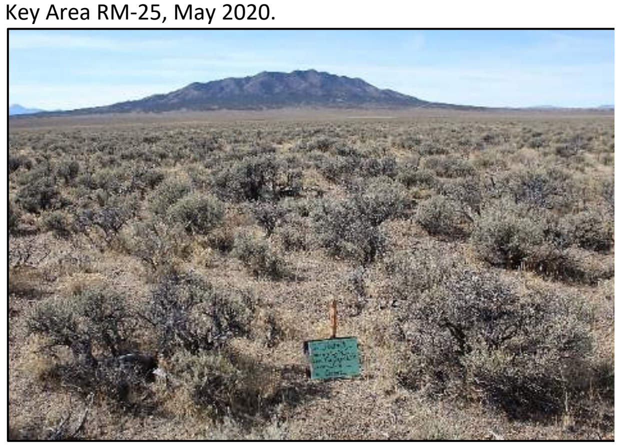
Key Area RM-7. Nichols Seeding November 2019.

Key Area RM-208 October 2020.

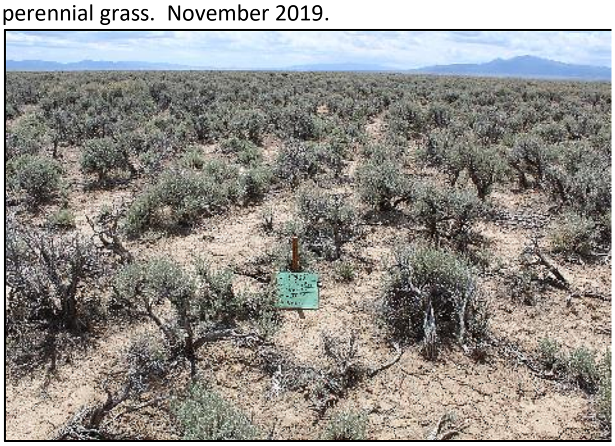
Key Area TB-07. November 2019.

Key Area RM-25, May 2020.

Key Area RO-11. Dominant cheatgrass and Pedestalled perennial grass. November 2019.



Key Area LC-6, October 2019. Note prevalent cheatgrass.



Key Area TB-24, May 2020.

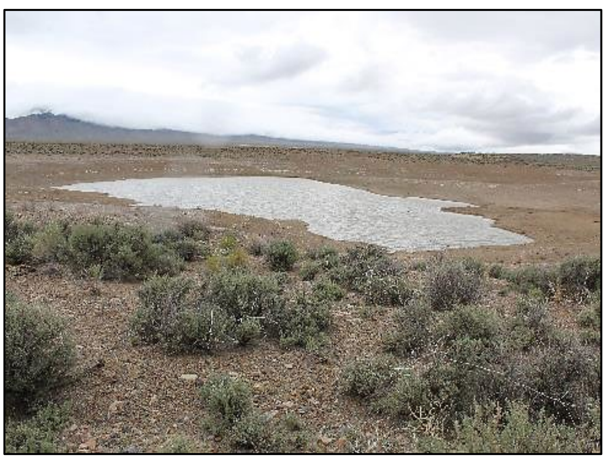
Roberts Mountain HMA, Trailing by wild horses. October 2019.

Mud Spring, July 2020.

Henderson Creek, Outside of HMA boundaries. November 2019.

Mud Spring February 2022, Helicopter Inventory.

Horse Spring, November 2019.



Atlas Mine Pond, May 2020.

Rabbit Spring outside of Roberts Mountain HMA.

5.0 WinEquus Population Modeling

5.1. Overview

The WinEquus Feral Horse Population Model, developed by Dr. Steven Jenkins at the University of Nevada at Reno, was designed to assist Wild Horse and Burro Specialists evaluate various management plans and possible outcomes for management of wild horses that might be considered for a particular area.

The purpose of the modeling was to compare the potential results of the Proposed Action and Alternatives including the No Action to include population size over time, growth rates, and the number of animals that could be gathered, removed and treated for fertility control over the next 10 years.

The model was run for 10 years to show potential effects over time. However, prior to future gathers, the data from this proposed gather along with future inventory data would be analyzed to determine the appropriate course of action.

The current WinEquus Population Model includes options for management by Fertility Control Only, Removals only or Removals and Fertility Control. The model was created to show implementation of all of the management through actual gathers, removals and treatment of horses. Currently, within WinEquus, there are no options to implement booster treatment of fertility control via darting, initial or repeat treatment of PZP-22 via bait and water trapping, IUD use, or gelding. The results of the modeling provide a range of potential outcomes and can display the range of possible variation in future population sizes or management results (Jenkins, 2002).

Certain assumptions are built into the model for example, the model reflects a foaling season the same year as the initial gather. Some settings can be changed, such as the percentage of the population that can be gathered; however, the model changes the variables for each trial, so as to reflect different results for each trial. The settings utilized and the assumptions made to approach the modeling are summarized at the end of this section.

The Proposed Action involves the use of fertility control and adjustment of the sex ratio to favor studs (60:40). To accomplish this in the modeling, the number of studs targeted for removal by age was adjusted to approximate what might realistically occur to accomplish the target ratio. This was based on the initial age structure, showing the younger horses removed for adoption and the older age groups released back to the range to provide a post gather population of 60% studs and 40% mares. Alternative A includes gelding of 37 studs. The model does not include analysis for gelding. The model was run showing a 50:50 sex ratio with fertility control with the addition of 37 studs using the initial age structure to develop the removal parameters per age group, Though the model does not include any analysis of potential growth rate reductions due to a proportion of geldings in the population, the model was set up with the best available scenario to provide data for comparison, with the knowledge that the gelding may further reduce population growth rates and would likely be similar to the Proposed Action. Alternative B was developed to manage through removals only, with no fertility control. The No Action includes no management, removals or fertility control to simulate continued growth of the population.

The Roberts Mountain Complex involves an estimated 700 wild horses outside of the HMA boundaries which would be removed regardless of Action Alternative. A scenario was run to show how the population would be reduced over time, with the assumption that the initial gather would not be successful in removing all of the horses from outside of the HMA boundaries as gather efficiencies rarely exceed 85%.

For the Action Alternatives, the estimated population of 324 wild horses within the HMA boundaries was analyzed through the model, as active population control measures would only apply to the management within the HMAs. The output from the model should provide a useful comparison of the population size, growth rates and gather and removal numbers as they differ between alternatives. In order to show potential variation from the management actions the beginning population was set as exact (324). Not activating this setting would allow the model to implement inherent variation of the starting population from trial to trial which can cause the variation between alternatives to be indistinct. Of course, this type of variation would exist in reality; however the goal of this exercise is to be able to understand the potential differences between the Alternatives as they may influence the population.

Refer to the end of this Section for the parameters used in the modeling.

5.2. Population Modeling Discussion

The goal of introducing population control methods to a wild horse population is to slow the average annual growth rates by reducing the number of foals born, which ultimately should result in less frequent gather events and smaller numbers of wild horses removed from the range over time. In assessing the Proposed Action and Alternatives within the Winequus population model, comparisons can be made of population sizes over time, growth rates, number of horses gathered, removed, and treated; and the overall number and schedule of gather events that might occur over time.

The modeling was approached to show the potential variations due to management within the HMA over time. Since a large number of wild horses currently exist outside of the HMA, it was necessary to separate out the modeling for the Action Alternatives to focus within the HMA. The situation outside of the HMA was also modelled as it is likely to take several gather events to remove all horses outside of the HMA boundaries and it was important not to exclude that data. Tables and graphs for the Action Alternatives include only scenarios for the 324 estimated wild horses within the HMA boundaries and the future potential management of those areas.

The Proposed Action includes periodic removals, fertility control and sex ratio adjustment (60:40 studs:mares). To assess the potential impact of the sex ratio adjustment, the model was run for both 60:40 and 50:50 sex ratios, with all other factors being the same. The parameters used for both the Proposed Action and a 50:50 sex ratio scenario are located in Tables 16 and 21. Population sizes over time are similar, but slightly lower for the Proposed Action where sex ratio adjustment is implemented (Tables 1 and 12). Population growth rates are several percentage points lower with the implementation of sex ratio adjustment (Table 13). The number of horses gathered over time is also similar, however the implementation of sex ratio adjustment shows measurable reductions in both numbers of horses gathered and removed (Table 7 and 14). The numbers of mares treated for fertility control is slightly higher for the 50:50 sex ratio scenario which may be explained by equal number of mares in the population, verses a smaller proportion under a 60:40 scenario, and a higher number of trials showing a higher number of gathers occurring over time, which would increase the opportunity for fertility control application. With the implementation of sex ratio adjustment, the model results show that there would be more trials with only two gathers over 10 years whereas a 50:50 sex ratio shows 21 more trials with three gathers rather than two gathers (Figures 7-8 and 14-15).

Alternative A includes management at the mid-AML (147 wild horses), and release of 37 geldings that would have otherwise been removed if the population was reduced to low-AML. This scenario also included fertility control similar to the Proposed Action. Refer to Tables 15 and 17 for Initial Modeling Parameters. When compared to the Proposed Action, population sizes were notably higher over time as the population is managed at mid-and high-AML (Table 2). A larger number of mares is present in the population under this alternative, so it is reflected in more foals born over time. The growth rates are slightly lower however (Table 6), as compared to the Proposed Action which shows a potential impact of increased male horses on the range (approximately 63%). Alternative A shows somewhat higher gather numbers than the Proposed Action, but removal numbers are notably lower (Table 7). The population averages a higher number over the years, yet a smaller number of horses would need to be removed to maintain the mid-AML post gather population level. The number of treated mares approximates double of the Proposed Action, which is likely due to increased numbers of gathers that occur over the Proposed Action. Alternative A shows 76 percent of the trials indicate a total of three gathers over time, whereas the Proposed Action only reflects 6 percent of trials with three gathers, and none with four gathers (Figures 8-9). The addition of the use of gelding and management of the population at the mid-AML would increase the level of needed future management over the years in the way of gathers and fertility control, and would maintain a higher average population size, but could result in a slightly lower number of wild horses removed and higher numbers of treated mares over time, which would show reduced growth rates of the population as compared to the Proposed Action.

Alternative B includes only gathers and removals to manage the population with no sex ratio adjustment, fertility control or gelding. Average population sizes are very similar to Alternative A, and notably higher than the Proposed Action (Table 3). Growth rates reflect those expected with no population management controls (Table 6). The numbers of horses gathered and removed within the HMAs is the highest under Alternative B, which is reflected in a higher number of gathers during the analysis period (Table 9, figures 10-11). Of the Action Alternatives, this alternative reflects the highest number of gathers with 89 percent of trials showing three gathers and two percent showing four gathers within the analysis period.

As mentioned above, the gather and removal of horses outside of the HMA boundaries was also modelled for the reduction of horses over time given an approximate gather efficiency of 85%. The modelling shows fairly normal growth rates and the need to gather every three years to reduce the population to under 100 wild horses by 2025 and to single digits by 2031. The overall average population following an initial gather event was 64 horses over the course of 10 years. Refer to Tables 5, 6, 10, and Figures 5, 12 and 13.

A Most Typical Trial was also run for each of the Action Alternatives to display the potential differences in a population over time under each management scenario, including average populations (Table 11). Most Typical Trials are also shown on the Spaghetti Graph for each Alternative in Figures 1-5.

The following table represents the comparison of alternative among the parameters measured through the modelling.

Table 1. Comparison of Alternatives

Parameter	Alternative Ranking
Average Population Size	Proposed Action < Alternative B < Alternative A
Growth Rates	Alternative A < Proposed Action < Alternative B
Numbers Gathered	Proposed Action < Alternative B < Alternative A
Number Removed	Alternative A < Proposed Action < Alternative B
Number Treated	Alternative A < Proposed Action
Number of Gathers	Proposed Action < Alternative A < Alternative B

As expected, the No Action Alternative shows normal population growth rates and a population with constant upward growth over the analysis period. As shown in Table 4, Maximum population would range between 3,678 and 8,984 through the 100 trials modeling under the No Action/No Management Alternative. This is further illustrated in Figure 4. Initial management parameters are available in Table 15 and 20.

5.3. Population Modeling Tables

Table 2: Population Size in 11 years – Proposed Action (inside HMAs)
Fertility Control, Sex Ratio 60:40, Low AML

Trial	Population Sizes in 11 Years – Proposed Action		
	Minimum	Average	Maximum
Lowest Trial	80	165	324
Median Trial	130	185	324
Highest Trial	158	217	324

Table 3: Population Size in 11 years – Alternative A (inside HMAs)
Fertility Control, Gelding 37 studs, Mid-AML

Trial	Population Sizes in 11 Years – Alternative A		
	Minimum	Average	Maximum
Lowest Trial	115	181	324
Median Trial	160	210	324
Highest Trial	192	232	324

Table 4: Population Size in 11 years – Alternative B (inside HMAs)
Removal Only, No Population Controls, Sex Ratio 50:50, Low AML

Trial	Population Sizes in 11 Years – Alternative B		
	Minimum	Average	Maximum
Lowest Trial	95	181	324
Median Trial	142	210	324
Highest Trial	168	224	324

Table 5: Population Size in 11 years – No Action (Entire Complex)
No Gather or Population Controls

Trial	Population Sizes in 11 Years – No Action		
	Minimum	Average	Maximum
Lowest Trial	1025	2023	3678
Median Trial	1025	3059	6380
Highest Trial	1025	3735	8984

Table 6: Population Sized in 11 years – All Action Alternatives (Outside of HMAs)
Removal Only

Trial	Population Sizes in 11 Years – Proposed Action		
	Minimum	Average	Maximum
Lowest Trial	1	106	701
Median Trial	5	123	701
Highest Trial	10	138	701

Table 7: Average Population Growth Rates in 10 Years

Trial	Population Growth Rates in 10 Years				
	Proposed Action	Alternative A	Alternative B	Outside of HMAs	No Action
Lowest Trial	4.8	4.4	12.1	-2.2	12.3
Median Trial	10.7	8.5	17.7	17.9	20.1
Highest Trial	16.2	12.5	24.0	30.9	24.2

Table 8: Gather Results in 11 Years – Proposed Action (inside HMAs)

Trial	Totals in 11 Years – Proposed Action		
	Gathered	Removed	Treated
Lowest	412	278	24
Median	456	323	40
Highest	704	478	84

Table 9: Gather Results in 11 Years – Alternative A (inside HMAs)

Trial	Totals in 11 Years –Alternative A		
	Gathered	Removed	Treated
Lowest	399	218	38
Median	608	300	91
Highest	765	366	137

Table 10: Gather Results in 11 Years – Alternative B (inside HMAs)

Trial	Totals in 11 Years –Alternative B		
	Gathered	Removed	Treated
Lowest	366	305	0
Median	524	439	0
Highest	664	559	0

Table 11: Gather Results in 11 Years – All Action Alternatives (Outside of HMAs)

Trial	Totals in 11 Years –Alternative B		
	Gathered	Removed	Treated
Lowest	664	618	0
Median	740	690	0
Highest	818	758	0

Table 12: Most Typical Trial Population by Year

Year	Proposed Action	Alternative A	Alternative B	Outside of HMAs
	Typical Trial Population			
Year 1 - 2021	324	324	324	701
Year 2 - 2022	135	183	144	129
Year 3 - 2023	148	191	159	159
Year 4 -- 2024	166	211	188	192
Year 5 - 2025	175	230	221	35
Year 6 - 2026	175	208	251	37
Year 7 - 2027	199	207	165	47
Year 8 - 2028	232	228	205	10
Year 9 - 2029	158	188	229	12
Year 10 - 2030	160	191	160	15
Year 11 -- 2031	163	187	181	4
11-year Average	185	213	202	122
Post initial Gather Average - 10 years	171	202	190	64

5.4. Comparison of 50:50 to 60:40, populations

Table 13: Population Sized in 11 years –inside HMAs
Fertility Control, Sex Ratio 50:50, Low AML

Trial	Population Sizes in 11 Years – Proposed Action		
	Minimum	Average	Maximum
Lowest Trial	102	172	324
Median Trial	139	195	324
Highest Trial	165	217	324

Table 14: Sex Ratio Comparison

Trial	Population Growth Rates in 10 Years	
	Sex Ratio 60:40	Sex Ratio 50:50
Lowest Trial	4.8	7.7
Median Trial	10.7	13.0
Highest Trial	16.2	19.4

Table 15: Sex Ratio Results at 50:50

Trial	Totals in 11 Years – Sex Ratio 50:50		
	Gathered	Removed	Treated
Lowest	424	292	37
Median	476	343	52
Highest	776	492	110

5.5. Population Modeling Graphics

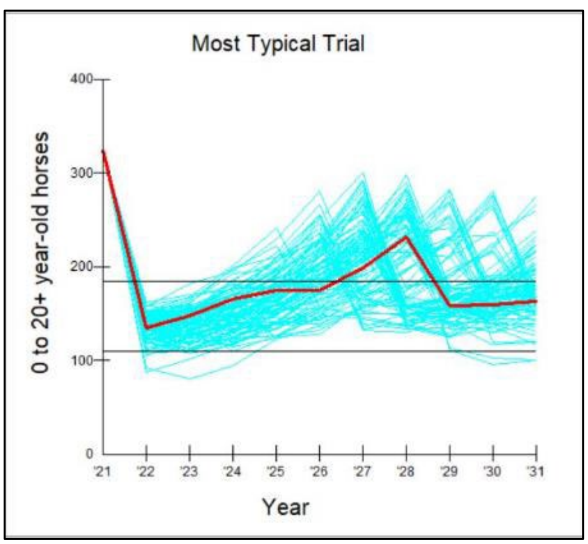


Figure 1: Proposed Action Most Typical Trial

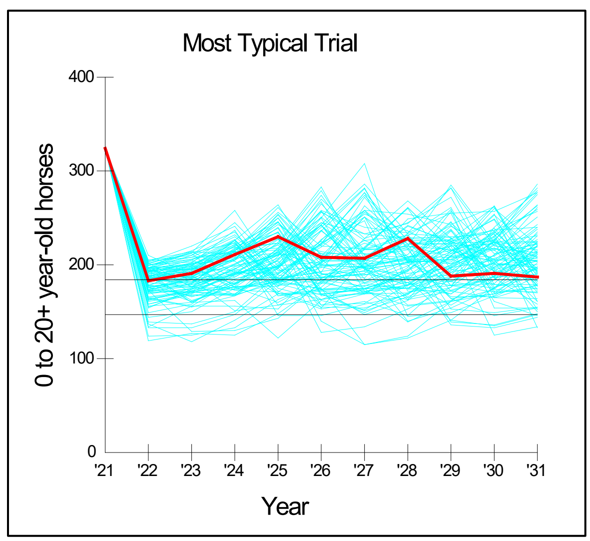


Figure 2: Alternative A Most Typical Trial

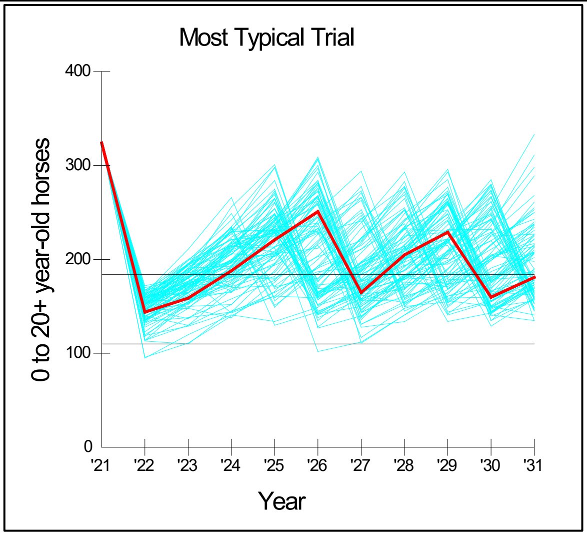


Figure 3: Alternative B Most Typical Trial

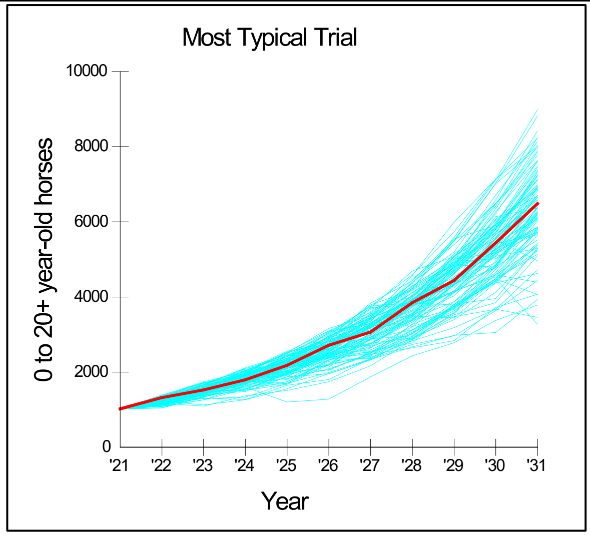


Figure 4: No Action Alternative Most Typical Trial

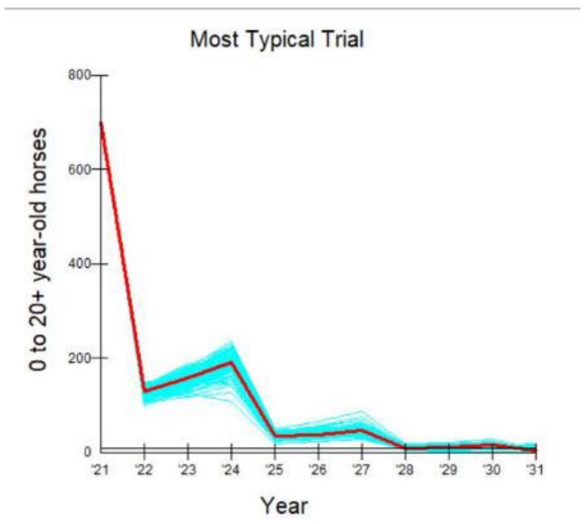


Figure 5: Outside of HMAs Most Typical Trial

Figure 6: Proposed Action – Schedule of Gathers

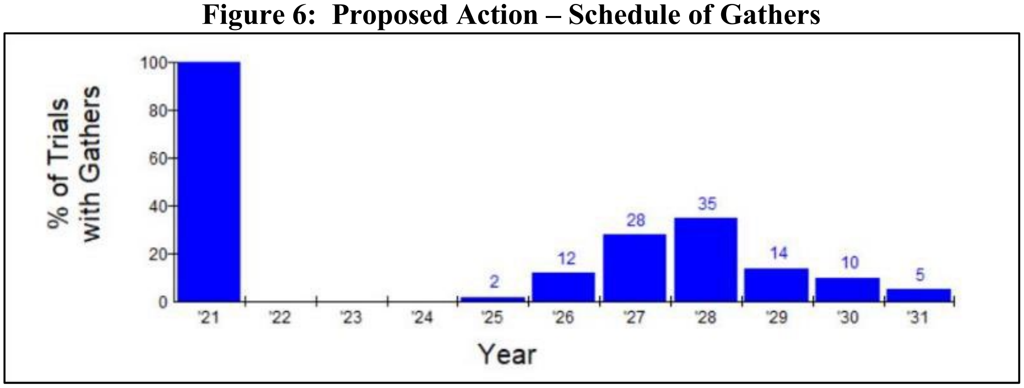


Figure 7: Proposed Action --- Gathers

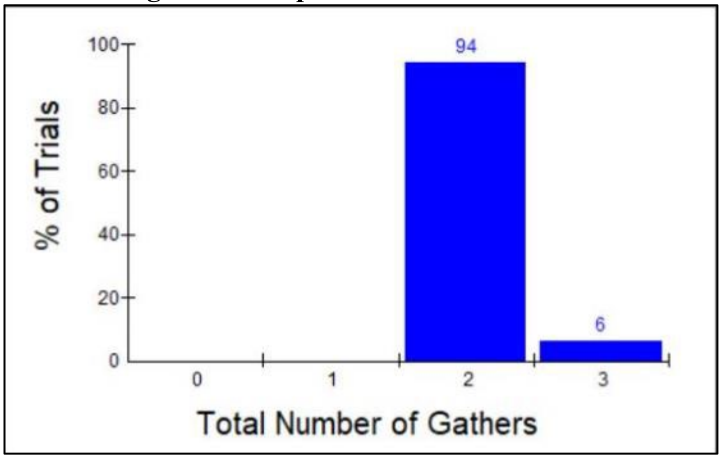


Figure 8: Alternative A Schedule of Gathers

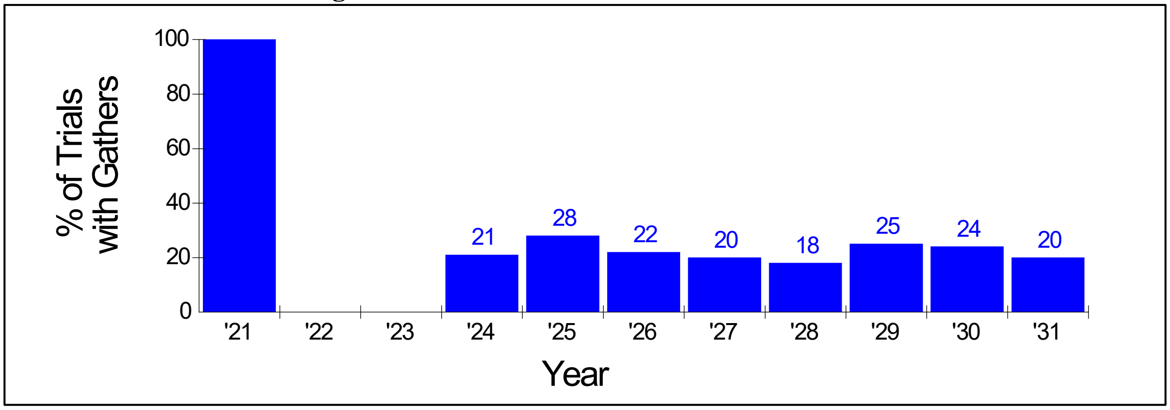


Figure 9: Alternative A Gathers

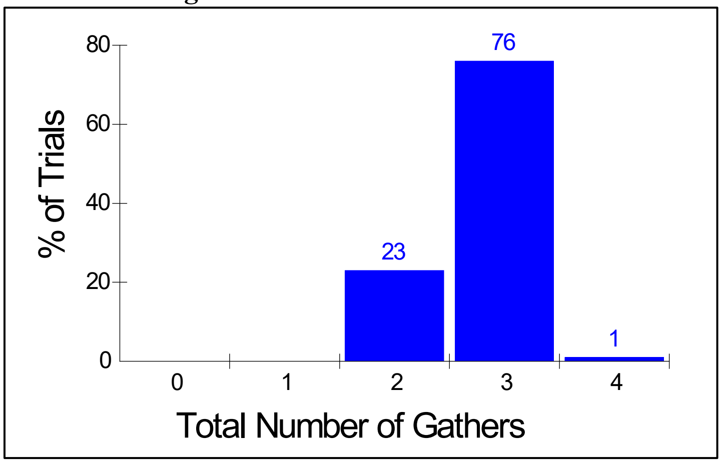


Figure 10: Alternative B Schedule of Gathers

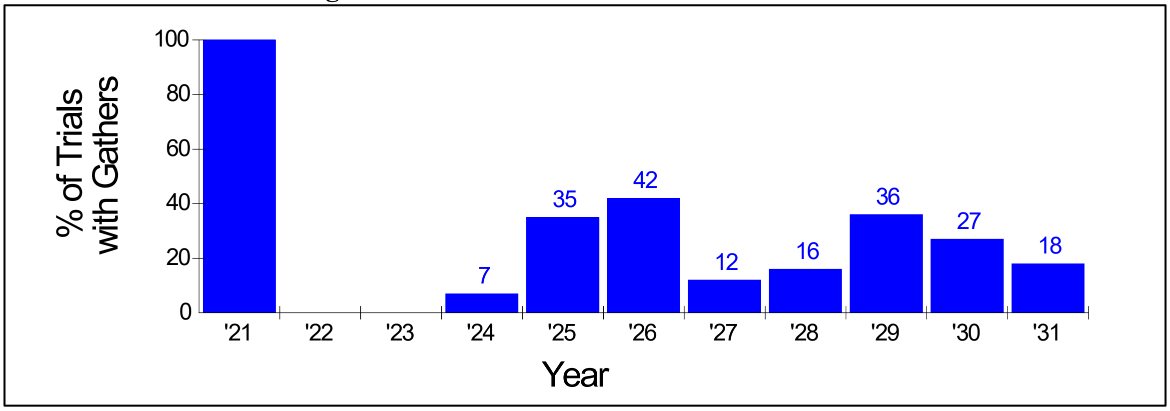


Figure 11: Alternative B Gathers

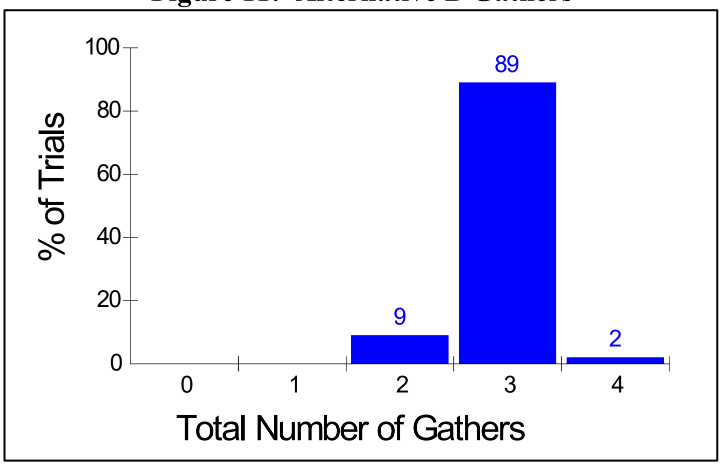


Figure 12: Outside of HMA Schedule of Gathers

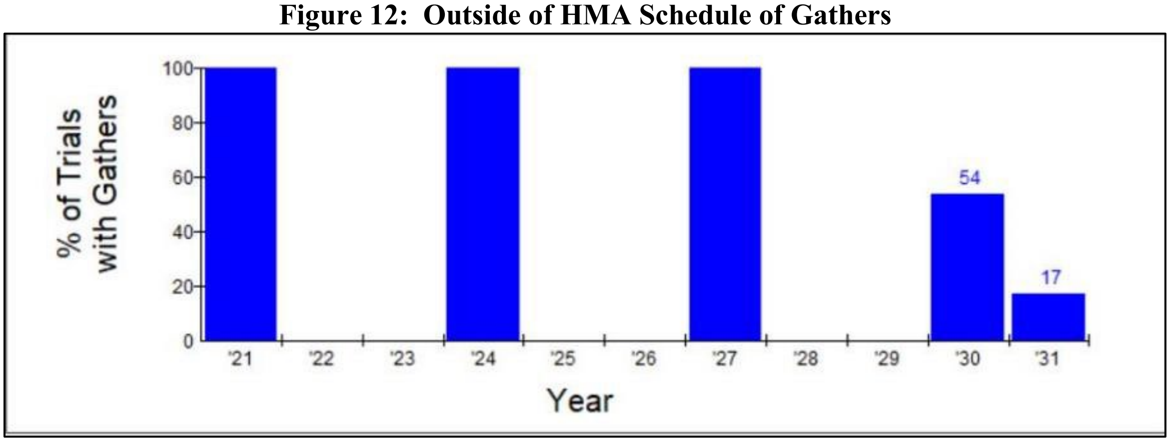


Figure 13: Outside of HMA Schedule of Gathers

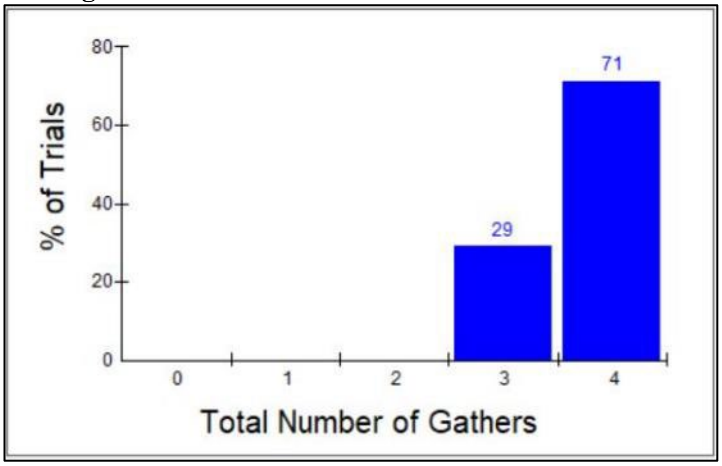


Figure 14: 50:50 Sex Ratio/Fertility Control Schedule of Gathers

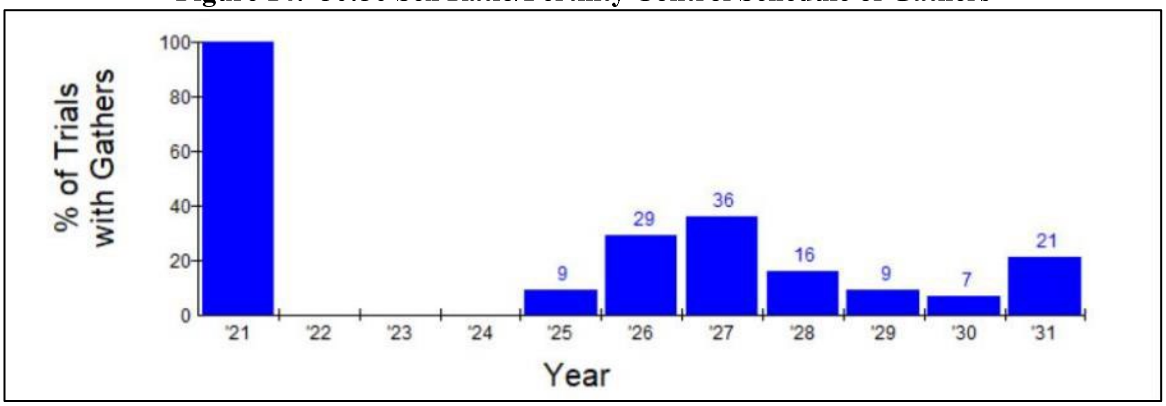
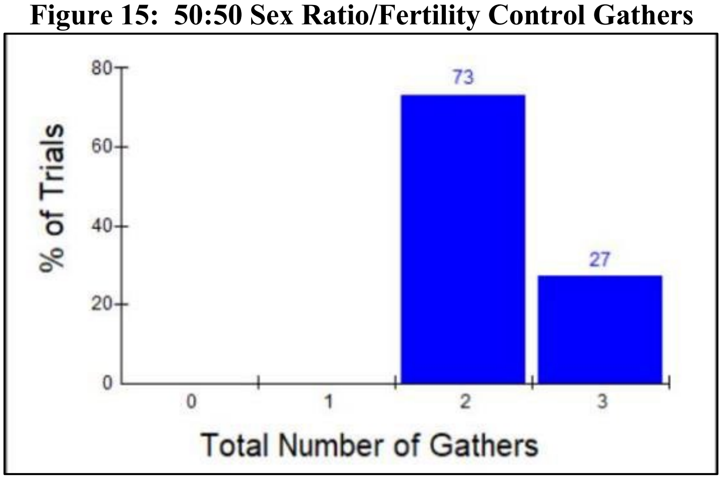


Figure 15: 50:50 Sex Ratio/Fertility Control Gathers



5.6. Population Modeling Criteria

Population Data, Criteria, and Parameters Used for Population Modeling

All simulations used the survival probabilities and foaling rates that were supplied with the WinEquus data file collected by M. Ashley and S. Jenkins at Garfield Flat, Nevada between 1993 and 1999.

- Initial age-sex distribution was based on an average age structure from a large population (Diamond Complex 1997), for 324 horses within the HMAs, 700 horses outside of the HMAs and 1024 wild horses total for the entire Roberts Mountain Complex
- Fertility control parameters: Year 1—94%, Year 2—82%, Year 3—68%
- Initial Gather Year: 2021[2]
- Gather: minimum interval of three years
- Gather for fertility treatment regardless of population size: No
- Continue to gather after reduction to treat females: Yes
- Percent of the population that can be gathered: 85%
- Minimum age for sanctuary horses: Not Applicable
- Foals are not included in the AML
- Starting population set as exact
- Smoother utilized on initial age distribution

Table 16: Summary table of WinEquus parameters selected for each analyzed scenario.

Simulations were run for 10 years with 100 trials each. Modeling Parameter	Proposed Action: selective removal down to low AML (110) with application of fertility control to mares, 60:40 male:female sex ratio	Alternative A: selective removal to mid-AML (147) with gelding of 37 males and fertility control	Alternative B: Removal only, low AML (110)	Outside of HMAs	No Action: no removal or fertility control
Threshold population for gathers	184	184	184	10	NA
Target post-gather population size	110	147	110	0	NA
Gather for fertility control regardless of population size	No	No	NA	NA	NA
Continue gathering after removals to treat additional females	Yes	Yes	NA	NA	NA
Year 1 effectiveness of fertility control	94%	94%	N/A	NA	NA
Year 2 effectiveness of fertility control	82%	82%	N/A	NA	NA

Simulations were run for 10 years with 100 trials each. Modeling Parameter	Proposed Action: selective removal down to low AML (110) with application of fertility control to mares, 60:40 male:female sex ratio	Alternative A: selective removal to mid-AML (147) with gelding of 37 males and fertility control	Alternative B: Removal only, low AML (110)	Outside of HMAs	No Action: no removal or fertility control
Year 3 effectiveness of fertility control	68%	68%	N/A	NA	NA

Table 17: Proposed Action: Initial Modeling Parameters (Inside HMAs)

Age Class	Initial Base Population[3]		Survival Probabilities		Foaling Rates	Percent for Removal[4]	
Foal	24	26	0.919	0.877	0.00	100%	100%
1	10	9	0.996	0.950	0.00	100%	100%
2	23	16	0.994	0.949	0.52	100%	100%
3	20	15	0.993	0.947	0.67	100%	100%
4	15	15	0.990	0.945	0.76	100%	100%
5	13	11	0.988	0.942	0.89	100%	100%
6	9	6	0.985	0.939	0.76	100%	100%
7	7	9	0.981	0.936	0.90	100%	100%
8	8	6	0.976	0.931	0.88	100%	100%
9	6	8	0.971	0.926	0.91	100%	0%
10-14	15	20	0.947	0.903	0.81	29%	0%
15-19	9	14	0.870	0.830	0.82	0%	0%
20+	3	7	0.591	0.564	0.75	0%	0%

Table 18: Alternative A: Initial Modeling Parameters (Inside HMAs)

Age Class	Initial Population		Survival Probabilities		Foaling Rates	Percent for Removal[5]	
Foal	24	26	0.919	0.877	0.00	100%	100%
1	10	9	0.996	0.950	0.00	100%	100%
2	23	16	0.994	0.949	0.52	100%	100%
3	20	15	0.993	0.947	0.67	100%	100%
4	15	15	0.990	0.945	0.76	100%	100%
5	13	11	0.988	0.942	0.89	100%	11%
6	9	6	0.985	0.939	0.76	100%	0%
7	7	9	0.981	0.936	0.90	100%	0%
8	8	6	0.976	0.931	0.88	43%	0%
9	6	8	0.971	0.926	0.91	0%	0%
10-14	15	20	0.947	0.903	0.81	0%	0%
15-19	9	14	0.870	0.830	0.82	0%	0%

[3] Initial Base Population was formulated from the age structure of the Diamond Complex 1997 gather, a large sample size of a herd not affected by age selection or population control and would represent an average, natural age structure. The age structure cannot be known of course until an actual gather occurs, so an average base was selected, which may or may not be similar to the Roberts Mountain Complex but should be a good approximation. Additionally, the model was set to apply a smoother of the initial population

[4] The removal parameters were calculated from the Initial Base Population, assuming the removal (shipping) of all younger age groups and release of older age groups to provide for a post gather population of 66 studs and 44 mares. Ungathered horses were assumed to have a sex ratio of 50:50.

[5] The removal parameters were calculated from the Initial Base Population, assuming the removal (shipping) of all younger age groups and release of older age groups to provide for a post gather population of 55 studs, 55 mares and 37 geldings. Ungathered horses were assumed to have a sex ratio of 50:50.

Age Class	Initial Population		Survival Probabilities		Foaling Rates	Percent for Removal[5]	
20+	3	7	0.591	0.564	0.75	0%	0%

Table 19: Alternative B: Initial Modeling Parameters (Inside HMAs)

Age Class	Initial Population		Survival Probabilities		Foaling Rates	Percent for Removal[6]	
Foal	24	26	0.919	0.877	0.00	100%	100%
1	10	9	0.996	0.950	0.00	100%	100%
2	23	16	0.994	0.949	0.52	100%	100%
3	20	15	0.993	0.947	0.67	100%	100%
4	15	15	0.990	0.945	0.76	100%	100%
5	13	11	0.988	0.942	0.89	100%	100%
6	9	6	0.985	0.939	0.76	100%	100%
7	7	9	0.981	0.936	0.90	100%	100%
8	8	6	0.976	0.931	0.88	57%	100%
9	6	8	0.971	0.926	0.91	0%	100%
10-14	15	20	0.947	0.903	0.81	0%	26%
15-19	9	14	0.870	0.830	0.82	0%	0%
20+	3	7	0.591	0.564	0.75	0%	0%

Table 120: All Action Alternatives: Initial Modeling Parameters (Outside of HMAs)

Age Class	Initial Population		Survival Probabilities		Foaling Rates	Percent for Removal[7]	
Foal	64	68	0.919	0.877	0.00	100%	100%
1	9	11	0.996	0.950	0.00	100%	100%
2	55	36	0.994	0.949	0.52	100%	100%
3	42	31	0.993	0.947	0.67	100%	100%
4	31	32	0.990	0.945	0.76	100%	100%
5	27	24	0.988	0.942	0.89	100%	100%
6	20	11	0.985	0.939	0.76	100%	100%
7	14	21	0.981	0.936	0.90	100%	100%
8	18	12	0.976	0.931	0.88	100%	100%
9	9	14	0.971	0.926	0.91	100%	100%
10-14	35	49	0.947	0.903	0.81	100%	100%
15-19	19	28	0.870	0.830	0.82	100%	100%
20+	7	14	0.591	0.564	0.75	100%	100%

Table 21: No Action: Initial Modeling Parameters (Entire Complex)

Age Class	Initial Population		Survival Probabilities		Foaling Rates	Percent for Removal	
Foal	94	99	0.919	0.877	0.00	0%	0%
1	14	16	0.996	0.950	0.00	0%	0%
2	81	53	0.994	0.949	0.52	0%	0%
3	61	45	0.993	0.947	0.67	0%	0%
4	46	47	0.990	0.945	0.76	0%	0%

[6] The removal parameters were calculated from the Initial Base Population, assuming the removal (shipping) of all younger age groups and release of older age groups to provide for a post gather population of 55 studs, and 55 mares. Ungathered horses were assumed to have a sex ratio of 50:50.

[7] The removal parameters were calculated from the Initial Base Population, assuming the removal (shipping) of all younger age groups and release of older age groups to provide for a post gather population of 55 studs, and 55 mares. Ungathered horses were assumed to have a sex ratio of 50:50.

Age Class	Initial Population		Survival Probabilities		Foaling Rates	Percent for Removal	
5	40	35	0.988	0.942	0.89	0%	0%
6	29	16	0.985	0.939	0.76	0%	0%
7	20	31	0.981	0.936	0.90	0%	0%
8	26	17	0.976	0.931	0.88	0%	0%
9	14	20	0.971	0.926	0.91	0%	0%
10-14	51	72	0.947	0.903	0.81	0%	0%
15-19	27	41	0.870	0.830	0.82	0%	0%
20+	10	20	0.591	0.564	0.75	0%	0%

Table 22: Initial Modeling Parameters Fertility Control with 50:50 Sex Ratio

Age Class	Initial Base Population		Survival Probabilities		Foaling Rates	Percent for Removal[8]	
Foal	24	26	0.919	0.877	0.00	100%	100%
1	10	9	0.996	0.950	0.00	100%	100%
2	23	16	0.994	0.949	0.52	100%	100%
3	20	15	0.993	0.947	0.67	100%	100%
4	15	15	0.990	0.945	0.76	100%	100%
5	13	11	0.988	0.942	0.89	100%	100%
6	9	6	0.985	0.939	0.76	100%	100%
7	7	9	0.981	0.936	0.90	100%	100%
8	8	6	0.976	0.931	0.88	57%	100%
9	6	8	0.971	0.926	0.91	0%	100%
10-14	15	20	0.947	0.903	0.81	0%	26%
15-19	9	14	0.870	0.830	0.82	0%	0%
20+	3	7	0.591	0.564	0.75	0%	0%

[8] The removal parameters were calculated from the Initial Base Population, assuming the removal (shipping) of all younger age groups and release of older age groups to provide for a post gather population of 55 studs and 55 mares. Ungathered horses were assumed to have a sex ratio of 50:50.

6.0 Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers (CAWP): Wild Horse Gather Standard Operating Procedures (SOPs)

In 2021 (IM 2021-002), BLM updated its comprehensive animal welfare program (CAWP) with WH&B gather SOPs to formalize the standards, training, and monitoring for conducting safe, efficient, and successful WH&B gather operations while ensuring humane care and handling of animals gathered. These standards include requirements for trap and temporary holding facility design; capture and handling; transportation; and appropriate care after capture. The standards have been incorporated into helicopter gather contracts as specifications for performance. It includes a requirement that all Incident Commanders (IC), Lead Contracting Officer Representatives (LCOR), Contracting Officer Representatives (COR), Project Inspectors (PI), and contractors must complete a mandatory training course covering all aspects of the CAWP prior to gathers. The goal is to ensure that the responsibility for humane care and treatment of WH&Bs remains a high priority for the BLM and its contractors at all times. The BLM's objective is to use the best available science, husbandry and handling practices applicable for WH&Bs and to make improvements whenever possible, while also meeting our overall gather goals and objectives in accordance with current BLM policy, SOPs, and contract requirements.

Gathers would be conducted by utilizing contractors from the Wild Horse Gathers-Western States Contract, or BLM personnel. The following procedures for gathering and handling wild horses would apply whether contractor or BLM personnel conduct a gather. For helicopter gathers conducted by BLM personnel, gather operations will be conducted in conformance with the *Wild Horse Aviation Management Handbook* (January 2009).

Prior to any gather operations, the BLM will provide a pre-gather evaluation of existing conditions in the gather area(s). The evaluation will include animal conditions, prevailing temperatures, drought conditions, soil conditions, road conditions, and a topographic map with wilderness boundaries, the location of fences, other physical barriers, and acceptable trap locations in relation to animal distribution. The evaluation will determine whether the proposed activities will necessitate the presence of a veterinarian during operations. If it is determined that a large number of animals may need to be euthanized or gather operations could be facilitated by a veterinarian, these services would be arranged before the gather would proceed. The contractor will be apprised of all conditions and will be given instructions regarding the gather and handling of animals to ensure their health and welfare is protected.

Trap sites and temporary holding sites will be located to reduce the likelihood of injury and stress to the animals, and to minimize potential damage to the natural resources of the area. These sites would be located on or near existing roads whenever possible.

The primary gather methods used in the performance of gather operations include:

1. Helicopter Drive Trapping. This gather method involves utilizing a helicopter to herd wild horses into a temporary trap.
2. Helicopter Assisted Roping. This gather method involves utilizing a helicopter to herd wild horses or burros to ropers.
3. Bait Trapping. This gather method involves utilizing bait (e.g., water or feed) to lure wild horses into a temporary trap.

The following procedures and stipulations will be followed to ensure the welfare, safety and humane treatment of wild horses in accordance with the provisions of 43 CFR 4700.

6.1. Methods Used In The Performance Of Gather Contract Operations

The primary concern of the contractor is the safe and humane handling of all animals gathered.
All gather attempts shall incorporate the following:

1. All trap and holding facilities locations must be approved by the Contracting Officer's Representative (COR) and/or the Project Inspector (PI) prior to construction. All trap and holding facilities locations must be approved by the LCOR/COR/PI prior to construction. The Contractor may also be required to change or move trap locations as determined by the LCOR/COR/PI. LCOR/COR/PI will determine when capture objectives are met. All traps and holding facilities not located on public land must have prior written approval of the landowner that will be provided to the LCOR prior to use. Selection of all traps and holding sites will include consideration for public and media observation.
2. The rate of movement and distance the animals travel must not exceed limitations set by the LCOR/COR/PI who will consider terrain, physical barriers, access limitations, weather, condition of the animals, urgency of the operation (animals facing drought, starvation, fire, etc.) and other factors. The trap site shall be moved close to WH&B locations whenever possible to minimize the distance the animals need to travel.
3. All traps, wings, and holding facilities shall be constructed, maintained and operated to handle the animals in a safe and humane manner and be in accordance with the following:
    a. When moving the animals from one pasture/allotment to another pasture/allotment, the fencing wire needs to be let down for a distance that is approved by the LCOR on either side of the gate or crossing.
    b. If jute is hung on the fence posts of an existing wire fence in the trap wing, the wire should either be rolled up or let down for the entire length of the jute in such a way that minimizes the possibility of entanglement by WH&Bs unless otherwise approved by the LCOR/COR/PI. No modification of existing fences will be made without authorization from the LCOR/COR/PI. The Contractor shall be responsible for restoration of any fence modification which they have made.
    c. Building a trail using domestic horses through the fence line, crossing or gate may be necessary to avoid animals hitting the fence.
    d. The trap site and temporary holding facility must be constructed of stout materials and must be maintained in proper working condition. Traps and holding facilities shall be constructed of portable panels, the top of which shall not be less than 72 inches high for horses and 60 inches for burros, and the bottom rail of which shall not be more than 12 inches from ground level. All traps and holding facilities shall be oval or round in design with rounded corners.
    e. All portable loading chute sides shall be a minimum of 6 feet high and shall be fully covered on the sides with plywood, or metal without holes.
    f. All alleyways that lead to the fly chute or sorting area shall be a minimum of 30 feet long and a minimum of 6 feet high for horses, and 5 feet high for burros and the bottom rail must not be more than 12 inches from ground level. All gates and panels in the animal holding and handling pens and alleys of the trap site must be covered with plywood, burlap, plastic snow fence or like material approximately 48” in height to provide a visual barrier for the animals. All materials shall be secured in place. These guidelines apply:
        i. For exterior fences, material covering panels and gates must extend from the top of the panel or gate toward the ground.
        ii. For alleys and small internal handling pens, material covering panels and gates shall extend from no more than 12 inches below the top of the panel or gate toward the ground to facilitate visibility of animals and the use of flags and paddles during sorting.
        iii. The initial capture pen may be left uncovered as necessary to encourage animals to enter the first pen of the trap.

iv. Padding must be installed on the overhead bars of all gates used in single file ally.
v. An appropriate chute designed for restraining WH&Bs must be available for necessary procedures at the temporary holding facility. The government furnished portable fly chute to restrain, age, or provide additional care for the animals shall be placed in the alleyway in a manner as instructed by or in concurrence with the LCOR/COR/PI.
vi. There must be no holes, gaps or openings, protruding surfaces, or sharp edges present in fence panels, latches, or other structures that may cause escape or possible injury.
vii. Hinged, self-latching gates must be used in all pens and alleys except for entry gates into the trap, which may be secured with tie ropes or chains.
viii. When dust conditions occur within or adjacent to the trap or holding facility, the Contractor shall be required to wet down the ground with water.

All animals gathered shall be sorted into holding pens as to age, size, temperament, sex, condition, and whether animals are identified for removal as excess or retained in the HMA. These holding pens shall be of sufficient size to minimize, to the extent possible, injury due to fighting and trampling as well as to allow animals to move easily and have adequate access to water and feed. All pens will be capable of expansion on request of the LCOR/COR/PI. Alternate pens, within the holding facility shall be furnished by the Contractor to separate mares or Jennies with small foals, sick and injured animals, and private animals from the other animals. Under normal conditions, the BLM will require that animals be restrained to determine an animal's age, sex, and ownership. In other situations, restraint may be required to conduct other procedures such as veterinary treatments, restraint for fertility control vaccinations, castration, spaying, branding, blood draw, collection of hair samples for genetic testing, testing for equine diseases, application of GPS collars and radio tags. In these instances, a portable restraining chute may be necessary and will be provided by the government. Alternate pens shall be furnished by the Contractor to hold animals if the specific gathering requires that animals be released back into the capture area(s) following selective removal and/or population suppression treatments. In areas requiring one or more satellite traps, and where a centralized holding facility is utilized, the contractor may be required to provide additional holding pens to segregate animals transported from remote locations so they may be returned to their traditional ranges. Either segregation or temporary marking and later segregation will be at the discretion of the LCOR/COR/PI. The LCOR will determine if the corral size needs to be expanded due to horses staying longer.

6.1.1. Feeding and Watering

1. Adult WH&Bs held in traps or temporary holding pens for longer than 12 hours must be fed every morning and evening and provided with drinking water at all times other than when animals are being sorted or worked.
2. Dependent foals must be reunited with their mares/jennies at the temporary holding facility within four hours of capture unless the LCOR/COR/PI authorizes a longer time or foals are old enough to be weaned. If a nursing foal is held in temporary holding pens for longer than 4 hours without its dam, it must be provided with water and good quality weed seed free hay.
3. Water must be provided at a minimum rate of 10 gallons per 1,000 pound animal per day, adjusted accordingly for larger or smaller horses, burros and foals, and environmental conditions, with each trough placed in a separate location of the pen (i.e. troughs at opposite ends of the pen) with a minimum of one trough per 30 horses. Water must be refilled at least every morning and evening when necessary.
4. Good quality weed-seed-free hay must be fed at a minimum rate of 20 pounds per 1,000 pound adult animal per day, adjusted accordingly for larger or smaller horses, burros and foals.
    a. Hay must not contain poisonous weeds or toxic substances.
    b. Hay placement must allow all WH&Bs to eat simultaneously.

5. When water or feed deprivation conditions exist on the range prior to the gather, the LCOR/COR/PI shall adjust the watering and feeding arrangements in consultation with the onsite veterinarian as necessary to provide for the needs of the animals to avoid any toxicity concerns.

6.1.2. Trap Site

A dependent foal or weak/debilitated animal must be separated from other WH&Bs at the trap site to avoid injuries during transportation to the temporary holding facility. Separation of dependent foals from mares must not exceed four hours unless the LCOR/COR/PI authorizes a longer time or the decision is made to wean the foals.

6.1.3. Temporary Holding Facility

1. All WH&Bs in confinement must be observed at least twice daily during feeding time to identify sick or injured WH&Bs and ensure adequate food and water.
2. Non-ambulatory WH&Bs must be located in a pen separate from the general population and must be examined by the LCOR/COR/PI and/or on-call or onsite veterinarian no more than 4 hours after recumbency (lying down) is observed. Unless otherwise directed by a veterinarian, hay and water must be accessible to an animal within six hours after recumbency.
3. Separate pens must be reserved for the following:
    1. WH&Bs that are weak or debilitated
    2. Mares/jennies with dependent foals
    3. Aggressive WH&Bs that could cause serious injury to other animals.
4. WH&Bs in pens at the temporary holding facility shall be maintained at a proper stocking density such that when at rest all WH&Bs occupy no more than half the pen area.
5. It is the responsibility of the Contractor to provide security to prevent loss, injury or death of captured animals until delivery to final destination.
6. It is the responsibility of the Contractor to provide for the safety of the animals and personnel working at the trap locations and temporary holding corrals in consultation with the LCOR/COR/PI. This responsibility will not be used to exclude or limit public and media observation as long as current BLM policies are followed.
7. The contractor will ensure that non-essential personnel and equipment are located as to minimize disturbance of WH&Bs. Trash, debris, and reflective or noisy objects shall be eliminated from the trapsite and temporary holding facility.
8. The Contractor shall restrain sick or injured animals if treatment is necessary in consultation with the LCOR/COR/PI and/or onsite veterinarian. The LCOR/COR/PI and/or onsite veterinarian will determine if injured animals must be euthanized and provide for the euthanasia of such animals. The Contractor may be required to humanely euthanize animals in the field and to dispose of the carcasses as directed by the LCOR/COR/PI, at no additional cost to the Government.
9. Once the animal has been determined by the LCOR/COR/PI to be removed from the HMA/HA, animals shall be transported to final destination from temporary holding facilities within 48 hours after capture unless prior approval is granted by the LCOR/COR/PI. Animals to be released back into the HMA following gather operations will be held for a specified length of time as stated in the Task Order/SOW. The Contractor shall schedule shipments of animals to arrive at final destination between 7:00 a.m. and 4:00 p.m. unless prior approval has been obtained by the LCOR. No shipments shall be scheduled to arrive at final destination on Sunday and Federal holidays, unless prior approval has been obtained by the LCOR. Animals shall not be allowed to remain standing on gooseneck or semi-trailers while not in transport for a combined period of greater than three (3) hours. Total planned transportation time from the temporary holding to the BLM facility will not exceed 10 hours. Animals that are to be released back into the capture area may need to be transported back to the original trap site per direction of the LCOR.

6.2. Handling

6.2.1. Willful Acts of Abuse

The following are prohibited:

1. Hitting, kicking, striking, or beating any WH&B in an abusive manner.
2. Dragging a recumbent WH&B across the ground without a sled, slide board or slip sheet. Ropes used for moving the recumbent animal must be attached to the sled, slide board or slip sheet unless being loaded as specified in Section C 9.2.h.
3. Deliberate driving of WH&Bs into other animals, closed gates, panels, or other equipment.
4. Deliberate slamming of gates and doors on WH&Bs.
5. Excessive noise (e.g., constant yelling) or sudden activity causing WH&Bs to become unnecessarily flighty, disturbed, or agitated.

6.2.2. General Handling

1. All sorting, loading or unloading of WH&Bs during gathers must be performed during daylight hours except when unforeseen circumstances develop, and the LCOR/COR/PI approves the use of supplemental light.
2. WH&Bs should be handled to enter runways or chutes in a forward direction.
3. WH&Bs should not remain in single-file alleyways, runways, or chutes longer than 30 minutes.
4. With the exception of helicopters, equipment should be operated in a manner to minimize flighty behavior and injury to WH&Bs.

6.2.3. Handling Aids

1. Handling aids such as flags and shaker paddles are the primary tools for driving and moving WH&Bs during handling and transport procedures. Contact of the flag or paddle end with a WH&B is allowed. Ropes looped around the hindquarters may be used from horseback or on foot to assist in moving an animal forward or during loading.
2. Routine use of electric prods as a driving aid or handling tool is prohibited. Electric prods may be used in limited circumstances only if the following guidelines are followed:
    a. Electric prods must only be a commercially available make and model that uses DC battery power and batteries should be fully charged at all times.
    b. The electric prod device must never be disguised or concealed.
    c. Electric prods must only be used after three attempts using other handling aids (flag, shaker paddle, voice, or body position) have been tried unsuccessfully to move the WH&Bs.
    d. Electric prods must only be picked up when intended to deliver a stimulus; these devices must not be constantly carried by the handlers.
    e. Space in front of an animal must be available to move the WH&B forward prior to application of the electric prod.
    f. Electric prods must never be applied to the face, genitals, anus, or underside of the tail of a WH&B.
    g. Electric prods must not be applied to any one WH&B more than three times during a procedure (e.g., sorting, loading) except in extreme cases with approval of the LCOR/COR/PI. Each exception must be approved at the time by the LCOR/COR/PI.

h. Any electric prod use that may be necessary must be documented daily by the LCOR/COR/PI including time of day, circumstances, handler, location (trap site or temporary holding facility), and any injuries (to WH&B or human).

6.3. Motorized Equipment

6.3.1. Loading and Unloading Areas

1. Facilities in areas for loading and unloading WH&Bs at the trap site or temporary holding facility must be maintained in a safe and proper working condition, including gates that swing freely and latch or tie easily.
2. The side panels of the loading chute must be a minimum of 6 feet high and fully covered with materials such as plywood or metal without holes that may cause injury.
3. There must be no holes, gaps or openings, protruding surfaces, or sharp edges present in fence panels or other structures that may cause escape or possible injury.
4. All gates and doors must open and close properly and latch securely.
5. Loading and unloading ramps must have a non-slip surface and be maintained in a safe and proper working condition to prevent slips and falls. Examples of non-slip flooring would include, but not be limited to, rubber mats, sand, shavings, and steel reinforcement rods built into ramp. There must be no holes in the flooring or items that can cause an animal to trip.
6. Trailers must be properly aligned with loading and unloading chutes and panels such that no gaps exist between the chute/panel and floor or sides of the trailer creating a situation where a WH&B could injure itself.
7. Stock trailers shall be positioned for loading or unloading such that there is no more than 12" clearance between the ground and floor of the trailer for burros and 18" for horses. If animals refuse to load, it may be necessary to dig a tire track hole where the trailer level is closer to ground level.

6.4. Transportation

6.4.1. General

1. All sorting, loading, or unloading of WH&Bs during gathers must be performed during daylight hours except when unforeseen circumstances develop and the LCOR/COR/PI approves the use of supplemental light.
2. WH&Bs identified for removal should be shipped from the temporary holding facility to a BLM facility within 48 hours.
3. Shipping delays for animals that are being held for release to range or potential onsite adoption must be approved by the LCOR/COR/PI.
4. Shipping should occur in the following order of priority: 1) debilitated animals, 2) pairs, 3) weanlings, 4) dry mares, and 5) studs.
5. Total planned transport time to the BLM preparation facility from the trap site or temporary holding facility must not exceed 10 hours.
6. WH&Bs should not wait in stock trailers and/or semi-trailers at a standstill for more than a combined period of three hours during the entire journey.

6.4.2. Vehicles

1. All motorized equipment employed in the transportation of captured animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The Contractor shall provide the CO annually, with a current safety inspection (less than

one year old) for all motorized equipment and tractor-trailers used to transport animals to final destination.
2. Only tractor-trailers or stock trailers with a covered top or overhead bars shall be allowed for transporting animals from trap site(s) to temporary holding facilities, and from temporary holding facilities to final destination(s). Sides or stock racks of all trailers used for transporting animals shall be a minimum height of 6 feet 6 inches from the floor. Single-deck tractor-trailers 40 feet or longer shall have two (2) partition gates providing three (3) compartments within the trailer to separate animals. Tractor-trailers less than 40 feet shall have at least one partition gate providing two (2) compartments within the trailer to separate the animals. Compartments in all tractor-trailers shall be of equal size plus or minus 10 percent. Each partition shall be a minimum of 6 feet high and shall have a minimum 5 foot wide swinging gate. The use of double deck tractor-trailers is prohibited. Only straight deck trailers and stock trailers are to be used for transporting WH&Bs.
3. WH&Bs must have adequate headroom during loading and unloading and must be able to maintain a normal posture with all four feet on the floor during transport without contacting the roof or overhead bars.
4. The width and height of all gates and doors must allow WH&Bs to move through freely.
5. All gates and doors must open and close easily and be able to be secured in a closed position.
6. The rear door(s) of stock trailers must be capable of opening the full width of the trailer.
7. Loading and unloading ramps must have a non-slip surface and be maintained in proper working condition to prevent slips and falls.
8. All partitions and panels inside of trailers must be free of sharp edges or holes that could cause injury to WH&Bs.
9. The inner lining of all trailers must be strong enough to withstand failure by kicking that would lead to injuries.
10. Partition gates in transport vehicles shall be used to distribute the load into compartments during travel.
11. Surfaces and floors of trailers must be cleaned of dirt, manure and other organic matter prior to the beginning of a gather.
12. Surfaces and floors of trailers shall have non-slip surface, use of shavings, dirt, and floor mates.

6.5. Care of WH&Bs during Transport Procedures

6.5.1. Transportation and Animal Care

The contractor, following coordination with the COR, shall schedule shipments of wild horses and burros to arrive during the normal operating hours of the designated facility unless prior approval has been obtained from the designated facility manager by the COR. Shipments scheduled to arrive at designated facilities on a Sunday or a Federal holiday requires prior facility personnel approval.

All motorized equipment employed in the transportation of captured wild horses and burros shall be incompliance with appropriate State and Federal laws and regulations.

Sides or dividers of all trailers used for transporting wild horses and burros shall be a minimum height of 6 feet 6 inches from the floor. A minimum of one full height partition is required in each stock trailer. All trailers shall be covered with solid material or bars to prevent horses from jumping out.

The contractor shall consider the condition and size of the wild horses and burros, weather conditions, distance to be transported, or other factors when planning for the movement of captured wild horses and burros.

The Government shall provide for any brand and/or veterinary inspection services required for captured wild horses and burros. Prior to shipping across state lines the Government will be responsible for coordinating with the receiving state veterinarian to transport the animals without a health certificate or Coggins test. If the receiving state does not agree to grant entry to animals without a current health certificate or Coggins test, the Government will obtain them prior to shipment.

When transporting wild horses and burros, drivers shall inspect for downed animals a minimum of every two hours when travelling on gravel roads or when leaving gravel roads onto paved roads and a minimum of every four hours when travelling on paved roads.

6.5.2. Use of Motorized Equipment

1. All motorized equipment employed in the transportation of captured animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The Contractor shall provide the COR/PI with a current safety inspection (less than one year old) for all motorized equipment and tractor-trailers used to transport animals to final destination.
2. All motorized equipment, tractor-trailers, and stock trailers shall be in good repair, of adequate rated capacity, and operated so as to ensure that captured animals are transported without undue risk or injury.
3. Only tractor-trailers or stock trailers with a covered top shall be allowed for transporting animals from gather site(s) to temporary holding facilities and from temporary holding facilities to final destination(s). Sides or stock racks of all trailers used for transporting animals shall be a minimum height of 6 feet 6 inches from the floor. Single-deck tractor-trailers 40 feet or longer shall have two (2) partition gates providing three (3) compartments within the trailer to separate animals. Tractor-trailers less than 40 feet shall have at least one partition gate providing two (2) compartments within the trailer to separate the animals. Compartments in all tractor-trailers shall be of equal size plus or minus 10 percent. Each partition shall be a minimum of 6 feet high and shall have a minimum 5-foot-wide swinging gate. The use of double-deck tractor-trailers is unacceptable and shall not be allowed.
4. All tractor-trailers used to transport animals to final destination(s) shall be equipped with at least one (1) door at the rear end of the trailer which is capable of sliding either horizontally or vertically. The rear door(s) of tractor-trailers and stock trailers must be capable of opening the full width of the trailer. Panels facing the inside of all trailers must be free of sharp edges or holes that could cause injury to the animals. The material facing the inside of all trailers must be strong enough so that the animals cannot push their hooves through the side. Final approval of tractor-trailers and stock trailers used to transport animals shall be held by the COR/PI.
5. Floors of tractor-trailers, stock trailers, and loading chutes shall be covered and maintained with wood shavings to prevent the animals from slipping.
6. If the COR/PI determines that dust conditions are such that the animals could be endangered during transportation, the Contractor will be instructed to adjust speed.
7. WH&Bs that are loaded and transported from the temporary holding facility to the BLM preparation facility must be fit to endure travel per direction of LCOR/COR/PI following consultation with onsite/on-call veterinarian.
8. WH&Bs that are non-ambulatory, blind in both eyes, or severely injured must not be loaded and shipped unless it is to receive immediate veterinary care or euthanasia.
9. WH&Bs that are weak or debilitated must not be transported without approval of the LCOR/COR/PI in consultation with the on-site veterinarian. Appropriate actions for their care during transport must be taken according to direction of the LCOR/COR/PI.
10. WH&Bs shall be sorted prior to transport to ensure compatibility and minimize aggressive behavior that may cause injury.

11. Trailers must be loaded using the minimum space allowance in all compartments as follows:
    a. For a 6.8 foot wide; 24 foot long stock trailer, 12 to 14 adult horses;
    b. For a 6.8 foot wide; 24 foot long stock trailer, 18 to 21 adult burros;
    c. For a 6.8 foot wide; 20 foot long stock trailer, 10 to 12 adult horses;
    d. For a 6.8 foot wide; 20 foot long stock trailer, 15 to 18 adult burros.

    For a semi-trailer:
    a. 12 square feet per adult horse.
    b. 6.0 square feet per dependent horse foal.
    c. 8.0 square feet per adult burro.
    d. 4.0 square feet per dependent burro foal.

12. Considering the condition of the animals, prevailing weather, travel distance and other factors or if animals are going down on trailers or arriving at their destination down or with injuries or a condition suggesting they may have been down, additional space or footing provisions may be necessary and will be required if directed by the LCOR/COR.
13. The LCOR/COR/PI, in consultation with the receiving Facility Manager, must document any WH&B that is recumbent or dead upon arrival at the destination. Non-ambulatory or recumbent WH&Bs must be evaluated on the trailer and either euthanized or removed from the trailers using a sled, slide board or slip sheet.
14. Saddle horses must not be transported in the same compartment with WH&Bs.

6.6. Euthanasia Or Death

6.6.1. Euthanasia Procedure during Gather Operations

1. An authorized, properly trained, and experienced person as well as a firearm appropriate for the circumstances must be available at all times during gather operations. When the travel time between the trap site and temporary holding facility exceeds one hour or if radio or cellular communication is not reliable, provisions for euthanasia must be in place at both the trap site and temporary holding facility during the gather operation.
2. Euthanasia must be performed according to American Veterinary Medical Association euthanasia guidelines (2013) using methods of gunshot or injection of an approved euthanasia agent.
3. The decision to euthanize and method of euthanasia must be directed by the LCOR/COR/PI who must be onsite and may consult with the onsite/on-call veterinarian. In event and rare circumstance that the LCOR/COR/PI is not available, the contractor if properly trained may euthanize an animal as an act of mercy.
4. All carcasses will be disposed of in accordance with state and local laws and as directed by the LCOR/COR/PI.
5. Carcasses left on the range should not be placed in washes or riparian areas where future runoff may carry debris into ponds or waterways. Trenches or holes for buried animals should be dug so the bottom of the hole is at least 6 feet above the water table and 4-6 feet of level earth covers the top of the carcass with additional dirt mounded on top where possible.

6.7. Safety and Communications

1. The Contractor shall have the means to communicate with the COR/PI and all contractor personnel engaged in the capture of wild horses and burros utilizing a VHF/FM Transceiver or VHF/FM portable Two-Way radio. If communications are ineffective the government will take steps necessary to protect the welfare of the animals.

a. The proper operation, service and maintenance of all contractor furnished property are the responsibility of the Contractor. The BLM reserves the right to remove from service any contractor personnel or contractor furnished equipment which, in the opinion of the contracting officer or COR/PI violate contract rules, are unsafe or otherwise unsatisfactory. In this event, the Contractor will be notified in writing to furnish replacement personnel or equipment within 48 hours of notification. All such replacements must be approved in advance of operation by the Contracting Officer or his/her representative.
b. The Contractor shall obtain the necessary FCC licenses for the radio system.
c. All accidents occurring during the performance of any task order shall be immediately reported to the COR/PI.

The nature of work performed under this contract may involve inherently hazardous situations. The primary concern of the contractor shall be the safety of all personnel involved and the humane handling of all wild horses and burros. It is the responsibility of the contractor to provide appropriate safety and security measures to prevent loss, injury or death of captured wild horses and burros until delivery to the final destination.

The BLM reserves the right to remove from service immediately any contractor personnel or contractor furnished equipment which, in the opinion of the COR and/or CO violate contract rules, are unsafe or otherwise unsatisfactory. In this event, BLM will notify the contractor to furnish replacement personnel or equipment within 24 hours of notification. All such replacements must be approved in advance by the COR and/or CO.

Contractor personnel who utilize firearms for purposes of euthanasia will be required to possess proof of completing a State or National Rifle Association firearm safety certification or equivalent (conceal carry, hunter safety, etc.).

All accidents involving wild horses and burros or people that occur during the performance of any task order shall be immediately reported to the COR/PI.

The contractor shall have the means to communicate with the COR/PI and all contractor personnel engaged in the capture of wild horses and burros utilizing a cell/satellite phone or radio at all times during the trapping operations. The Contractor will be responsible for furnishing all communication equipment for contractor use. BLM will provide the frequency for radio communications.

The contractor will provide daily gather activity reports to the COR/PI if they are not present (bait and water trap operations)

6.8. Safety And Security

1. All accidents involving animals or people that occur during the performance of any task order shall be immediately reported to the LCOR/COR/PI.
2. It is the responsibility of the Contractor to provide security to prevent unauthorized release, injury or death of captured animals until delivery to final destination.
3. The contractor must comply with all applicable federal, state, and local regulations.
4. Fueling operations shall not take place within 1,000 feet of animals or personnel and equipment other than the refueling truck and equipment.
5. Children under the age of 12 shall not be allowed within the gather's working areas which include near the chute when working animals at the temporary holding facility, or near the pens at the trap site when working and loading of animals. Children under the age of 12 in the non-working area must be accompanied by an adult at either location at all times.

6.9. Biosecurity

1. Health records for all saddle and pilot horses used on WH&B gathers must be provided to the LCOR during the BLM/Contractor pre-work meeting, including:
    a. Certificate of Veterinary Inspection (Health Certificate, within 30 days).
    b. Proof of:
        1. A negative test for equine infectious anemia (Coggins or EIA ELISA test) within 12 months.
        2. Vaccination for tetanus, eastern and western equine encephalomyelitis, West Nile virus, equine herpes virus, influenza, *Streptococcus equi*, and rabies within 12 months.
2. Saddle horses and pilot horses must not be removed from the gather operation (such as for an equestrian event) and allowed to return unless they have been observed to be free from signs of infectious disease for a period of at least three weeks and a new Certificate of Veterinary Inspection is obtained after three weeks and prior to returning to the gather.
3. WH&Bs, saddle horses, and pilot horses showing signs of infectious disease must be examined by the onsite/on-call veterinarian.
    a. Any saddle or pilot horses showing signs of infectious disease (fever, nasal discharge or illness) must be removed from service and isolated from other animals on the gather until such time as the horse is free from signs of infectious disease and approved by the onsite/on-call veterinarian to return to the gather.
    b. WH&Bs showing signs of infectious disease will normally not be mixed with groups of healthy WH&Bs at the temporary holding facility, or during transport.

6.10. Public And Media Interaction

1. Due to public interest in wild horse and burro gathers, the BLM expects an increasing number of requests from the public and media to view the operation. All requests received by the Contractor to view gather operation shall be forwarded to the BLM, who will provide a person with the expertise necessary to escort the public and media. The safety of the WHB's, BLM employees, Contractor crew, Contractor's private animals, and the media and public will be the first priority in determining whether a viewing opportunity will be provided, and if so, the time, location, and conditions associated with the viewing opportunity.
2. Assuming the BLM determines that providing a viewing opportunity for the media and the public is appropriate, the Contractor will establish the viewing area in accordance with instructions from the LCOR/COR/PI and current wild horse and burro program policy and guidance. BLM's observation policy will be discussed with the contractor during the pre-work meeting.
3. Member(s) of the viewing public or media whose conduct interferes with the gather operation in a way that threatens the safety of the WH&Bs, BLM employees, contractor crew (including animals), the media, or the public will be warned once to terminate the conduct. If the conduct persists, the offending individual(s) will be asked to leave the viewing area and the gather operation. The LCOR/COR/PI may direct the Contractor to temporarily shut down the gather operation until the situation is resolved.
4. Under no circumstances will the public or any media or media equipment be allowed in or on the gather helicopter or on the trap or holding equipment. The public, media, and media equipment must be at least 500 feet away from the trap during the trapping operation.
5. The public and media may be escorted closer than 500 feet to the trap site if approved by the LCOR/COR and in consultation with the Contractor during the time between gather runs or before or after the gather operation.

6. The Contractor shall not release any information to the news media or the public regarding the activities being conducted under this contract. All communications regarding BLM WH&B management, including but not limited to media, public and local stakeholders, are to come from the BLM unless it expressly authorizes the Contractor to give interviews, etc.

6.11. Bait and Water Trapping

Any media or visitation requests received by the contractor shall be forwarded to the COR immediately. Only the COR or CO can approve these requests.

The Contractor shall not post any information or images to social media networks or release any information to the news media or the public regarding the activities conducted under this contract.

If the public or media interfere in any way with the trapping operation, such that the health and well-being of the crew, or horses and burros are threatened, the contractor will immediately report the incident to the COR and trapping operations will be suspended until the situation is resolved as directed by the COR.

1. Due to this type of operation (luring wild horses and burros to bait) spectators and viewers will be prohibited as it will have impacts on the ability to capture wild horses and burros. Only essential personnel (COR/PI, veterinarian, contractor, contractor employees, etc.) will be allowed at the trap site during operations.
2. Public viewing of the wild horses and burros trapped may be provided at the staging area and/or the BLM preparation facility by appointment.
3. The Contractor agrees that there shall be no release of information to the news media regarding the removal or remedial activities conducted under this contract.
4. All information will be released to the news media by the assigned government public affairs officer.
5. If the public or media interfere in any way with the trapping operation, such that the health and wellbeing of the crew, horses and burros is threatened, the trapping operation will be suspended until the situation is resolved.

6.12. Contractor-Furnished Property

1. As specified herein, it is the contractor's responsibility to provide all necessary support equipment and vehicles including weed seed free hay and water for the captured animals and any other items, personnel, vehicles (which shall include good condition trucks and stock trailers to haul horses and burros from the trap site to the holding facility and two tractor trailers in good condition to haul horses from the holding facility to the preparation facility), saddle horses, etc. to support the humane and compassionate capture, care, feeding, transportation, treatment, and as appropriate, release of WH&Bs. Other equipment includes but is not limited to, a minimum 2,500 linear feet of 72-inch high (minimum height) panels for horses or 60-inch high (minimum height) for burros for traps and holding facilities. Separate water troughs shall be provided at each pen where animals are being held meeting the standards in section C.6. Water troughs shall be constructed of such material (e.g., rubber, galvanized metal with rolled edges, rubber over metal) so as to avoid injury to the animals.
2. The Contractor shall provide a radio transceiver to ensure communications are maintained with the BLM project PI when driving or transporting the wild horses/burros. The contractor needs to ensure communications can be made with the BLM and be capable of operating in the 150 MHz to 174 MHz frequency band, frequency synthesized, CTCSS 32 sub-audible tone capable, operator programmable, 5kHz channel increment, minimum 5 watts carrier power.
3. The Contractor shall provide water and weed seed-free hay.

4. The proper operation, service, and maintenance of all contractor furnished property is the responsibility of the Contractor.

6.13. BLM Roles And Responsibilities

6.13.1. Veterinarian

1. Onsite veterinary support must be provided for all helicopter gathers.
2. Veterinary support will be under the direction of the LCOR/COR/PI. Upon request, the onsite/on-call veterinarian will consult with the LCOR/COR/PI on matters related to WH&B health, handling, welfare, and euthanasia. All final decisions regarding medical treatment or euthanasia will be made by the onsite LCOR/COR/PI based on recommendations from the onsite veterinarian.

6.13.2. Transportation

1. The LCOR/COR/PI shall consider the condition and size of the animals, weather conditions, distance to be transported to the final destination or release, recommendations from the contractor and onsite veterinarian and other factors when planning for the movement of captured animals. The LCOR/COR/PI shall provide for any brand inspection services required for the movement of captured animals to BLM prep facilities. If animals are to be transported over state lines, the LCOR will be responsible for obtaining a waiver from the receiving State Veterinarian.
2. If the LCOR/COR/PI determines that conditions are such that the animals could be endangered during transportation, the Contractor will be instructed to adjust speed or delay transportation until conditions improve.

6.13.3. Government Furnished Equipment/Supplies/Materials

1. The government will provide:
    a. A portable restraining chute for each contractor to be used for the purpose of restraining animals to determine the age of specific individuals or other similar procedures. The contractor will be responsible for the maintenance of the portable restraining chute during the gather season.
    b. All inoculate syringes, freezemarking equipment, and all related equipment for fertility control treatments.
    c. A boat to transport burros as appropriate.
    d. Sleds, slide boards, or slip sheets for loading of recumbent animals.
2. The Contractor shall be responsible for the security of all Government Furnished Property.

6.13.4. Site Clearances

Prior to setting up a trap or temporary holding facility, BLM will conduct all necessary legal reviews and clearances (NEPA, ARPA, NHPA, etc.). All proposed site(s) must be inspected by a government archaeologist. Once archaeological clearance has been obtained, the trap or temporary holding facility may be set up. Said clearance shall be coordinated and arranged for by the COR/ PI or other BLM employees.

6.14. COR/PI Responsibilities

1. In emergency situations, the COR/PI will implement procedures to protect animals as rehab is initiated, i.e. rationed feeding and watering at trap and or staging area.
2. The COR/PI will authorize the contractor to euthanize any wild horse or burros as an act of mercy.
3. The COR/PI will ensure wild horses or burros with pre-existing conditions are euthanized in the field according to BLM policy.
4. Prior to setting up a trap or staging area on public land, the BLM and/or Forest Service will conduct all necessary clearances (archaeological, T&E, etc.). All proposed sites must be inspected by a

government archaeologist or equivalent. Once archaeological clearance has been obtained, the trap or staging area may be set up. Said clearances shall be arranged for by the COR/PI.

5. The COR/PI will provide the contractor with all pertinent information on the areas and wild horses and burros to be trapped.
6. The COR/PI will be responsible to establish the frequency of communicating with the contractor.
7. The COR/PI shall inspect trap operation prior to Contractor initiating trapping.
8. The Contractor shall make all efforts to allow the COR/PI to observe a minimum of at least 25% of the trapping activity.
9. The COR/PI is responsible to arrange for a brand inspector and/or veterinarian to inspect all wild horses and burros prior to transporting to a BLM preparation facility when legally required.
10. The COR/PI will be responsible for the establishing a holding area for administering PZP, gelding of stallions, holding animals in poor condition until they are ready of shipment, holding for EIA testing, etc.
11. The COR/PI will ensure the trailers are cleaned and disinfected before WH&Bs are transported. This will help prevent transmission of disease into our populations at a BLM Preparation Facility.

6.15. Responsibility and Lines of Communication

The Wild Horse Specialist (COR) or delegate has direct responsibility to ensure human and animal safety. The Field Manager will take an active role to ensure that appropriate lines of communication are established between the field, field office, state office, national program office, and BLM holding facility offices.

All employees involved in the gathering operations will keep the best interests of the animals at the forefront at all times.

All publicity and public contact and inquiries will be handled through the Office of Communications. These individuals will be the primary contact and will coordinate with the COR on any inquiries.

The BLM delegate will coordinate with the corrals to ensure animals are being transported from the capture site in a safe and humane manner and are arriving in good condition.

The BLM require humane treatment and care of the animals during removal operations. These specifications are designed to minimize the risk of injury and death during and after capture of the animals. The specifications will be vigorously enforced.

6.16. Resource Protection

Gather sites and holding facilities would be located in previously disturbed areas whenever possible to minimize potential damage to the natural and cultural resources. Gather sites and temporary holding facilities would not be constructed on wetlands or riparian zones.

Prior to implementation of gather operations, gather sites and temporary holding facilities would be evaluated to determine their potential for containing cultural resources. All gather facilities (including gather sites, gather runways, blinds, holding facilities, camp locations, parking areas, staging areas, etc.) that would be located partially or totally in new locations (i.e. not at previously used gather locations) or in previously undisturbed areas would be inventoried by a Qualified BLM archaeologist or district archaeological technician before initiation of the gather. A buffer of at least 50 meters would be maintained between gather facilities and any identified cultural resources.

Gather sites and holding facilities would not be placed in known areas of Native American concern. The contractor would not disturb, alter, injure, or destroy any scientifically important paleontological remains;

any historical or archaeological site, structure, building, grave, object or artifact; or any location having Native American traditional or spiritual significance within the project area or surrounding lands. The contractor would be responsible for ensuring that its employees, subcontractors or any others associated with the project do not collect artifacts and fossils, or damage or vandalize archaeological, historical or paleontological sites or the artifacts within them.

Should damage to cultural or paleontological resources occur during the period of gather due to the unauthorized, inadvertent or negligent actions of the contractor or any other project personnel, the contractor would be responsible for costs of rehabilitation or mitigation. Individuals involved in illegal activities may be subject to penalties under the Archaeological Resources Protection Act (ARPA).

6.17. Capture Methods That May Be Used In The Performance Of A Gather

6.17.1. Helicopter Drive Trapping

The following describes many of the procedures that occur during a helicopter drive trap gather.

The gather contractor supplies and transports all equipment needed to conduct a gather to a central location where Holding Corrals are constructed. These corrals consist of six or more pens constructed of sturdy panels, with a central alleyway and working/squeeze chute in the center. Corral panels are covered with snow fencing to keep animals calm, and water tanks are located within the pens. The central alley and pen arrangement allows the BLM staff and the contractor to sort recently captured animals, separating animals to ship to the adoption facilities, and mares and foals from studs to prevent fighting and injury. The pen arrangement allows the contractor to off-load wild horses from stock trailers into the pens, and facilitates the loading of the horses to be transported to facilities onto large straight deck trucks.

At various locations throughout the gather area, smaller sets of gather corrals are constructed called “traps”. The trap or gather corrals consists of a series of pens made out of panels, and “wings” made out of jute netting that funnel wild horses into the corrals as they are captured. Refer to photos 2-3 and 10-13 at the end of this Appendix. Once captured, the horses are loaded into stock trailers and transported to the central Holding Corrals for sorting. Horses may remain in the gather site or on the stock trailer for no time at all, or up to an hour or more while other groups of horses are brought to the gather corrals.

The contractor utilizes a helicopter and pilot to conduct gathers. Use of a helicopter is humane, safe and effective. Methods for use of helicopter are well established, and the contract pilots very skilled. Wild horses settle down once gathered and do not appear to be more than slightly annoyed by the helicopter.

The pilot locates groups of wild horses within the HMA and guides them towards the gather corrals. In most cases, horses are allowed to travel at their own pace, and are not “pushed”. Distances average 4-7 miles over mixed terrain which may consist of rolling foothills, or steeper terrain, drainages, ridges and valley bottoms. The horses often follow their own trails. The pilot and the BLM staff monitor the condition of the horses to ensure their safety, checking for signs of exhaustion, injuries etc. The contractor and pilots are very skilled at designing and building gather corrals, and safely herding the horses to them. Generally, wild horses are very fit, and recover quickly from being captured. Distances that the horses travel are modified to account for summer temperatures, snow depth, animals in weakened condition, young foals, or older/lame animals. Some horses could occasionally be herded 10 miles or more at the discretion of the COR/Wild Horse and Burro Specialist.

Once near the gather site, the contractor holds a guide horse at the mouth of the wings. As the pilot pushes the wild horses closer, the guide horse is released, who then runs into the gather corrals, leading all of the wild horses with him. Crewmembers secure gates once the horses are within the corrals. During summer gathers, the crew often separates foals from adults at the gather site so that they may be transported to the Holding Corrals separately and avoids the risk of injury by adult animals. Foals may be loaded into a separate stock trailer where they can have shade, water, and electrolyte if necessary. Once unloaded at the Holding Corrals, foals may be rejoined with the mothers if not old enough to wean and monitored to ensure that all of the foals "join-up". Often paint marks are applied to the foals and mothers to assist the contractor and BLM staff in identifying pairs.

Occasionally helicopter-assisted roping is implemented, in which the pilot moves a small group of horses, or a single horse to the gather area, and the crewmembers rope the animals by horseback. This method often prevents overstressing the wild horses from repeated attempts to move them into the gather corrals. The roped horses are then led to the corrals, to awaiting stock trailers, or immobilized on the ground until they can be loaded into stock trailers.

Once horses are loaded and transported to the Holding Corrals, they are sorted by the contractor's staff and BLM employees. The contractor looks at the horse's teeth to estimate age while held in the chute, and the BLM staff documents age, color, body condition and lactation status of the horse. Refer to photo 6. Aging wild horses is a process of estimation due to the type of wear that can occur to the teeth of a wild horse on the range.

Injuries are noted and treated if needed. Once sorted, the wild horses are given hay and unlimited water. During this time, the BLM may consult with a veterinarian to treat sick or injured animals or make recommendations for euthanasia.

When the pens hold enough animals to transport to the BLM adoption facility, they are loaded into the straight deck trailers that hold 35-45 wild horses depending upon their size. The trailers have three compartments so that mares, studs and foals can be transported separately. It may require 3-6+ hours for the wild horses to arrive at the adoption preparation facility.

During sorting, the BLM staff identifies wild horses to be re-released back to the HMA according to the objectives for the herd. Mares may be held until the end of the gather so that fertility control can be given to them to slow future population growth rates. When it is time for the release, the mares and studs are each loaded into separate stock trailers and transported back inside the HMA. The rear of the trailer is opened up, and the horses are allowed to step off and travel back into the HMA. Sometimes the horses are released directly from the holding corrals if they are centrally located within the HMA.

1. The helicopter must be operated using pressure and release methods to herd the animals in a desired direction and shall not repeatedly evoke erratic behavior in the WH&Bs that causes injury or exhaustion. Animals must not be pursued to a point of exhaustion; the onsite veterinarian must examine WH&Bs for signs of exhaustion.
2. The rate of movement and distance the animals travel must not exceed limitations set by the LCOR/COR/PI who will consider terrain, physical barriers, access limitations, weather, condition of the animals, urgency of the operation (animals facing drought, starvation, fire, etc.) and other factors.
    a. WH&Bs that are weak or debilitated must be identified by BLM staff or the contractors. Appropriate gather and handling methods shall be used according to the direction of the LCOR/COR/PI as defined in this contract.
    b. The appropriate herding distance and rate of movement must be determined the LCOR/COR/PI on a case-by-case basis considering the weakest or smallest animal in the group (e.g., foals, pregnant mares, or horses that are weakened by body condition, age, or poor health) and the range and environmental conditions present.

c. Rate of movement and distance travelled must not result in exhaustion at the trap site, unless the exhausted animals were already in a severely compromised condition prior to the gather. Where compromised animals cannot be left on the range or where doing so would only serve to prolong their suffering, the LCOR/COR/PI will determine if euthanasia will be performed in accordance with BLM policy.

3. WH&Bs must not be pursued repeatedly by the helicopter such that the rate of movement and distance travelled exceeds the limitation set by the LCOR/COR/PI. Abandoning the pursuit or alternative capture methods may be considered by the LCOR/COR/PI in these cases.
4. The helicopter is prohibited from coming into physical contact with any WH&B regardless of whether the contact is accidental or deliberate.
5. WH&Bs may escape or evade the gather site while being moved by the helicopter. If there are mare/dependent foal pairs in a group being brought to a trap and half of an identified pair is thought to have evaded capture, multiple attempts by helicopter may be used to bring the missing half of the pair to the trap or to facilitate capture by roping. In these instances, animal condition and fatigue will be evaluated by the LCOR/COR/PI or on-site veterinarian on a case-by-case basis to determine the number of attempts that can be made to capture an animal.
6. Horse captures must not be conducted when ambient temperature at the trap site is below 10ºF or above 95ºF without approval of the LCOR/COR/PI. Burro captures must not be conducted when ambient temperature is below 10ºF or above 100ºF without approval of the LCOR/COR/PI. The LCOR/COR/PI will not approve captures when the ambient temperature exceeds 105 ºF.
7. The contractor shall assure that dependent foals shall not be left behind. Any animals identified as such will be recovered as a priority in completing the gather.
8. Any adult horse or burro that cannot make it to the trap due to physical limitations shall be identified to the LCOR/COR/PI by the pilot or contractor immediately. An inspection of the animal will be made to determine the problem and the LCOR/COR/PI and/or veterinarian will decide if that animal needs to be humanely euthanized.

6.17.2. Roping

1. The roping of any WH&Bs must be approved by the LCOR/COR/PI prior to the action.
2. The roping of any WH&Bs will be documented by the LCOR/COR/PI along with the circumstances. WH&Bs may be roped under circumstances which include but are not limited to the following: reunite a mare or jenny and her dependent foal; capture nuisance, injured or sick WH&Bs or those that require euthanasia; environmental reasons such as deep snow or traps that cannot be set up due to location or environmental sensitivity; and public and animal safety or legal mandates for removal.
3. Ropers should dally the rope to their saddle horn such that animals can gradually be brought to a stop and must not tie the rope hard and fast to the saddle, which can cause the animals to be jerked off their feet.
4. WH&Bs that are roped and tied down in recumbency must be continuously observed and monitored by an attendant at a maximum of 100 feet from the animal.
5. WH&Bs that are roped and tied down in recumbency must be untied within 30 minutes.
6. If the animal is tied down within the wings of the trap, helicopter drive trapping within the wings will cease until the tied-down animal is removed.
7. Sleds, slide boards, or slip sheets must be placed underneath the animal's body to move and/or load recumbent WH&Bs.
8. Halters and ropes tied to a WH&B may be used to roll, turn, and position or load a recumbent animal, but a WH&B must not be dragged across the ground by a halter or rope attached to its body while in a recumbent position.

9. All animals captured by roping must be marked at the trap site by the contractor for evaluation by the onsite/on-call veterinarian within four hours after capture, and re-evaluation periodically as deemed necessary by the onsite/on-call veterinarian.

6.17.3. Water and Bait Trapping Standard Operating Procedures

The work consists of the capture, handling, care, feeding, daily rate, and transportation of wild horses and/or burros from the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah and Wyoming. The method of capture will be with the use of bait and/or water traps in accordance with the standards identified in the Comprehensive Animal Welfare Program (CAWP) for Wild horse and Burro Gathers, Bureau of Land Management (BLM) Instruction Memorandum 2015-151 (Attachment 1). Items listed in the sections of the Statement of Work (SOW) either are not covered or deviate from the CAWP, the SOW takes precedence over the CAWP when there is conflicting information. Extended care, handling and animal restraint for purposes of population growth suppression treatments may be required for some trapping operations. The contractor shall furnish all labor, supplies, transportation, and equipment necessary to accomplish the individual task order requirements with the exception of a Government provided restraint fly chute, as needed for population growth suppression. The work shall be accomplished in a safe and humane manner and be in accordance with the provisions of 43 CFR Part 4700, the CAWP, the specifications and provisions included in this SOW, and any subsequent SOW documents issued with individual task orders. The primary concern of the contractor shall be the safety of all personnel involved and the humane capture and handling of all wild horses and burros. It is the responsibility of the contractor to provide appropriate safety and security measures to prevent loss, injury or death of captured wild horses and burros.

Any reference to hay in this SOW or subsequent SOW documents issued with individual task orders will be implied as certified weed-free hay (grass or alfalfa). The contractor will be responsible for providing certifications upon request from the Government. The COR/PIs will observe a minimum of at least 25% of the trapping activity. BLM reserves the right to place game cameras or other cameras in the capture area to document animal activity and response, capture techniques and procedures, and humane care during trapping. No private/non-BLM camera will be placed within the capture areas.

Trapping activities would be on the HA/HMA/WHBT or outside areas specified in the task order. However, trapping could be required on adjacent land, federal, state, tribal, military, or private property. If trapping operations include work on military and/or other restricted areas, the BLM will coordinate all necessary clearances, such as background checks, to conduct operations for equipment and personnel.

The permissions to use private/state/tribal lands during task order performance will be coordinated by the BLM, contractor, and landowner. The need for these permissions will be identified in the Task Order SOW and will be obtained in writing.

Prior to any gathering operation, the BLM will provide for a pre-capture evaluation of existing conditions in the gather area(s). The evaluation will include animal conditions, prevailing temperatures, drought conditions, soil conditions, road conditions, and preparation of a topographic map with wilderness boundaries, the location of fences, other physical barriers, and acceptable gather site locations in relation to animal distribution. The evaluation will determine whether the proposed activities will necessitate the presence of a veterinarian during operations. If it is determined that capture operations necessitate the services of a veterinarian, one would be obtained before the capture would proceed. The contractor will be apprised of all conditions and will be given instructions regarding the capture and handling of animals to ensure their health and welfare is protected.

Gather sites and temporary holding sites will be located to reduce the likelihood of undue injury and stress to the animals, and to minimize potential damage to the natural and cultural resources of the area. Temporary holding sites would be located on or near existing roads.

6.17.4. Bait Trapping—Facility Design (Temporary Holding Facility Area and Traps)

All trap and temporary holding facility areas locations must be approved by the COR and/or the Project Inspector (PI) prior to construction and/or operation. The contractor may also be required to change or move trap locations as determined by the COR/PI. All traps and temporary holding facilities not located on public land must have prior written approval of the landowner or other management agency.

Facility design to include traps, wings, alleys, handling pens, finger gates, and temporary holding facilities, etc. shall be constructed, maintained, and operated to handle the wild horses and burros in a safe and humane manner in accordance with the standards identified in the Comprehensive Animal Welfare Program (CAWP) for Wild Horse and Burro Gathers, Bureau of Land Management (BLM) Instruction Memorandum 2015-151 (Attachment 1).

Some gather operations will require the construction of an off-site temporary holding facility as identified in specific individual task orders for extended care and handling for purposes of slow trapping conditions or management activities such as research, population growth suppression treatments, etc.

No modification of existing fences will be made without authorization from the COR/PI. The contractor shall be responsible for restoring any fences that are modified back to the original condition.

Temporary holding and sorting pens shall be of sufficient size to prevent injury due to fighting and trampling. These pens shall also allow for captured horses and burros to move freely and have adequate access to water and feed.

All pens will be capable of expansion when requested by the COR/PI.

Separate water troughs shall be provided for each pen where wild horses and burros are being held. Water troughs shall be constructed of such material (e.g., rubber, plastic, fiberglass, galvanized metal with rolled edges, and rubber over metal) so as to avoid injury to the wild horses and burros.

Any changes or substitutions to trigger and/or trip devices previously approved for use by the Government must be approved by the COR prior to use.

6.17.5. Bait Trapping, Animal Care, and Handling

If water is to be used as the bait agent and the Government determines that cutting off other water sources is the best action to take under the individual task order, elimination of other water sources shall not last longer than a period of time approved by the COR/PI.

Hazing/driving of wild horses and burros for the purpose of trapping the animals will not be allowed for the purposes of fulfilling individual task orders. Roping will be utilized only as directed by the COR.

Darting of wild horses and burros for trapping purposes will not be allowed.

No barbed wire material shall be used in the construction of any traps or used in new construction to exclude horses or burros from water sources.

Captured wild horses and burros shall be sorted into separate pens (i.e. by age, gender, animal health/condition, population growth suppression, etc.).

A temporary holding facility area will be required away from the trap site for any wild horses and burros that are being held for more than 24 hours.

The contractor shall assure that captured mares/jennies and their dependent foals shall not be separated for more than 4 hours, unless the COR/PI determines it necessary.

The contractor shall provide a saddle horse on site that is available to assist with the pairing up of mares/jennies with their dependent foals and other tasks as needed.

Contractor will report any injuries/deaths that resulted from trapping operations as well as preexisting conditions to the COR/PI within 12 hours of capture and will be included in daily gather activity report to the COR.

The COR/PI may utilize contractor constructed facilities, when necessary, in the performance of individual task orders for such management actions as population growth suppression, and/or selecting animals to return to the range.

In performance of individual task orders, the contractor may be directed by the COR to transport and release wild horses or burros back to the range.

At the discretion of the COR/PI the contractor may be required to delay shipment of horses until the COR/PI inspects the wild horses and burros at the trap site and/or the temporary holding facility prior to transporting them to the designated facility.

7.0 Literature Reviews of PZP, GonaCon, and Gelding

Various forms of fertility control can be used in wild horses and wild burros, with the goals of maintaining herds at or near AML, reducing fertility rates, and reducing the frequency of gathers and removals. The WFRHBA of 1971 specifically provides for contraception and sterilization (16 U.S.C. 1333 section 3.b.1). Fertility control measures have been shown to be a cost-effective and humane treatment to slow increases in wild horse populations or, when used in combination with gathers, to reduce horse population size (Bartholow 2004, de Seve and Boyles-Griffin 2013, Fonner and Bohara 2017). Although fertility control treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, those impacts are generally minor and transient, do not prevent overall maintenance of a self-sustaining population, and do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013). An extensive body of peer-reviewed scientific literature details the impacts of fertility control methods on wild horses and burros. This review focuses on peer-reviewed scientific literature. Cited studies are generally limited to those involving horses and burros, except where including studies on other species helps in making inferences about physiological or behavioral questions not yet addressed in horses or burros specifically. While most studies reviewed here refer to horses, burros are extremely similar in terms of physiology, such that expected effects are comparable, except where differences between the species are noted.

On the whole, the identified impacts are generally transient and affect primarily the individuals treated. Fertility control that affects individual horses and burros does not prevent BLM from ensuring that there will be self-sustaining populations of wild horses and burros in single herd management areas (HMAs), in complexes of HMAs, and at regional scales of multiple HMAs and complexes. Under the WFRHBA of 1971, BLM is charged with maintaining self-reproducing populations of wild horses and burros. The National Academies of Sciences (2013) encouraged BLM to manage wild horses and burros at the spatial scale of "metapopulations" – that is, across multiple HMAs and complexes in a region. All fertility control methods affect the behavior and physiology of treated animals (NAS 2013), and are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception alone does not remove excess horses from an HMA's population, so one or more gathers are usually needed in order to bring the herd down to a level close to AML. Fertility control methods such as immunocontraceptive vaccines and sex ratio manipulation are not very effective at reducing population growth rates to the point where births equal deaths in a herd. However, even more modest fertility control activities can reduce the frequency of horse gather activities, and costs to taxpayers. Bartholow (2007) concluded that the application of 2-year or 3-year contraceptives to wild mares could reduce operational costs in a project area by 12-20%, or up to 30% in carefully planned population management programs. Because applying contraception to horses requires capturing and handling, the risks and costs associated with capture and handling of horses may be comparable to those of gathering for removal, but with expectedly lower adoption and long-term holding costs. Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000).

7.1 Porcine Zona Pellucida (PZP) Vaccine

Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that PZP was one of the three 'most promising' available methods for contraception in wild horses and burros at that time (NRC 2013). PZP use can reduce the need for gathers and removals (Turner et al. 1997). PZP vaccines meet most of the criteria that the National Research Council (2013) used to identify promising fertility control methods, in terms of delivery method, availability, efficacy, and side effects. It has been used extensively in wild horses (NRC 2013), and in feral burros on Caribbean islands (Turner et al. 1996, French et al. 2017). PZP is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced as ZonaStat-H, an EPA-registered commercial product (EPA

2012, SCC 2015), as PZP-22, which is a formulation of PZP in polymer pellets that can lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017), and as Spayvac, where the PZP protein is enveloped in liposomes (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018). 'Native' PZP proteins can be purified from pig ovaries (Liu et al. 1989). Recombinant ZP proteins may be produced with molecular techniques (Gupta and Minhas 2017, Joonè et al. 2017a, Nolan et al. 2018a). It can easily be remotely administered in the field in cases where mares are relatively approachable. Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010).

7.1.2. PZP Direct Effects

The historically accepted hypothesis explaining PZP vaccine effectiveness posits that when injected as an antigen in vaccines, PZP causes the mare's immune system to produce antibodies that are specific to zona pellucida proteins on the surface of that mare's eggs. The antibodies bind to the mare's eggs surface proteins (Liu et al. 1989), and effectively block sperm binding and fertilization (Zoo Montana, 2000). Because treated mares do not become pregnant but other ovarian functions remain generally unchanged, PZP can cause a mare to continue having regular estrus cycles throughout the breeding season. More recent observations support a complementary hypothesis, which posits that PZP vaccination causes reductions in ovary size and function (Mask et al. 2015, Joonè et al. 2017b, Joonè et al. 2017c, Nolan et al. 2018b, 2018c). Antibodies specific to PZP protein do not appear to cross-react with tissues outside of the reproductive system (Barber and Fayrer-Hosken 2000).

Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90 percent or more for mares treated twice in one year (Turner and Kirkpatrick 2002, Turner et al. 2008). The highest success for fertility control has been reported when the vaccine has been applied November through February. High contraceptive rates of 90 percent or more can be maintained in horses that are boostered annually (Kirkpatrick et al. 1992). Approximately 60 percent to 85 percent of mares are successfully contracepted for one year when treated simultaneously with a liquid primer and PZP-22 pellets (Rutberg et al. 2017, Carey et al. 2019, Grams et al. 2022). Application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011).

The contraceptive result for a single application of the liquid PZP vaccine primer dose along with PZP vaccine pellets (PZP-22), based on winter applications, can be expected to fall in the approximate efficacy ranges as follows (based on figure 2 in Rutberg et al. 2017). Below, the approximate efficacy is measured as the relative decrease in foaling rate for treated mares, compared to control mares:

Table 1: Approximate Efficacy

Year 1	Year 2	Year 3
0 (developing fetuses come to term)	~30-75 percent	~20-50 percent

If mares that have been treated with PZP-22 vaccine pellets subsequently receive a booster dose of either the liquid PZP vaccine or the PZP-22 vaccine pellets, the subsequent contraceptive effect is apparently more pronounced and long-lasting. The approximate efficacy following a booster dose can be expected to be in the following ranges (based on figure 3 in Rutberg et al. 2017).

Table 2: Approximate Efficacy following a Booster

Year 1	Year 2	Year 3	Year 4
0 (developing fetuses come to term)	~50-90 percent	~55-75 percent	~40-75 percent

The efficacies noted above, which are based on results in Rutberg et al. (2017), call into question population and economic models that assume PZP-22 can have an 85 percent efficacy in years 2 and 3 after immunization, such as Fonner and Bohara (2017).

The fraction of mares treated in a herd can have a large effect on the realized change in growth rate due to PZP contraception, with an extremely high portion of mares required to be treated to lead prevent population-level growth (e.g., Turner and Kirkpatrick 2002, Grams et al. 2022). Gather efficiency would likely not exceed 85 percent via helicopter, and may be less with bait and water trapping, so there would be a portion of the female population uncaptured that is not treated in any given year. Additionally, some mares may not respond to the fertility control vaccine, but instead may continue to foal normally.

7.1.2. Reversibility and Effects on Ovaries

In most cases, PZP contraception appears to be temporary and reversible, with most treated mares returning to fertility over time (Kirkpatrick and Turner 2002). The NRC (2013) criterion by which PZP is not optimal for wild horse contraception was duration. The ZonaStat-H formulation of the vaccine tends to confer only one year of efficacy per dose. Some studies have found that a PZP vaccine in long-lasting pellets (PZP-22) can confer multiple years of contraception (Turner et al. 2007), particularly when boostered with subsequent PZP vaccination (Rutberg et al. 2017). Other trial data, though, indicate that the pelleted vaccine may only be effective for one year (J. Turner, University of Toledo, Personal Communication).

The purpose of applying PZP treatment is to prevent mares from conceiving foals, but BLM acknowledges that long-term infertility, or permanent sterility, could be a result for some number of wild horses receiving PZP vaccinations. The rate of long-term or permanent sterility following vaccinations with PZP is hard to predict for individual horses, but that outcome appears to increase in likelihood as the number of doses increases (Kirkpatrick and Turner 2002). Permanent sterility for mares treated consecutively 5-7 years was observed by Nuñez et al. (2010, 2017). In a graduate thesis, Knight (2014) suggested that repeated treatment with as few as three to four years of PZP treatment may lead to longer-term sterility, and that sterility may result from PZP treatment before puberty. Repeated treatment with PZP led long-term infertility in Przewalski's horses receiving as few as one PZP booster dose (Feh 2012). However, even if some number of mares become sterile as a result of PZP treatment, that potential result would be consistent with the contraceptive purpose that motivates BLM's potential use of the vaccine.

In some mares, PZP vaccination may cause direct effects on ovaries (Gray and Cameron 2010, Joonè et al. 2017b, Joonè et al. 2017c, Joonè et al. 2017d, Nolan et al. 2018b). Joonè et al. (2017a) noted reversible effects on ovaries in mares treated with one primer dose and booster dose. Joonè et al. (2017c) and Nolan et al. (2018b) documented decreased anti-Mullerian hormone (AMH) levels in mares treated with native or recombinant PZP vaccines; AMH levels are thought to be an indicator of ovarian function. Bechert et al. (2013) found that ovarian function was affected by the SpayVac PZP vaccination, but that there were no effects on other organ systems. Mask et al. (2015) demonstrated that equine antibodies that resulted from SpayVac immunization could bind to oocytes, ZP proteins, follicular tissues, and ovarian tissues. It is possible that result is specific to the immune response to SpayVac, which may have lower PZP purity than ZonaStat or PZP-22 (Hall et al. 2016). However, in studies with native ZP proteins and recombinant ZP proteins, Joonè et al. (2017a) found transient effects on ovaries after PZP vaccination in some treated mares; normal estrus cycling had resumed 10 months after the last treatment. SpayVac is a patented formulation of PZP in liposomes that led to multiple years of infertility in some breeding trials (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018), but unacceptably poor efficacy in a subsequent trial (Kane 2018). Kirkpatrick et al. (1992) noted effects on horse ovaries after three years of treatment with PZP. Observations at Assateague Island National Seashore indicate that the more times a mare is consecutively treated, the longer the time lag before fertility returns, but that even mares treated 7 consecutive years did eventually return to ovulation (Kirkpatrick and Turner 2002). Other studies have reported that continued applications of PZP may result in decreased estrogen levels (Kirkpatrick et al. 1992) but that decrease was not biologically significant, as ovulation remained similar between treated and untreated mares (Powell and Monfort 2001). Permanent sterility for mares treated consecutively 5-7 years was observed by Nuñez et al. (2010, 2017). Bagavant et al. (2003) demonstrated T-cell clusters on ovaries, but no loss of ovarian function after ZP protein immunization in macaques. Skinner et al. (1984) raised concerns about PZP effects on ovaries, based on their study in laboratory rabbits, as did Kaur and Prabha (2014), though neither paper was a study of PZP effects in equids.

7.1.4. Effects on Existing Pregnancies, Foals, and Birth Phenology

Although fetuses are not explicitly protected under the WFRHBA of 1971, as amended, it is prudent to analyze the potential effects of fertility control vaccines on developing fetuses and foals. Any impacts identified in the literature have been found to be transient, and do not influence the future reproductive capacity of offspring born to treated females.

If a mare is already pregnant, the PZP vaccine has not been shown to affect normal development of the fetus or foal, or the hormonal health of the mare with relation to pregnancy (Kirkpatrick and Turner 2003). It is possible that there may be transitory effects on foals born to mares or jennies treated with PZP. In mice, Sacco et al. (1981) found that antibodies specific to PZP can pass from mother mouse to pup via the placenta or colostrum, but that did not apparently cause any innate immune response in the offspring: the level of those antibodies were undetectable by 116 days after birth. There was no indication in that study that the fertility or ovarian function of those mouse pups was compromised, nor is BLM aware of any such results in horses or burros. Unsubstantiated speculative connections between PZP treatment and foal stealing has not been published in a peer-reviewed study and thus cannot be verified. Similarly, although Nettles (1997) noted reported stillbirths after PZP treatments in cynomolgus monkeys, those results have not been observed in equids despite extensive use.

On-range observations from more than 20 years of application to wild horses indicate that PZP vaccine use in wild mares does not generally cause mares to give birth to foals out of season or late in the year (Kirkpatrick and Turner 2003). Nuñez's (2010) research showed that a small number of mares that had previously been treated with PZP foaled later than untreated mares and expressed the concern that this late foaling "may" impact foal survivorship and decrease band stability, or that higher levels of attention from stallions on PZP-treated mares might harm those mares. However, that paper provided no evidence that such impacts on foal survival or mare well-being actually occurred. Rubenstein (1981) called attention to a number of unique ecological features of horse herds on Atlantic barrier islands, which calls into question whether inferences drawn from island herds can be applied to western wild horse herds. Ransom et al. (2013), though, identified a potential shift in reproductive timing as a possible drawback to prolonged treatment with PZP, stating that treated mares foaled on average 31 days later than non-treated mares. Results from Ransom et al. (2013), however, showed that over 81percent of the documented births in this study were between March 1 and June 21, i.e., within the normal, peak, spring foaling season. Ransom et al. (2013) pointedly advised that managers should consider carefully before using PZP in small refugia or rare species. Wild horses and burros managed by BLM do not generally occur in isolated refugia, nor are they rare species. Moreover, an effect of shifting birth phenology was not observed uniformly: in two of three PZP-treated wild horse populations studied by Ransom et al. (2013), foaling season of treated mares extended three weeks and 3.5 months, respectively, beyond that of untreated mares. In the other population, the treated mares foaled within the same time period as the untreated mares. Furthermore, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season. If there are shifts in birth phenology, though, it is reasonable to assume that some negative effects on foal survival might result from particularly severe weather events (Nuñez et al. 2018).

7.1.4. Effects of Marking and Injection

Standard practices for PZP treatment require that immunocontraceptive-treated animals be readily identifiable, either via brand marks or unique coloration (BLM 2010). BLM has instituted guidelines to reduce the sources of handling stress in captured animals (BLM 2015). Some level of transient stress is likely to result in newly captured mares that do not have markings associated with previous fertility control treatments. It is difficult to compare that level of temporary stress with long-term stress that can result from food and water limitation on the range (e.g., Creel et al. 2013). Handling may include freezemarking and / or RFID chipping for the purpose of identifying that mare and identifying her PZP vaccine treatment history. Under past management practices, captured mares experienced increased stress levels from handling (Ashley and Holcombe 2001), but BLM has instituted guidelines to reduce the sources of handling stress in captured animals (BLM 2021). Markings may also be used into the future to determine the approximate fraction of mares in a herd that have been previously treated, and could provide additional insight regarding gather efficiency.

Most mares recover from the stress of capture and handling quickly once released back to the HMA, and none are expected to suffer serious long term effects from the fertility control injections, other than the direct consequence of becoming temporarily infertile. Injection site reactions associated with fertility control treatments are possible in treated mares (Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017), but swelling or local reactions at the injection site are expected to be minor in nature. Roelle and Ransom (2009) found that the most time-efficient method for applying PZP is by hand-delivered injection of 2-year pellets when horses are gathered. They observed only two instances of swelling from that technique. Use of remotely delivered, 1-year PZP is generally limited to populations where individual animals can be accurately identified and repeatedly approached. The dart-delivered formulation produced injection-site reactions of varying intensity, though none of the observed reactions appeared debilitating to the animals (Roelle and Ransom 2009). Joonè et al. (2017a) found that injection site reactions had healed in most mares within 3 months after the booster dose, and that they did not affect movement or cause fever. The longer term nodules observed did not appear to change any animal's range of movement or locomotor patterns and in most cases did not appear to differ in magnitude from naturally occurring injuries or scars.

7.1.5. Indirect Effects

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health (Turner and Kirkpatrick 2002). Many treated mares would not experience the biological stress of reproduction, foaling, and lactation as frequently as untreated mares. The observable measure of improved health is higher body condition scores (Nuñez et al. 2010). After a treated mare returns to fertility, her future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mare's milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition remains improved even after fertility resumes. PZP treatment may increase mare survival rates, leading to longer potential lifespan (Turner and Kirkpatrick 2002, Ransom et al. 2014a). To the extent that this happens, changes in lifespan and decreased foaling rates could combine to cause changes in overall age structure in a treated herd (i.e., Turner and Kirkpatrick 2002, Roelle et al. 2010), with a greater prevalence of older mares in the herd (Gross 2000). Observations of mares treated in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares (BLM, anecdotal observations).

Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called a 'rebound effect.' Elevated fertility rates have been observed after horse gathers and removals (Kirkpatrick and Turner 1991). More research is needed to document and quantify these hypothesized effects in PZP-treated herds. If repeated contraceptive treatment leads to a prolonged contraceptive effect, then that may minimize or delay the hypothesized rebound effect.

Selectively applying contraception to older animals and returning them to the HMA could reduce long-term holding costs for such horses, which are difficult to adopt, and may reduce the compensatory reproduction that often follows removals (Kirkpatrick and Turner 1991).

Because successful fertility control would reduce foaling rates and population growth rates, another indirect effect should be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception would be expected to lead to a relative increase in the fraction of older animals in the herd. Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to off-range holding corrals or pastures for long-term holding. Among mares in the herd that remain fertile, a high level of physical health and future reproductive success would be expected because reduced population sizes should lead to more availability of water and forage resources per capita.

Reduced population growth rates and smaller population sizes could also allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse habitat quality. As the population nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available to wild horses and wildlife throughout the HMA. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses across the HMA, there should also be less trailing and concentrated use of water sources. Lower population density would be expected to lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users, including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas. Should PZP booster treatment continue into the future, there may be fewer instances of overpopulation and large gathers and removals, but instead a consistent cycle of balance and stability would ensue, resulting in continued improvement of overall habitat conditions and animal health. While it is conceivable that widespread and continued treatment with PZP could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated in almost every year.

7.1.6. Behavioral Effects

The NRC report (2013) noted that all fertility suppression has effects on mare behavior, mostly as a result of the lack of pregnancy and foaling, and concluded that PZP was among the 'most promising' methods for use in the program. The result that PZP-treated mares may continue estrus cycles throughout the breeding season can lead to behavioral differences (as discussed below), when compared to mares that are fertile. Such behavioral differences should be considered as potential consequences of successful contraception.

PZP vaccine-treated mares may continue estrus cycles throughout the breeding season. Ransom and Cade (2009) delineate behaviors that can be used to test for quantitative differences due to treatments. Ransom et al. (2010) found no differences in how PZP-treated and untreated mares allocated their time between feeding, resting, travel, maintenance, and most social behaviors in three populations of wild horses, which is consistent with Powell's (1999) findings in another population. Likewise, body condition of PZP-treated and control mares did not differ between treatment groups in Ransom et al.'s (2010) study. Nuñez (2010) found that PZP-treated mares had higher body condition than control mares in another population, presumably because energy expenditure was reduced by the absence of pregnancy and lactation. Knight (2014) found that PZP-treated mares had better body condition, lived longer and switched harems more frequently, while mares that foaled spent more time concentrating on grazing and lactation and had lower overall body condition. Studies on Assateague Island (Kirkpatrick and Turner 2002) showed that once fillies (female foals) that were born to mares treated with PZP during pregnancy eventually breed, they produce healthy, viable foals.

In two studies involving a total of four wild horse populations, both Nuñez et al. (2009) and Ransom et al. (2010) found that PZP-treated mares were involved in reproductive interactions with stallions more often than control mares, which is not surprising given the evidence that PZP-treated females of other mammal species can regularly demonstrate estrus behavior while contracepted (Shumake and Killian 1997, Heilmann et al. 1998, Curtis et al. 2001, Duncan et al. 2017). There was no evidence, though, that mare welfare was affected by the increased level of herding by stallions noted in Ransom et al. (2010). Nuñez's later analysis (2017) noted no difference in mare reproductive behavior as a function of contraception history.

Ransom et al. (2010) found that control mares were herded by stallions more frequently than PZP-treated mares, and Nuñez et al. (2009, 2014, 2017, 2018) found that PZP-treated mares exhibited higher infidelity to their band stallion during the non-breeding season than control mares. Madosky et al. (2010) and Knight (2014) found this infidelity was also evident during the breeding season in the same population that Nuñez et al. (2009, 2010, 2014, 2017, 2018) studied. Nuñez et al. (2014, 2017, 2018) concluded that PZP-treated mares changing bands more frequently than control mares could lead to band instability. Nuñez et al. (2009), though, cautioned against generalizing from that island population to other herds. Nuñez et al. (2014) found elevated levels of fecal cortisol, a marker of physiological stress, in mares that changed bands. The research is inconclusive as to whether all the mares' movements between bands were related to the PZP treatments themselves or the fact that the mares were not nursing a foal, and did not demonstrate any long-term negative consequence of the transiently elevated cortisol levels. Nuñez et al. 2014 wrote that these effects "…may be of limited concern when population reduction is an urgent priority." Nuñez (2018) noted (based on unpublished results) that band stallions of mares that have received PZP treatment can exhibit changes in behavior and physiology. Nuñez (2018) cautioned that PZP use may limit the ability of mares to return to fertility, but also noted that, "such aggressive treatments may be necessary when rapid reductions in animal numbers are of paramount importance….If the primary management goal is to reduce population size, it is unlikely (and perhaps less important) that managers achieve a balance between population control and the maintenance of more typical feral horse behavior and physiology."

In contrast to transient stresses, Creel et al. (2013) highlight that variation in population density is one of the most well-established causal factors of chronic activation of the hypothalamic-pituitary-adrenal axis, which mediates stress hormones; high population densities and competition for resources can cause chronic stress. Creel et al. (2013) also state that "…there is little consistent evidence for a negative association between elevated baseline glucocorticoids and fitness." Band fidelity is not an aspect of wild horse biology that is specifically protected by the WFRHBA of 1971. It is also notable that Ransom et al. (2014b) found higher group fidelity after a herd had been gathered and treated with a contraceptive vaccine; in that case, the researchers postulated that higher fidelity may have been facilitated by the decreased competition for forage after excess horses were removed. At the population level, available research does not provide evidence of the loss of harem structure among any herds treated with PZP. Long-term implications of these changes in social behavior are currently unknown, but no negative impacts on the overall animals or populations overall, long-term welfare or well-being have been established in these studies.

The National Research Council (2013) found that harem changing was not likely to result in serious adverse effects for treated mares:

> "The studies on Shackleford Banks (Nuñez et al., 2009; Madosky et al., 2010) suggest that there is an interaction between pregnancy and social cohesion. The importance of harem stability to mare well-being is not clear, but considering the relatively large number of free-ranging mares that have been treated with liquid PZP in a variety of ecological settings, the likelihood of serious adverse effects seem low."

Nuñez (2010) stated that not all populations will respond similarly to PZP treatment. Differences in habitat, resource availability, and demography among conspecific populations will undoubtedly affect their physiological and behavioral responses to PZP contraception, and need to be considered. Kirkpatrick et al. (2010) concluded that "the larger question is, even if subtle alterations in behavior may occur, this is still far better than the alternative," and that the "…other victory for horses is that every mare prevented from being removed, by virtue of contraception, is a mare that will only be delaying her reproduction rather than being eliminated permanently from the range. This preserves herd genetics, while gathers and adoption do not."

The NRC report (2013) provides a comprehensive review of the literature on the behavioral effects of contraception that puts research up to that date by Nuñez et al. (2009, 2010) into the broader context of all of the available scientific literature, and cautions, based on its extensive review of the literature that:

> ". . . in no case can the committee conclude from the published research that the behavior differences observed are due to a particular compound rather than to the fact that treated animals had no offspring during the study. That must be borne in mind particularly in interpreting long-term impacts of contraception (e.g., repeated years of reproductive 'failure' due to contraception)."

7.1.7. Genetic Effects of PZP Vaccination

In HMAs where large numbers of wild horses have recent and / or an ongoing influx of breeding animals from other areas with wild or feral horses, contraception is not expected to cause an unacceptable loss of genetic diversity or an unacceptable increase in the inbreeding coefficient. In any diploid population, the loss of genetic diversity through inbreeding or drift can be prevented by large effective breeding population sizes (Wright 1931) or by introducing new potential breeding animals (Mills and Allendorf 1996). The NRC report (2013) recommended that single HMAs should not be considered as isolated genetic populations. Rather, managed herds of wild horses should be considered as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. Introducing 1-2 mares every generation (about every 10 years) is a standard management technique that can alleviate potential inbreeding concerns (BLM 2010).

In the last 10 years, there has been a high realized growth rate of wild horses in most areas administered by the BLM, such that most alleles that are present in any given mare are likely to already be well represented in her siblings, cousins, and more distant relatives. With the exception of horses in a small number of well-known HMAs that contain a relatively high fraction of alleles associated with old Spanish horse breeds (NRC 2013), the genetic composition of wild horses in lands administered by the BLM is consistent with admixtures from domestic breeds. As a result, in most HMAs, applying fertility control to a subset of mares is not expected to cause irreparable loss of genetic diversity. Improved longevity and an aging population are expected results of contraceptive treatment that can provide for lengthening generation time; this result would be expected to slow the rate of genetic diversity loss (Hailer et al. 2006). Based on a population model, Gross (2000) found that a strategy to preferentially treat young animals with a contraceptive led to more genetic diversity being retained than either a strategy that preferentially treats older animals, or a strategy with periodic gathers and removals.

Even if it is the case that repeated treatment with PZP may lead to prolonged infertility, or even sterility in some mares, most HMAs have only a low risk of loss of genetic diversity if logistically realistic rates of contraception are applied to mares. Wild horses in most herd management areas are descendants of a diverse range of ancestors coming from many breeds of domestic horses. As such, the existing genetic diversity in the majority of HMAs does not contain unique or historically unusual genetic markers. Past interchange between HMAs, either through natural dispersal or through assisted migration (i.e., human movement of horses) means that many HMAs are effectively indistinguishable and interchangeable in terms of their genetic composition. Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Their results show that the risk of the loss of genetic heterozygosity is extremely low except in case where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5 percent per year), and very large fractions of the female population are permanently sterilized.

It is worth noting that, although maintenance of genetic diversity at the scale of the overall population of wild horses is an intuitive management goal, there are no existing laws or policies that require BLM to maintain genetic diversity at the scale of the individual herd management area or complex. Also, there is no Bureau-wide policy that requires BLM to allow each female in a herd to reproduce before she is treated with contraceptives.

One concern that has been raised with regards to genetic diversity is that treatment with immunocontraceptives could possibly lead to an evolutionary increase in the frequency of individuals whose genetic composition fosters weak immune responses (Cooper and Larson 2006, Ransom et al. 2014a). Many factors influence the strength of a vaccinated individual's immune response, potentially including genetics, but also nutrition, body condition, and prior immune responses to pathogens or other antigens (Powers et al. 2013). This premise is based on an assumption that lack of response to PZP is a heritable trait, and that the frequency of that trait will increase over time in a population of PZP-treated animals. Cooper and Herbert (2001) reviewed the topic, in the context of concerns about the long-term effectiveness of immunocontraceptives as a control agent for exotic species in Australia. They argue that immunocontraception could be a strong selective pressure, and that selecting for reproduction in individuals with poor immune response could lead to a general decline in immune function in populations where such evolution takes place. Other authors have also speculated that differences in antibody titer responses could be partially due to genetic differences between animals (Curtis et al. 2001, Herbert and Trigg 2005). However, Magiafolou et al. (2013) clarify that if the variation in immune response is due to environmental factors (i.e., body condition, social rank) and not due to genetic factors, then there will be no expected effect of the immune phenotype on future generations. It is possible that general health, as measured by body condition, can have a causal role in determining immune response, with animals in poor condition demonstrating poor immune reactions (NRC 2013).

Correlations between physical factors and immune response would not preclude, though, that there could also be a heritable response to immunocontraception. In studies not directly related to immunocontraception, immune response has been shown to be heritable (Kean et al. 1994, Sarker et al. 1999). Unfortunately, predictions about the long-term, population-level evolutionary response to immunocontraceptive treatments are speculative at this point, with results likely to depend on several factors, including: the strength of the genetic predisposition to not respond to PZP; the heritability of that gene or genes; the initial prevalence of that gene or genes; the number of mares treated with a primer dose of PZP (which generally has a short-acting effect); the number of mares treated with multiple booster doses of PZP; and the actual size of the genetically-interacting metapopulation of horses within which the PZP treatment takes place.

BLM is not aware of any studies that have quantified the heritability of a lack of response to immunocontraception such as PZP vaccine or GonaCon-Equine in horses. At this point there are no studies available from which one could make conclusions about the long-term effects of sustained and widespread immunocontraception treatments on population-wide immune function. Although a few, generally isolated, feral horse populations have been treated with high fractions of mares receiving PZP immunocontraception for long-term population control (e.g., Assateague Island and Pryor Mountains), no studies have tested for changes in immune competence in those areas. Relative to the large number of free-roaming feral horses in the western United States, immunocontraception has not been used in the type of widespread or prolonged manner that might be required to cause a detectable evolutionary response. Although this topic may merit further study, lack of clarity should not preclude the use of immunocontraceptives to help stabilize extremely rapidly growing herds.

7.2 Gonadotropin Releasing Hormone (GnRH) Vaccine (GonaCon)

This literature review is intended to summarize what is known and what is not known about potential effects of treating mares with GonaCon. As noted below, some negative consequences of vaccination are possible. Anti-GnRH vaccines can be administered to either sex, but this analysis is limited to effects on females, except where inferences can be made to females, based on studies that have used the vaccine in males.

Whether to use or not use this method to reduce population growth rates in wild horses is a decision that must be made considering those effects as well as the potential effects of inaction, such as continued overpopulation and rangeland health degradation.

Reference in this text to any specific commercial product, process, or service, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement, recommendation, or favoring by the Department of the Interior.

7.2.1. Registration and Safety of GonaCon-Equine

Taking into consideration available literature on the subject, the National Research Council concluded in their 2013 report that GonaCon-B (which is produced under the trade name GonaCon-Equine for use in feral horses and burros) was among of the 'most promising' available methods for contraception in wild horses and burros (NRC 2013), in terms of delivery method, availability, efficacy, and side effects. GonaCon-Equine is approved for use by authorized federal, state, tribal, public and private personnel, for application to wild and feral equids in the United States (EPA 2013, 2015). Its use is appropriate for free-ranging wild horse herds. GonaCon-Equine has been used on feral horses in Theodore Roosevelt National Park (Baker et al. 2018) and on wild horses by BLM (BLM 2015). GonaCon-Equine can be remotely administered in the field in cases where mares are relatively approachable, using a customized pneumatic dart (McCann et al. 2017). Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010).

Miller et al. (2013) reviewed the vaccine environmental safety and toxicity. When advisories on the product label (EPA 2015) are followed, the product is safe for users and the environment (EPA 2009b). EPA waived a number of tests prior to registering the vaccine, because GonaCon was deemed to pose low risks to the environment, so long as the product label is followed (Wang-Cahill et al., *in press*).

Under the Proposed Action, the BLM would return to the HMA as needed to re-apply GonaCon-Equine and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. GonaCon-Equine can safely be reapplied as necessary to control the population growth rate; booster dose effects may lead to increased effectiveness of contraception, which is generally the intent. Even with one booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point, although the average duration of effect after booster doses has not yet been quantified. Although it is unknown what would be the expected rate for the return to fertility rate in mares boosted more than once with GonaCon-Equine, a prolonged return to fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception). Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM could make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon, to maintain the number of horses within AML.

7.2.2. GnRH Vaccine Direct Effects

GonaCon-Equine is one of several vaccines that have been engineered to create an immune response to the gonadotropin releasing hormone peptide (GnRH). GnRH is a small peptide that plays an important role in signaling the production of other hormones involved in reproduction in both sexes. GnRH is highly conserved across mammalian taxa, so some inferences about the mechanism and effects of GonaCon-Equine in horses can be made from studies that used different anti-GnRH vaccines, in horses and other taxa. Other commercially available anti-GnRH vaccines include: Improvac (Imboden et al. 2006, Botha et al. 2008, Janett et al. 2009a, Janett et al. 2009b, Schulman et al. 2013, Dalmau et al. 2015), made in South Africa; Equity (Elhay et al. 2007), made in Australia; Improvest, for use in swine (Bohrer et al. 2014); Repro-BLOC (Boedeker et al. 2011); and Bopriva, for use in cows (Balet et al. 2014). Of these, GonaCon-Equine, Improvac, and Equity are specifically intended for horses. Other anti-GnRH vaccine formulations have also been tested, but did not become trademarked products (e.g., Goodloe 1991, Dalin et al. 2002, Stout et al. 2003, Donovan et al. 2013, Schaut et al. 2018, Yao et al. 2018). The effectiveness and side-effects of these various anti-GnRH vaccines may not be the same as would be expected from GonaCon-Equine use in horses. Results could differ as a result of differences in the preparation of the GnRH antigen, and the choice of adjuvant used to stimulate the immune response. While GonaCon-Equine can be administered as a single dose, most other anti-GnRH vaccines require a primer dose and at least one booster dose to be effective.

GonaCon has been produced by USDA-APHIS (Fort Collins, Colorado) in several different formulations, the history of which is reviewed by Miller et al. (2013). In any vaccine, the antigen is the stimulant to which the body responds by making antigen-specific antibodies. Those antibodies then signal to the body that a foreign molecule is present, initiating an immune response that removes the molecule or cell. GonaCon vaccines present the recipient with hundreds of copies of GnRH as peptides on the surface of a linked protein that is naturally antigenic because it comes from invertebrate hemocyanin (Miller et al. 2013). Early GonaCon formulations linked many copies of GnRH to a protein from the keyhole limpet (GonaCon-KHL), but more recently produced formulations where the GnRH antigen is linked to a protein from the blue mussel (GonaCon-B) proved less expensive and more effective (Miller et al. 2008). GonaCon-Equine is in the category of GonaCon-B vaccines.

Adjuvants are included in vaccines to elevate the level of immune response, inciting recruitment of lymphocytes and other immune cells which foster a long-lasting immune response that is specific to the antigen. For some formulations of anti-GnRH vaccines, a booster dose is required to elicit a contraceptive response, though GonaCon can cause short-term contraception in a fraction of treated animals from one dose (Powers et al. 2011, Gionfriddo et al. 2011a, Baker et al. 2013, Miller et al. 2013). The adjuvant used in GonaCon, Adjuvac, generally leads to a milder reaction than Freund's Complete Adjuvant (Powers et al. 2011). Adjuvac contains a small number of killed *Mycobacterium avium* cells (Miller et al. 2008, Miller et al. 2013). The antigen and adjuvant are emulsified in mineral oil, such that they are not all presented to the immune system right after injection It is thought that the mineral oil emulsion leads to a 'depot effect' that is associated with slow or sustained release of the antigen, and a resulting longer-lasting immune response (Miller et al. 2013). Miller et al. (2008, 2013) have speculated that, in cases where memory-B leukocytes are protected in immune complexes in the lymphatic system, it can lead to years of immune response. Increased doses of vaccine may lead to stronger immune reactions, but only to a certain point; when Yoder and Miller (2010) tested varying doses of GonaCon in prairie dogs, antibody responses to the 200µg and 400µg doses were equal to each other but were both higher than in response to a 100µg dose.

The most direct result of successful GnRH vaccination is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation. Antibody titer measurements are proximate measures of the antibody concentration in the blood specific to a given antigen. Anti-GnRH titers generally correlate with a suppressed reproduction system (Gionfriddo et al. 2011a, Powers et al. 2011). Various studies have attempted to identify a relationship between anti-GnRH titer levels and infertility, but that relationship has not been universally predictable or consistent. The time length that titer levels stay high appears to correlate with the length of suppressed reproduction (Dalin et al. 2002, Levy et al. 2011, Donovan et al. 2013, Powers et al. 2011). For example, Goodloe (1991) noted that mares did produce elevated titers and had suppressed follicular development for 11-13 weeks after treatment, but that all treated mares ovulated after the titer levels declined. Similarly, Elhay (2007) found that high initial titers correlated with longer-lasting ovarian and behavioral anoestrus. However, Powers et al. (2011) did not identify a threshold level of titer that was consistently indicative of suppressed reproduction despite seeing a strong correlation between antibody concentration and infertility, nor did Schulman et al. (2013) find a clear relationship between titer levels and mare acyclicity.

In many cases, young animals appear to have higher immune responses, and stronger contraceptive effects of anti-GnRH vaccines than older animals (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). Vaccinating with GonaCon at too young an age, though, may prevent effectiveness; Gionfriddo et al. (2011a) observed weak effects in 3-4 month old fawns. It has not been possible to predict which individuals of a given age class will have long-lasting immune responses to the GonaCon vaccine. Gray (2010) noted that mares in poor body condition tended to have lower contraceptive efficacy in response to GonaCon-B. Miller et al. (2013) suggested that higher parasite loads might have explained a lower immune response in free-roaming horses than had been observed in a captive trial. At this time it is unclear what the most important factors affecting efficacy are.

Females that are successfully contracepted by GnRH vaccination enter a state similar to anoestrus, have a lack of or incomplete follicle maturation, and have no ovarian cycling (Botha et al. 2008). A leading hypothesis is that anti-GnRH antibodies bind GnRH in the hypothalamus-pituitary 'portal vessels,' preventing GnRH from binding to GnRH-specific binding sites on gonadotroph cells in the pituitary, thereby limiting the production of gonadotropin hormones, particularly luteinizing hormone (LH) and, to a lesser degree, follicle-stimulating hormone (FSH) (Powers et al. 2011, NRC 2013). This reduction in LH (and FSH), and a corresponding lack of ovulation, has been measured in response to treatment with anti-GnRH vaccines (Boedeker et al. 2011, Garza et al. 1986).

Females successfully treated with anti-GnRH vaccines have reduced progesterone levels (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay 2007, Botha et al. 2008, Killian et al. 2008, Miller et al. 2008, Janett et al. 2009, Schulman et al. 2013, Balet et al. 2014, Dalmau et al. 2015) and β-17 estradiol levels (Elhay et al. 2007), but no great decrease in estrogen levels (Balet et al. 2014). Reductions in progesterone do not occur immediately after the primer dose, but can take several weeks or months to develop (Elhay et al. 2007, Botha et al. 2008, Schulman et al. 2013, Dalmau et al. 2015). This indicates that ovulation is not occurring and corpora lutea, formed from post-ovulation follicular tissue, are not being established.

Changes in hormones associated with anti-GnRH vaccination lead to measurable changes in ovarian structure and function. The volume of ovaries reduced in response to treatment (Garza et al. 1986, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Botha et al. 2008, Gionfriddo 2011a, Dalmau et al. 2015). Treatment with an anti-GnRH vaccine changes follicle development (Garza et al. 1986, Stout et al. 2003, Imboden et al. 2006, Elhay et al. 2007, Donovan et al. 2013, Powers et al. 2011, Balet et al. 2014), with the result that ovulation does not occur. A related result is that the ovaries can exhibit less activity and cycle with less regularity or not at all in anti-GnRH vaccine treated females (Goodloe 1991, Dalin et al. 2002, Imboden et al. 2006, Elhay et al. 2007, Janett et al. 2009a, Powers et al. 2011, Donovan et al. 2013). In studies where the vaccine required a booster, hormonal and associated results were generally observed within several weeks after delivery of the booster dose.

7.2.3. GnRH Vaccine Contraceptive Effects

The NRC (2013) review pointed out that single doses of GonaCon-Equine do not lead to high rates of initial effectiveness, or long duration. Initial effectiveness of one dose of GonaCon-Equine vaccine appears to be lower than for a combined primer plus booster dose of the PZP vaccine Zonastat-H (Kirkpatrick et al. 2011), and the initial effect of a single GonaCon dose can be limited to as little as one breeding season. However, the effects of boostered doses of GonaCon-Equine indicate that it can have high efficacy and longer-lasting effects in free-roaming horses (Baker et al. 2018) than the one-year effect that is generally expected from a single booster of Zonastat-H.

GonaCon and other anti-GnRH vaccines can be injected while a female is pregnant (Miller et al. 2000, Powers et al. 2011, Baker et al. 2013)—in such a case, a successfully contracepted mare will be expected to give birth during the following foaling season, but to be infertile during the same year's breeding season. Thus, a mare injected in November of 2018 would not show the contraceptive effect (i.e., no new foal) until spring of 2020.

Too few studies have reported on the various formulations of anti-GnRH vaccines to make generalizations about differences between products, but GonaCon formulations were consistently good at causing loss of fertility in a statistically significant fraction of treated mares for at least one year (Killian et al. 2009, Gray et al. 2010, Baker et al. 2013, 2017). With few exceptions (e.g., Goodloe 1991), anti-GnRH treated mares gave birth to fewer foals in the first season when there would be an expected contraceptive effect (Botha et al. 2008, Killian et al. 2009, Gray et al. 2010, Baker et al. 2013). Goodloe (1991) used an anti-GnRH-KHL vaccine with a triple adjuvant, in some cases attempting to deliver the vaccine to horses with a hollow-tipped "biobullet," but concluded that the vaccine was not an effective immunocontraceptive in that study.

Not all mares should be expected to respond to the GonaCon-equine vaccine; some number should be expected to continue to become pregnant and give birth to foals. In studies where mares were exposed to stallions, the fraction of treated mares that are effectively contracepted in the year after anti-GnRH vaccination varied from study to study, ranging from ~50 percent (Baker et al. 2017, Baker et al. 2018), to 61 percent (Gray et al. 2010), to ~90 percent (Killian et al. 2006, 2008, 2009). Miller et al. (2013) noted lower effectiveness in free-ranging mares (Gray et al. 2010) than captive mares (Killian et al. 2009). Some of these rates are lower than the high rate of effectiveness typically reported for the first year after PZP vaccine treatment (Kirkpatrick et al. 2011). In the one study that tested for a difference, darts and hand-injected GonaCon doses were equally effective in terms of fertility outcome (McCann et al. 2017).

In studies where mares were not exposed to stallions, the duration of effectiveness also varied. A primer and booster dose of Equity led to anoestrus for at least 3 months (Elhay et al. 2007). A primer and booster dose of Improvac also led to loss of ovarian cycling for all mares in the short term (Imboden et al. 2006). It is worth repeating that those vaccines do not have the same formulation as GonaCon.

Results from horses (Baker et al. 2018) and other species (Curtis et al. 2001) suggest that providing a booster dose of GonaCon-Equine will increase the fraction of temporarily infertile animals to higher levels than would a single vaccine dose alone.

Longer-term infertility has been observed in some mares treated with anti-GnRH vaccines, including GonaCon-Equine. In a single-dose mare captive trial with an initial year effectiveness of 94 percent, Killian et al. (2008) noted infertility rates of 64 percent, 57 percent, and 43 percent in treated mares during the following three years, while control mares in those years had infertility rates of 25 percent, 12 percent, and 0 percent in those years. GonaCon effectiveness in free-roaming populations was lower, with infertility rates consistently near 60 percent for three years after a single dose in one study (Gray et al. 2010) and annual infertility rates decreasing over time from 55 percent to 30 percent to 0 percent in another study with one dose (Baker et al. 2017, 2018). Similarly, gradually increasing fertility rates were observed after single dose treatment with GonaCon in elk (Powers et al. 2011) and deer (Gionfriddo et al. 2011a).

Baker et al. (2017, 2018) observed a return to fertility over 4 years in mares treated once with GonaCon, but then noted extremely low fertility rates of 0 percent and 16 percent in the two years after the same mares were given a booster dose four years after the primer dose. Four of nine mares treated with primer and booster doses of Improvac did not return to ovulation within 2 years of the primer dose (Imboden et al. 2006), though one should probably not make conclusions about the long-term effects of GonaCon-Equine based on results from Improvac.

It is difficult to predict which females will exhibit strong or long-term immune responses to anti-GnRH vaccines (Killian et al. 2006, Miller et al. 2008, Levy et al. 2011). A number of factors may influence responses to vaccination, including age, body condition, nutrition, prior immune responses, and genetics (Cooper and Herbert 2001, Curtis et al. 2001, Powers et al. 2011). One apparent trend is that animals that are treated at a younger age, especially before puberty, may have stronger and longer-lasting responses (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). It is plausible that giving ConaGon-Equine to prepubertal mares will lead to long-lasting infertility, but no published data are available.

To date, short term evaluation of anti-GnRH vaccines, show contraception appears to be temporary and reversible. Killian et al. noted long-term effects of GonaCon in some captive mares (2009). However, Baker et al. (2018) observed horses treated with GonaCon-B return to fertility after they were treated with a single primer dose; after four years, the fertility rate was indistinguishable between treated and control mares. It appears that a single dose of GonaCon results in reversible infertility. Although it is unknown whether long-term treatment would result in permanent infertility, such permanent infertility fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception).

Other anti-GnRH vaccines also have had reversible effects in mares. Elhay (2007) noted a return to ovary functioning over the course of 34 weeks for 10 of 16 mares treated with Equity. That study ended at 34 weeks, so it is not clear when the other six mares would have returned to fertility. Donovan et al. (2013) found that half of mares treated with an anti-GnRH vaccine intended for dogs had returned to fertility after 40 weeks, at which point the study ended. In a study of mares treated with a primer and booster dose of Improvac, 47 of 51 treated mares had returned to ovarian cyclicity within 2 years; younger mares appeared to have longer-lasting effects than older mares (Schulman et al. 2013). Joonè et al. (2017c) analyzed samples from the Schulman et al. (2013) study, and found no significant decrease in anti-Mullerian hormone (AMH) levels in mares treated with GnRH vaccine. AMH levels are thought to be an indicator of ovarian function, so results from Joonè et al. (2017c) support the general view that the anoestrus resulting from GnRH vaccination is physiologically similar to typical winter anoestrus. In a small study with a non-commercial anti-GnRH vaccine (Stout et al. 2003), three of seven treated mares had returned to cyclicity within 8 weeks after delivery of the primer dose, while four others were still suppressed for 12 or more weeks. In elk, Powers et al. (2011) noted that contraception after one dose of GonaCon was reversible. In white-tailed deer, single doses of GonaCon appeared to confer two years of contraception (Miller et al. 2000). Ten of 30 domestic cows treated became pregnant within 30 weeks after the first dose of Bopriva (Balet et al. 2014).

Permanent sterility as a result of single-dose or boostered GonaCon-Equine vaccine, or other anti-GnRH vaccines, has not been recorded, but that may be because no long-term studies have tested for that effect. It is conceivable that some fraction of mares could become sterile after receiving one or more booster doses of GonaCon-Equine, but the rate at which that could be expected to occur is currently unknown. If some fraction of mares treated with GonaCon-Equine were to become sterile, though, that result would be consistent with text of the WFRHBA of 1971, as amended, which allows for sterilization to achieve population goals.

In summary, based on the above results related to fertility effects of GonaCon and other anti-GnRH vaccines, application of a single dose of GonaCon-Equine to gathered or remotely-darted wild horses could be expected to prevent pregnancy in perhaps 30-60 percent of mares for one year. Some smaller number of wild mares should be expected to have persistent contraception for a second year, and less still for a third year. Applying one booster dose of GonaCon to previously-treated mares should lead to four or more years with relatively high rates (80+percent) of additional infertility expected (Baker et al. 2018), with the potential that some as-yet-unknown fraction of boostered mares may be infertile for several to many years. There is no data to support speculation regarding efficacy of multiple boosters of GonaCon-Equine; however, given it is formulated as a highly immunogenic long-lasting vaccine, it is reasonable to hypothesize that additional boosters would increase the effectiveness and duration of the vaccine.

GonaCon-Equine only affects the fertility of treated animals; untreated animals will still be expected to give birth. Even under favorable circumstances for population growth suppression, gather efficiency might not exceed 85 percent via helicopter, and may be less with bait and water trapping. Similarly, not all animals may be approachable for darting. The uncaptured or undarted portion of the female population would still be expected to have normally high fertility rates in any given year, though those rates could go up slightly if contraception in other mares increases forage and water availability.

7.2.4. GnRH Vaccine Effects on Other Organ Systems

BLM requires individually identifiable marks for immunocontraceptive treatment; this may require handling and marking. Mares that receive any vaccine as part of a gather operation would experience slightly increased stress levels associated with handling while being vaccinated and freeze-marked, and potentially microchipped. Newly captured mares that do not have markings associated with previous fertility control treatments would be marked with a new freeze-mark and or chip for the purpose of identifying that mare, and identifying her vaccine treatment history. This information would also be used to determine the number of mares captured that were not previously treated, and could provide additional insight regarding gather efficiency, and the timing of treatments required into the future. Most mares recover from the stress of capture and handling quickly once released back to the HMA, and none are expected to suffer serious long term effects from the fertility control injections, other than the direct consequence of becoming temporarily infertile.

Injection site reactions associated with immunocontraceptive treatments are possible in treated mares (Roelle and Ransom 2009). Whether injection is by hand or via darting, GonaCon-Equine is associated with some degree of inflammation, swelling, and the potential for abscesses at the injection site (Baker et al. 2013). Swelling or local reactions at the injection site are generally expected to be minor in nature, but some may develop into draining abscesses. When PZP vaccine was delivered via dart it led to more severe swelling and injection site reactions (Roelle and Ransom 2009), but that was not observed with dart-delivered GonaCon (McCann et al. 2017). Mares treated with one formulation of GnRH-KHL vaccine developed pyogenic abscesses (Goodloe 1991). Miller et al. (2008) noted that the water and oil emulsion in GonaCon will often cause cysts, granulomas, or sterile abscesses at injection sites; in some cases, a sterile abscess may develop into a draining abscess. In elk treated with GonaCon, Powers et al. (2011) noted up to 35 percent of treated elk had an abscess form, despite the injection sites first being clipped and swabbed with alcohol. Even in studies where swelling and visible abscesses followed GonaCon immunization, the longer-term nodules observed did not appear to change any animal's range of movement or locomotor patterns (Powers et al. 2013, Baker et al. 2017).

The result that other formulations of anti-GnRH vaccine may be associated with less notable injection site reactions in horses may indicate that the adjuvant formulation in GonaCon leads a single dose to cause a stronger immune reaction than the adjuvants used in other anti-GnRH vaccines. Despite that, a booster dose of GonaCon-Equine appears to be more effective than a primer dose alone (Baker et al. 2017). Horses injected in the hip with Improvac showed only transient reactions that disappeared within 6 days in one study (Botha et al. 2008), but stiffness and swelling that lasted 5 days were noted in another study where horses received Improvac in the neck (Imboden et al. 2006). Equity led to transient reactions that resolved within a week in some treated animals (Elhay et al. 2007). Donovan et al. noted no reactions to the canine anti-GnRH vaccine (2013). In cows treated with Bopriva there was a mildly elevated body temperature and mild swelling at injection sites that subsided within 2 weeks (Balet et al. 2014).

Several studies have monitored animal health after immunization against GnRH. GonaCon treated mares did not have any measurable difference in uterine edema (Killian 2006, 2008). Powers et al. (2011, 2013) noted no differences in blood chemistry except a mildly elevated fibrinogen level in some GonaCon treated elk. In that study, one sham-treated elk and one GonaCon-treated elk each developed leukocytosis, suggesting that there may have been a causal link between the adjuvant and the effect. Curtis et al. (2008) found persistent granulomas at GonaCon-KHL injection sites three years after injection, and reduced ovary weights in treated females. Yoder and Miller (2010) found no difference in blood chemistry between GonaCon treated and control prairie dogs. One of 15 GonaCon treated cats died without explanation, and with no determination about cause of death possible based on necropsy or histology (Levy et al. 2011). Other anti-GnRH vaccine formulations have led to no detectable adverse effects (in elephants; Boedeker et al. 2011), though Imboden et al. (2006) speculated that young treated animals might conceivably have impaired hypothalamic or pituitary function.

Kirkpatrick et al. (2011) raised concerns that anti-GnRH vaccines could lead to adverse effects in other organ systems outside the reproductive system. GnRH receptors have been identified in tissues outside of the pituitary system, including in the testes and placenta (Khodr and Siler-Khodr 1980), ovary (Hsueh and Erickson 1979), bladder (Coit et al. 2009), heart (Dong et al. 2011), and central nervous system, so it is plausible that reductions in circulating GnRH levels could inhibit physiological processes in those organ systems. Kirkpatrick et al. (2011) noted elevated cardiological risks to human patients taking GnRH agonists (such as leuprolide), but the National Academy of Sciences (2013) concluded that the mechanism and results of GnRH agonists would be expected to be different from that of anti-GnRH antibodies; the former flood GnRH receptors, while the latter deprive receptors of GnRH.

7.2.5. GnRH Vaccine Effects on Fetus and Foal

Although fetuses are not explicitly protected under the WFRHBA of 1971, as amended, it is prudent to analyze the potential effects of GonaCon-Equine or other anti-GnRH vaccines on developing fetuses and foals.

GonaCon and other anti-GnRH vaccines can be injected while a female is pregnant (Miller et al. 2000, Powers et al. 2011, Baker et al. 2013) – in such a case, a successfully contracepted mare will be expected to give birth during the following foaling season, but to be infertile during the same year’s breeding season. Thus, a mare injected in November of 2018 would not show the contraceptive effect (i.e., no new foal) until spring of 2020.

GonaCon had no apparent effect on pregnancies in progress, foaling success, or the health of offspring, in horses that were immunized in October (Baker et al. 2013), elk immunized 80-100 days into gestation (Powers et al. 2011, 2013), or deer immunized in February (Miller et al. 2000). Kirkpatrick et al. (2011) noted that anti-GnRH immunization is not expected to cause hormonal changes that would lead to abortion in the horse, but this may not be true for the first 6 weeks of pregnancy (NRC 2013). Curtis et al. (2011) noted that GonaCon-KHL treated white-tailed deer had lower twinning rates than controls, but speculated that the difference could be due to poorer sperm quality late in the breeding season, when the treated does did become pregnant. Goodloe (1991) found no difference in foal production between treated and control animals.

Offspring of anti-GnRH vaccine treated mothers could exhibit an immune response to GnRH (Khodr and

Siler-Khodr 1980), as antibodies from the mother could pass to the offspring through the placenta or colostrum. In the most extensive study of long-term effects of GonaCon immunization on offspring, Powers et al. (2012) monitored 15 elk fawns born to GonaCon treated cows. Of those, 5 had low titers at birth and 10 had high titer levels at birth. All 15 were of normal weight at birth, and developed normal endocrine profiles, hypothalamic GnRH content, pituitary gonadotropin content, gonad structure, and gametogenesis. All the females became pregnant in their second reproductive season, as is typical. All males showed normal development of secondary sexual characteristics. Powers et al. (2012) concluded that suppressing GnRH in the neonatal period did not alter long-term reproductive function in either male or female offspring. Miller et al. (2013) report elevated anti-GnRH antibody titers in fawns born to treated white-tailed deer, but those dropped to normal levels in 11 of 12 of those fawns, which came into breeding condition; the remaining fawn was infertile for three years.

Direct effects on foal survival are equivocal in the literature. Goodloe (1991), reported lower foal survival for a small sample of foals born to anti-GnRH treated mares, but she did not assess other possible explanatory factors such as mare social status, age, body condition, or habitat in her analysis (NRC 2013). Gray et al. (2010) found no difference in foal survival in foals born to free-roaming mares treated with GonaCon.

There is little empirical information available to evaluate the effects of GnRH vaccination on foaling phenology. It is possible that immunocontracepted mares returning to fertility late in the breeding season could give birth to foals at a time that is out of the normal range (Nuñez et al. 2010, Ransom et al. 2013). Curtis et al. (2001) did observe a slightly later fawning date for GonaCon treated deer in the second year after treatment, when some does regained fertility late in the breeding season. In anti-GnRH vaccine trials in free-roaming horses, there were no published differences in mean date of foal production (Goodloe 1991, Gray et al. 2010). Unpublished results from an ongoing study of GonaCon treated free-roaming mares indicate that some degree of aseasonal foaling is possible (D. Baker, Colorado State University, personal communication to Paul Griffin, BLM WH&B Research Coordinator). Because of the concern that contraception could lead to shifts in the timing of parturitions for some treated animals, Ransom et al. (2013) advised that managers should consider carefully before using PZP immunocontraception in small refugia or rare species; the same considerations could be advised for use of GonaCon, but wild horses and burros in most areas do not generally occur in isolated refugia, they are not a rare species at the regional, national, or international level, and genetically they represent descendants of domestic livestock with most populations containing few if any unique alleles (NRC 2013). Moreover, in PZP-treated horses that did have some degree of parturition date shift, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season; however, this may be more related to stochastic, inclement weather events than extended foaling seasons. If there were to be a shift in foaling date for some treated mares, the effect on foal survival may depend on weather severity and local conditions; for example, Ransom et al. (2013) did not find consistent effects across study sites.

7.2.6. Indirect Effects of GnRH Vaccination

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health. Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares, and their better health is expected to be reflected in higher body condition scores. After a treated mare returns to fertility, her future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mares' milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition can remain improved even after fertility resumes. Anecdotal, subjective observations of mares treated with a different immunocontraceptive, PZP, in past gathers showed that many of the treated mares were larger, maintained better body condition, and had larger healthy foals than untreated mares.

Body condition of anti-GnRH-treated females was equal to or better than that of control females in published studies. Ransom et al. (2014b) observed no difference in mean body condition between GonaCon-B treated mares and controls. Goodloe (1991) found that GnRH-KHL treated mares had higher survival rates than untreated controls. In other species, treated deer had better body condition than controls (Gionfriddo et al. 2011b), treated cats gained more weight than controls (Levy et al. 2011), as did treated young female pigs (Bohrer et al. 2014).

Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called by some a 'rebound effect.' Elevated fertility rates have been observed after horse gathers and removals (Kirkpatrick and Turner 1991). More research is needed to document and quantify these hypothesized effects. If repeated contraceptive treatment leads to a prolonged contraceptive effect, then that may minimize or delay the hypothesized rebound effect. Selectively applying contraception to older animals and returning them to the HMA could reduce long-term holding costs for such horses, which are difficult to adopt, and could negate the compensatory reproduction that can follow removals (Kirkpatrick and Turner 1991).

Because successful fertility control would reduce foaling rates and population growth rates, another indirect effect would be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception would be expected to lead to a relative increase in the fraction of older animals in the herd. Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to off-range holding corrals or pastures for long-term holding. Among mares in the herd that remain fertile, a high level of physical health and future reproductive success would be expected because reduced population sizes should lead to more availability of water and forage resources per capita.

Reduced population growth rates and smaller population sizes could also allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse habitat quality. As the local horse abundance nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available to wild horses and wildlife throughout the HMA or HMAs. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses across the HMA, there should also be less trailing and concentrated use of water sources. Lower population density would be expected to lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas. Should GonaCon-Equine treatment, including booster doses, continue into the future, with treatments given on a schedule to maintain a lowered level of fertility in the herd, there may be less frequent need for large gathers and removals, but instead a consistent abundance of wild horses could be maintained, resulting in continued improvement of overall habitat conditions and animal health. While it is conceivable that widespread and continued treatment with GonaCon-Equine could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated with primer and booster doses, and perhaps repeated booster doses.

7.2.7. Behavioral Effects of GnRH Vaccination

Behavioral differences should be considered as potential consequences of contraception with GonaCon. The NRC (2013) noted that all successful fertility suppression has effects on mare behavior, mostly as a result of the lack of pregnancy and foaling, and concluded that GonaCon was a good choice for use in the program. The result that GonaCon treated mares may have suppressed estrous cycles throughout the breeding season can lead treated mares to behave in ways that are functionally similar to pregnant mares or mares in seasonal anoestrus.

While successful in mares, GonaCon and other anti-GnRH vaccines are expected to induce fewer estrous cycles when compared to non-pregnant control mares. This has been observed in many studies (Garza et al. 1986, Curtis et al. 2001, Dalin et al. 2002, Killian et al. 2006, Dalmau et al. 2015). In contrast, PZP vaccine is generally expected to lead mares to have more estrous cycles per breeding season, as they continue to be receptive to mating while not pregnant. Females treated with GonaCon had fewer estrous cycles than control or PZP-treated mares (Killian et al. 2006) or deer (Curtis et al. 2001). Thus, concerns about PZP treated mares receiving more courting and breeding behaviors from stallions (Nuñez et al. 2009, Ransom et al. 2010) are not generally expected to be a concern for mares treated with anti-GnRH vaccines (Botha et al. 2008).

Ransom et al. (2014b) found that GonaCon treated mares had similar rates of reproductive behaviors that were similar to those of pregnant mares. Among other potential causes, the reduction in progesterone levels in treated females may lead to a reduction in behaviors associated with reproduction. Despite this, some females treated with GonaCon or other anti-GnRH vaccines did continue to exhibit reproductive behaviors, albeit at irregular intervals and durations (Dalin et al. 2002, Stout et al. 2003, Imboden et al. 2006), which is a result that is similar to spayed (ovariectomized) mares (Asa et al. 1980). Gray et al. (2009) found no difference in sexual behaviors in mares treated with GonaCon and untreated mares. When progesterone levels are low, small changes in estradiol concentration can foster reproductive estrous behaviors (Imboden et al. 2006). Owners of anti-GnRH vaccine treated mares reported a reduced number of estrous-related behaviors under saddle (Donovan et al. 2013). Treated mares may refrain from reproductive behavior even after ovaries return to cyclicity (Elhay et al. 2007). Studies in elk found that GonaCon treated cows had equal levels of precopulatory behaviors as controls (Powers et al. 2011), though bull elk paid more attention to treated cows late in the breeding season, after control cows were already pregnant (Powers et al. 2011).

Stallion herding of mares, and harem switching by mares are two behaviors related to reproduction that might change as a result of contraception. Ransom et al. (2014b) observed a 50 percent decrease in herding behavior by stallions after the free-roaming horse population at Theodore Roosevelt National Park was reduced via a gather, and mares there were treated with GonaCon-B. The increased harem tending behaviors by stallions were directed to both treated and control mores. It is difficult to separate any effect of GonaCon in this study from changes in horse density and forage following horse removals.

Mares in untreated free-roaming populations change bands; some have raised concerns over effects of PZP vaccination on band structure (Nuñez et al. 2009), with rates of band fidelity being suggested as a measure of social stability. With respect to treatment with GonaCon or other anti-GnRH vaccines, it is probably less likely that treated mares will switch harems at higher rates than untreated animals, because treated mares are similar to pregnant mares in their behaviors (Ransom et al. 2014b). Indeed, Gray et al. (2009) found no difference in band fidelity in a free-roaming population of horses with GonaCon treated mares, despite differences in foal production between treated and untreated mares. Ransom et al. (2014b) actually found increased levels of band fidelity after treatment, though this may have been partially a result of changes in overall horse density and forage availability.

Even in cases where there may be changes in band fidelity, the National Research Council (2013) found that harem changing was not likely to result in serious adverse effects for treated mares:

> "The studies on Shackleford Banks (Nuñez et al., 2009; Madosky et al., 2010) suggest that there is an interaction between pregnancy and social cohesion. The importance of harem stability to mare well-being is not clear, but considering the relatively large number of free-ranging mares that have

> been treated with liquid PZP in a variety of ecological settings, the likelihood of serious adverse effects seem low."

Kirkpatrick et al. (2010) concluded that "the larger question is, even if subtle alterations in behavior may occur, this is still far better than the alternative."

The NRC (2013) provides a comprehensive review of the literature on the behavioral effects of contraception that puts Nuñez's (2009, 2010) research into the broader context of all of the available scientific literature, and cautions, based on its extensive review of the literature that:

> ". . . in no case can the committee conclude from the published research that the behavior differences observed are due to a particular compound rather than to the fact that treated animals had no offspring during the study. That must be borne in mind particularly in interpreting long-term impacts of contraception (e.g., repeated years of reproductive 'failure' due to contraception)."

Gray et al. (2009) and Ransom et al. (2014b) monitored non-reproductive behaviors in GonaCon treated populations of free-roaming horses. Gray et al. (2009) found no difference between treated and untreated mares in terms of activity budget, sexual behavior, proximity of mares to stallions, or aggression. Ransom et al. (2014b) found only minimal differences between treated and untreated mare time budgets, but those differences were consistent with differences in the metabolic demands of pregnancy and lactation in untreated mares, as opposed to non-pregnant treated mares.

7.2.8. Genetic Effects of GnRH Vaccination

In HMAs where large numbers of wild horses have recent and / or an ongoing influx of breeding animals from other areas with wild or feral horses, contraception is not expected to cause an unacceptable loss of genetic diversity or an unacceptable increase in the inbreeding coefficient. In any diploid population, the loss of genetic diversity through inbreeding or drift can be prevented by large effective breeding population sizes (Wright 1931) or by introducing new potential breeding animals (Mills and Allendorf 1996). The NRC (2013) recommended that managed herds of wild horses would be better viewed as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. In the last 10 years, there has been a high realized growth rate of wild horses in most areas administered by the BLM, such that most alleles that are present in any given mare are likely to already be well represented in her siblings, cousins, and more distant relatives. With the exception of horses in a small number of well-known HMAs that contain a relatively high fraction of alleles associated with old Spanish horse breeds (NRC 2013), the genetic composition of wild horses in lands administered by the BLM is consistent with admixtures from domestic breeds. As a result, in most HMAs, applying fertility control to a subset of mares is not expected to cause irreparable loss of genetic diversity. Improved longevity and an aging population are expected results of contraceptive treatment that can provide for lengthening generation time; this result which would be expected to slow the rate of genetic diversity loss (Hailer et al., 2006). Based on a population model, Gross (2000) found that an effective way to retain genetic diversity in a population treated with fertility control is to preferentially treat young animals, such that the older animals (which contain all the existing genetic diversity available) continue to have offspring. Conversely, Gross (2000) found that preferentially treating older animals (preferentially allowing young animals to breed) leads to a more rapid expected loss of genetic diversity over time.

Even if it is the case that booster treatment with GonaCon may lead to prolonged infertility, or even sterility in some mares, most HMAs have only a low risk of loss of genetic diversity if logistically realistic rates of contraception are applied to mares. Wild horses in most herd management areas are descendants of a diverse range of ancestors coming from many breeds of domestic horses. As such, the existing genetic diversity in the majority of HMAs does not contain genetic markers that have been identified as unique or historically unusual (NRC 2013). Past interchange between HMAs, either through natural dispersal or through assisted migration (i.e. human movement of horses) means that many HMAs are effectively indistinguishable and interchangeable in terms of their genetic composition. Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Their results show that the risk of the loss of genetic heterozygosity is extremely low except in cases where all four of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, intrinsic population growth rate is low (5 percent per year), and very large fractions of the female population are permanently sterilized.

Many factors influence the strength of a vaccinated individual's immune response, potentially including genetics, but also nutrition, body condition, and prior immune responses to pathogens or other antigens (Powers et al. 2013). One concern that has been raised with regards to genetic diversity is that treatment with immunocontraceptives could possibly lead to an evolutionary increase in the frequency of individuals whose genetic composition fosters weak immune responses (Cooper and Larson 2006, Ransom et al. 2014a). This premise is based on a hypothesis that lack of response to immunocontraceptives could be a heritable trait, and that the frequency of that trait will increase over time in a population of treated animals. Cooper and Herbert (2001) reviewed the topic, in the context of concerns about the long-term effectiveness of immunocontraceptives as a control agent for exotic species in Australia. They argue that immunocontraception could be a strong selective pressure, and that selecting for reproduction in individuals with poor immune response could lead to a general decline in immune function in populations where such evolution takes place. Other authors have also speculated that differences in antibody titer responses could be partially due to genetic differences between animals (Curtis et al. 2001, Herbert and Trigg 2005).

BLM is not aware of any studies that have quantified the heritability of a lack of response to immunocontraception such as PZP vaccine or GonaCon-Equine in horses. At this point there are no studies available from which one could make conclusions about the long-term effects of sustained and widespread immunocontraception treatments on population-wide immune function. Although a few, generally isolated, feral horse populations have been treated with high fractions of mares receiving PZP immunocontraception for long-term population control (e.g., Assateague Island and Pryor Mountains), no studies have tested for changes in immune competence in those areas. Relative to the large number of free-roaming feral horses in the western United States, immunocontraception has not been used in the type of widespread or prolonged manner that might be required to cause a detectable evolutionary response at a large scale.

Magiafolou et al. (2013) clarify that if the variation in immune response is due to environmental factors (i.e., body condition, social rank) and not due to genetic factors, then there will be no expected effect of the immune phenotype on future generations. Correlations between immune response and physical factors such as age and body condition have been documented; it remains untested whether or not those factors play a larger role in determining immune response to immunocontraceptives than heritable traits. Several studies discussed above noted a relationship between the strength of individuals' immune responses after treatment with GonaCon or other anti-GnRH vaccines, and factors related to body condition. For example, age at immunization was a primary factor associated with different measures of immune response, with young animals tending to have stronger and longer-lasting responses (Stout et al. 2003, Schulman et al. 2013). It is also possible that general health, as measured by body condition, can have a causal role in determining immune response, with animals in poor condition demonstrating poor immune reactions (Gray 2009, NRC 2013). Miller et al. (2013) speculated that animals with high parasite loads also may have weaker immune reactions to GonaCon.

Correlations between such physical factors and immune response would not preclude, though, that there could also be a heritable response to immunocontraception. In studies not directly related to immunocontraception, immune response has been shown to be heritable (Kean et al. 1994, Sarker et al. 1999). Unfortunately, predictions about the long-term, population-level evolutionary response to immunocontraceptive treatments would be speculative at this point, with results likely to depend on several factors, including: the strength of the genetic predisposition to not respond to GonaCon-Equine; the heritability of that gene or genes; the initial prevalence of that gene or genes; the number of mares treated with a primer dose of GonaCon-Equine (which generally has a short-acting effect, if any); the number of mares treated with a booster dose of GonaCon-Equine (which appears to cause a longer-lasting effect); and the actual size of the genetically-interacting metapopulation of horses within which the GonaCon treatment takes place.

7.3. Intrauterine Devices (IUDs)

Based on promising results from pasture-based studies in domestic mares, BLM has begun to use IUDs to control fertility as a wild horse and burro fertility control method on the range. The initial management application used Y-shaped silicone IUDs (EPA 2020) in mares from the Swasey HMA, in Utah. The BLM has supported and continues to support research into the development and testing of effective and safe IUDs for use in wild horse mares (Baldrighi et al. 2017, Holyoak et al. 2021). However, existing literature on the use of IUDs in horses allows for inferences about expected effects of any management alternatives that might include use of IUDs, and support the apparent safety and efficacy of some types of IUDs for use in horses. Overall, as with other methods of population growth suppression, use of IUDs and other fertility control measures are expected to help reduce population growth rates, extend the time interval between gathers, and reduce the total number of excess animals that will need to be removed from the range. The genetic effects of use of IUDs are expected to be comparable to those expected from fertility control vaccine use, insofar as reversible fertility control treatments can temporarily reduce the fraction of fertile mares in a herd.

The 2013 National Academies of Sciences (NAS) report considered IUDs, and suggested that research should test whether IUDs cause uterine inflammation, and should also test how well IUDs stay in mares that live and breed with fertile stallions. Since that report, a recent study by Holyoak et al. (2021) indicate that a flexible, inert, y-shaped, medical-grade silicone IUD design prevented pregnancies in all the domestic mares that retained the device, even when exposed to fertile stallions. Domestic mares in that study lived in large pastures, mating with fertile stallions. Biweekly ultrasound examinations showed that IUDs stayed in 75% of treated mares over the course of two breeding seasons. The IUDs were then removed so the researchers could monitor the mares' return to fertility. Uterine health, as measured in terms of inflammation, was not seriously affected by the IUDs, and most mares became pregnant within months after IUD removal. The overall results are consistent with results from an earlier study (Daels and Hughes 1995), which used O-shaped silicone IUDs. Similarly, a flexible IUD with three components connected by magnetic force (the 'iUPOD') was retained over 90 days in mares living and breeding with a fertile stallion; after IUD removal, the majority of mares became pregnant in the following breeding season (Hoopes et al. 2021).

IUDs are considered a temporary fertility control method that does not generally cause future sterility (Daels and Hughes 1995). Use of IUDs is an effective fertility control method in women, and IUDs have historically been used in livestock management, including in domestic horses. Insertion of an IUD can be a very rapid procedure, but it does require the mare to be temporarily restrained, such as in a squeeze chute. IUDs in mares may cause physiological effects including discomfort, infection, perforation of the uterus if the IUD is hard and angular, endometritis, uterine edema (Killian et al. 2008), and pyometra (Klabnik-Bradford et al. 2013). In women, deaths attributable to IUD use may be as low as 1.06 per million (Daels and Hughes 1995).

The exact mechanism by which IUDs prevent pregnancy is uncertain (Daels and Hughes 1995, Gradil et al. 2021, Hoopes et al. 2021), but the presence of an IUD in the uterus may, like a pregnancy, prevent the mare from coming back into estrus (Turner et al. 2015). However, some domestic mares did exhibit repeated estrus cycles during the time when they had IUDs (Killian et al. 2008, Gradil et al. 2019, Lyman et al. 2021, Hoopes et al. 2021). The main cause for an IUD to not be effective at contraception is its failure to stay in the uterus (Daels and Hughes 1995, NRC 2013). As a result, one of the major challenges to using IUDs to control fertility in mares on the range is preventing the IUD from being dislodged or otherwise ejected over the course of daily activities, which could include, at times, frequent breeding.

At this time, it is thought that any IUD inserted into a pregnant mare may cause the pregnancy to terminate, which may also cause the IUD to be expelled. For that reason, it is expected that IUDs would only be inserted in non-pregnant (open) mares. Wild mares receiving IUDs would be checked for pregnancy by a veterinarian prior to insertion of an IUD. This can be accomplished by transrectal palpation and/or ultrasound performed by a veterinarian. Pregnant mares would not receive an IUD. Only a veterinarian would apply IUDs in any BLM management action. The IUD is inserted into the uterus using a thin, tubular applicator similar to a shielded culture tube, and would be inserted in a manner similar to that routinely used to obtain uterine cultures in domestic mares. If a mare has a zygote or very small, early phase embryo, it is possible that it will fail to be detected in screening, and may develop further, but without causing the expulsion of the IUD. Wild mares with IUDs would be individually marked and identified, so that they can be monitored occasionally and examined, if necessary, in the future, consistent with other BLM management activities.

Using metallic or glass marbles as IUDs may prevent pregnancy in horses (Nie et al. 2003), but can pose health risks to domestic mares (Turner et al. 2015, Freeman and Lyle 2015). Marbles may break into shards (Turner et al. 2015), and uterine irritation that results from marble IUDs may cause chronic, intermittent colic (Freeman and Lyle 2015). Metallic IUDs may cause severe infection (Klabnik-Bradford et al. 2013).

In domestic ponies, Killian et al. (2008) explored the use of three different IUD configurations, including a silastic polymer O-ring with copper clamps, and the “380 Copper T” and “GyneFix” IUDs designed for women. The longest retention time for the three IUD models was seen in the “T” device, which stayed in the uterus of several mares for 3-5 years. Reported contraception rates for IUD-treated mares were 80%, 29%, 14%, and 0% in years 1-4, respectively. They surmised that pregnancy resulted after IUD fell out of the uterus. Killian et al. (2008) reported high levels of progesterone in non-pregnant, IUD-treated ponies.

Soft or flexible IUDs may cause relatively less discomfort than hard IUDs (Daels and Hughes 1995). Daels and Hughes (1995) tested the use of a flexible O-ring IUD, made of silastic, surgical-grade polymer, measuring 40 mm in diameter; in five of six breeding domestic mares tested, the IUD was reported to have stayed in the mare for at least 10 months. In mares with IUDs, Daels and Hughes (1995) reported some level of uterine irritation, but surmised that the level of irritation was not enough to interfere with a return to fertility after IUD removal.

More recently, several types of IUDs have been tested for use in breeding mares. When researchers attempted to replicate the O-ring study (Daels and Hughes 1995) in an USGS / Oklahoma State University (OSU) study with breeding domestic mares, using various configurations of silicone O-ring IUDs, the IUDs fell out at unacceptably high rates over time scales of less than 2 months (Baldrighi et al. 2017, Lyman et al. 2021). Subsequently, the USGS / OSU researchers tested a Y-shaped IUD to determine retention rates and assess effects on uterine health; retention rates were greater than 75% for an 18-month period, and mares returned to good uterine health and reproductive capacity after removal of the IUDs (Holyoak et al. 2021). It is possible that some individual mares may become permanently infertile as a result of IUD use, even after IUD removal or expulsion; however, available evidence indicates that flexible IUDs should be considered a reversible fertility control method for most mares. The University of Massachusetts has developed a magnetic IUD that has been effective at preventing estrus, or prolonging the period of time between estrus, in non-breeding domestic mares (Gradil et al. 2019, Joonè et al. 2021, Gradil et al. 2021, Hoopes et al. 2021). After insertion in the uterus, the three subunits of the device are held together by magnetic forces as a flexible triangle. A metal detector can be used to determine whether the device is still present in the mare. In an early trial, two sizes of those magnetic IUDs fell out of breeding domestic mares at high rates (Holyoak et al. unpublished results), but more recent trials have shown that the magnetic IUD was retained even in the presence of breeding with a fertile stallion (Hoopes et al. 2021). The magnetic IUD was used in two trials where mares were exposed to stallions, and in one where mares were artificially inseminated; in all cases, the IUDs were reported to stay in the mares without any pregnancy (Gradil 2019, Joonè et al. 2021, Gradil et al. 2021, Hoopes et al. 2021). Because IUDs may prolong the time between estrus, but still allow for some degree of estrus behavior, it could be surmised that treated mares would continue to engage in behaviors consistent with estrus, though perhaps at somewhat reduced frequency. The effects of temporary infertility due to IUDs use would also be comparable to those expected from PZP or GonaCon vaccination.

7.4. Effects on Genetic Diversity

"Fertility control application should achieve a substantial treatment effect while maintaining some long-term population growth to mitigate the effects of environmental catastrophes" (BLM IM 2009-090). This statement applies to all population growth suppression techniques. According to the WinEquus population model trials of removal with fertility control, the health of individual animals or the long-term viability of the herd would not be threatened because between 2021 and 2029, the lowest possible population growth rate would be 4.8 percent (refer to Heading 5.0 of this document). Under this scenario, there would be another gather anywhere from 2025 to 20231 depending on the treatment type chosen, at which time hair samples would be collected and genetic analysis completed if necessary to determine if appropriate management changes (such as translocations from a nearby HMA) are needed. Periodic gathers allow BLM to collect DNA samples, closely monitor the genetic variability of the herd, and make appropriate changes (i.e. translocation from other HMAs) when testing deems them necessary.

Although BLM is unable to precisely quantify cumulative effects under the Proposed Action, the effects of this alternative on present and RFFAs and in wild horse and burro habitat would aid in the long-term maintenance of habitat conditions necessary for a thriving natural ecological balance within the HMA. By maintaining AML and potentially slowing the population growth rate of wild horses, the SERA RMP/ROD (1986), and the 2019 Nevada and Northeastern California GRSG ARMPA would be achieved and maintained over the long term (at least 10 years). Maintenance of an appropriate wild horse population under this alternative encourages the success of noxious weed treatments, wildfire rehabilitation efforts, and livestock grazing management activities. Maintenance of AML provides consistency in the annual livestock grazing authorizations, with the exception of climatic fluctuations that may influence timing or level of use. Interference competition and/or direct competition for resources among wild horses, wildlife, and livestock would be reduced or avoided by maintaining AML.

In HMAs where large numbers of wild horses have recent and/or an ongoing influx of breeding animals from other areas with wild or feral horses, contraception is not expected to cause an unacceptable loss of genetic diversity or an unacceptable increase in the inbreeding coefficient. In any diploid population, the loss of genetic diversity through inbreeding or drift can be prevented by large effective breeding population sizes (Wright 1931) or by introducing new potential breeding animals (Mills and Allendorf 1996). The NRC Review (2013) recommended that single HMAs should not be considered as isolated genetic populations. Rather, managed herds of wild horses should be considered as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. It is worth noting that, although maintenance of genetic diversity at the scale of the overall population of wild horses is an intuitive management goal, there are no existing laws or policies that require BLM to maintain genetic diversity at the scale of the individual herd management area or complex. Also, there is no Bureau-wide policy that requires BLM to allow each female in a herd to reproduce before she is treated with contraceptives. Introducing 1-2 mares every generation (about every 10 years) is a standard management technique that can alleviated potential inbreeding concerns (BLM 2010). There would be little concern for effects to genetic variability of the herd because all action alternatives incorporate BLM's management plan for genetic monitoring and maintenance of genetic variability.

In the last 10 years, there has been a high realized growth rate of wild horses in most areas administered by the BLM. As a result, most alleles that are present in any given mare are likely to already be well represented in her siblings, cousins, and more distant relatives in an HMA. With the exception of horses in a small number of well-known HMAs that contain a relatively high fraction of alleles associated with old Spanish horse breeds (NRC Review 2013), the genetic composition of wild horses in lands administered by the BLM is consistent with admixtures from domestic breeds. As a result, in most HMAs, applying fertility control to a subset of mares is not expected to cause irreparable loss of genetic diversity. Improved longevity and an aging population are expected results of contraceptive treatment that can provide for lengthening generation time; this result would be expected to slow the rate of genetic diversity loss (Hailer et al. 2006). Based on a population model, Gross (2000) found that a strategy to preferentially treat young animals with a contraceptive led to more genetic diversity being retained than either a strategy that preferentially treats older animals, or a strategy with periodic gathers and removals.

Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Their results show that the risk of the loss of genetic heterozygosity is extremely low except in case where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5% per year), and very large fractions of the female population are permanently sterilized. Methods being proposed in this EA are not permanent but are reversible.

Refer to Section 3.3.4 within the 2022 Roberts Mountain Gather EA for specific detail regarding the genetic health of the RMC.

7.5. Sex Ratio Manipulation

Skewing the sex ratio of a herd so that there are more males than females is an established BLM management technique for reducing population growth rates. As part of a wild horse and burro gather process, the number of animals returned to the range may include more males, the number removed from the range may include more females, or both. By reducing the proportion of breeding females in a population (as a fraction of the total number of animals present), the technique leads to fewer foals being born, relative to the total herd size.

Sex ratio is typically adjusted in such a way that 60 percent of the horses are male. In the absence of other fertility control treatments, this 60:40 sex ratio can temporarily reduce population growth rates from approximately 20% to approximately 15% (Bartholow 2004). While such a decrease in growth rate may not appear to be large or long-lasting, the net result can be that fewer foals being born, at least for a few years – this can extend the time between gathers, and reduce impacts on-range, and costs off-range. Any impacts of sex ratio manipulation are expected to be temporary because the sex ratio of wild horse and burro foals at birth is approximately equal between males and females (NAS 2013), and it is common for female foals to reproduce by their second year (NAS 2013). Thus, within a few years after a gather and selective removal that leads to more males than females, the sex ratio of reproducing wild horses and burros will be returning toward a 50:50 ratio.

Having a larger number of males than females is expected to lead to several demographic and behavioral changes as noted in the NAS report (2013), including the following. Having more fertile males than females should not alter the fecundity of fertile females. Wild mares may be distributed in a larger number of smaller harems. Competition and aggression between males may cause a decline in male body condition. Female foraging may be somewhat disrupted by elevated male-male aggression. With a greater number of males available to choose from, females may have opportunities to select more genetically fit sires. There would also be an increase the genetic effective population size because more stallions would be breeding and existing females would be distributed among many more small harems. This last beneficial impact is one reason that skewing the sex ratio to favor males is listed in the BLM wild horse and burro handbook (BLM 2010) as a method to consider in herds where there may be concern about the loss of genetic diversity; having more males fosters a greater retention of genetic diversity.

Infanticide is a natural behavior that has been observed in wild equids (Feh and Munktuya 2008, Gray 2009), but there are no published accounts of infanticide rates increasing as a result of having a skewed sex ratio in wild horse or wild burro herds. Any comment that implies such an impact would be speculative.

The BLM wild horse and burro management handbook (BLM 2010) discusses this method. The handbook acknowledges that there may be some behavioral impacts of having more males than females. The handbook includes guidelines for when the method should be applied, specifying that this method should be considered where the low end of the AML is 150 animals or greater, and with the result that males comprise 60-70 percent of the herd. Having more than 70 percent males may result in unacceptable impacts in terms of elevated male-male aggression. In NEPA analyses, BLM has chosen to follow these guidelines in some cases, for example:

- In the 2015 Cold Springs HMA Population Management Plan EA (DOI-BLM-V040-2015-022), the low end of AML was 75. Under the preferred alternative, 37 mares and 38 stallions would remain on the HMA. This is well below the 150 head threshold noted above.
- In the 2017 Hog Creek HMA Population Management Plan EA (DOI-BLM-ORWA-V000-2017-0026-EA), BLM clearly identified that maintaining a 50:50 sex ratio was appropriate because the herd size at the low end of AML was only 30 animals.

It is relatively straightforward to speed the return of skewed sex ratios back to a 50:50 ratio. The BLM wild horse and burro handbook (BLM 2010) specifies that, if post-treatment monitoring reveals negative impacts to breeding harems due to sex ratio manipulation, then mitigation measures could include removing males, not introducing additional males, or releasing a larger proportion of females during the next gather.

7.6. Effects of Sterilization (gelding)

Castration (the surgical removal of the testicles, also called gelding or neutering) is a surgical procedure for the horse sterilization that has been used for millennia. The procedure is fairly straightforward and has a relatively low complication rate. As noted in the review of scientific literature that follows, the expected effects of gelding are well understood overall, even though there is some degree of uncertainty about the exact quantitative outcomes for any given individual (as is true for any natural system). Reference in this text to any specific commercial product, process, or service, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement, recommendation, or favoring by the Department of the Interior.

Including a portion of geldings in a herd can lead to a reduced population-level per-capita growth rate, by virtue of having fertile mares comprise a lower fraction of the herd. By having a skewed sex ratio with fewer females than males (stallions and geldings), the result will be that there will be a lower number of breeding females in the population. Including geldings in herd management is not new for BLM and federal land management. Geldings have been released on BLM lands as a part of herd management in the Barren

Valley complex in Oregon (BLM 2011), the Challis HMA in Idaho (BLM 2012), and the Conger HMA in Utah (BLM 2016). Geldings were also included in US Fish and Wildlife Service management plans for the Sheldon National Wildlife Refuge that relied on sterilization and removals (Collins and Kasbohm 2016).

The more commonly applied methods for managing population growth of free-roaming wild horses focus largely on suppressing female fertility through contraceptive vaccines (e.g., Ballou et al. 2008, Killian et al. 2008, Turner et al. 2008, Gray et al. 2010, Ransom et al. 2011). Fewer studies have been conducted on techniques for reducing male fertility. Nelson (1980) and Garrott and Siniff (1992) modeled potential efficacy of male-oriented contraception as a population management tool, and both studies agreed that while slowing growth, sterilizing only dominant males (i.e., harem-holding stallions) would result in only marginal reduction in female fertility rates. Eagle et al. (1993) and Asa (1999) tested this hypothesis on herd management areas (HMAs) where dominant males were vasectomized. Their findings agreed with modeling results from previous studies, and they also concluded that sterilizing only dominant males would not provide the desired reduction in female fertility and overall population growth rate, assuming that the numbers of fertile females is not changed. While bands with vasectomized harem stallions tended to have fewer foals, breeding by bachelors and subordinate stallions meant that population growth still occurred – female fertility was not dramatically reduced. Garrott and Siniff (1992) concluded from their modeling that male sterilization would effectively cause there to be zero population growth (the point where births roughly equal deaths) only if a large proportion of males (i.e., >85%) could be sterilized. In cases where the goal of harem stallion sterilization is to reduce population growth rates, success appears to be dependent on a stable group structure, as strong bonds between a stallion and mares reduce the probability of a mare mating an extra-group stallion (Nelson 1980, Garrott and Siniff 1992, Eagle et al. 1993, Asa 1999). Collins and Kasbohm (2016) demonstrated that there was a reduced fertility rate in a feral horse herd with both spayed and vasectomized horses—some geldings were also present in that herd. At Conger HMA, a fraction of geldings that were returned to the range with their social band did continue with females, apparently excluding fertile stallions, for at least 2 years (King et al. 2022).

Despite these studies, geldings can be used to reduce overall growth rates in a management strategy that does not rely on any expectation that geldings will retain harems or lead to a reduction in per-female fertility rates. In alternatives being considered in this environmental analysis, the primary goal of including geldings in the herd is not necessarily to reduce female fertility. Rather, by including some geldings in a herd that also has fertile mares and stallions, the geldings would take some of the spaces toward AML that would otherwise be taken by fertile females. If the total number of horses is constant but geldings are included in the herd, this can reduce the number of fertile mares, therefore reducing the absolute number of foals produced. Put another way, if geldings occupy spaces toward AML that would otherwise be filled by fertile mares, that will reduce growth rates merely by providing a lower baseline number of fertile mares.

Surgical sterilization techniques, while not reversible, may control horse reproduction without the kind of additional handling or darting that can be needed to administer contraceptive vaccines. In this sense, sterilization surgeries can be used to achieve herd management objectives with a relative minimum level of animal handling and management over the long term. The WFRHBA (as amended) indicates that management should be at the minimum level necessary to achieve management objectives (CFR 4710.4), and if gelding some fraction of a managed population can reduce population growth rates by replacing breeding mares, it then follows that gelding some individuals can lead to a reduced number of handling occasions and removals of excess horses from the range, which is consistent with legal guidelines. Other fertility control options that may be temporarily effective on male horses, such as the injection of GonaCon-Equine immunocontraceptive vaccine, apparently require multiple handling occasions to achieve longer-term male infertility. Similarly, PZP immunocontraception that is currently available for use in wild mares requires handling or darting every year. By some measures, any management activities that require multiple capture operations to treat a given individual would be more intrusive for wild horses and potentially less sustainable than an activity that requires only one handling occasion.

7.6.1. Direct Effects of Gelding

No animals which appear to be distressed, injured, or in poor health or condition would be selected for gelding. Stallions would not typically be neutered within 72 hours of capture. The surgery would be performed by a veterinarian using general anesthesia and appropriate surgical techniques. The final determination of which specific animals would be gelded would be based on the professional opinion of the attending veterinarian in consultation with the Authorized Officer.

Though neutering males is a common surgical procedure, especially gelding, some level of minor complications after surgery may be expected (Getman 2009), and it is not always possible to predict when postoperative complications would occur. Fortunately, the most common complications are almost always self-limiting, resolving with time and exercise. Individual impacts to the stallions during and following the gelding process should be minimal and would mostly involve localized swelling and bleeding. Complications may include, but are not limited to: minor bleeding, swelling, inflammation, edema, infection, peritonitis, hydrocele, penile damage, excessive hemorrhage, and eventration (Schumacher 1996, Searle et al. 1999, Getman 2009). A small amount of bleeding is normal and generally subsides quickly, within 2-4 hours following the procedure. Some degree of swelling is normal, including swelling of the prepuce and scrotum, usually peaking between 3-6 days after surgery (Searle et al. 1999). Swelling should be minimized through the daily movements (exercise) of the horse during travel to and from foraging and watering areas. Most cases of minor swelling should be back to normal within 5-7 days, more serious cases of moderate to severe swelling are also self-limiting and are expected to resolve with exercise after one to 2 weeks. Older horses are reported to be at greater risk of post-operative edema, but daily exercise can prevent premature closure of the incision, and prevent fluid buildup (Getman 2009). In some cases, a hydrocele (accumulation of sterile fluid) may develop over months or years (Searle et al. 1999). Serious complications (eventration, anesthetic reaction, injuries during handling, etc.) that result in euthanasia or mortality during and following surgery are rare (e.g., eventration rate of 0.2% to 2.6% noted in Getman 2009, but eventration rate of 4.8% noted in Shoemaker et al. 2004) and vary according to the population of horses being treated (Getman 2009). Normally one would expect serious complications in less than 5% of horses operated under general anesthesia, but in some populations these rates have been as high as 12% (Shoemaker 2004). Serious complications are generally noted within 3 or 4 hours of surgery but may occur any time within the first week following surgery (Searle et al. 1999). If they occur, they would be treated with surgical intervention when possible, or with euthanasia when there is a poor prognosis for recovery. There was no observed mortality in geldings at the Conger HMA study, and geldings retained good body condition (King et al. 2022). Vasectomized stallions may remain fertile for up to 6 weeks after surgery, so it is optimal if that treatment occurs well in advance of the season of mare fertility starting in the spring (NAS 2013). The NAS report (2013) suggested that chemical vasectomy, which has been developed for dogs and cats, may be appropriate for wild horses and burros.

For intact stallions, testosterone levels appear to vary as a function of age, season, and harem size (Khalil et al 1998). It is expected that testosterone levels will decline over time after castration. Testosterone levels should not change due to vasectomy. Vasectomized stallions should retain their previous levels of libido. Domestic geldings had a significant prolactin response to sexual stimulation, but lacked the cortisol response present in stallions (Colborn et al. 1991). Although libido and the ability to ejaculate tends to be gradually lost after castration (Thompson et al. 1980), some geldings continue to mount mares and intromit (Rios and Houpt 1995, Schumacher 2006).

7.6.2. Effects of Handling and Marking

It is prudent for gelded animals to be readily identifiable, either via freezebrand marks and/or chips, or unique coloration, so that their treatment history is easily recognized (e.g., BLM 2010). Markings may also be useful into the future to determine the approximate fraction of geldings in a herd and could provide additional insight regarding gather efficiency. BLM has instituted guidelines to reduce the sources of handling stress in captured animals (BLM 2015). Handling may include freeze-markingand /or chipping, for the purpose of identifying an individual. Some level of transient stress is likely to result in newly captured horses that are not previously marked. Under past management practices, captured horses experienced increased, transient stress levels from handling (Ashley and Holcombe 2001) , but BLM has instituted guidelines to reduce the sources of handling stress in captured animals (BLM 2021). It is difficult to compare that level of temporary stress with long-term stress that can result from food and water limitation on the range (e.g., Creel et al. 2013), which could occur in the absence of herd management.

Most horses recover from the stress of capture and handling quickly once released back to the HMA, and none are expected to suffer serious long-term effects from gelding, other than the direct consequence of becoming infertile.

Selected stallions would be shipped to the facility, gelded, and returned to the range within 30 days. Gelded animals could be monitored periodically for complications for approximately 7-10 days following release. In the proposed alternatives, gelding is not part of any research study, but additional monitoring on the range could be completed either through aerial recon, if available, or field observations from major roads and trails. It is not anticipated that all the geldings would be observed but if the goal is to detect complications on the range, then this level of casual observation may help BLM determine if they are occurring. Observations of the long term outcomes of gelding could be recorded during routine resource monitoring work. Such observations could include but not be limited to band size, social interactions with other geldings and harem bands, distribution within their habitat, forage utilization and activities around key water sources. Periodic population inventories and future gather statistics could provide additional anecdotal information about how logistically effective it is to manage a portion of the herd as non-breeding animals.

7.6.3. Indirect Effects of Gelding

Other than the short-term outcomes of surgery, castration is not expected to reduce geldings' survival rates. Castration is thought to increase survival as males are released from the cost of reproduction (Jewell 1997). In Soay sheep castrates survived longer than rams in the same cohort (Jewell 1997), and Misaki horse geldings lived longer than intact males (Kaseda et al. 1997, Khalil and Murakami 1999). Moreover, it is unlikely that a reduced testosterone level will compromise gelding survival in the wild, considering that wild mares survive with low levels of testosterone. Consistent with geldings not expending as much energy toward in attempts to obtain or defend a harem, it is expected that wild geldings may have a better body condition that wild fertile stallions. King et al. (2022) noted that geldings maintained good body condition in the wild.

Under the proposed action, reproductive stallions would still be a component of the population's age and sex structure. The question of whether or not a given gelding would or would not attempt to maintain a harem is not germane to population-level management. Gelding a subset of stallions in the proposed action would not prevent other stallions and mares from continuing with the typical range of social behaviors for sexually active adults. For fertility control strategies where gelding is intended to reduce growth rates by virtue of sterile males defending harems, the National Academies of Sciences (NRC 2013) suggested that the effectiveness of gelding on overall reproductive rates may depend on the pre-castration social roles of those animals. However, in this decision the alternatives being considered that include gelding would reduce population growth rates by a different means: including geldings as a component of the total horses counted toward AML would effectively reduce the relative number of fertile mares in the herd. Having a post-gather herd with some geldings and a lower fraction of fertile mares necessarily reduces the absolute number of foals born per year, compared to a herd that includes more fertile mares. An additional benefit is that geldings that would otherwise be permanently removed from the range (for adoption, sale or other disposition) may be released back onto the range where they can engage in free-roaming behaviors.

BLM would expect that wild horse family structures will continue to exist under the proposed action within wild horse population, because fertile mares, stallions, and their foals will continue to be a component of the herd. Because the fraction of males gelded is not expected to come anywhere close to the ~85% threshold suggested by Garrott and Siniff (1992) as being necessary to substantially reduce population growth rates, is not expected that gelding a subset of stallions will significantly change the social structure or herd demographics (age and sex ratios) of fertile wild horses. It is worth noting, though, that the BLM is not required to manage populations of wild horses in a manner that ensures that any given individual maintains its social standing within any given harem or band.

7.6.4. Behavioral Effects of Gelding

Gelding adult male horses is expected to result in reduced testosterone production, which is expected to directly influence reproductive behaviors (NRC 2013). However, testosterone levels alone are not a predictor of masculine behavior (Line et al. 1985, Schumacher 2006). In domestic geldings, 20-30% continued to show stallion-like behavior, whether castrated pre- or post-puberty (Line et al. 1985). Gelding of domestic horses most commonly takes place before or shortly after sexual maturity, and age-at-gelding can affect the degree to which stallion-like behavior is expressed later in life. In intact stallions, testosterone levels peak increase up to an age of ~4-6 years, and can be higher in harem stallions than bachelors (Khalil et al. 1998). It is assumed that free roaming wild horse geldings would generally exhibit reduced aggression toward other horses and reduced reproductive behaviors (NRC 2013). In a herd that included some geldings and some fertile stallions, there were few behavioral differences between those groups, other than that geldings engaged in more affiliative and less marking and reproductive behaviors (King et al. 2022). The behavior of wild horse geldings in the presence of intact stallions has not otherwise been well documented, but the literature review below can be used to make reasonable inferences about their likely behaviors.

Despite livestock being managed by castrating males for millennia, there is relatively little published research on castrates' behaviors (Hart and Jones 1975). Stallion behaviors in wild or pasture settings are better documented than gelding behaviors, but it inferences about how the behaviors of geldings will change, how quickly any change will occur after surgery, or what effect gelding an adult stallion and releasing him back in to a wild horse population will have on his behavior and that of the wider population must be surmised from the existing literature. There is an ongoing BLM study in Utah focused on the individual and population-level effects of including some geldings in a free-roaming horse population (BLM 2016), but results from that study are not yet available. However, inferences about likely behavioral outcomes of gelding can be made based on available literature.

Feral horses typically form bands composed of an adult male with 1 to 3 adult females and their immature offspring (Feist and McCullough 1976, Berger 1986, Roelle et al. 2010). In many populations subordinate "satellite" stallions have been observed associating with the band, although the function of these males continues to be debated (see Feh 1999, and Linklater and Cameron 2000). Juvenile offspring of both sexes leave the band at sexual maturity (normally around two or three years of age (Berger 1986), but adult females may remain with the same band over a span of years. Group stability and cohesion is maintained through positive social interactions and agonistic behaviors among all members and herding and reproductive behaviors from the stallion (Ransom and Cade 2009). Group movements and consortship of a stallion with mares is advertised to other males through the group stallion marking dung piles as they are encountered, and over-marking mare eliminations as they occur (King and Gurnell 2006).

In horses, males play a variety of roles during their lives (Deniston 1979): After dispersal from their natal band they generally live as bachelors with other young males, before associating with mares and developing their own breeding group as a harem stallion or satellite stallion. In any population of horses not all males will achieve harem stallion status, so all males do not have an equal chance of breeding (Asa 1999). Stallion behavior is thought to be related to androgen levels, with breeding stallions having higher androgen concentrations than bachelors (Angle et al. 1979, Chaudhuri and Ginsberg 1990, Khalil et al. 1998). A bachelor with low libido had lower levels of androgens, and two-year-old bachelors had higher testosterone levels than two-year olds with undescended testicles who remained with their natal band (Angle et al. 1979).

The effect of castration on aggression in horses has not often been quantified. One report has noted that high levels of aggression continued to be observed in domestic horse geldings who also exhibited sexual behaviors (Rios and Houpt 1995). Stallion-like behavior in domestic horse geldings is relatively common (Smith 1974, Schumacher 1996), being shown in 20-33% of cases whether the horse was castrated pre- or post-puberty (Line et al. 1985, Rios and Houpt 1995, Schumacher 2006). While some of these cases may be due to cryptorchidism or incomplete surgery, it appears that horses are less dependent on hormones than other mechanisms for the maintenance of sexual behaviors (Smith 1974). Domestic geldings exhibiting masculine behavior had no difference in testosterone concentrations than other geldings (Line et al. 1985, Schumacher 2006), and in some instances the behavior appeared context dependent (Borsberry 1980, Pearce 1980).

Dogs and cats are commonly neutered, and it is also common for them to continue to exhibit reproductive behaviors several years after castration (Dunbar 1975). Dogs, ferrets, hamsters, and marmosets continued to show sexually motivated behaviors after castration, regardless of whether they had previous experience or not, although in beagles and ferrets there was a reduction in motivation post-operatively (Hart 1968, Dunbar 1975, Dixson 1993, Costantini et al. 2007, Vinke et al. 2008). Ungulates continued to show reproductive behaviors after castration, with goats and llamas continuing to respond to females even a year later in the case of goats, although mating time and the ejaculatory response was reduced (Hart and Jones 1975, Nickolmann et al. 2008).

The likely effects of castration on geldings' social interactions and group membership can be inferred from available literature, even though wild horses are rarely gelded and released back into the wild, resulting in few studies that have investigated their behavior in free-roaming populations. In the western US—where ranges are much larger, intact stallions are present year-round, and population density varies—free-roaming gelding behaviors may differ somewhat from those noted below. In a pasture study of domestic horses, Van Dierendonk et al. (1995) found that social rank among geldings was directly correlated to the age at which the horse was castrated, suggesting that social experiences prior to sterilization may influence behavior afterward. Of the two geldings present in a study of semi-feral horses in England, one was dominant over the mares whereas a younger gelding was subordinate to older mares; stallions were only present in this population during a short breeding season (Tyler 1972). A study of domestic geldings in Iceland held in a large pasture with mares and sub-adults of both sexes, but no mature stallions, found that geldings and sub-adults formed associations amongst each other that included interactions such as allo-grooming and play, and were defined by close proximity (Sigurjónsdóttir et al. 2003). These geldings and sub-adults tended to remain in a separate group from mares with foals, similar to castrated Soay sheep rams (Ovis aries) behaving like bachelors and grouping together, or remaining in their mother's group (Jewell 1997). In Japan, Kaseda et al. (1997) reported that young males dispersing from their natal harem and geldings moved to a different area than stallions and mares during the non-breeding season. Although the situation in Japan may be the equivalent of a bachelor group in natural populations, in Iceland this division between mares and the rest of the horses in the herd contradicts the dynamics typically observed in a population containing mature stallions. Sigurjónsdóttir et al. (2003) also noted that in the absence of a stallion, allo-grooming between adult females increased drastically. Other findings included increased social interaction among yearlings, display of stallion-like behaviors such as mounting by the adult females, and decreased association between females and their yearling offspring (Sigurjónsdóttir et al. 2003). In the same population in Iceland, Van Dierendonck et al. (2004) concluded that the presence of geldings did not appear to affect the social behavior of mares or negatively influence parturition, mare-foal bonding, or subsequent maternal activities. Additionally, the welfare of broodmares and their foals was not affected by the presence of geldings in the herd (Van Dierendonck et al. 2004). These findings are important because treated geldings will be returned to the range in the presence of pregnant mares and mares with foals of the year.

The likely effects of castration on geldings' home range and habitat use can also be surmised from available literature. Bands of horses tend to have distinct home ranges, varying in size depending on the habitat and varying by season, but always including a water source, forage, and places where horses can shelter from inclement weather or insects (King and Gurnell 2005). By comparison, bachelor groups tend to be more transient, and can potentially use areas of good forage further from water sources, as they are not constrained by the needs of lactating mares in a group. The number of observations of gelded wild stallion behavior are still too few to make general predictions about whether a particular gelded stallion individuals will behave like a harem stallion, a bachelor, or form a group with geldings that may forage and water differently from fertile wild horses.

Gelding wild horses does not change their status as wild horses under the WFRHBA (as amended). In terms of whether geldings will continue to exhibit the free-roaming behavior that defines wild horses, BLM does expect that geldings would continue to roam unhindered in the HMA where this action would take place. Wild horse movements may be motivated by a number of biological impulses, including the search for forage, water, and social companionship that is not of a sexual nature. As such, a gelded animal would still be expected to have a number of internal reasons for moving across a landscape and, therefore, exhibiting "free-roaming" behavior. Despite marginal uncertainty about subtle aspects of potential changes in habitat preference, there is no expectation that gelding wild horses will cause them to lose their free-roaming nature. It is worth noting that individual choices in wild horse group membership, home range, and habitat use are not protected under the WFRHBA. BLM acknowledges that geldings may exhibit some behavioral differences after surgery, compared to intact stallions, but those differences are not be expected to remove the geldings' rebellious and feisty nature, or their defiance of man. While it may be that a gelded horse could have a different set of behavioral priorities than an intact stallion, the expectation is that geldings will choose to act upon their behavioral priorities in an unhindered way, just as is the case for an intact stallion. In this sense, a gelded male would be just as much "wild" as defined by the WFRHBA as any intact stallion, even if his patterns of movement differ from those of an intact stallion. Congress specified that sterilization is an acceptable management action (16 USC §1333.b.1). Sterilization is not one of the clearly defined events that cause an animal to lose its status as a wild free-roaming horse (16 USC §1333.2.C.d). Several academics have offered their opinions about whether gelding a given stallion would lead to that individual effectively losing its status as a wild horse (Rutberg 2011, Kirkpatrick 2012, Nock 2017). Those opinions are based on a semantic and subjective definition of "wild," while BLM must adhere to the legal definition of what constitutes a wild horse, based on the WFRHBA (as amended). Those individuals have not conducted any studies that would test the speculative opinion that gelding wild stallions will cause them to become docile. BLM is not obliged to base management decisions on such opinions, which do not meet the BLM's principle and practice to "Use the best available scientific knowledge relevant to the problem or decision being addressed, relying on peer reviewed literature when it exists" (Kitchell et al. 2015).

7.6.5. Genetic Effects of Gelding

It is true that geldings are unable to contribute to the genetic diversity of the herd, but that does not lead to an expectation that the Complex would necessarily experience high levels of inbreeding, because there would be a core breeding population of stallions consistent with low end AML. Existing levels of genetic diversity were high in this area when last measured, and expectations are that heterozygosity levels are higher now because the population has continued to grow exponentially in the recent past. In addition, many of the stallions that would be gelded would have already had a chance to breed, passing on genetic material to their offspring. BLM is not obligated to ensure that any given individual in a herd has the chance to sire a foal and pass on genetic material. The herd in which the proposed action is to take place is not at immediate or future risk of catastrophic loss of genetic diversity, nor does the genetic diversity in this herd represent unique genetic information. This action does not prevent BLM from augmenting genetic diversity in the treated herd in the future, if future genetic monitoring indicates that would be necessary.

Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Although those results are specific to mares, some inferences about potential effects of stallion sterilization may be made from their results. Roelle and Oyler-McCance (2015) showed that the risk of the loss of genetic heterozygosity is extremely low except in cases where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5% per year), and very large fractions of the population are permanently sterilized.

BLM acknowledges that if the management goal was to sterilize >85% of males in a population, that could lead to genetic consequences of reduced heterozygosity and increased inbreeding coefficients, as it would potentially allow a very small group of males to dominate the breeding (e.g., Saltz et al. 2000). Such genetic consequences could be mitigated by natural movements or human-facilitated translocations (BLM 2010). However, the question of how >85% gelded males in a population would interact with intact stallions and mares and with their habitat is not relevant to this decision because that level of castration is not being considered as an alternative in this decision. Garrott and Siniff's (1992) model predicts that gelding 50-80% of mature males in the population would result in reduced, but not halted, mare fertility rates. However, within a few years after any male sterilization treatment, a number of fertile male colts would become sexually mature stallions who could contribute genetically to the herd. Refer to Section 3.3.4 within the 2022 Roberts Mountain Gather EA for specific detail regarding the genetic health of the RMC.

8.0 Dietary Overlap with Other Species

Wild horse populations above AML compete for forage, water, and cover allocated to wildlife and livestock. Over populations of wild horses impact riparian areas with increased trailing, vegetative use, and trampling. Wild horses in such situations will drive away livestock and native ungulates from watering and feeding areas (Miller 1981).

Numerous studies identify dietary overlap of preferred forage species and habitat preference between horses, cattle, and wildlife species in the Great Basin ecosystems for all season (Ganskopp 1983; Gandskopp et al. 1986, 1987; McInnis 1984; McInnis 1987; Smith et al 1982; Vavra and Sneva 1987). A strong potential exists for exploitative competition between horses and cattle under conditions of limited forage (water and space) availability (McInnis et al. 1987).

Although horses and cattle are often compared as grazers, horses can be more destructive to the range than cattle due to their differing digestive systems and grazing habits. The dietary overlap between wild horses and cattle is much higher than with wildlife, and averages between 60 and 80% (Hubbard and Hansen 1976, Hansen et al. 1977, Hanley 1982, Krysl et al. 1984, McInnis and Vavra 1987). Horses are cecal digesters while most other ungulates including cattle, pronghorn, and others are ruminants (Hanley and Hanley 1982, Beever 2003). Cecal digesters do not ruminate, or have to regurgitate and repeat the cycle of chewing until edible particles of plant fiber are small enough for their digestive system. Ruminants, especially cattle, must graze selectively, searching out digestible tissue (Olsen and Hansen 1977). Horses, however, are one of the least selective grazers in the West because they can consume high fiber foods and digest larger food fragments (Hanley and Hanley 1982, Beever 2003). Because horses have a cecal digestive system and can cover longer distances than domestic ruminants, wild horses can remain in good health under forage conditions fatal to domestic ruminants (Holechek 1989).

Wild horses can exploit the high cellulose of graminoids, or grasses, which have been observed to make up over 88% of their diet (McInnis and Vavra 1987, Hanley 1982). However, this lower quality diet requires that horses consume 20-65% more forage than a cow of equal body mass (Hanley 1982, Menard et al. 2002). With more flexible lips and upper front incisors, both features that cattle do not have, wild horses trim vegetation more closely to the ground (Symanski 1994, Menard et al. 2002, Beever 2003). As a result, areas grazed by horses may retain fewer plant species and may be subject to higher utilization levels than areas grazed by cattle or other ungulates. A potential benefit of a horse's digestive system may come from seeds passing through system without being digested but the benefit is likely minimal when compared to the overall impact wild horse grazing has on vegetation in general.

Competition from a large dominant species may drive niche partitioning of other species (Carothers and Jaksi, 1984; Ziv et al., 1993; Schuette et al., 2013). The study found that during times of greatest physiological stress (increased temperature, decreased precipitation), horses monopolized access to water sources where they were present up to 73% of the day, leaving limited time for other species. The potential for an exotic species, such as the wild horses, to outcompete native species for a limited communal resourced during peak need raises concern for native communities in water-limited environments (Hall et al. 2016).

9.0 Fertility Control Treatment (SOPs)

The following management and monitoring requirements are part of the Proposed Action and Alternative A:

9.1. PZP Vaccine SOPs

1. PZP vaccine would be administered by trained BLM personnel.

2. The fertility control drug is administered with two separate injections: (1) a liquid dose of PZP is administered using an 18-gauge needle primarily by hand injection; (2) the pellets are preloaded into a 14-gauge needle. These are loaded on the end of a trocar (dry syringe with a metal rod) which is loaded into the jab-stick which then pushes the pellets into the breeding mares being returned to the range. The pellets and liquid are designed to release the PZP over time similar to a time-release cold capsule.

3. Delivery of the vaccine would be as an intramuscular injection while the mares are restrained in a working chute. Half a cubic centimeter (cc) of the PZP vaccine would be emulsified with half a cc of adjuvant (a compound that stimulates antibody production) and loaded into the delivery system. The pellets would be loaded into the jab-stick for the second injection. With each injection, the liquid and pellets would be propelled into the left hindquarters of the mare, just below the imaginary line that connects the point of the hip and the point of the buttocks.

4. All treated mares would be freezemarked on the hip and / or chipped to enable researchers to positively identify the animals during the research project as part of the data collection phase.

5. At a minimum, monitoring of reproductive rates using helicopter flyovers will be conducted in years two through four by checking for the presence or absence of foals. The flight scheduled for year four will also assist in determining the percentage of mares that have returned to fertility. In addition, field monitoring will be routinely conducted as part of other regular ground-based monitoring activities.

6. A field data sheet will be used by the field applicators to record all the pertinent data relating to identification of the mare including a photograph when possible, date of treatment, type of treatment (1 or 2 year vaccine, adjuvant used) and HMA. The original form with the data sheets will be forwarded to the Authorized Officer at the National Program Office (NPO) in Reno, Nevada. A copy of the form and data sheets and any photos taken will be maintained at the district office.

7. A tracking system will be maintained by NPO detailing the quantity of PZP issued, the quantity used, and disposition of any unused PZP, the number of treated mares by HMA, district office, and state along with the freeze-mark and / or chip applied by HMA.

8. The field office will assure that treated mares do not enter the adoption market for 3 years following treatment. In the rare instance, due to unforeseen circumstances, that treated mare(s) are removed from an HMA before 3 years have lapsed, they will be maintained in either a BLM facility or BLM-contracted Long-Term Pastures (LTPs) until expiration of the 3-year holding period. In the event it is necessary to remove treated mares, their removal and disposition will be coordinated through NPO. After expiration of the 3-year holding period, the animal may be placed in the adoption program or sent to long-term pastures.

9.2. PZP Remote Darting SOPs

1. PZP vaccine would be administered through darting by trained BLM personnel or collaborating partners only. For any darting operation, the designated personnel must have successfully completed a nationally recognized wildlife darting course and who have documented and successful experience darting wildlife under field conditions.
2. All mares targeted for treatment will be clearly identifiable through photographs to enable darters and HMA managers to positively identify the animals during the project and at the time of removal during subsequent gathers.
3. Mares that have never been treated would receive 0.5 cc of PZP vaccine emulsified with 0.5 cc of Freund's Modified Adjuvant (FMA) and loaded into darts at the time a decision has been made to dart a specific mare. Mares identified for re-treatment receive 0.5 cc of the PZP vaccine emulsified with 0.5 cc of Freund's Incomplete Adjuvant (FIA).
4. The liquid dose of PZP vaccine is administered using 1.0 cc Pneu-Darts with 1.25" or 1.5" barbless needles fired from either Dan Inject®, Pneu-Dart® X-Caliber or Palmer® Cap-Chur rifle.
5. Only designated darters would mix the vaccine/adjuvant and prepare the emulsion. Vaccine-adjuvant emulsion would be loaded into darts at the darting site and delivered by means of an appropriate CO_2 powered or cartridge darting delivery system.
6. Delivery of the vaccine would be by intramuscular injection into the left or right hip/gluteal muscles while the mare is standing still.
7. Safety for both humans and the horse is the foremost consideration in deciding to dart a mare. Safe darting distances would depend on the skill and ability of the darter, and the particular model of dart gun being utilized. No attempt would be taken when other persons are within a 30-m radius of the target animal.
8. No attempts would be taken in high wind or when the horse is standing at an angle where the dart could miss the hip/gluteal region and hit the rib cage. The ideal is when the dart would strike the skin of the horse at a perfect 90° angle.
9. If a loaded dart is not used within two hours of the time of loading, the contents would be transferred to a new dart before attempting another horse. If the dart is not used before the end of the day, it would be stored under refrigeration and the contents transferred to another dart the next day. Refrigerated darts would not be used in the field.
10. No more than two people should be present at the time of a darting. The second person is responsible for locating fired darts. The second person should also be responsible for identifying the horse and keeping onlookers at a safe distance.
11. To the extent possible, all darting would be carried out in a discrete manner. However, if darting is to be done within view of non-participants or members of the public, an explanation of the nature of the project would be carried out either immediately before or after the darting.
12. Attempts will be made to recover all darts. To the extent possible, all darts which are discharged and drop from the horse at the darting site would be recovered before another darting occurs. In exceptional situations, the site of a lost dart may be noted and marked, and recovery efforts made at a later time. All discharged darts would be examined after recovery in order to determine if the charge fired and the plunger fully expelled the vaccine. Personnel conducting darting operations should be equipped with a two-way radio or cell phone to provide a communications link with the Project Veterinarian for advice and/or assistance. In the event of a veterinary emergency, darting personnel would immediately contact the Project Veterinarian, providing all available information concerning the nature and location of the incident.
13. In the event that a dart strikes a bone or imbeds in soft tissue and does not dislodge, the darter would follow the affected horse until the dart falls out or the horse can no longer be found. The darter would be responsible for daily observation of the horse until the situation is resolved.

9.3. GonaCon SOPs

Orders for GonaCon – Equine should be placed with the Unites States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS), Pocatello Supply Depot (PSD). The PSD requires all orders to be placed in writing. Orders can be emailed to ws.psd@usda.gov and should include the name of the product being ordered, the quantity being ordered, a physical shipping address for UPS shipping and contact information for the person that should receive the billing invoice. Once the PSD receives the order and determines the shipping charges, an invoice and payment instructions will be emailed to the designated person. Payment can be made via credit card on the pay.gov webpage. Orders for GonaCon-Equine will be shipped once payment confirmation has been received at the PSD. Any questions regarding the ordering process can be sent to ws.psd@usda.gov or call 208-236-6920.

9.3.1. Delivering GonaCon by Hand-Injection of GonaCon

1. GonaCon-Equine vaccine is administered by hand-injection to mares that are appropriately immobilized or restrained. Important: label instructions must be followed for this product. Females identified for treatment application are hand-injected with an intramuscular injection of Gona-Equine vaccine (2 ml) in the lower gluteal musculature using a hand-held, luer-lock syringe (18-gauge, 3.8 cm needle). The syringe is made of transparent plastic with the barrel showing graduated marks indicating the volume of the vaccine in the syringe. This facilitates the visual assessment of the quantity of vaccine injected into the animal without the need to weigh the syringes. Pre-loaded syringes should be kept refrigerated overnight and then set out the morning of application at room temperature. They should not be allowed to get too warm or cold during the day.

2. The vaccine is distributed as preloaded doses (2 mL) in labeled syringes. Upon receipt, the vaccine should be kept refrigerated (4° C) until use. Do not freeze. The vaccine has a 6-month shelf-life from the time of production and the expiration date will be noted on each syringe that is provided.

3. Although infrequent, hand-injections to immobilized or restrained horses can result in partial delivery of the vaccine due to inexperienced personnel and/or unexpected movement of the horse. As a precaution, order extra doses of the vaccine. For hand-injection application, assume a 10% failure rate and increase the original quantity accordingly.

4. Examine each syringe before and after injection and visually determine approximately how much vaccine was injected. A full dose is considered 90% (1.8 ml) or greater of the original 2 ml dose. Ensure a full dose is administered.

5. It is recommended that all treated mares be photographed to facilitate identification by individual markings, RFID chip, and/or freeze-marked on the hip or neck to positively identify the animals as a GonaCon-Equine vaccinated mare during field observations or subsequent gathers.

9.3.2. Preparation of Darts for GonaCon Remote Delivery:

1. The vaccine is distributed as preloaded doses (2 mL) in labeled syringes. Upon receipt, the vaccine should be kept refrigerated (4° C) until use. Do not freeze. The vaccine has a 6-month shelf-life from the time of production and the expiration date will be noted on each syringe that is provided. Important: label instructions must be followed for this product.
2. Although infrequent, dart injections can result in partial injections of the vaccine, and shots are missed. As a precaution, it is recommended that extra doses of the vaccine be ordered to accommodate failed delivery (~15 %). To determine the amount of vaccine delivered, the dart must be weighed before loading, and before and after delivery in the field.

3. For best results, darts with a gel barb should be used. (i.e. 2 cc Pneu-Dart brand darts configured with Slow-inject technology, 3.81 cm long 14 ga.tri-port needles, and gel collars positioned 1.27 cm ahead of the ferrule).

4. Wearing latex gloves, darts are numbered and filled with vaccine by attaching a loading needle (7.62 cm; provided by dart manufacturer) to the syringe containing vaccine and placing the needle into the cannula of the dart to the fullest depth possible. Slowly depress the syringe plunger and begin filling the dart. Periodically, tap the dart on a hard surface to dislodge air bubbles trapped within the vaccine. Due to the viscous nature of the fluid, air entrapment typically results in a maximum of approximately 1.8 ml of vaccine being loaded in the dart. The dart is filled to max once a small amount of the vaccine can be seen at the tri-ports.

5. Important! Do not load and refrigerate darts the night before application. When exposed to moisture and condensation, the edges of gel barbs soften, begin to dissolve, and will not hold the dart in the muscle tissue long enough for full injection of the vaccine. The dart needs to remain in the muscle tissue for a minimum of 1 minute to achieve dependable full injection. Sharp gel barbs are critical.

6. Darts (configured specifically as described above) can be loaded in the field and stored in a cooler prior to application. Darts loaded, but not used can be maintained in a cooler at about 4° C and used the next day, but do not store in a refrigerator or any other container likely to cause condensation.

9.3.3. Administering the GonaCon Vaccine Remotely (via Darting):

1- For initial and booster treatments, mares would ideally receive 2.0 ml of GonaCon-Equine. However, experience has demonstrated that only 1.8 ml of vaccine can typically be loaded into 2 cc darts, and this dose has proven successful. Calculations below reflect a 1.8 ml dose.

2- With each injection, the vaccine should be injected into the left or right hind quarters of the mare, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).

3- Darts should be weighed to the nearest hundredth gram by electronic scale when empty, when loaded with vaccine, and after discharge, to ensure that 90% (1.62 ml) of the vaccine has been injected. Animals receiving <50% should be darted with another full dose; those receiving >50% but <90% should receive a half dose (1 ml). All darts should be weighed to verify a combination of ≥1.62 ml has been administered. Therefore, every effort should be made to recover darts after they have fallen from animals.

4- A booster vaccine may be administered 90 or more days after the first injection to improve efficacy of the product over subsequent years.

5- Free ranging animals may be photographed using a telephoto lens and high quality digital receiver as a record of treated individuals, and the injection site can be recorded on data sheets to facilitate identification by animal markings and potential injection scars.

9.4. SOPs for Intrauterine Devices

9.4.1. Background

Mares must be open. A veterinarian must determine pregnancy status via palpation or ultrasound. Ultrasound should be used as necessary to confirm open status of mares down to at least 14 days for those that have recently been with stallions. For mares segregated from stallions, this determination may be made at an earlier time when mares are identified as candidates for treatment, or immediately prior to IUD insertion. Pregnant mares should not receive an IUD.

Insertion of an IUD can be a rapid procedure, but it requires the mare to be temporarily restrained, such as in a squeeze chute.

IUDs would only be inserted in non-pregnant (open) mares. Wild mares receiving IUDs would be checked for pregnancy prior to insertion of an IUD. This can be accomplished by transrectal palpation and/or ultrasound performed by a veterinarian. Pregnant mares would not receive an IUD.

After cleaning of the perineal area, the sterile IUD is inserted by a veterinarian into the uterus using a sterilized, thin, tubular applicator similar to a shielded culture tube, and would be inserted in a manner similar to that routinely used to obtain uterine cultures in domestic mares.

Wild mares with IUDs would be individually marked and identified, so that they can be monitored occasionally and examined, if necessary, in the future, consistent with other BLM management activities.

9.4.2. Preparation

IUDs must be clean and sterile. Sterilize IUDs with a low-temperature sterilization system, such as Sterrad.

The Introducer is two PVC pipes. The exterior pipe is a 29” length of ½” diameter pipe, sanded smooth at one end, then heat-treated to smooth its curvature further (Fig. 1). The IUD will be placed into this smoothed end of the exterior pipe. The interior pipe is a 29 ½” long, ¼” riser tube (of the kind used to connect water lines to sinks), with one end slightly flared out to fit more snugly inside the exterior pipe (Fig. 1), and a plastic stopper attached to the other end (Fig. 2).

Figure 1. Interior and exterior pipes (unassembled), showing the ends that go into the mare

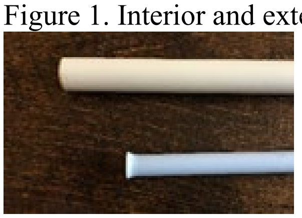


Figure 2. Interior pipe shown within exterior pipe. After the introducer is 4” beyond the os, the stopper is pushed forward (outside the mare), causing the IUD to be pushed out from the exterior pipe.

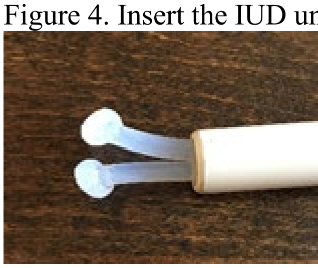
Introducers should be sterilized in Benz-all cold steriliant, or similar. Do not use iodine-based sterilant solution. A suitable container for sterilant can be a large diameter (i.e., 2”) PVC pipe with one end sealed and one end removable.

Prepare the IUD: Lubricate with sterile veterinary lube, and insert into the introducer. The central stem of the IUD goes in first (Fig. 3).

Figure 3. Insert the stem end of the IUD into the exterior pipe.

Fold the two 'legs' of the IUD, and push the IUD further into the introducer, until just the bulbous ends are showing (Fig. 4).

Figure 4. Insert the IUD until just the tips of the 'legs' are showing.



Restraint and Medication: The mare should be restrained in a padded squeeze chute to provide access to the rear end of the animal, but with a solid lower back door, or thick wood panel, for veterinarian safety.

Some practitioners may choose to provide sedation. If so, when the mare's head starts to droop, it may be advisable to tie the tail up to prevent risk of the animal sitting down on the veterinarian's arm (i.e., double half hitch, then tie tail to the bar above the animal).
Some practitioners may choose to provide a dose of long-acting progesterone to aid in IUD retention. Example dosage: 5mL of BioRelease LA Progesterone 300 mg/mL (BET labs, Lexington KY), *or* long-acting Altrenogest). No other intrauterine treatments of any kind should be administered at the time of IUD insertion.

9.4.3. Insertion Procedure

1. Prep clean the perineal area.
2. Lubricate the veterinarian's sleeved arm and the Introducer+IUD.
3. Carry the introducer (IUD-end-first) into the vagina.
4. Dilate the cervix and gently move the tip of the introducer past the cervix.
5. Advance the end of the 1/2" PVC pipe about 4 inches past the internal os of the cervix.
6. Hold the exterior pipe in place, but push the stopper of the interior pipe forward, causing the IUD to be pushed out of the exterior pipe, into the uterus.
7. Placing a finger into the cervical lumen just as the introducer tube is removed from the external os allows the veterinarian to know that the IUD is left in the uterus, and not dragged back into or past the cervix.
8. Remove the introducer from the animal, untie the tail.

Mares that have received an IUD should be observed closely for signs of discharge or discomfort for 24 hours following insertion after which they may be released back to the range.

10.0 Field Castration (Gelding) SOPs

Gelding will be performed with general anesthesia and by a veterinarian. The combination of pharmaceutical compounds used for anesthesia, method of physical restraint, and the specific surgical technique used will be at the discretion of the attending veterinarian with the approval of the authorized officer (IM 2009-063).

Pre-Surgery Animal Selection, Handling, and Care

1. Stallions selected for gelding will be greater than 6 months of age and less than 20 years of age.
2. All stallions selected for gelding will have a Henneke body condition score of 3 or greater. No animals which appear distressed, injured or in failing health or condition will be selected for gelding.
3. Stallions will not be gelded within 36 hours of capture and no animals that were roped during capture will be gelded at the temporary holding corrals for rerelease.
4. Whenever possible, a separate holding corral system will be constructed on site to accommodate the stallions that will be gelded. These gelding pens will include a minimum of 3 pens to serve as a working pen, recovery pen(s), and holding pen(s). An alley and squeeze chute built to the same specifications as the alley and squeeze chutes used in temporary holding corrals (solid sides in alley, minimum 30 feet in length, squeeze chute with non-slip floor) will be connected to the gelding pens.
5. When possible, stallions selected for gelding will be separated from the general population in the temporary holding corral into the gelding pens, prior to castration.
6. When it is not possible or practical to build a separate set of pens for gelding, the gelding operation will only proceed when adequate space is available to allow segregation of gelded animals from the general population of stallions following surgery. At no time will recently anesthetized animals be returned to the general population in a holding corral before they are fully recovered from anesthesia.
7. All animals in holding pens will have free access to water at all times. Water troughs will be removed from working and recovery pens prior to use.
8. Prior to surgery, animals in holding pens may be held off feed for a period of time (typically 12-24 hours) at the recommendation and direction of the attending veterinarian.
9. The final determination of which specific animals will be gelded will be based on the professional opinion of the attending veterinarian in consultation with the Authorized Officer.
10. Whether the procedure will proceed on a given day will be based on the discretion of the attending veterinarian in consultation with the Authorized Officer taking into consideration the prevailing weather, temperature, ground conditions and pen set up. If these field situations cannot be remedied, the procedure will be delayed until they can be, the stallions will be transferred to a prep facility, gelded, and later returned, or they will be released to back to the range as intact stallions.

Gelding Procedure

1. All gelding operations will be performed under a general anesthetic administered by a qualified and experienced veterinarian. Stallions will be restrained in a portable squeeze chute to allow the veterinarian to administer the anesthesia.
2. The anesthetics used will be based on a Xylazine/ketamine combination protocol. Drug dosages and combinations of additional drugs will be at the discretion of the attending veterinarian.
3. Animals may be held in the squeeze chute until the anesthetic takes effect or may be released into the working pen to allow the anesthesia to take effect. If recumbency and adequate anesthesia is not achieved following the initial dose of anesthetics, the animal will either be re-dosed or the surgery will not be performed on that animal at the discretion of the attending veterinarian.

4. Once recumbent, rope restraints or hobbles will be applied for the safety of the animal, the handlers and the veterinarian.
5. The specific surgical technique used will be at the discretion of the attending veterinarian.
6. Flunixin meglumine or an alternative analgesic medication will be administered prior to recovery from anesthesia at the professional discretion of the attending veterinarian.
7. Tetanus prophylaxis will be administered at the time of surgery.

The animal would be sedated then placed under general anesthesia. Ropes are placed on one or more limbs to help hold the animal in position and the anesthetized animals are placed in either lateral or dorsal recumbency. The surgical site is scrubbed and prepped aseptically. The scrotum is incised over each testicle, and the testicles are removed using a surgical tool to control bleeding. The incision is left open to drain. Each animal would be given a tetanus shot, antibiotics, and an analgesic.

Any males that have inguinal or scrotal hernias would be removed from the population, sent to a regular BLM facility, and be treated surgically as indicated, if possible, or euthanized if they have a poor prognosis for recovery (IM 2009-041, IM 2009-063). Horses with only one descended testicle may be removed from the population and managed at a regular BLM facility according to BLM policy or anesthetized with the intent to locate the undescended testicle for castration. If an undescended testicle cannot be located, the animal may be recovered and removed from the population if no surgical exploration has started. Once surgical exploration has started, those that cannot be completely castrated would be euthanized prior to recovering them from anesthesia according to BLM policy (IM 2009-041, IM 2009-063). All animals would be rechecked by a veterinarian the day following surgery. Those that have excessive swelling, are reluctant to move or show signs of any other complications would be held in captivity and treated accordingly. Once released no further veterinary interventions would be possible.

Selected stallions would be shipped to the facility, gelded, and returned to the range within 30 days. Before release back to the range, they may be marked for visibility with a freeze brand or other method of marking. Gelded animals could be monitored periodically for complications for approximately 7-10 days following release. In the proposed alternatives, gelding is not part of a research study, but additional monitoring on the range could be completed either through aerial reconnaissance, if available, or field observations from major roads and trails. It is not anticipated that all the geldings would be observed but if the goal is to detect complications on the range, then this level of casual observation may help BLM determine if those are occurring. Periodic observations of the long term outcomes of gelding could be recorded during routine resource monitoring work. Such observations could include but not be limited to band size, social interactions with other geldings and harem bands, distribution within their habitat, forage utilization, and activities around key water sources. Periodic population inventories and future gather statistics could provide additional anecdotal information about how logistically effective it is to manage a portion of the herd as non-breeding animals.

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11.5. Citations About IUDs

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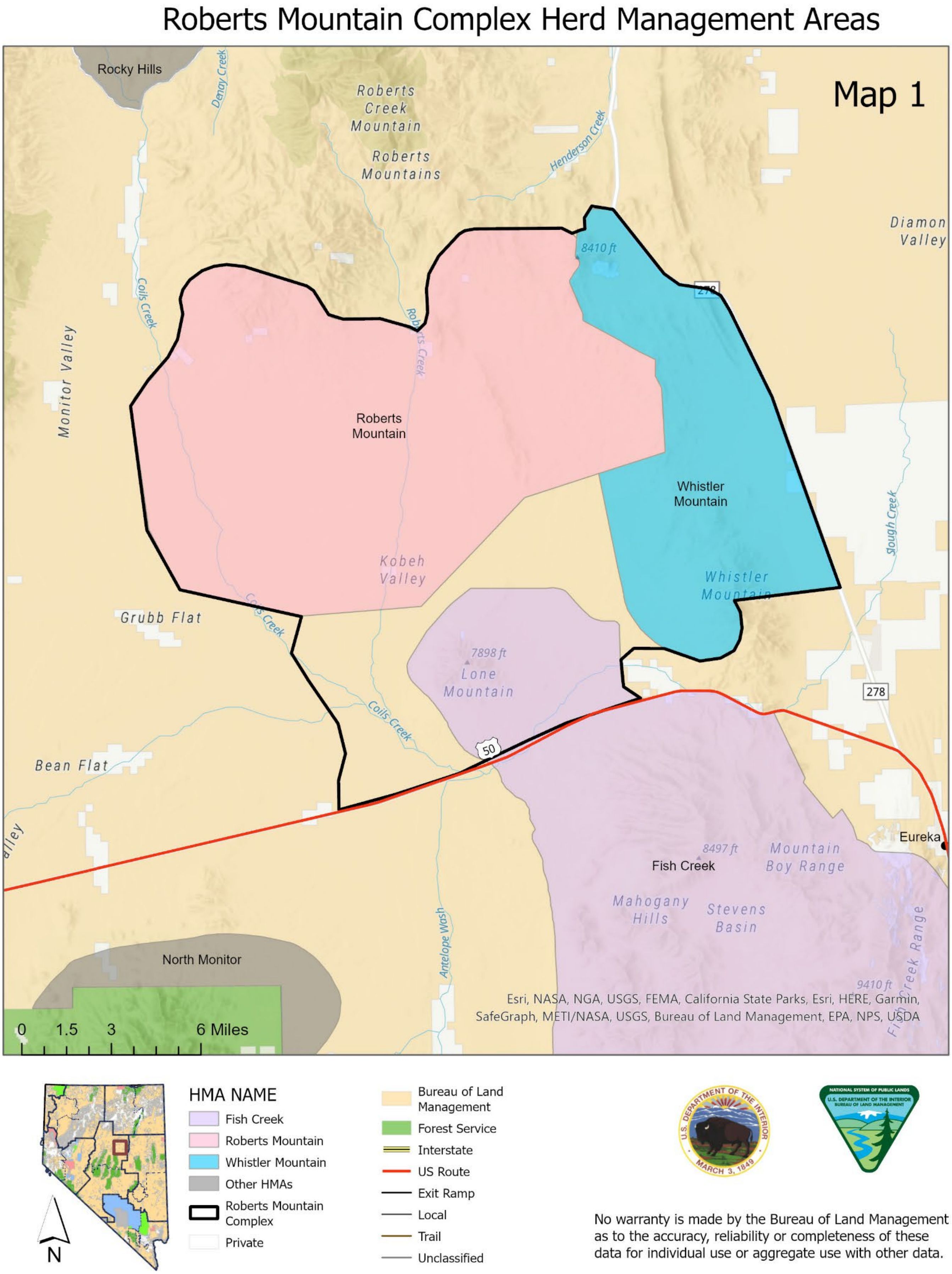
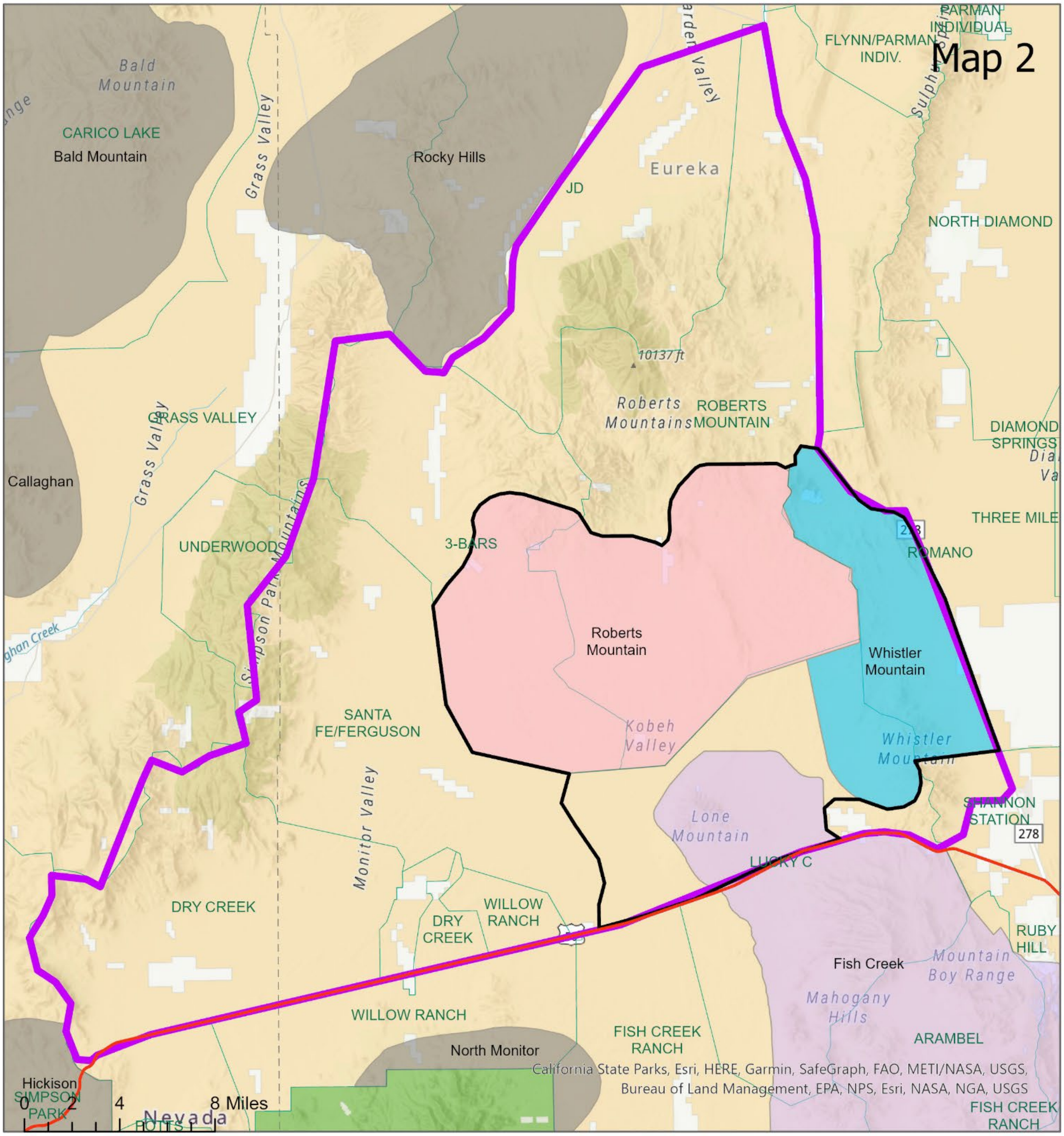
12.0 Acronyms

BLM-Bureau of Land Management
BIA- Bureau of Indian Affairs
CFR-Code of Federal Regulations
DR-Decision Record
EA-Environmental Assessment
EIS-Environmental Impact Statement
FLPMA-Federal Land Policy and Management Act
FMUD – Final Multiple Use Decision
FONSI-Finding of No Significant Impact
HA – Herd Area
HMA – Herd Management Area
ID-Interdisciplinary
IM-Instructional Memorandum
LUP – Land Use Plan
MLFO – Mount Lewis Field Office
NEPA-National Environmental Policy Act
RFS-Reasonably Foreseeable Future Action
RHA – Rangeland Health Evaluation
RMC – Roberts Mountain Complex
RMP-Resource Management Plan
WSA – Wilderness Study Area

13.0: Maps


Roberts Mountain Complex Herd Management Areas
Map 1
Rocky Hills
Roberts Creek Mountain
Roberts Mountains
Henderson Creek
Diamond Valley
8410 ft
278
Coils Creek
Roberts Creek
Monitor Valley
Roberts Mountain
Whistler Mountain
Slough Creek
Kobeh Valley
Whistler Mountain
Grubb Flat
Coils Creek
7898 ft
Lone Mountain
278
Coils Creek
50
Bean Flat
Eureka
8497 ft
Mountain Boy Range
Fish Creek
Mahogany Hills
Stevens Basin
Antelope Wash
North Monitor
9410 ft
Fish Creek Range
Esri, NASA, NGA, USGS, FEMA, California State Parks, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
0 1.5 3 6 Miles
N
HMA NAME
Fish Creek
Roberts Mountain
Whistler Mountain
Other HMAs
Roberts Mountain Complex
Private
Bureau of Land Management
Forest Service
Interstate
US Route
Exit Ramp
Local
Trail
Unclassified
No warranty is made by the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual use or aggregate use with other data.

RMC Grazing Allotments and Gather/Project Area



100k Roads
- Interstate
- US Route
- Roberts Mountain Complex
- RMC Gather Area

Herd Management Area (HMA) Polygons
- Fish Creek
- Roberts Mountain
- Whistler Mountain
- Other HMAs
- Grazing Allotment Polygons
- Cities & Towns
- Private
- Bureau of Land Management
- Forest Service

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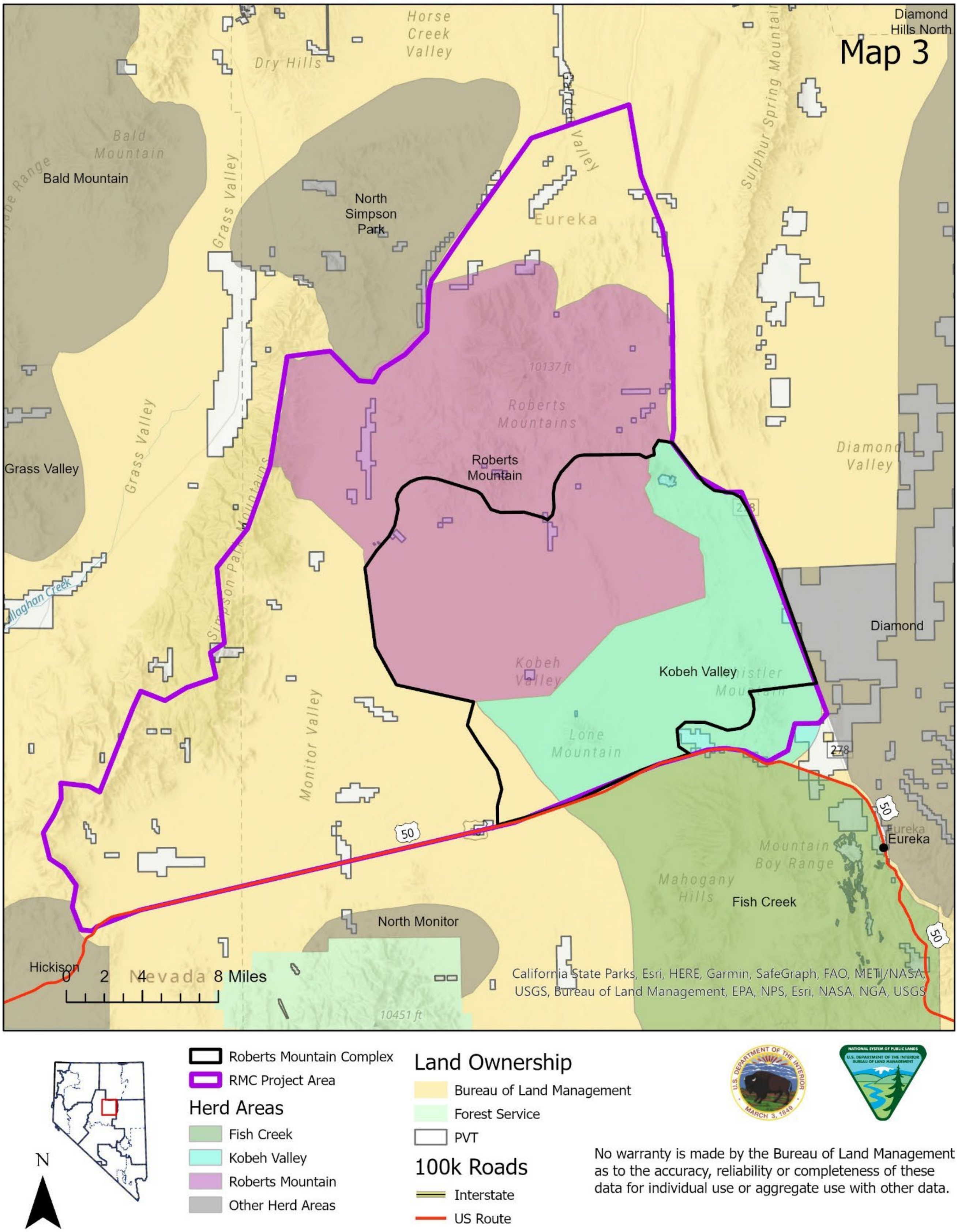
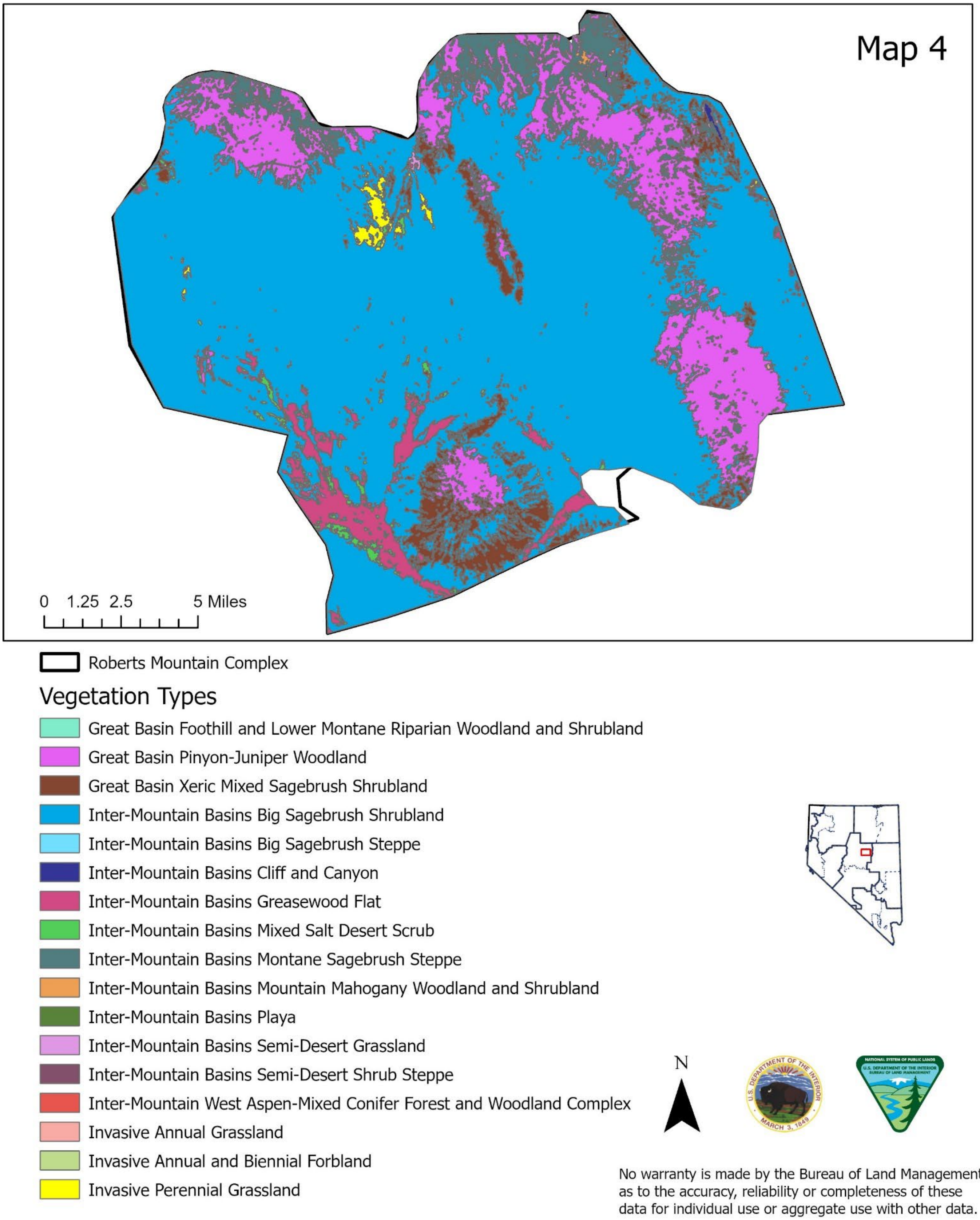
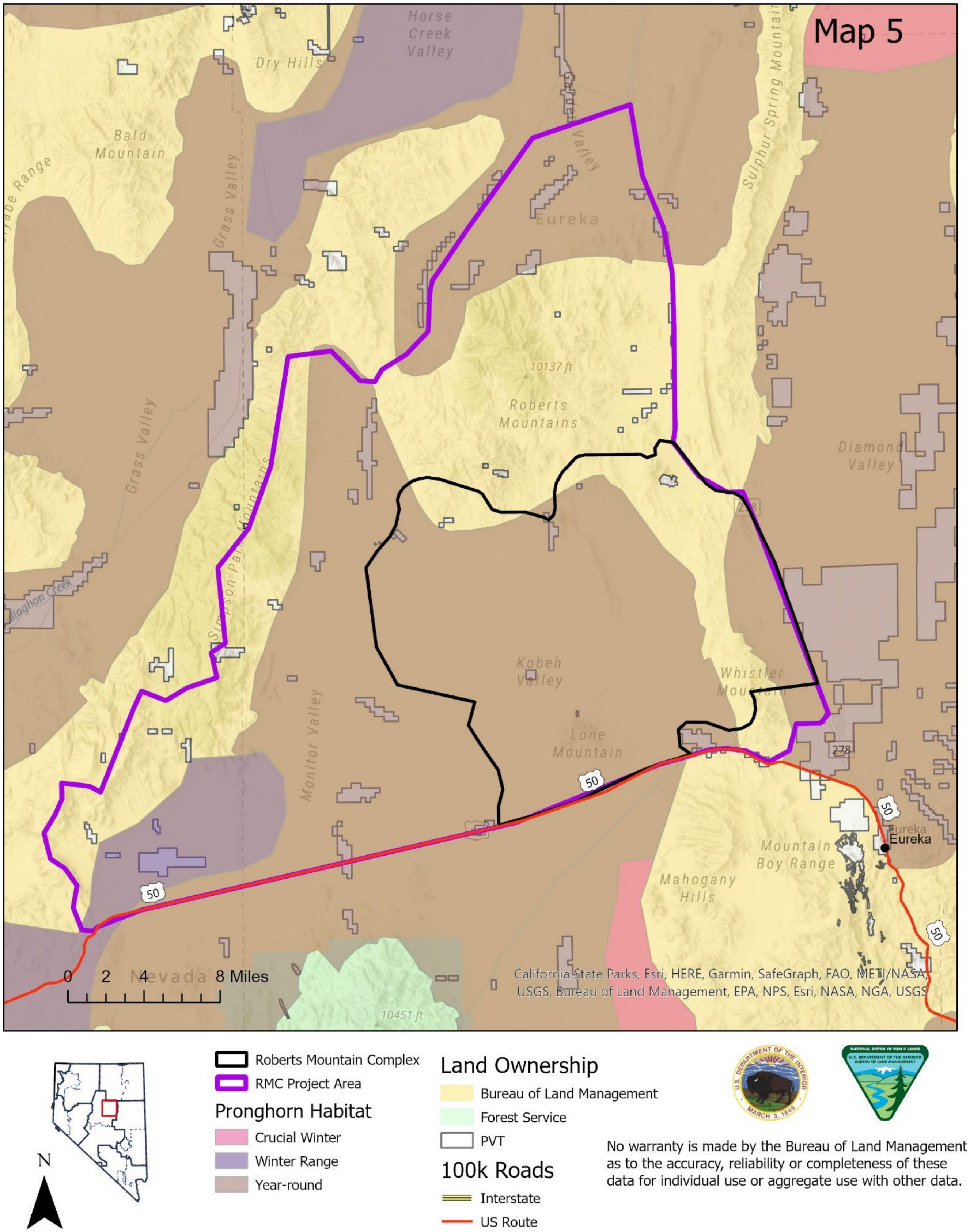
Roberts Mountain Complex Herd Areas



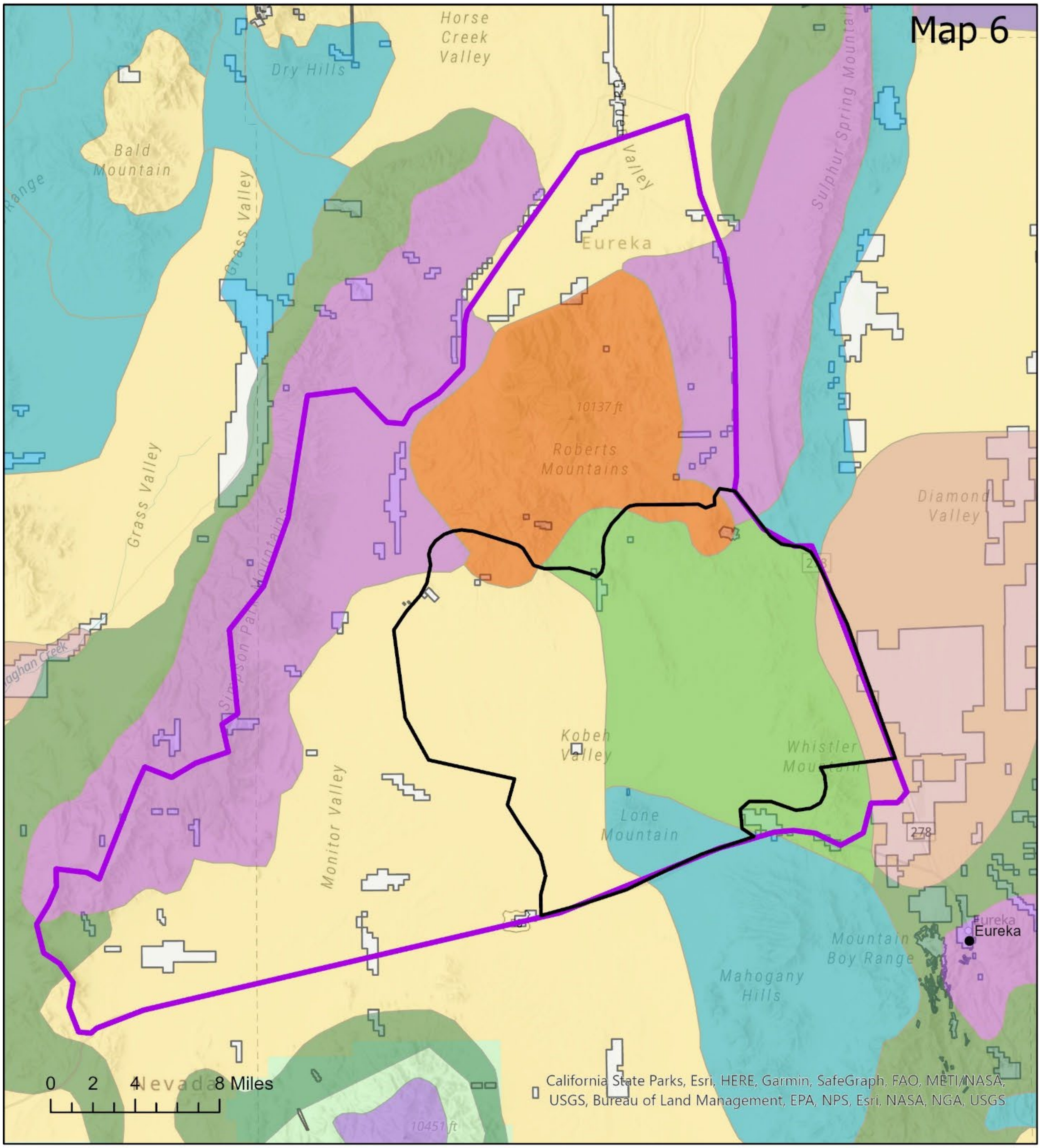
Roberts Mountain Complex Vegetation Types

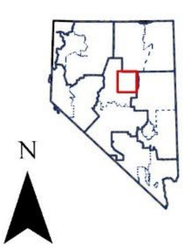


Roberts Mountain Complex Pronghorn Habitat



Roberts Mountain Complex Mule Deer Habitat





Roberts Mountain Complex
RMC Project Area

Mule Deer Habitat
- Winter Range
- Agricultural
- Crucial Summer
- Crucial Winter
- Limited Use
- Summer Range
- Transition Range

Land Ownership
- Bureau of Land Management
- Forest Service
- PVT

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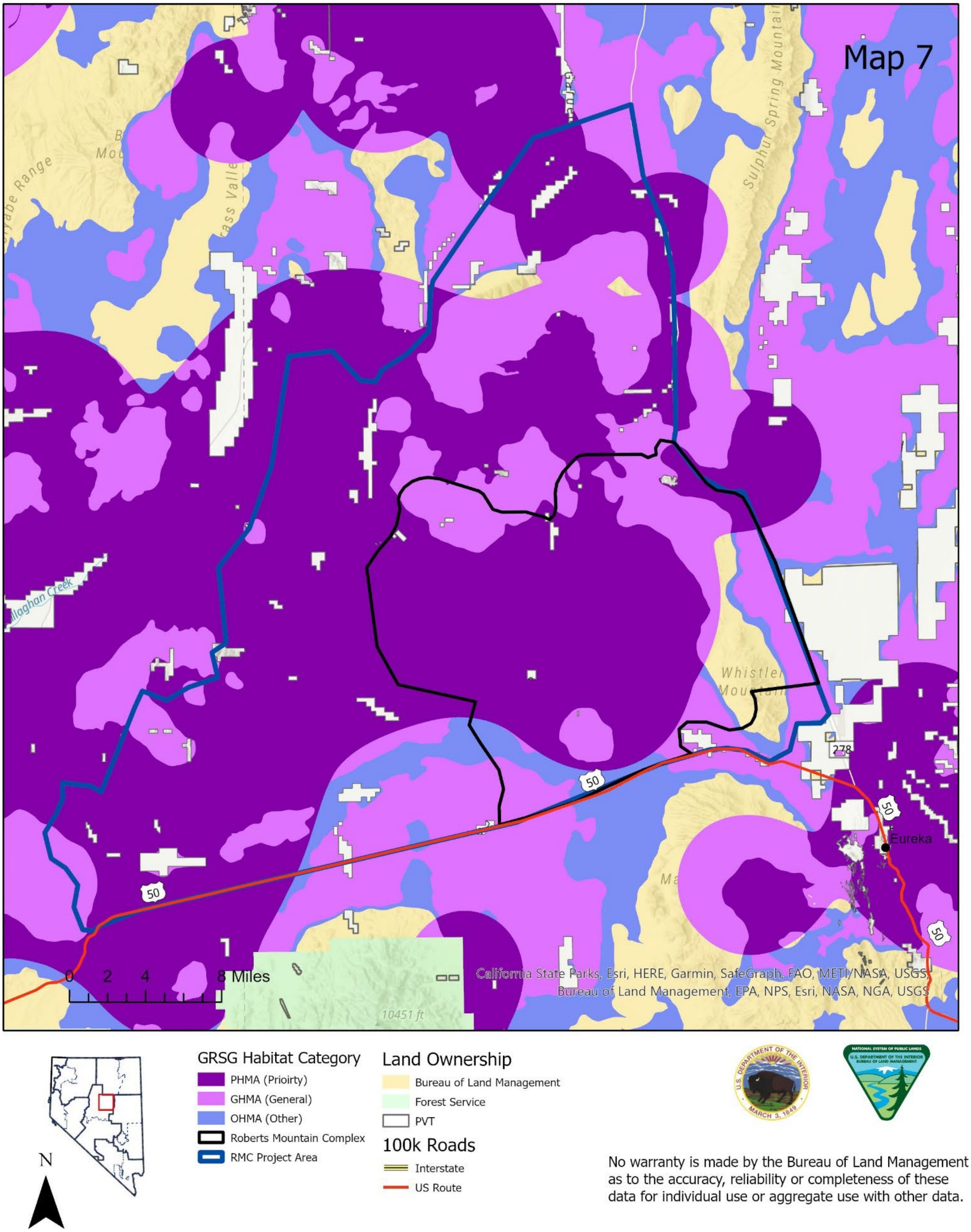
Roberts Mountain Complex Sage Grouse Habitat



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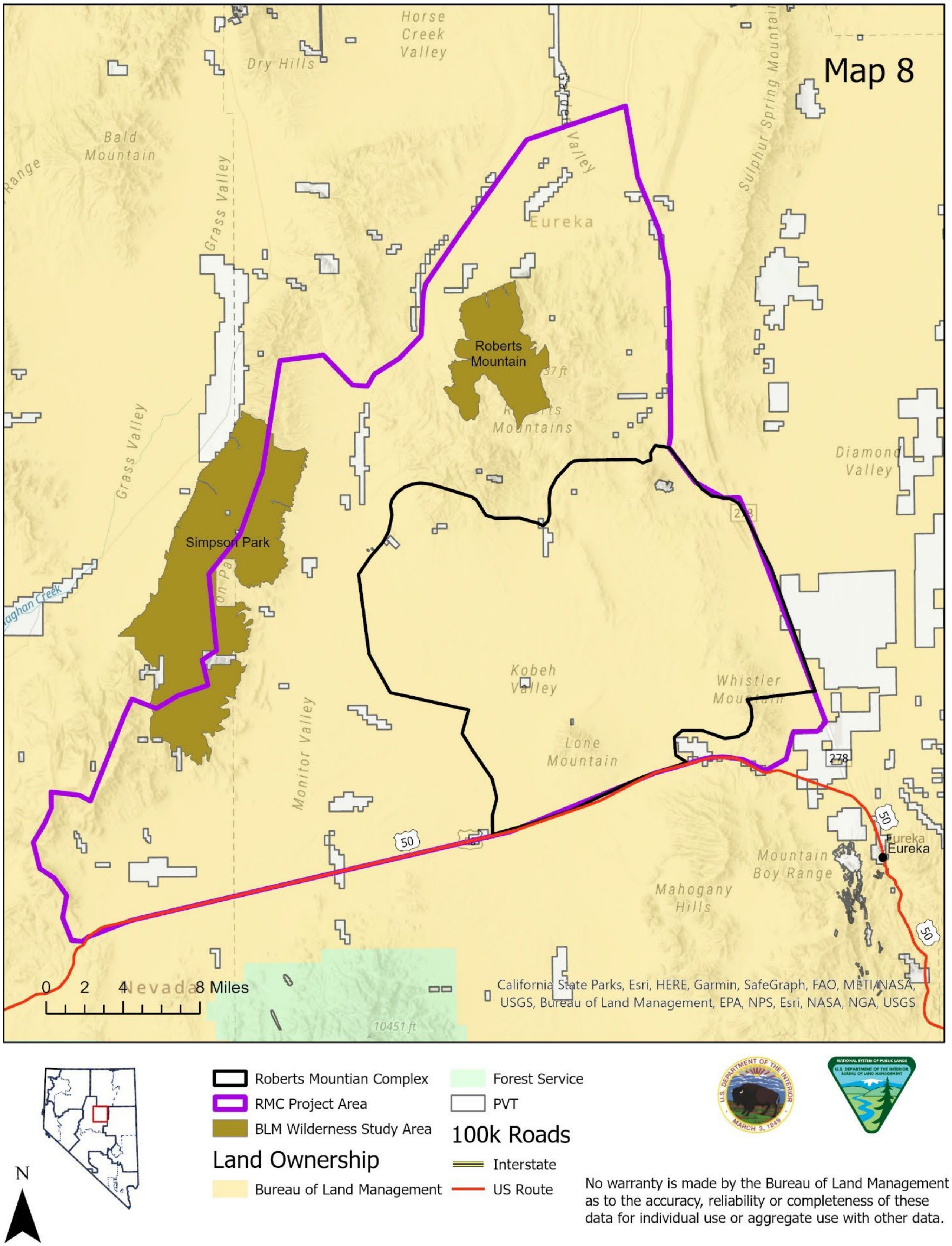
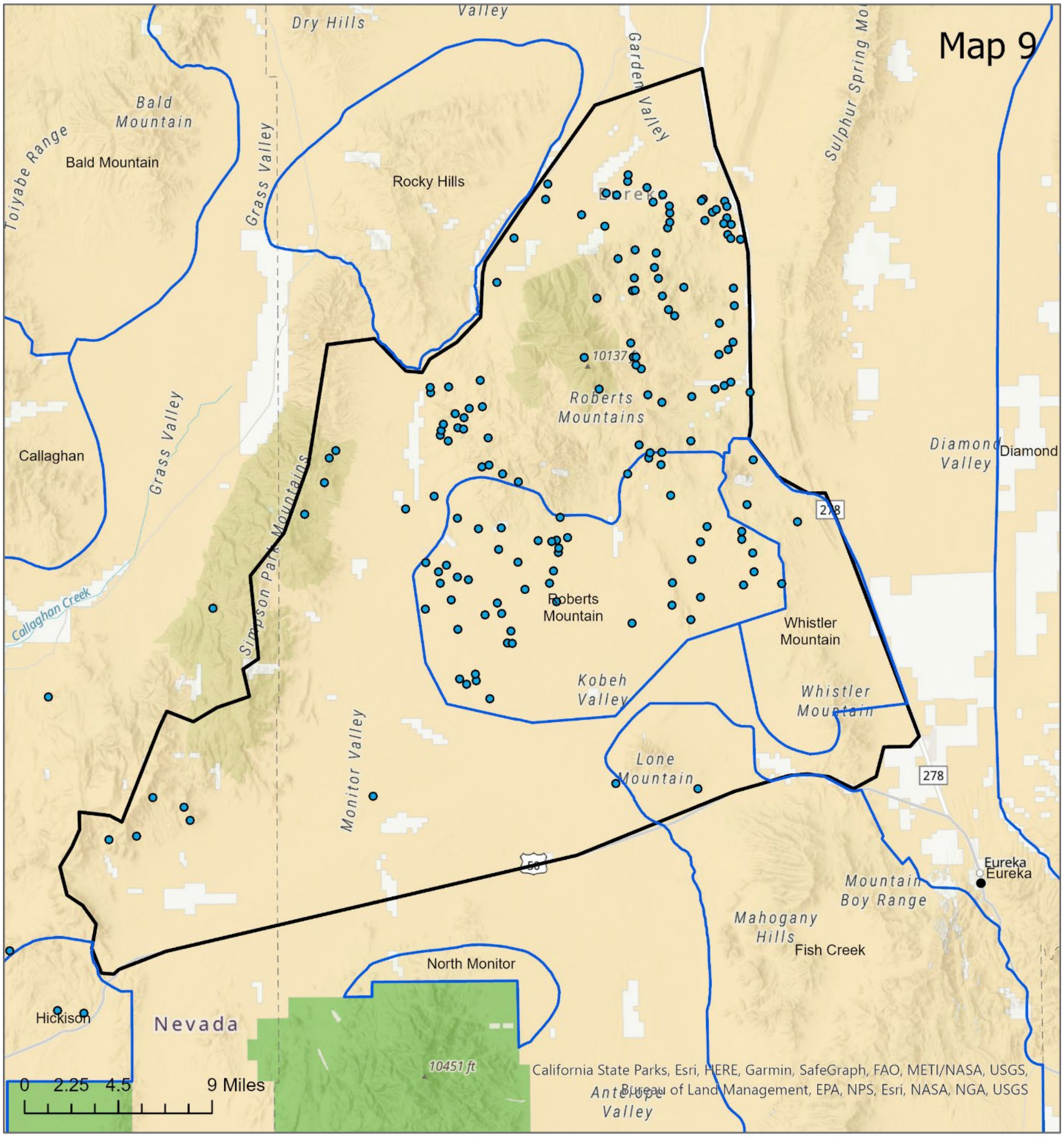
Roberts Mountain Complex Wilderness Study Areas



February 2022 Roberts Mountain Complex Helicopter Survey



Private
Bureau of Land Management
Forest Service
Roberts Mountain Complex Wild Horse Observations
Roberts Mountain Complex Gather Area

No warranty is made by the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual use or aggregate use with other data.

14.0 Wild Horse Gather Observation Protocol

BLM recognizes and respects the right of interested members of the public and the press to observe wild horse gather operations. At the same time, BLM must ensure the health and safety of the public, BLM's employees and contractors, and America's wild horses. Accordingly, the BLM developed these rules to maximize the opportunity for reasonable public access to the gather while ensuring that BLM's health and safety responsibilities are fulfilled. Failure to maintain safe distances from operations at the gather and temporary holding sites could result in members of the public inadvertently getting in the path of the wild horses or gather personnel, thereby placing themselves and others at risk, or causing stress and potential injury to the wild horses. The BLM and the contractor's helicopter pilot must comply with 14 CFR Part 91 of the Federal Aviation Regulations, which determines the minimum safe altitudes and distance people must be from the aircraft. To be in compliance with these regulations, the viewing location at the gather site and holding corrals must be approximately 500 feet from the operating location of the helicopter at all times. The viewing locations may vary depending on topography, terrain and other factors.

Daily Visitor Protocol

- ❖ A Wild Horse Gather Information Phone Line would be set up prior to the gather so the public can call for daily updates on gather information and statistics. Visitors are strongly encouraged to check the phone line the evening before they plan to attend the gather to confirm the gather and their tour of it is indeed taking place the next day as scheduled (weather, mechanical issues or other things may affect this) and to confirm the meeting location.

- ❖ Visitors must direct their questions/comments to either their designated BLM representative or the BLM spokesperson on site, and not engage other BLM/contractor staff and disrupt their gather duties/responsibilities - professional and respectful behavior is expected of all. BLM may make the BLM staff available during down times for a Q&A session on public outreach and education days. However, the contractor and its staff would not be available to answer questions or interact with visitors.

- ❖ Observers must provide their own 4-wheel drive high clearance vehicle, appropriate shoes, winter clothing, food and water. Observers are prohibited from riding in government and contractor vehicles and equipment.

- ❖ Gather operations may be suspended if bad weather conditions create unsafe flying conditions.

- ❖ BLM would establish one or more observation areas, in the immediate area of the gather and holding sites, to which individuals would be directed. These areas would be placed so as to maximize the opportunity for public observation while providing for a safe and effective wild horse gather. The utilization of such observation areas is necessary due to the use and presence of heavy equipment and aircraft in the gather operation and the critical need to allow BLM personnel and contractors to fully focus on attending to the needs of the wild horses while maintaining a safe environment for all involved. In addition, observation areas would be sited so as to protect the wild horses from being spooked, startled or impacted in a manner that results in increased stress.

- ❖ BLM would delineate observation areas with yellow caution tape (or a similar type of tape or ribbon).
- ❖ Visitors would be assigned to a specific BLM representative on public outreach and education days and must stay with that person at all times.

- ❖ Visitors are NOT permitted to walk around the gather site or temporary holding facility unaccompanied by their BLM representative.

- Observers are prohibited from climbing/trespassing onto or in the trucks, equipment or corrals, which is the private property of the contractor.

- When BLM is using a helicopter or other heavy equipment in close proximity to a designated observation area, members of the public may be asked to stay by their vehicle for some time before being directed to an observation area once the use of the helicopter or the heavy machinery is complete.

- When given the signal that the helicopter is close to the gather site bringing wild horses in, visitors must sit down in areas specified by BLM representatives and must not move or talk as the wild horses are guided into the corral.

- Individuals attempting to move outside a designated observation area would be requested to move back to the designated area or to leave the site. Failure to do so may result in citation or arrest. It is important to stay within the designated observation area to safely observe the wild horse gather.

- Observers would be polite, professional and respectful to BLM managers and staff and the contractor/employees. Visitors who do not cooperate and follow the rules would be escorted off the gather site by BLM law enforcement personnel and would be prohibited from participating in any subsequent observation days.

- BLM reserves the right to alter these rules based on changes in circumstances that may pose a risk to health, public safety or the safety of wild horses (such as weather, lightening, wildfire, etc.).

Public Outreach and Education Day

- The media and public are welcome to attend the gather any day and are encouraged to attend on public outreach and education days. On this day, BLM would have additional interpretive opportunities and staff available to answer questions.

- The number of public outreach and education days per week, and which days they are, would be determined prior to the gather and would be announced through a press release and on the website. Interested observers should RSVP ahead through the BLM-Ely District Office number (TBD). A meeting place would be set for each public outreach and education day and the RSVP list notified. BLM representatives would escort observers on public outreach and education days to and from the gather site and temporary holding facility.

15.0 Special Status Species that may occur within or near the Complex (2017)

Common Name	Scientific Name
Amphibians	
Columbia Spotted Frog	*Rana luteiventris*
Northern Leopard Frog	*Lithobates pipiens*
Western Toad	*Anazyrus boreas*
Birds	
Bald Eagle	*Haliaeetus leucocephalus*
Black Rosy-finch	*Leucosticte atrata*
Brewer's Sparrow	*Spizella breweri*
Ferruginous Hawk	*Buteo regalis*
Flammulated Owl	*Otus flammeolus*
Golden Eagle	*Aquila chrysaetos*
Gray-crowned Rosy Finch	*Leucosticte tephrocotis*
Gray Vireo	*Vireo vicinior*
Great Basin Willow Flycatcher	*Empidonax traillii adastus*
Greater Sage-grouse	*Centrocercus urophasianus*
Lewis's Woodpecker	*Melanerpes lewis*
Loggerhead Shrike	*Lanius ludovicianus*
Long-billed Curlew	*Numenius americanus*
Mountain Quail	*Oreortyx pictus*
Northern Goshawk	*Accipiter gentilis*
Peregrine Falcon	*Falco peregrinus*
Pinyon Jay	*Gymnorhinus cyanocephalus*
Sage Thrasher	*Oreoscoptes montanus*
Sandhill Crane	*Antigone canadensis*
Short-eared Owl	*Asio flammeus*
Swainson's Hawk	*Buteo swainsoni*
Vesper Sparrow	*Pooecetes graminueus*
Western Burrowing Owl	*Athene cunicularia hypugaea*
Western Least Bittern	lxobrychus exilis hesperis
Western Snowy Plover	*Charadrius nivosus nivosus*
Mammals	
American Water Shrew	*Sorex palustris*
Big Brown Bat	*Eptesicus fuscus*
Brazilian Free-tailed Bat	*Tadarida brasiliensis*
Canyon Bat	*Parastrellus hesperus*
California Myotis	*Myotis californicus*
Dark kangaroo mouse	*Mycrodipodops megacephalus*
Fringed Myotis	*Myotis thysanodes*
Hoary Bat	*Lasiurus cinereus*
Little Brown Myotis	*Myotis lucifugus*
Long-eared Myotis	*Myotis evotis*
Long-legged Myotis	*Myotis volans*
Pallid Bat	*Antrozous pallidus*
Pygmy Rabbit	*Brachylagus idahoensis*
Silver-Haired Bat	*Lasionycteris noctivagans*
Spotted Bat	*Euderma maculatum*

Townsend's Big-eared Bat	*Corynorhinus townsendii*
Western Small-footed Bat	*Myotis ciliolabrum*
Reptiles	
Desert Horned Lizard	*Phrynosoma platyrhinos*
Great Basin Collared Lizard	*Crotaphytus bicinctores*
Long-nosed Leopard Lizard	*Gambelia wislizenii*
Plants	
Alkali ivesia	*Ivestia kingii var. kingii*
Blaine Pincushion	*Sclerocactus blainei*
Cima Milkvetch	*Astragalus cimae var. cimae*
Currant Milkvetch	*Astragalus uncialis*
Deeth Buckwheat	*Eriogonum nutans var. glabratum*
Eastwood Milkweed	*Asclepias eastwoodiana*
Elko Rockcress	*Boechera falcifructa*
Goodrich Biscuitroot	*Cymopterus goodrichii*
Holmgren Lupine	*Nevada holmgrenii*
Lahontan Beardtongue	*Penstemon palmeri var. macranthus*
Monte Neva Paintbrush	*Castilleja salsuginosa*
Mojave Thistle	Cirsium mohavense
Nevada Willowherb	Epilobium nevadense
Pahute Mesa Beardtongue	Penstemon pahutensis
Spring-loving centaury	Centaurium namophilum
Tecopa Birdbeak	Cordylanthus tecopensis
Insects	
Monarch Butterfly	*Danaus plexippus plexippus*
Fish	
*Lahontan Cutthroat Trout	*Oncorhynchus clarkii henshawi*

*Federally Threatened Species