UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Land Management

January 21, 2022

Environmental Assessment DOI-BLM-UT-C010-2020-0029-EA

Project Title: Sulphur HMA Wild Horse Gather Plan

Location: Iron, Beaver, and Millard Counties, Utah

United States Department of the Interior
Bureau of Land Management
Cedar City Field Office
176 East DL Sargent Drive
Cedar City, Utah 84721
Phone: (435) 865-3000

TABLE OF CONTENTS

Documents Available on ePlanning (https://eplanning.blm.gov/eplanning-ui/project/1505407/570). These documents are incorporated by reference.

Standards and Guidelines for Rangeland Health

Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers Standards (CAWP 2016)

Data on Allotments outside HMA

Fillmore Data Summaries

Sulphur Monitoring report May 2021

Environmental Assessment DOI-UT-C010-2020-0029-EA

Sulphur HMA Wild Horse Gather

Chapter 1. Introduction

This Environmental Assessment (EA) has been prepared to disclose and analyze environmental effects of the Bureau of Land Management (BLM) Cedar City Field Office's (CCFO) Proposed Action which consists of achieving and maintaining a herd population within the appropriate management level (AML) by gathering and removing excess wild horses from the Sulphur Herd Management Area (HMA) and conducting fertility control management, and alternatives to the Proposed Action. Maps of the HMA are contained in Appendix 1. The Proposed Action would achieve management objectives through gather and removal of excess horses within and near the Sulphur HMA, implementation of population control measures and maintenance gathers.

1.1. Background

Since the passage of the Wild Free-Roaming Horses and Burros Act of 1971 (WFRHBA, Public Law 92-195), the BLM has refined its understanding of how to manage wild horse population levels. By law, BLM is required to control overpopulation by removing excess animals once a determination has been made that excess animals are present and removal is necessary. The WFRHBA requires BLM to achieve and maintain a Thriving Natural Ecological Balance (TNEB) on public land to protect the range from the deterioration associated with overpopulation of wild horses and burros. To achieve program goals, BLM must, among other things, identify the AML for individual herds. The AML is defined as the number of wild horses that can be sustained within a designated HMA which achieves and maintains a TNEB in keeping with BLM's multiple-use mandate. Program goals have also included the application of contraceptive treatments to reduce total population growth rates in the short-term and increase the time between gathers necessary to remove excess animals. Other management efforts include improving the accuracy of population inventories and collecting genetic baseline data to support genetic health assessments.

Sulphur HMA

The Sulphur HMA is located in western Iron, Beaver, and Millard counties, Utah, approximately 50 miles west of Minersville, Utah, in the Indian Peak and Mountain Home Mountain ranges. The Sulphur HMA contains approximately 265,675 acres, with elevations ranging from 9,790 feet on top of Indian Peak to 6,000 feet in the valley floors. The Appropriate Management Level (AML) for the Sulphur HMA is 165 -250 head. In August of 2020, 620 horses were captured with 528 head removed. Since 2015, 49 mares have been treated in the Sulphur HMA with GonaCon-Equine and 89 have been treated with PZP. The current estimated population of wild horses for the Sulphur HMA is 497 head, which is over the established AML identified above.

1.2. Purpose and Need

The purpose and need of the Proposed Action is to restore a TNEB and multiple use relationship on the public lands consistent with the provisions of the WFRHBA, to remove excess wild horses from within and outside the Sulphur HMA, and to manage wild horses to achieve and maintain established AML ranges for the HMA. The purpose and need of the Proposed Action is also to adopt measures that will increase BLM's ability to collect information on herd characteristics, habitat use and movement of wild horses within the HMA, understand their interactions with other resources and uses of public lands, improve population inventories, and gather additional information on herd health.

1.3. Land Use Plan Conformance and Consistency with Statutes, Regulations, and Other Plans

The action alternatives are subject to two land use plans – the Pinyon Management Framework Plan (MFP) approved in 1983 and the Warm Springs Resource Area Resource Management Plan(RMP)/Record of Decision (ROD) approved in 1987.

The action alternatives are in conformance with MFP Decision RM 1.8 and WH 1.1 which states that the BLM will "…remove horses as required to maintain horse numbers at or below 1982 inventory levels…consolidate and stabilize the Mountain Home-Sulphur herd unit and establish these numbers between 135 and 180 horses." The MFP also states that the number of herd units and the population of each herd would depend on the results of monitoring studies, range condition, viewing opportunities, movement of wild horses, cooperative management, and range developments.

The action alternatives are in conformance with the Warm Springs RMP/ROD Page 29 which states that "Horse numbers in the…Sulphur HMA will be maintained near…50 head (600 AUMs)" and that "Horse numbers will be kept between…75 and 35 head in the Sulphur HMA. This will require periodic removals about every 5 years."

The Sulphur HMA overlaps with the Hamlin Valley greater sage-grouse (GRSG) Priority Habitat Management Area (PHMA) and, as such, is subject to the Greater Sage Grouse Environmental Impact Statement Record of Decision (ROD) and Approved Resource Management Plan Amendments (ARMPA) for Utah, approved in September 2015. The action alternatives are in conformance with MA-WHB-1, which states that the BLM will "Manage HMAs in GRSG habitat within established appropriate management level ranges to achieve and maintain GRSG habitat objectives" and MA-WHB-3, which states that the BLM will "Prioritize gathers 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."

An HMA Plan (HMAP) was completed for the Sulphur HMA in 1987, which contains the current AML for the HMA. The purpose of the HMAP is to "outline BLM's future management plans and direction for the Sulphur HMA and to assess the environmental impacts to all resources resulting from the proposed actions." The action alternatives are consistent with HMAP

Objective II.A. 1. Which states, “Maintain a viable population of wild horses in the Sulphur HMA which does not fall below 135 head or exceed 180 head of adult horses defined as those over two years of age.” Objective II. A. 5. States, “Remove excess wild horses from the Sulphur HMA when the population of adult horses reaches the upper level of 180 horses.” These numbers correlate with those listed in the land use plans. If wild horses of all ages are included in the AML number, the AML is 165 head to 250 horses.

The action alternatives are consistent with all applicable BLM policies and regulations implementing the WFRHBA at Title 43 Code of Federal Regulations (CFR) 4700. The action alternatives are also consistent with the WFRHBA, which mandates, among other things, that the Bureau “prevent the range from deterioration associated with overpopulation,” and “remove excess horses in order to preserve and maintain a TNEB and multiple use relationships in that area.” Additionally, 43 CFR 4700.0-6 (a) states that “Wild horses shall be managed as self-sustaining populations of healthy animals in balance with other uses and the productive capacity of their habitat.”

The action alternatives are consistent with local county plans. The Beaver County RMP (2017) states in Objective 2, “keep wild free-roaming horses at or below established AMLs in all HMAs in Beaver County.” Iron County RMP (2017) states, “excess wild horses that exceed appropriate management levels must be removed to keep the fragile balance with other uses.”

1.3. Decision to Be Made

The authorized officer will determine whether to implement actions to achieve management objectives of maintaining the Sulphur HMA wild horse population within the established AML, protect the range from deterioration resulting from excess wild horse population, and implementing fertility control. Any decision would not adjust AML or livestock use, including forage allocations, as these were set through previous land-use planning decisions reflected in the Pinyon MFP and Warm Springs Resource Area RMP/ROD.

1.4. Scoping and Identification of Issues

Identification of issues for this assessment was accomplished by considering the resources that could be affected by implementation of at least one of the alternatives, through involvement with the public and input from the BLM interdisciplinary team. Resources which are not present or are not affected by the proposed action or alternatives are included as part of the Interdisciplinary Team NEPA Checklist (Appendix 2). Issues which are necessary to make a reasoned choice between alternatives or determine levels of significance include the following and are analyzed in Chapter 3.

- How will the removal of wild horses affect rangeland health (riparian/water, soils, and vegetation)?
- How will removal of wild horses affect livestock grazing?
- How will removal of wild horses affect wildlife?
- How will removal of wild horses affect wild horse health?

Chapter 2. Proposed Action and Alternatives

2.1. Introduction

Based on identified issues, four alternatives are considered in detail:

- Alternative 1: Proposed Action – Gather wild horses and remove excess wild horses to low AML (165) and implement population growth suppression using Porcine zona pellucida (PZP)-22 (which includes liquid injection followed by pellets) or most current formulation.
- Alternative 2: Same as Alternative 1 except population growth suppression would be implemented using GonaCon-Equine immunocontraceptive.
- Alternative 3: Same as Alternative 1 but without population growth suppression.
- Alternative 4: No Action – No gather, removal, or use of population growth suppression.

Alternatives considered but not analyzed in detail (see Appendix 3) include:

- Population growth suppression without removals.
- Use intrauterine devices (IUD) as a population growth suppression method.
- Remove or reduce livestock within the HMA.
- Gather wild horses to the AML upper limit.
- Population growth suppression treatment only including using bait/water trapping to remotely dart mares with PZP liquid only (no removal).
- Bait or water trap only.
- Control wild horse numbers by natural means.
- Gather and release excess wild horses every two years and apply PZP-22 to horses for release.
- Make individualized excess wild horse determinations prior to removal.
- Use of gelding as non-reproductive population to reduce population growth rate.
- Allow the public to capture and remove wild horses.
- Use alternative capture techniques instead of helicopters to capture excess wild horses.

2.2. Description of Alternatives Considered in Detail

2.2.1. Alternative 1 – Proposed Action – Gather, Removal, and Use of PZP-22

Under Alternative 1, BLM would gather and remove excess wild horses within and around the HMA to low AML as expeditiously as feasible through one or more gathers, manage population growth using PZP-22, and equip horses with GPS tracking units (either collar or tag).

The number of horses removed would be based on the latest population inventory from within and around the Sulphur HMA and would achieve and/or maintain low AML. BLM would also collect information on herd characteristics, collect genetic samples for monitoring, determine herd health, provide for public safety, and establish a TNEB with the other resources within the HMA. Information gained from these management actions and subsequent monitoring of

results would then be used to inform future management of wild horses. The gather area would include the Sulphur HMA and lands where wild horses have strayed outside the HMA (up to 10 miles). In addition, the wild horses that have strayed to areas along Highway 21 and have become a public health and safety issue would be gathered and removed.

Gather

The BLM would conduct gathers over a 10-year period to remove excess wild horses until the Sulphur HMA wild horse population is at the lower AML (see Table 2.1). The 10-year period would begin with the first gather on this HMA after the decision record for this EA is signed. BLM would strive to reach low AML as quickly as possible, but it is expected that gather efficiencies and holding space available during the initial gather would not allow for the attainment of low AML during the initial gather. Based on past gathers that the BLM has conducted in the Sulphur HMA area, only 60-70% of the population can be gathered in a single gather operation due to excessive tree cover, vast area, terrain, and behavior of the target animals. Consequently, follow-up gathers to remove any additional excess wild horses would be necessary to achieve low AML and to gather a sufficient number of wild horses to implement the population control component of Alternative 1. Gather efforts would prioritize public health and safety. Once low AML is reached, if fertility controls do not keep population within AML and the wild horse population exceeds AML, conduct maintenance gather(s) to keep the population within AML during the 10-year period so that degraded range resources have sufficient opportunity to recover.

Regular population inventories would be conducted at a minimum of every 3 to 4 years to calculate the estimated population size. That estimate would be used to determine the number of horses to be captured, removed, and treated with population growth suppression during each gather. A population inventory was conducted on the Sulphur HMA in June 2020 and was used to estimate the population, capture, removal, and treated numbers for the 2020 gather associated with this alternative (Table 2.1). This process would be followed over the 10-year period to achieve and maintain the wild horse population within AML. Other administrative factors (budget, adoptions, holding space, etc.) and individual gather success could also impact the numbers gathered, removed, or treated over the 10-year period.

Authorized wild horse capture techniques would be used to capture excess wild horses from the Sulphur HMA. These techniques include helicopter drive trapping, water and bait trapping, and roping. One or a combination of capture techniques may be used. The selected technique(s) would depend on herd health and the season (fall, winter, or summer) in which the gather is scheduled to maximize gather success and minimize impacts to wild horses. All techniques would be consistent with the comprehensive animal welfare program[1] outlined in

[1] The Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers Standards, published in 2016, outlines the Welfare Assessment Standards that BLM follows to assure humane care of wild horses and burros. It covers facility design, capture technique, wild horse and burro care, handling, transportation, euthanasia or death, and required documentation and responsibilities of lead DOR/PI at gathers. This document is available on the ePlanning website for this project (https://eplanning.blm.gov/eplanning-ui/project/1505407/570)

BLM Permanent Instruction Memorandum (IM) 2021-002.[2] Appendix 4 includes Standard Operating Procedures for Wild Horse Gathers.

Collected Data

During most gather operations BLM will record data including sex and age distribution, reproduction, survival, condition class information (using the Henneke rating system), color, size, and other information, along with the disposition of that animal (removed or released). Consistent with BLM IM 2009-062,[3] hair follicle and/or blood samples will be acquired every gather to determine whether the herd is maintaining acceptable genetic diversity (*e.g.*, avoiding inbreeding depression). Periodic introduction of a small number of studs or mares from a different HMA, with desired characteristics similar to the wild horses within the HMA could be made, to augment genetic diversity in the HMA, as measured by observed heterozygosity, if the results of genetic monitoring indicate that is prudent.

A population inventory was conducted in June 2020. A gather was conducted in September 2020. In November 2020, 46 mares which were treated with ConaCon-Equine were returned to the HMA. The estimated population is based on an aerial population inventory completed in June 2020 minus horses removed in September 2020 plus the 46 treated and returned. A Simultaneous Double Observer Method (Griffen et al 2020) was used. Horses were identified as individuals or as a band by their color, leg markings, face markings, and area/time recorded. The photos were used to eliminate any horses that were observed more than once. The planned flight paths were loaded into a Global Positioning System (GPS) and followed. The actual fight paths were recorded by GPS. The BLM notes that the estimated population could be 20%-30% lower than the actual population (NAS 2013).

Removal numbers listed below were based on the estimated population as of January 1, 2022. From the June 2020 population estimate an additional population increase of the foal crops in the spring of 2021 (estimated at 20% increase per year) was added to estimate the removal numbers in Table 2.1.

Table 2.1. Estimated 2021 Population, Capture, and Removal Numbers

HMA	AML	2022 Estimated Population 1/1/2022	February 2022 Gather Numbers to Lower AML	February 2022 Gather Numbers to Higher AML
Sulphur	**165-250**	497	332	247

Fertility Control

BLM would begin implementing the population control component of this alternative as a part of the initial gather or follow-up gathers. Under this alternative, BLM would use PZP-22, which consists of an initial fluid injection followed by pellets. PZP proteins are the antigens in PZP

[2] This document is available at https://www.blm.gov/policy/pim-2021-002.
[3] This document is available at https://www.blm.gov/policy/im-2009-062.

contraceptive. The PZP-22 treatment is one form of PZP vaccine that can lead to longer-lasting effects than the PZP ZonaStat-H liquid PZP alone (Rutberg, et al., 2017). The primary purpose of population growth suppression would be to slow the herd's growth rate to help maintain the population within AML once achieved. BLM may apply PZP-22 prior to achieving AML if gather success, holding capacity limitations, population growth rates, other national gather priorities, or other circumstances prevent the BLM from achieving AML during the initial gather operation(s). The procedures to be followed for implementing fertility control are detailed in Appendix 5. SOPs for Population Growth Suppression Methods and Scientific Literature Review and in Appendix 6. Standard Operating Procedures for Population-level Growth Control Treatments. Mares initially treated with any form of PZP vaccine will be subsequently treated only with forms of PZP vaccine.

Each released mare would receive the most current formation of a single dose of PZP-22 or a similar PZP population growth suppression treatment while in a temporary holding facility. The general understanding of PZP-22 vaccines is that when injected, PZP (antigen) causes the mare's immune system to produce antibodies; these antibodies bind to the mare's eggs and effectively block sperm binding and fertilization (Zoo Montana, 2000). PZP-22 can be relatively inexpensive, meets BLM requirements for safety to mares and the environment, and can easily be administered in the field (NAS, 2013). However, in this and other HMAs, darting horses is not feasible due to excessive tree cover, vast area, terrain, and behavior of the target animals. In addition, among mares, PZP contraception appears to be completely reversible if fewer than approximately 4-5 doses are given to the same mare (Kirkpatrick and Turner, 2002; Nuñez, et al., 2017). Permanent sterility for mares treated consecutively in each of 5-7 years was observed by Nuñez, et al. (2010, 2017). Repeated treatment with PZP led to 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.

Identification and Tracking

Under this alternative, every animal that is handled and returned to the range would be identifiable by a uniquely numbered radio-frequency identification (RFID) chip, placed in the nuchal ligament, in keeping with standard equine veterinary practice. Individual identification is consistent with BLM policy for fertility control application (BLM H-4700-1, 2010), and allows for vaccine applicators to have access to the complete treatment history of any given mare. Additional guidelines for visibly marking fertility vaccine-treated animals are noted in the SOPs for fertility control use. Also, BLM would fit some wild horses with GPS and very high frequency (VHF) radio collars and tags with the intent to collect high spatial and temporal resolution information for recording free-roaming horse movement, locations, and for other monitoring purposes including but not limited to effectiveness of population inventories, demographics, habitat use, and interactions with other resources. Not every treated mare would be fitted with a tracking device. Procedures for attaching the collars are described in Appendix 7. Affixing Radio Collars.

Only female horses would be fitted with GPS collars, while males or females could have a GPS radio transmitter tag braided into their tails (Schoenecker, et al., 2020). Once tags are braided into the tails, they would be held in place with a non-toxic, low temperature curing epoxy resin. Collars would only be placed on horses that are 3 years old or older and in Henneke body condition score 4 or greater. Animals that are "thin" (Henneke score of $\leq$3), deformed, or who have any apparent neck problems would not be fitted with a collar. As tail tags are small (<200g) and are not worn around the neck, they are considered of low burden to the animal and, therefore, could potentially be worn by animals in lower body condition. All radio collars would have a remote manual release mechanism in case of emergency and a timed-release mechanism which would be programmed to release at the end of the monitoring period. No collars would remain on wild horses indefinitely. If the collar drop-off mechanism fails at the end of the monitoring period, those individual horses would be captured, and the collars manually removed. The welfare of each collared horse would be observed once per month while collared. Radio tagged horses would not need to be observed as often but would be observed regularly (6-10 times per year).

The gather and removal operations would be accomplished using design features listed below. Additional design features are contained in Appendix 8. Additional Design Features. Horses that stray along Highway 21 would be the highest priority for removal to ensure public safety. Removal of animals from outside the HMA and on lands not managed by the BLM would be given priority where possible.

Design Features to Minimize Impacts

- When actively trapping wild horses, traps would be checked daily. Horses would be either removed immediately or fed and watered for up to several days prior to transport to a holding facility.
- Whenever possible, capture sites would be placed in previously disturbed areas. Generally, these activity sites would be small (less than one half acre) in size.
- No new roads would be constructed.
- No trap sites would be located on areas where threatened, endangered, or special status species occur without clearance. Staff would follow best management practices (BMP) for kit fox and pygmy rabbit if habitat for those species is suspected within the trap site.
- All capture and handling activities would be conducted in accordance with the most current BLM policies and procedures.
- Helicopter gathers and water/bait trap gathers of a large size (more than 30 horses) would not be conducted between March 1 and June 30.
- During capture operations, safety precautions would be taken to protect all personnel, animals, and property involved in the process from injury or damage.
- Only authorized personnel would be allowed on site during the removal operation (see Appendix 9. Observation Protocol and Ground Rules).

- Private landowners or the proper administering agency(s) would be contacted, and authorization obtained prior to setting up traps on any lands which are not administered by BLM.
- Wherever possible, traps would be constructed in such a manner as to not block vehicular access on existing roads.
- If possible, traps would be constructed so that no riparian vegetation is contained within them. Impacts to riparian vegetation and/or running water located within a trap (and available to horses) would be mitigated by removing horses from the trap immediately upon capture. No vehicles would be operated on riparian vegetation or on saturated soils associated with riparian/wetland areas.
- Scheduling of gathers would minimize impacts with big game hunting seasons whenever possible.
- The helicopter would avoid eagles and other raptors and would not be flown repeatedly over any identified active raptor nests.
- No unnecessary flying would occur over big game on their winter ranges or active fawning/calving grounds during the period of use.
- Small amounts of carefully managed veterinary medicines and treatments may be used to treat sick or injured animals at the capture sites.
- Weed-free hay would be used in trap sites and temporary holding facilities located on BLM-administered lands.
- Females 3 years and older being returned to the HMA may be collared. No males would be collared. If collars are too tight, the release function would be deployed remotely, or collar would be removed after capture. If neck abrasions or sores caused by a collar are observed and have not healed within 4 weeks of when they are observed, the collar's remote release would be activated or the horse would be captured as soon as possible to remove the collar.

2.2.2. Alternative 2 – Gather, Removal, and Use of GonaCon-Equine

Under Alternative 2, management actions and design features would be the same as the Proposed Action (Alternative 1) with the exception that the released mares would be treated with the population growth suppression vaccine GonaCon-Equine™ instead of a PZP vaccine. The vaccine would be administered by hand injection. Treated animals would need to be held for approximately thirty days after the first treatment to administer a booster shot to increase efficacy and treatment longevity. Mares initially treated with GonaCon vaccine will be subsequently treated only with forms of the GonaCon vaccine.

The immune-contraceptive GonaCon-Equine vaccine meets most of the criteria that the National Research Council of the National Academy of Sciences (NAS 2013) used to identify the most promising fertility control methods, 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. 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 one of the most preferable available methods for contraception in wild horses and burros (NAS 2013). In 2013, the NAS suggested that additional studies be done on the contraceptive efficacy and behavioral effects of GonaCon-Equine, and such suggested studies have been published since that time. GonaCon-Equine has been used on feral horses in Theodore Roosevelt National Park (Baker et al. 2018), on a small number of wild horses in the Water Canyon area within the Antelope Complex (DOI-BLM-NV-L020-2015-0014-EA) and was given to over 150 wild mares in fiscal year 2020. As with other contraceptives applied to wild horses, the long-term goal of GonaCon-Equine use is to reduce or eliminate the need for gathers and removals (NAS 2013). GonaCon-Equine vaccine is an EPA approved pesticide (EPA, 2009, 2013, 2015) that is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is produced in a USDA-APHIS laboratory. Its categorization as a pesticide is consistent with regulatory framework for controlling overpopulated vertebrate animals, and in no way is meant to convey that the vaccine is lethal; the intended effect of the vaccine is as a contraceptive. GonaCon-Equine is produced as a pharmaceutical-grade vaccine, including aseptic manufacturing technique to deliver a sterile vaccine product (Miller et al. 2013). If stored at 4° C, the shelf life is 6 months (Miller et al 2013).

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).

Please refer to Appendix 5 for further information on BLM's use of contraception in wild horse management and the effects of those various contraceptive methods and refer to Appendix 6 for procedures to be followed for implementation of fertility control.

2.2.3. Alternative 3 - Gather and Removal

This alternative would be the same as the Proposed Action (Alternative 1); however, no population growth suppression treatments would be applied.

2.2.4. Alternative 4 - No Action Alternative

No wild horse gathers, removals, or use of any population growth suppression would be undertaken to address the wild horse overpopulation and associated range degradation at this time. The No Action Alternative does not comply with the WFRHBA, regulations, or the Pinyon MFP and Warm Springs Resource Area RMP/ROD and does not meet the purpose and need for action in this EA. It is included as a basis for comparison with the Proposed Action.

2.3. Alternatives Considered but Eliminated from Further Analysis

Alternatives considered but eliminated from detailed analysis are included in Appendix 3, which has discussion and rationale about why each alternative was not carried forward.

Chapter 3. Affected Environment and Environmental Impacts

3.1. Introduction

Chapter 3 contains the effects analysis related to the issues. Section 3.2 presents an overview of reasonably foreseeable environmental trends and planned actions considered in the effects analysis. The Interdisciplinary Team NEPA Checklist (Appendix 2) indicates which resources of concern are either not present in the project area or would not be impacted to a degree that requires detailed analysis. Issues which are necessary to make a reasoned choice between alternatives or determine levels of significance are described in Section 3.3. A scientific literature review is also included in Appendix 5. SOPs for Population Growth Suppression Methods and Scientific Literature Review.

3.2. Reasonably Foreseeable Environmental Trends and Planned Actions

The Sulphur HMA is mainly being utilized by livestock, wildlife, and wild horses. All of these uses are expected to continue. The area has also been impacted by ongoing drought. Vegetation treatments on Federal land, private land, and land administered by the Utah School and Institutional Trust Lands Administration (SITLA) have helped to offset the impacts from drought and excess horse numbers. Dispersed recreation would likely continue. No other reasonably foreseeable future actions are known in the HMA.

3.3. Issues

For all issues, the impact analysis area is considered to be the nine grazing allotments (or portions of grazing allotments) that overlap the Sulphur HMA. Horses may also be gathered outside of the HMA where horses have strayed in search of forage, water, and space.

3.3.1. Issue 1. How will removal of wild horses affect livestock grazing?

Affected Environment

Sheep and cattle are permitted on 9 allotments that have some portion of the allotment within the HMA (see Table 3.1). In general, actual annual livestock use over the past 15 years within the HMA or in the allotments has been substantially below the numbers of Animal Unit Months (AUMs) contained in the grazing permit due to drought and excess wild horses (see Sulphur Monitoring Report May 2021, (https://eplanning.blm.gov/eplanning-ui/project/1505407/570). As livestock grazing permits are evaluated, additional adjustments to the total livestock grazing permits may be made through the permit renewal process based on past and current vegetative and climatic monitoring information. Changes to the actual grazing permit are outside of the scope of this document. Table 3.1 identifies the current season of use and permitted use within each of the allotments associated with the Sulphur HMA.

Livestock permit renewals were completed from 2007 to 2014 on the allotments within and adjacent to the Sulphur HMA. Each of these renewals had environmental assessments and decision records completed. These decisions established stocking rates for livestock, established seasons of use, areas of use, kind and class of livestock, and management actions to improve livestock distribution. These management actions included the establishment of

grazing systems, allowable use levels, and salting and herding practices. Some livestock reductions were made in these decisions on allotments within the Sulphur HMA during the permit renewal process. Livestock grazing continues to be evaluated for allotments and use areas within the Sulphur HMA.

Table 3.1. Allotments in or near the Sulphur HMA

FILLMORE ALLOTMENTS	CLASS OF LIVESTOCK	SEASON OF USE	ACTIVE AUMS	PERCENT OF ALLOTMENT WITHIN HMA
Fairview (I)	Sheep	10/16-2/28	4,254	73%
Hamblin (I)	Cattle	10/16-6/5	2,225	100%
Stateline (M)	Sheep	11/1-4/30	4,753	51%
CEDAR CITY ALLOTMENTS	**CLASS OF LIVESTOCK**	**SEASON OF USE**	**ACTIVE AUMS**	**PERCENT OF ALLOTMENT WITHIN HMA**
Atchison Creek (M)	Cattle	7/1-8/15	267	93%
Bennion Spring (I)	Cattle	4/1-11/30	2,130	5%
Indian Peak (I)	Cattle Sheep	3/1-2/28 6/15-2/28	1,476 282	92%
Mountain Home (M)	None			100%
North Pine Valley (I)	Cattle	3/1-2/28	5,172	8%
South Pine Valley (M)	Cattle	3/1-2/28	5,806	2%

*Management Category (I-Improve, M-Maintain) as determined by the applicable land use plan.

Environmental Impacts

Alternatives 1 and 2

Past experience has shown that wild horse gathers have few direct impacts to cattle and sheep grazing. Livestock located near gather activities would be temporarily disturbed or displaced by the helicopter and the increased vehicle traffic during the gather operation. Typically, livestock would move back into the area once gather operations cease. Under the Proposed Action and Alternative 2, forage availability and quality would improve over time since the excess wild horse population would be gathered in increments and growth rates would be less.

Annual authorized livestock use may be adjusted – usually on a voluntary basis – due to several factors, including rangeland health or drought. Other adjustments to grazing permits (if any) would be made during the grazing allotment permit renewal process, which is outside the scope of this document. Alternatives 1 and 2 would have no direct impact on current livestock permits in terms of active AUMs, season of use, and/or terms and conditions.

Forage availability and quality would improve over time since the wild horse population would be within AML and growth rates would be reduced. Competition between livestock, wildlife, and wild horses would be reduced. There would also be a reduced likelihood of reductions to

current active livestock permits attributable to overuse of resources by wild horses and an increase in the long-term sustainability of authorized livestock use on the allotments within and adjacent to the HMA at the permitted levels.

Alternative 3 – No Population Growth Suppression

Impacts of the gather and removal without population growth suppression would be similar to Alternatives 1 and 2; however, wild horse populations would be expected to increase at a faster rate and exceed the high end of the AML, increasing competition between livestock and wild horses sooner than Alternatives 1 and 2.

Alternative 4 – No Action

Eventually, rangeland health would be reduced below a threshold from which it would be difficult to recover. Considerable progress towards achieving BLM Utah's Standards and Guidelines for Rangeland Health would not occur (see Standards and Guidelines for Rangeland Health (https://eplanning.blm.gov/eplanning-ui/project/1505407/570). Because wild horses compete directly with cattle and sheep for resources, there is the potential for authorized livestock to be reduced in line with forage availability, which could impact permittees and result in long-term changes in grazing management. As wild horse numbers increase, combined with dry conditions, livestock grazing on allotments within and adjacent to the HMA would be negatively impacted by excess wild horses.

3.3.2. Issue 2. How will removal of wild horses affect rangeland health (riparian/water, soils, and vegetation)?

Affected Environment

BLM is required to keep an inventory of how well grazing allotments are meeting BLM Utah's Standards and Guidelines for Rangeland Health , which includes rating soil conditions in terms of current conditions and causal factors for those conditions.[4] Rangeland Health Standard 1 requires productive upland soils as evidenced by sufficient cover and litter to protect soil surfaces from erosion, the absence of erosion indicators, and appropriate kind and amounts of vegetation to allow properly functioning ecological conditions. The Key Species method has been used to monitor how much vegetation has been removed (primarily by large ungulates) and may be used to reflect whether or not adequate protective vegetation cover and litter has been left on-site to protect soils surfaces from erosion (Technical Reference 1734-3 1999).

The HMA has received below normal moisture. This placed the HMA in extreme drought from summer 2020 through the present time.[5] The BLM has completed Rangeland Health

[4] BLM Utah's Standards and Guidelines for Rangeland Health includes a summary of the Fundamentals for Rangeland Health contained in 43 C.F.R. 4180; the Utah Standards of Rangeland Health, published in 1997; and the Utah Guidelines for Grazing Management, published in 1997. This document is available on the ePlanning website for this project (https://eplanning.blm.gov/eplanning-ui/project/1505407/570).

[5] Drought monitoring data for the HMA is available on the ePlanning website for this project (https://eplanning.blm.gov/eplanning-ui/project/1505407/570).

Assessments on 5 grazing allotments within the gather area since 2007.[6] The other four are in progress. All of the assessed portions of allotments within the HMA failed to meet at least one of the standards. Causal factors for not meeting standards included, but were not limited to, Pinyon Pine/Juniper (PJ) encroachment, drought, and grazing by livestock, wildlife, and wild horses. Wild horses mainly affect rangeland health standards by trampling of vegetation and soils and through utilization of forage. When current livestock use was found to be a causal factor, changes to livestock management have occurred.

Rangeland Health Standard 1 for Upland Soils was being met on the Bennion Spring, Indian Peak, and South Pine Valley allotments. Two of the allotments (Atchison Creek and Stateline) did not meet Standard 1. Indicators used to reach the "not meeting" conclusion were excessive plant pedestals, percent bare ground, litter movement, and soil loss. Many of the sites lacked resistance to soil erosion and lacked residual vegetation (and litter). Overland water flow patterns were identified both in and outside of animal trails, and hoof action from livestock, wild horses, and wildlife were found to be contributing to the compaction and loss of soil in areas within one half mile of water sources, including riparian areas.

Soils within the area proposed for gather in the action alternatives are highly variable in terms of parent material, erosion potential, productivity, and other aspects. Detailed soil descriptions and maps may be found in the Soil Survey of Iron – Washington Area, Utah (Natural Resource Conservation Service (NRCS), 1998)[7] for that portion of the analysis area in Iron County. No similar data is available for the Beaver County or Millard County portion of the analysis area.

There are approximately 16 miles of lotic riparian habitat and 20 acres of lentic riparian habitat associated with the Sulphur HMA. These riparian resources, consisting of streams, seeps, and springs, are fairly abundant within the Sulphur HMA and are typically quite small. They occur on public, state, and private lands, and they represent less than 1 percent of the total acreage of public lands in the Sulphur HMA. The majority of the riparian systems within the HMA were rated in the "Functioning at Risk" (FAR) category, with very few sites rated in the "Proper Functioning Condition" (PFC) category. The causal factors for ratings below PFC vary depending on the specific riparian system, though they are typically attributed to a handful of concerns including water development, dewatering, road encroachment, upstream channel conditions, upland vegetation encroachment, recreation, and excessive use/trampling by livestock, wild horses, and wildlife. Damage to wetland and riparian areas often increases during drought years when wild horses may trample and dig in these areas in search of water. Wild horses, wildlife, and livestock graze riparian areas because of the presence of water, shade, and succulent vegetation. While livestock only utilize riparian areas during their permitted season of use, wild horses utilize riparian areas year-round. Riparian areas are vulnerable to the effects of overgrazing due to heavy concentration of wild horses, wildlife, and livestock within these

[6] *See* the Sulphur Monitoring Report, May 2021, for the allotments within the Sulphur HMA. This document includes summaries for precipitation, livestock permitted use, allotment acres, standards and guidelines, drought maps, actual Use, and utilization. It is available on the ePlanning website for this project.

[7] This document is available on the NRCS website at https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/utah/UT634/0/UT634.pdf.

areas. Livestock, wildlife, and wild horse grazing affects water in many ways, and it can alter the chemical, physical and biologic integrity of the water. For example, grazing can modify the hydrologic response of watersheds by reducing infiltration, reducing vegetative cover, degrading stream channels/floodplains, accelerating erosion processes, increasing surface roughness, and increasing soil compaction.

The Sulphur HMA supports multiple vegetation types including aspen, mountain fir, spruce-fir, mountain shrub, PJ, sagebrush- grasslands, and salt desert shrub. The PJ woodland type dominates the HMA and is very dense with minimal understory forage. Open areas outside the PJ canopy are dominated by Wyoming big sagebrush with Indian ricegrass, wheatgrass, bluegrass, and squirrel tail grass as the primary forage species.

Within portions of the HMA, previous chaining and/or burning of PJ woodlands, followed by aerial seeding, changed much of the PJ woodlands to a grassland and shrub community. Many of these treatments are now 20-30 years old, and PJ or sagebrush have re-populated the areas, reducing vegetation diversity. This reduction in plant species diversity has placed the HMA in the FAR category (USDI BLM, 2004-2008).

The current drought cycle has had a tremendous influence on rangeland vegetation. During the period from 1999-2004, 2012-2014, and 2019-2021, average annual precipitation never exceeded 12 inches within the impact analysis area except at the high elevations of the Mountain Home and Indian Peak allotments. The annual average for the rest of the area proposed for gather in the action alternatives was 75 percent or below of the historic precipitation for that area. The extreme drought conditions occurred throughout 2021 (see Appendix 10. Drought Monitoring Data).

Year-long grazing by wild horses has put additional stress on key forage species already affected by drought. These stressors have increased the vulnerability to the spread of noxious weeds. Utilization studies conducted by the BLM within the analysis area, which also cover areas with no livestock authorization (Mountain Home Allotment}, show heavy to severe use (see Appendix 11. Utilization Studies). Utilization and trend studies that the BLM has completed during the past 20 years, along with qualified staff observations, suggest that as wild horse populations increase, they contribute to the decrease of forage species by trampling and utilizing forage. This is especially true in grassland, sagebrush/grassland, and seeded areas. Even if the wild horse herd is brought to within AML, recovery of forage species could take 5 to 15 years, depending on how severely the drought affected a particular area. (Holechek, 1989). Two or more years of drought have a far greater impact on vegetation than one year of drought followed by normal or above-normal precipitation.

Environmental Impacts

This analysis assumes that livestock use would continue at levels established by grazing permit renewal decisions, big game population numbers would continue as established by herd management plans and state law, and removal of wild horses would be conducted as proposed in the action alternatives to within the AML levels specified for the HMA.

Impacts from Alternatives 1 and 2

Alternatives 1 and 2 would have a direct impact to soils in the area immediately around the trap locations. These areas would be disturbed by the hoof action of wild horses when they are concentrated in the trap area to be loaded on the trailers. The disturbance would be limited to one quarter- to one half-acre in size at each trap and would normally be in an area already disturbed like a road, wash, or previous trap site. Most operations would occur when soils are dry or frozen, reducing the impact to soils. In BLM's experience with previous gathers, trap site locations have recovered within one year with vegetation to stabilize the soils. Additionally, past experience has demonstrated that gather operations do not result in substantial compaction of soils.

In general, the reduction of wild horses to proposed levels would reduce utilization levels, which would allow more residual vegetation and litter to remain on site and protect the soil resource. Reduction of wild horse numbers would enable the allotments within the HMA to achieve established utilization objectives. Increased litter would provide additional protection from wind and water erosion, promote infiltration, detain surface flows, and retard soil moisture loss by evaporation, allowing for increased vegetative productivity. Indicators, such as pedestals, bare ground, litter movement, flow patterns, etc., should lessen with implementation of Alternatives 1 or 2. Further, reduced numbers of wild horses should result in less compaction of wet sites, such as riparian areas, and enhance soil and vegetation production there.

Alternatives 1 and 2 would not have any direct impacts to riparian wetland zones or water quality. Trap sites and temporary holding facilities would not be constructed on riparian resources. Alternatives 1 and 2 would indirectly impact riparian wetland zones and water quality due to the decreased utilization by wild horses in these sensitive areas allowing for the possibility of riparian wetland areas to improve through natural processes. Implementing Alternative 1 and 2 would decrease competition for water sources and alleviate pressures exerted on riparian habitat due to wild horses congregating around these sensitive areas. The riparian resources would improve towards a PFC rating with the removal of excess wild horses and implementation of population growth suppression.

There would be direct impacts to the vegetation immediately in and around temporary trap sites and holding, sorting, and animal handling facilities. Impacts are created by vehicle traffic and hoof action of penned horses and can be locally severe in the immediate vicinity of the corrals or holding facilities. Keeping the sites approximately one half-acre in size would minimize the disturbance area. Since most trap sites and holding facilities are re-used during recurring wild horse gather operations, any impacts would remain site-specific and isolated in nature. In addition, most trap sites or holding facilities are selected to enable easy access by vehicles and logistical support equipment and would, therefore, generally be near or on roads, pullouts, water haul sites, or other previously disturbed flat spots.

A reduced demand for forage resulting from bringing the population to within AML would help improve the vigor of vegetation, allow for seedling establishment, and increase ground cover,

thereby maintaining a TNEB. The recovery of vegetation from effects of the extended drought and overgrazing by wild horses would occur and improved vegetative trend of key forage species are expected under average precipitation normal. Long-term rangeland health would improve within the allotments as key forage and riparian areas would receive less use, especially during times of drought.

Reducing the wild horse population to within AML would contribute to maintaining sufficient vegetation and litter within the HMA, protect soil from erosion, meet plant physiological requirements, facilitate plant reproduction, and reduce potential for the spread of noxious weeds.

Alternative 3 – No Population Growth Suppression
Impacts under this Alternative would be similar to Alternatives 1 and 2, but under this alternative, AML would be more difficult to maintain as the growth rate (population increase) would be higher than alternatives 1 and 2. This would result in the need for more frequent gathers of the Sulphur HMA once the AML was achieved. Increased gathers would result in greater short-term disturbance to vegetation and soils in and around temporary trap sites and holding and handling facilities. If more frequent gathers could not be performed to maintain the population within AML, long-term impacts would be similar to the No Action Alternative, including continued and increased heavy use of vegetation resources, damage to plant communities, increased soil erosion, and increased susceptibility to invasive species.

Alternative 4 – No Action
Under the No Action Alternative, wild horses within and adjacent to the HMA would continue to increase in population size beyond the capacity of the habitat to provide water and forage. Heavy and severe use of vegetation resources by wild horses would continue and increase, resulting in further degradation of plant communities, increased soil erosion, and greater susceptibility to invasive species. Downward trends in key perennial species would be expected in conjunction with reductions in ecological condition and soil stability. The vegetative functional/structural groups (i.e. grass, shrubs, trees, etc.) would be changed as grasses are over utilized during critical growing seasons. Vegetation would also experience reduced production, which would result in reduced forage availability to wildlife, livestock, and wild horses. Eventually, rangeland health would be reduced below a threshold from which it would be difficult to recover. Considerable progress towards the Standards and Guidelines for Rangeland Health would not occur.

Riparian areas currently rated at PFC could experience downward trends caused by utilization of riparian vegetation and browse and trampling by populations of wild horses in excess of AML. Riparian areas rated below PFC (FAR and Non-Functional categories) where wild horses were identified as a potential causal factor would likely not improve, and downward trends would continue.

Horses are opportunistic feeders, and as their population increases, they may eventually have to choose non-forage species, such as three-awn grass, rabbitbrush, and junipers for their

survival, which would result in even less litter and residual vegetation left on site than under the current situation. Current indicators of poor soil conditions would remain on the allotments currently not meeting BLM Utah's Standards and Guidelines for Rangeland Health. Additional indicators, such as increased overland flows, rills, and gullies could occur as additional soil is lost from the allotments. Wind erosion could become a factor where it is not currently. Horses would have to expand their ranges because of the distances they would need to travel from water to obtain forage. Ultimately, the allotments currently meeting Rangeland Health Standard 1 would likely fail to meet Standard 1 (or other standards) as soil conditions deteriorated. It is also likely that wild horses would continue to expand outside the current HMA boundaries as long as they were not restricted by adequate fencing. Under the No Action Alternative, additional trailing, trampling, and compaction would occur at riparian zones and other water sources, resulting in decreased percolation and water holding capacity and increased surface runoff.

3.3.3. Issue 3. How will the proposed action affect wildlife?

Affected Environment

No threatened, endangered, or candidate species would be affected by the action alternatives. Greater sage-grouse, pygmy rabbits, and burrowing owls occur within the HMA and may be affected.

Part of the Sulphur HMA is located in the Hamlin Valley greater sage-grouse PHMA. There are three occupied leks within or in close proximity to the Sulphur HMA. Typically, proximity and abundance of nesting habitat are key factors for lek locations. Nesting habitat for sage-grouse includes sagebrush with an understory of native grasses and forbs, with horizontal and vertical structural diversity. This provides an insect prey base, herbaceous forage for pre-laying and nesting hens, and cover for the hen while she is incubating. Brood rearing habitat is typically defined for early-brood rearing and late-brood rearing activities. Late spring/early summer grazing by wild horses generally impacts the habitat and the ability of the vegetative communities to provide adequate cover for brood-rearing sage-grouse. Competition between wild horses and sage-grouse occurs during the winter because sage-grouse feed exclusively on the leaves of sagebrush. Many studies corroborate the general conclusion that wild horses can lead to biologically significant changes in rangeland ecosystems, particularly when their populations are overabundant relative to water and forage resources, and other wildlife living on the landscape (Eldridge, et al., 2020). The presence of wild horses is associated with a reduced degree of greater sage-grouse lekking behavior (Muñoz, et al., 2020). Moreover, increasing densities of wild horses, measured as a percentage above AML, are associated with decreasing greater sage-grouse population sizes, measured by lek counts (Coates, et al., 2021).

Big game species that occur in the Sulphur HMA include mule deer, Rocky Mountain elk, and pronghorn. All three species are year-long residents. Competition for forage between big game species and wild horses is greatest during the spring and summer months when mule deer, elk and pronghorn are feeding primarily on grasses and forbs. Additionally, forb consumption is crucial during the early spring months for does to maintain a healthy body condition while

meeting the nutrient requirements of nursing fawns. Competition is reduced in fall and winter when mule deer and pronghorn shift their diets to browse (i.e., bitterbrush, sagebrush) species. Typically, elk move to wintering areas throughout the Pine and Hamlin Valleys. During periods of drought, competition between wildlife and wild horses increases dramatically when less forage is available.

Environmental Impacts

Alternatives 1 and 2

Wildlife and wildlife habitat would be indirectly affected by the improvements in resource health from the removal of excess horses and population growth suppression. Implementing Alternative 1 or 2 would reduce utilization on key forage species, improving the quantity and quality of forage available to wildlife and decreasing competition for water sources.

Activities such as using helicopters and roping can have short-term effects on wildlife due to increased noise (i.e., helicopters, roping) and increased human presence in the project area.

Bait and water trapping impacts would vary by individual wildlife species. The intensity of these impacts would be indicated by behaviors ranging from nervous agitation to physical distress. Temporary disturbance and/or displacement would occur to wildlife during set up of traps or the inability to escape if wildlife becomes caught in traps; however, since traps are monitored, it is very unlikely wildlife would be trapped. Minimal impacts are expected since trap sites and temporary holding facilities would be located primarily in already disturbed sites. If traps are located in areas of intact wildlife habitat, a wildlife inventory clearance would be required.

Population growth suppression would decrease the rate of growth of the wild horse population and lessen the competition between wildlife and wild horses. Implementation of Alternatives 1 or 2 would reduce utilization on key forage species, improving the quantity and quality of forage available to wildlife and decreasing competition for water resources. Although impacts are expected to be minimal to these species, temporary displacement may occur during the gather activities.

Greater sage-grouse and/or its habitat could be impacted temporarily and in the short-term through disturbance and/or displacement. After gather activities have ceased, sage-grouse would be expected to return to the area. Bringing the population of wild horses to within AML would benefit sage-grouse in the short-term through improved access to water sources and in the long-term through improved habitat conditions, both at water sources/riparian areas and in upland habitat containing sagebrush (ARMPA MA-WHB-3).

Alternative 3 – No Population Growth Suppression

Impacts to wildlife would be the same as those described for Alternatives 1 and 2. However, a faster increase of wild horse populations under this alternative would decrease the term of the beneficial impacts to wildlife species.

Alternative 4 – No Action
Under the No Action Alternative, important wildlife upland habitats would continue to be impacted to a greater degree as the wild horse population increases. Downward trends in key perennial species would be expected in conjunction with reductions in ecological condition. As this occurs, vegetation would also experience reduced production levels resulting in reduced forage available to wildlife. Wild horses would increasingly compete with wildlife for habitat suitable for breeding, nesting, foraging, and burrowing for the greater sage-grouse, pygmy rabbits, and burrowing owls. Sagebrush obligates dependent on suitable sagebrush ecosystems for nesting and breeding would continue to be depleted. Competition between mule deer, pronghorn and wild horses for forage and water resources during the spring and summer months would continue. However, the potential impacts from disruption due to increased human activity and helicopter use would not occur.

3.3.4. Issue 4. How will the proposed action affect wild horses?

Affected Environment
The BLM currently estimates that there are nearly 500 horses in the Sulphur HMA. The agency developed this estimated population after completion of an aerial population inventory flight in June 2020 using the Simultaneous Double Observer Method (see Appendix 14. Population Inventory). This estimated population level represents over double the lower AML, but the BLM notes that the population estimate could be 20-30 percent lower than the actual population (NAS, 2013). During each transect, the BLM took photos of each band of horses and recorded additional data. Horses were identified as individuals or as a band by their color, leg markings, face markings, and area/time recorded. The BLM used this information to eliminate any horse groups that were observed more than once. The planned flight paths were loaded into a GPS device and followed. The actual flight paths were recorded by GPS. Table 3.2 identifies the current AML range, total horse population in 2010 and 2016, and estimated current total horse population for the Sulphur HMA.

Table 3.2. Sulphur HMA AML, Population Estimates, and Wild Horse AUMs

AML	Population 2010	Population 2016	Estimated Population January 2022	Wild Horse AUMs at High AML	Estimated Wild Horse AUMs being Utilized by 497 horses
165-250	500	957	497*	3,000	5,964

*This number does not include the estimated 2022 foal crop.

The most recent gather and removal of wild horses from this HMA took place in 2020. At that time, a total of 620 animals were gathered. 574 were removed from the range. 46 untreated stallions were returned to the range after the gather. 49 mares were treated with GonaCon vaccine, and 46 were returned to the range.

Based on available results from past genetic monitoring in the Sulphur HMA herd (Cothran, 1997, Cothran, 2010, and Cothran, 2017), it appears that the herd is genetically diverse, as indicated by measures of observed heterozygosity (see Appendix 13. Genetic Analysis of the

Sulphur Herd, UT448). Because of history, context, and periodic introductions, wild horses that live in the Sulphur HMA herd are not a truly isolated population. The National Academies of Sciences recommended that managed herds of wild horses should be considered as components of interacting metapopulations, connected by interchange of individuals and genes due to both natural and human-facilitated movements (NAS, 2013). The ancestry of horses in this area is of mixed origin from a number of domestic breeds commonly used in the region. Even though the 1997 genetic monitoring samples had indicated an above average component of Spanish breed type ancestry in the herd, subsequent sampling in 2006, 2009, and 2017 indicated a mixed breed ancestry, with close affinity to the "…Light Racing and Riding breeds, followed closely by the North American Gaited breeds" (Cothran, 2017). Additional data about the genetic relatedness between a large number of herds (NAS, 2013) indicated that over 70 other wild horse genetic sample sets had pairwise Fst values with Sulphur HMA of less than 0.10 – this indicates very little genetic differentiation from those other herds (Frankham, et al., 2010).

Forage utilization levels by wild horses on rangelands within the Sulphur HMA increase as the population increases. The potential for loss of key forage species also increases as the amount of sustainable forage is depleted through higher levels of use. When grazer density is high relative to available forage resources, overgrazing by any species can lead to long-term reductions in plant productivity, including decreased root biomass (Herbel, 1982; Williams, et al., 1968) and potential reduction of stored carbon in soil horizons. Drought events over the past fifteen years have shown the effects of limited resources for wild horses through body condition and range condition. Areas inside and outside the Sulphur HMA are experiencing increased use on forage species and resources by wild horses as they expanded outside the HMA in search of forage and water.

Although a portion of the HMA does not have any livestock grazing and livestock numbers were reduced and/or completely removed from the allotments within the HMA since 2015, excess wild horses have overgrazed many areas during critical forage growth periods. Grazing is most harmful during the critical growth period of a plant because food reserves are the lowest. The critical growth period begins in the boot stage and closes with complete mature seed (about April 15 – June 15). Additionally, BLM data shows that wild horse and wildlife utilization within key areas on the Mountain Home Allotment for 2020 was heavy. This heavy utilization, along with the reduced vigor and composition of the plants due to drought within the Mountain Home Allotment -–– where no livestock are currently permitted -–– has been observed throughout the HMA with high concentrations of wild horses.

Because horses have a cecal digestive system and can cover longer distances than can domestic ruminants, wild horses can remain in good health under forage conditions fatal to domestic ruminants (Holechek, 1989). In 1999 and 2000, range conditions within the HMA deteriorated to the point that even with reduced livestock use and several hundred head of wild horses removed, the wild horse population was still over AML and the health of some horses declined to critical conditions. Some horses were lost to starvation and dehydration during those years. In 2015, eight wild horses are known to have died due to lack of forage and/or water. In 2021,

at least three wild horses are known to have died due to lack of forage and/or water. There are several wild horses in body condition 2 (very thin) that are not expected to live through the winter of 2022.

In 2015, the BLM hauled approximately 160,000 gallons of water to three different sites on the northern part of the HMA to sustain wild horse health. In 2020, all the reliable water sources have had valves replaced, troughs patched and replaced, pipelines repaired, solar system rehabilitated, pipelines blown out, etc. in an attempt to maintain water at those locations. This maintenance was in addition to what would normally be required if horse populations were within the range of AML. In 2021, the BLM hauled approximately 16,000 gallons of water to the Mountain Home Spring troughs to sustain the wild horse and wildlife populations. BLM data shows that upland vegetation in proximity to reliable water sources and these water haul sites is used heavily by wild horses, wildlife, and livestock, while vegetation in areas farther from water is used slightly. There are areas in the southern part of the HMA that have adequate forage but are not usable for most of the year due to lack of water and/or seasonal condition (i.e., snow depth). During drought conditions, as has occurred during 1999-2004, 2013-2015, and the last few years, several water sources dry up for part of the year, concentrating wild horses at the remaining water sources and limiting the number of horses that the HMA can support without hauling water.

Due to the high population levels of wild horses, BLM data demonstrates that wild horses have used what is considered their winter habitat during the summer. Many are traveling outside the HMA in search of water and forage and to avoid conflict with other wild horses. More information is needed to determine the expanse of these movements. Similar conditions in 1999-2001 of high wild horse population combined with drought reduced horse health, and several wild horses died on the range as a result. In 2015, similar conditions resulted in the need to euthanize several horses due to poor body condition and injuries that occurred from fighting at the limited water sources.

From 2014 to present, several horses have been hit and killed in vehicle collisions along Highway 21. In 2018, nine miles of new fence was constructed along Highway 21 from Mormon Gap to mile marker 25. This helped reduce the number of wild horses getting onto Highway 21, but several miles outside the HMA remain open to the horses. Currently there are approximately 150 head of wild horses that are within 6 miles of Highway 21. These horses are on the highway in search of space, forage, and water. They have been observed drinking out of the rumble strips in the road after rain showers.

Environmental Impacts

Impacts from Alternatives 1-3

Removal of excess wild horses would improve herd health. Decreased competition for space, forage and water resources would reduce stress and promote healthier animals. Average gather success in the HMA is between 60-70% using the helicopter drive trap method. Because it would take several successive gather operations over a period of up to ten years to get the

wild horse population to the low end of AML, bands of horses may continue to leave the boundaries of the HMA for areas not designated for their use in search of space, forage, and water. Once low AML is reached, additional gathers may be needed to maintain the population within AML. The stated objectives for the HMA would not be met with the first gather operation but would be met over time. Appendix 12. Sulphur HMA 2021 Population Modeling identifies general trends of growth rates, removal numbers, treatment numbers, and populations under each of the action alternatives; this modeling indicates that none of the action alternatives would cause a population crash.

Impacts to individual animals may occur as a result of handling stress associated with the gathering, processing, and transportation of animals. The intensity of these impacts varies by individual animal and is indicated by behaviors ranging from nervous agitation to physical distress. Individual animal mortality because of these impacts is infrequent, but BLM's experience with previous operations demonstrates that it does occur in 0.5% to 1% of wild horses gathered in a given gather (Scasta, 2019). Other impacts to individual wild horses include separation of members of individual bands of wild horses and removal of animals from the population.

Indirect impacts can occur after the initial stress event and may include increased social displacement or increased conflict between stallions. These impacts are known to occur intermittently during wild horse gather operations. Traumatic injuries may occur and typically involve bruises from biting and/or kicking, which do not break the skin.

Water/Bait Trapping

Water and bait trapping would be used in some small areas of the HMA to remove small numbers of wild horses or, under Alternatives 1 and 2, to conduct fertility treatments. This method is slightly less stressful to the horses; after frequent gathers, however, wild horses would become more difficult to trap using this method. Horses would begin to avoid water sources or areas where the traps are set. During past water trap operations, some wild horses near death have been observed avoiding going into a water trap. As a result, the water trap operations had to be stopped and panels removed to allow these horses to drink before dying.

Water and bait trapping generally requires a long window of time for success. Although the trap would be set in a high probability area for capturing excess wild horses residing within the area and at the most effective time periods, time is required for the horses to acclimate to the trap and/or decide to access the water or bait.

Trapping involves setting up portable panels around an existing water source or in an active wild horse area, or around a pre-set water or bait source. The portable panels would be set up to allow wild horses to go freely in and out of the corral until they have adjusted to it. When the wild horses fully adapt to the corral, it is fitted with a gate system. The acclimatization of the horses creates a low stress trap. During this acclimation period, the horses would experience some stress due to the panels being set up and perceived access restriction to the water/bait source.

When actively trapping wild horses, the trap would be checked daily. Horses would be either removed immediately or fed and watered for up to several days prior to transport to a holding facility.

Generally, water/bait trapping is most effective when a specific resource is limited, such as water during the summer months. For example, in some areas, a group of wild horses may congregate at a given watering site during the summer because few perennial water resources are available nearby. Under those circumstances, water trapping could be a useful means of reducing the number of horses at a given location, which can also relieve the resource pressure caused by too many horses. As the proposed water and/or bait trapping in this area is a lower stress approach to gathering of wild horses, such trapping can continue into the foaling season without harming the mares or foals. Conversely, BLM has documented that at times water trapping can be stressful to wild horses due to their reluctance of approaching new, human structures or intrusions. In these situations, wild horses may avoid watering or may travel greater distances in search of other watering sources or panels may have to be removed to let the horse drink.

Transport, Short-Term Holding, and Adoption Preparation

During transport, potential impacts to individual horses can include stress, as well as slipping, falling, kicking, biting, or being stepped on by another animal. Unless wild horses are in extremely poor condition, it is rare for an animal to die during transport.

Recently captured wild horses, generally mares, in very thin condition may have difficulty transitioning to feed. A small percentage of animals can die during this transition; however, some of these animals are in such poor condition that it is unlikely they would have survived if left on the range.

During the preparation process, potential impacts to wild horses are similar to those that can occur during transport. Risk of injury and/or mortality during the preparation process is low but can occur.

Mortality at short-term holding facilities averages approximately 5 percent (US General Accounting Office, 2008, at 51) and includes animals that are euthanized due to a pre-existing condition, in extremely poor condition, injured and would not recover, and unable to transition to feed, as well as animals which die accidentally during sorting, handling, or preparation.

Wild Horses Remaining or Released into the HMA Following Gather

The wild horses that are not captured may be temporarily disturbed and move into another area during the gather operations. With the exception of changes to herd demographics, BLM's experience is that direct population-wide impacts following gathers have proven, over the last 25 years, to be temporary in nature with most if not all impacts disappearing within hours to several days of when wild horses are released back into the HMA. No observable effects associated with these impacts would be expected within one month of the gather operations or release, except for a heightened awareness of human presence.

As a result of lower density of wild horses across the HMA following the removal of excess horses, competition for resources would be reduced, allowing wild horses to utilize preferred, quality habitat. Confrontations between stallions would also become less frequent, as would fighting among wild horse bands at water sources. Achieving the AML and improving the overall health and fitness of wild horses could also increase foaling and foaling survival rates over the current conditions.

The primary effects to the wild horse population that would be directly related to Alternatives 1-3 would be to herd population dynamics, age structure or sex ratio, population size, and, for Alternatives 1 and 2, also to the growth rates over time. The remaining wild horses not captured would maintain their social structure and herd demographics (age and sex ratios).

Indirect individual impacts are those impacts which occur to individual wild horses after the initial stress event, and may include spontaneous abortions in mares, and increased social displacement, and conflict in studs. These impacts, like direct individual impacts, are known to occur intermittently during wild horse gather operations. An example of an indirect individual impact would be the brief skirmish which occurs among older studs following sorting and release into the stud pen, which lasts less than two minutes and ends when one stud retreats. Traumatic injuries usually do not result from these conflicts. These injuries typically involve a bite and/or kicking with bruises which do not break the skin. Like direct individual impacts, the frequency of occurrence of these impacts among a population varies with the individual.

Spontaneous abortion events among pregnant mares following capture is also rare, though poor body condition can increase the incidence of such spontaneous abortions. Given the timing of this gather, spontaneous abortion is not considered to be an issue for the proposed gather.

A few foals may be orphaned during gathers. This may occur due to the following:

- The mare rejecting the foal. This occurs most often with young mothers or very young foals.
- The foal and mother becoming separated during sorting and cannot be matched.
- The mare dying or being humanely euthanized during the gather.
- A foal being ill, weak, or needing immediate special care that requires removal from the mother.
- The mother not producing enough milk to support the foal.

Occasionally, foals are gathered that were already orphaned on the range (prior to the gather) because the mother rejected it or died. These foals are usually in poor, unthrifty condition. Orphans encountered during gathers are cared for promptly and rarely die or have to be euthanized. Nearly all foals that would be gathered would be over four months of age and some would be ready for weaning from their mothers. In private industry, domestic horses are normally weaned between four and six months of age.

Gathering the wild horses during the fall/winter reduces risk of heat stress, although this can occur during any gather, especially in older or weaker animals. Adherence to the design features and techniques used by the gather crew or contractor helps minimize the risks of heat stress. Heat stress does not occur often, but if it does, death can result.

Radio Collaring and Tagging

Based on numerous studies that have used modern radio collars with remote releases and tags to study the ecology of wild ungulates and equids in particular, these devices have minimal effects on the animals wearing them. The impact of radio collars and tags is very minimal. From March 2015 into 2020, researchers at the U.S. Geological Survey conducted a preliminary study on captive wild horses and burro jennies to determine proper fit and wear of radio collars (Schoenecker, et al., 2020). As part of this study, the condition of wild horses wearing radio collars was compared to non-collared controls and documented with photographs. In addition, both collared individuals and controls were observed for 80 minutes each week for 14 weeks in order to quantify any impact of the collar on their behavior and health. At the end of the study period (2020), the collars were removed. Analyses indicate that mares had almost no impact in terms of rubbing or wear from radio collars and behavior of collared and uncollared mares did not differ (Schoenecker, et al., 2020). Additionally, there was no impact of radio tags on behavior or wear.

There are some possible effects from the use of collars on horses. On males, on rare occasions, a collar over an ear has been observed, so no males would be collared in the action alternatives. Also, collars may be fitted too tightly, or a horse may grow – tightening the collar. If these situations are observed, the remote-release function would be deployed remotely. If this failed, the collar would be removed after capturing the animal through the methods described in the action alternatives. Neck abrasions or sores have not been reported in studies where equids have been collared (e.g., Collins, et al., 2014, Schoenecker, et al., 2020). If neck abrasions or sores caused by a collar are observed and have not healed within 4 weeks of when it is observed, the collar's remote-release would be activated or the horse would be captured as soon as possible to remove the collar.

No effects are expected from the tags; however, it is possible that they may form an irritation to individuals should vegetation get tangled in the tail. In this case, it is expected that the tag would ultimately rip out of the hair (leaving no injury) as the horse rubs it.

The use of collar and tag technology is critical to understanding how free-roaming horses move across the HMA and use increasingly scarce resources. Lack of this information has contributed to the management complexity of this species. Applying this technology to the study of free-roaming horses would provide BLM with the opportunity to better understand horse resource use, habitat preference, home range, and movement patterns and can be incorporated into investigations of social structure and herd or band dynamics as well as behavioral modifications associated with reproductive management including contraceptive use and sterilization. Such information can be used for future management decisions within the HMA.

Alternatives 1 and 2 Additional Impacts

Population Growth Suppression Treatments

Impacts from the two types of treatment would be essentially the same. One-time application of population growth suppression at the capture site would not affect normal development of a fetus should the mare already be pregnant when vaccinated, the overall health of the mare, or the mare's behavioral responses to stallions (Kirkpatrick, et al., 1995). Fertility control vaccines have also proven to have no apparent effect on pregnancies in progress or the health of offspring. A more thorough review of the effects of population growth suppression methods is included in Appendix 5. SOPs for Population Growth Suppression Methods and Scientific Literature Review.

The more an area is gathered, the more likely it is for horses to learn to evade the helicopter by taking cover in forested areas and canyons. Wild horses would also move out of the area when they hear a helicopter, thereby further reducing the overall gather efficiency. Frequent gathers would increase the stress to wild horses, as individuals and as entire herds.

Once AML is achieved and fertility treatments are conducted on a regular basis, the number of gathers needed to maintain AML would be reduced. As a result, there would be fewer disturbances to individual animals and the herd, and a more stable wild horse social structure would be provided.

Mares receiving the vaccine would experience slightly increased stress levels associated with handling while being vaccinated and freeze marked. Serious injection site reactions associated with population growth suppression treatments may occur but are rare in treated mares. Any direct impacts associated with population growth suppression, such as swelling or local reactions at the injection site, would be minor in nature and of short duration. Most mares recover quickly once released back to the HMA, and none are expected to have long term impacts from the population growth suppression injections other than the physiological and behavioral changes directly associated with contraception.

The removal of excess animals coupled with anticipated reduced reproduction (population growth rate) as a result of population growth suppression should result in improved health and condition of mares and foals as the actual population comes into line with the population level that can be sustained with available forage and water resources. This would allow for healthy range conditions (and healthy animals) over the longer-term. Reduced population growth rates with the use of population growth suppression would be expected to extend the time interval between gathers and reduce disturbance to individual animals as well as to the herd social structure over the foreseeable future.

Ransom, et al. (2010) found no differences in how PZP-treated and control mares allocated their time between feeding, resting, travel, maintenance, and 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 the study by Ransom, et al. (2010). Turner and Kirkpatrick (2002) 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.

In two studies involving a total of four wild horse populations, both Nunez, 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)). Ransom, et al. (2010) found that control mares were herded by stallions more frequently than PZP-treated mares, and Nunez, et al. (2009) found that PZP-treated mares exhibited higher infidelity to their band stallion during the non-breeding season than control mares. Madosky, et al. (2010) found that this infidelity was also evident during the breeding season in the same population that Nunez, et al. (2009) studied, resulting in PZP-treated mares changing bands more frequently than control mares. Long-term implications of these changes in social behavior are currently unknown.

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. Booster dose effects may lead to increased effectiveness of contraception, which is generally the intent. GonaCon-Equine can safely be reapplied as necessary to control the population growth rate. 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 has not been yet quantified. It is unknown what would be the expected rate for the return to fertility rate in mares boosted more than once with GonaCon-Equine. Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM would make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon-Equine or other fertility control methods, to maintain the number of horses within AML.

For a more thorough review of the effects of population growth suppression methods, refer to Appendix 5. SOPs for Population Growth Suppression Methods and Scientific Literature Review.

Alternative 4 – No Action

The No Action Alternative would not meet the purpose and need and would violate the WFRHBA, Federal regulations, and BLM/US Forest Service policy. The BLM realizes that some members of the public advocate for zero active management of wild horses. However, allowing horses to die of dehydration and starvation would be inhumane treatment and clearly indicates that an overpopulation of horses exists in the HMA. The No Action Alternative would not allow for data collection of genetic information of the wild horses in the Sulphur HMA.

The No Action Alternative would allow wild horse populations to further increase beyond the carrying capacity of the rangeland resources within the HMA. Visual observations have noted

that the general health of the wild horse population in the HMA have declined as horse numbers increased. Large die-offs have occurred in the past as the wild horse population has increased, if the population increased to a point where available forage and water were further depleted. This would be especially true during ongoing drought or other events such as wildfire.

Short-term herd dynamics would not be impacted under this alternative. Horses would continue to be free-roaming and follow natural patterns. However, if populations increased further beyond the AML, herd dynamics could be impacted because of declines in individual horse health. Near normal populations exhibit a 1:1 sex ratio. Population shifts favoring males could occur as males are better adapted to compete for resources during changing environmental conditions.

Chapter 4. Monitoring

Under all alternatives, including the No Action Alternative, monitoring would be required to determine if the program goals are being met. BLM personnel would collect and maintain the data during gather and removal operations as outlined in Alternatives 1-3. Population inventory via aerial survey would be conducted every three to four years on the HMA as required by the WFRHBA and BLM policy. Additionally, vegetation monitoring studies (rangeland health, trend, and utilization) would be ongoing and continue to be conducted in conjunction with livestock, wildlife, and wild horse use. During gather operations under Alternatives 1-3, an Animal and Plant Inspection Service (APHIS) or other licensed veterinarian will be on-site, if needed, to examine animals and make recommendations to BLM for care and treatment of the wild horses.

For Alternatives 1-3, supplemental monitoring would take place, based on available funding and personnel, using GPS/VHF radio collars or radio tags to locate individuals and to monitor and record population dynamics, group size responses to change in animal density, management interventions, seasonal weather, and climate. Birth rates and population increase would be monitored after population growth suppression as funding and priorities allow. Samples for genetic monitoring will be collected during gathers. Periodic introduction of studs or mares from a different HMA, with desired characteristics similar to the wild horses within the HMA could be made, to augment genetic diversity in the HMA, as measured by observed heterozygosity, if the results of genetic monitoring indicate that is prudent.

Chapter 5. Consultation and Coordination

A state-wide public hearing is held annually regarding the use of helicopters and motorized vehicles to capture wild horses (or burros) within the state of Utah. During the hearing, the public is given the opportunity to present new information and to voice any concerns or opinions regarding the use of these methods to capture wild horses (or burros). As required by 43 CFR 4740.1(b), BLM held a hearing in the agency's Cedar City Field Office in Cedar City, Utah, on November 14, 2019. Primary issues discussed were: (1) how helicopters are used during gathers and their effects on wild horses; (2) appropriate management levels in HMAs and how

they are established and monitored; and (3) legal ability of BLM using motorized vehicles. More recently, BLM held a national public hearing via Zoom on May 25, 2021, to discuss the use of helicopters and motorized vehicles in the management of Utah BLM's wild horses and burros. General questions and answers were discussed at both the 2019 and 2021 hearings.

Pursuant to the January 6, 2021, Settlement Agreement reached in *Beaver County, Utah v. U.S. Department of the Interior*, *et al*., No. 2:17-cv-00088 (D. Utah) (2021 Settlement Agreement), the BLM held a virtual meeting via Zoom with The Cloud Foundation on August 31, 2021.

5.1. Persons, Groups, and Agencies Consulted

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
SHPO	Consultation for undertakings, as required by the National Historic Preservation Act (NHPA) (16 USC 470)	No cultural resources would be affected. The project will be reviewed by SHPO as part of the quarterly submittal as per existing protocol.
PITU	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1531) and NHPA (16 USC 1531)	The PITU stated in writing on April 14, 2021, that they do not have any concerns with the project.
Beaver County Commission	Cooperating Agency	Submitted comments before the public comment period.
The Cloud Foundation	2021 Settlement Agreement	The Cedar City Field Manager and BLM staff listened to concerns from The Cloud Foundation and considered the concerns regarding the analysis and the decision. All comments are addressed in Appendix 15.

5.2 List of Preparers

The list of BLM preparers is included in Appendix 2.

5.3 Public Involvement and Scoping

Notification of the Proposed Action was posted on the BLM's ePlanning website on May 6, 2020. The BLM offered a 30-day public comment period on the EA beginning March 22, 2021. The EA information was provided on the project's ePlanning website and announced through a news release, letters, and emails. A summary of the public comments and the BLM responses are contained in Appendix 15.

List of Appendices

References

Animal Protection Institute of America v. Nevada BLM. 1989. 118 Interior Board of Land Appeals 20. IBLA 89-206, 90-243.

Animal Protection Institute of America v. Nevada BLM. 1989b. 109 Interior Board of Land Appeals 112. IBLA 88-591, 88-638, 88-648, 88-679.

Animal Protection Institute of America et al. v. Rock Springs District, Wyoming BLM. 1991. 118 Interior Board of Land Appeals 63. IBLA 90-412, 90-413, 90-414.

Baker, D.L., J.G. Powers, J.I. Ransom, B.E. McCann, M.W. Oehler, J.E. Bruemmer, N.L. Galloway, D. C. Eckery, and T. M. Nett. 2018. Reimmunization increases contraceptive effectiveness of gonadotropin-releasing hormone vaccine (GonaCon-Equine) in free-ranging horses (Equus caballus): Limitations and side effects. PLoS ONE 13(7): e0201570.

Beaver County. 2019. Beaver County, Utah Resource Management Plan, as amended. Available at https://rmp.utah.gov/wp-content/uploads/Beaver-CRMP_Final_Amended-12.17.19.pdf.

Coates, P.S., S.T. O'Neil, D.A. Muñoz, I.A. Dwight, and J.C. Tull. 2021. Sage-grouse population dynamics are adversely impacted by overabundant free-roaming horses. The Journal of Wildlife Management 85:1132-1149.

Collins G.H., S.L. Petersen, C.A. Carr, L. Pielstick. 2014. Testing VHF/GPS Collar Design and Safety in the Study of Free-Roaming Horses. PLoS ONE 9(9): e103189. doi:10.1371/journal.pone.0103189.

Cothran, G.E. 1997. Genetic Analysis of Two Feral Horse Herds, pp.9.

Cothran, G.E. 2010. Genetic Analysis of Sulphur HMA, UT, pp.6.

Cothran, G.E. 2017. Genetic Analysis of Sulphur HMA, UT, pp.9.

Curtis, P.D., R.L. Pooler, M.E. Richmond, L.A. Miller, G.F. Mattfeld, and F.W Quimby. 2001. Comparative effects of GnRH and porcine zona pellucida (PZP) immunocontraceptive vaccines for controlling reproduction in white-tailed deer (Odocoileus virginianus). Reproduction (Cambridge, England) Supplement 60:131-141.

Derner, J.D., G.E. Schuman. 2007. Carbon sequestration and rangelands: A synthesis of land management and precipitation effects Journal of Soil and Water Conservation; Mar/Apr 2007; 62, 2; Research Librarypg. 77, Researchgate.net.

Duncan, C.L., J.L. King, and P. Stapp. 2017. Effects of prolonged immunocontraception on the breeding behavior of American bison. Journal of Mammalogy 98:1272-1287

Eldridge, D.J., J. Ding, and S. K. Travers. 2020. Feral horse activity reduces environmental quality in ecosystems globally. Biological Conservation 241:108367.

Environmental Protection Agency (EPA). 2009a. Pesticide Fact Sheet: Mammalian Gonadotropin Releasing Hormone (GnRH), New Chemical, Nonfood Use, USEPA-OPP, Pesticides and Toxic Substances. US Environmental Protection Agency, Washington, DC.

Environmental Protection Agency (EPA). 2009b. Memorandum on GonaCon Immunocontraceptive Vaccine for Use in White-Tailed Deer. Section 3 Registration.

Environmental Protection Agency (EPA). 2013. Notice of pesticide registration for GonaCon-Equine. US Environmental Protection Agency, Washington, DC.

Environmental Protection Agency (EPA). 2015. Label and CSF Amendment. November 19, 2015 memo and attachment from Marianne Lewis to David Reinhold. US Environmental Protection Agency, Washington, DC.

Feh, C. 2012. Delayed reversibility of PZP (porcine zona pellucida) in free-ranging Przewalski's horse mares. In International Wild Equid Conference. Vienna, Austria: University of Veterinary Medicine.

Frankham, R., J. D. Ballou, and D. A. Briscoe. 2010. Introduction to conservation genetics, second edition. Cambridge University Press, New York, New York.

Girard, T.L., E.W Bork, S.E. Nielsen, M.J. Alexander. 2013. Seasonal variation in habitat selection by free-ranging feral horses within Alberta's forest reserve. J Range Ecol Manage 66: 428–437. doi: 10.2111/rem-d-12-00081.1.
Heilmann, T.J., R.A. Garrott, L.L. Cadwell, and B.L. Tiller. 1998. Behavioral response of free-ranging elk treated with an immunocontraceptive vaccine. Journal of Wildlife Management 62: 243-250.Herbel, C.H. 1982. Grazing management on rangelands. Journal of Soil and Water Conservation 37:77-79.

Herbel, C.H. 1982. Grazing management on rangelands. Journal of Soil and Water Conservation 37:77-79.

Holecheck, J.L., R.D. Pieper, and C.H. Herbel. 1989. Range Management Principles and Practices, Chapter 2, pp. 21, 26, 372

Hubbard, R. E., and R. M. Hansen. 1976. Diets of wild horses, cattle, and mule deer in the Piceance Basin, Colorado. Journal of Range Management 29(5):389-392.

Iron County. 2017. Iron County Resource Management Plan. Available at https://rmp.utah.gov/wp-content/uploads/Iron-County-RMP2.pdf.

Kirkpatrick, J.F., R. Naugle, I.K.M. Lui, J. W. Turner Jr., M. Bernoco (1995) Effects of Seven Consecutive years of PZP Contraception on Ovarian Function in Feral Mares, Biology of Reproduction Monograph Series 1: Equine Reproduction VI: 411-418.

Kirkpatrick, J.F. and A. Turner. 2002. Reversibility of action and safety during pregnancy of immunization against porcine zona pellucida in wild mares (Equus caballus). Reproduction Supplement 60:197-202.

Klages, K.H.W. 1942. Ecological Crop Geography. The Macmillan Company, New York.

Miller, R. 1981. Male aggression, dominance, and breeding behavior in Red Desert horses. Z Tielropychol. 57:340-351.

Miller, L.A., K.A. Fagerstone, and D.C. Eckery. 2013. Twenty years of immunocontraceptive research: lessons learned. Journal of Zoo and Wildlife Medicine 44:S84-S96.Muñoz, D.A., P.S. Coates, and M.A. Ricca. 2020. Free-roaming horses disrupt greater sage-grouse lekking activity in the great basin. Journal of Arid Environments 184: 104304.

Muñoz, D.A., P.S. Coates, and M.A. Ricca. 2020. Free-roaming horses disrupt greater sage-grouse lekking activity in the great basin. Journal of Arid Environments 184: 104304.

National Academy of Sciences (NAS). 2013. Using Science to Improve the BLM Wild Horse and Burro Program.

Nuñez, C.M.V., J.S. Adelman, C. Mason, and D.I. Rubenstein. 2009. Immunocontraception decreases group fidelity in a feral horse population during the non-breeding season. Applied Animal Behaviour Science 117:74-83.
Nuñez, C.M., J.S. Adelman, and D.I. Rubenstein. 2010. Immunocontraception in wild horses (Equus caballus) extends reproductive cycling beyond the normal breeding season. PLoS one, 5(10), p.e13635.

Nuñez, C.M., J.S. Adelman, H.A. Carr, C.M. Alvarez, and D.I. Rubenstein. 2017. Lingering effects of contraception management on feral mare (Equus caballus) fertility and social behavior. Conservation Physiology 5(1): cox018.

Nuñez, C.M.V. 2018. Consequences of porcine zona pellucida immunocontraception to feral horses. Human-Wildlife Interactions 12:131-142.

Osterheld, M., S.J. McNaughton. 1991. Effects of stress and time for recovery on the amount of compensatory growth after grazing. Oecologia 85: 305-312. Researchgate.net.

Powell, D.M. 1999. Preliminary evaluation of porcine zona pellucida (PZP) immunocontraception for behavioral effects in feral horses (Equus caballus). Journal of Applied Animal Welfare Science 2:321-335.

Ransom, J.I., B.S. Cade, and N.T. Hobbs. 2010. Influences of immunocontraception on time budgets, social behavior, and body condition in feral horses. Applied Animal Behavior Science 124:51-60.

Ransom, J.I and P. Kaczensky,P eds., 2016. Wild equids; ecology, management and conservation. Johns Hopkins University Press, Baltimore, Maryland.) Wild and feral equid population dynamics. pages 68-86.

Rutberg, A., K. Grams, J.W. Turner, and H. Hopkins. 2017. Contraceptive efficacy of priming and boosting does of controlled-release PZP in wild horses. Wildlife Research 44:174-181.

Scasta, J.D. 2019. Mortality and operational attributes relative to feral horse and burro capture techniques based on publicly available data from 2010-2019. Journal of Equine Veterinary Science 86:102893.

Schoenecker, K.A., S.R.B. King, and G.H. Collins. 2020. Evaluation of the impacts of radio-marking devices on feral horses and burros in a captive setting. Human-Wildlife Interactions 14:73-86.

Shumake, S.A. and G. Killian. 1997. White-tailed deer activity, contraception, and estrous cycling. Great Plains Wildlife Damage Control Workshop Proceedings, Paper 376.

Schuman, G.E., J. D. Reeder, J. T. Manley, R. H. Hart, W. A. Manley. 1999. Impact of grazing management on the carbon and nitrogen balance of a mixed-gras rangeland. Ecological Application, 9(1):65-71

Society for Range Mgt. 1974. A glossary of terms used in Range Management, 2nd Edition. Society for Range Management, Denver, Colo.

Technical Reference 1734-03. 1999. Utilization Studies and Residual Measurements. Interagency Technical Reference. Available at https://www.blm.gov/sites/blm.gov/files/documents/files/Library_BLMTechnicalReference1734-03.pdf

Toombs, T.P. 2007. Utah Prairie Dog Habitat Evaluation Guide. Environmental Defense Publication.

Turner Jr, J.W., I.K.M. Lui, Rutberg, A., J.W., Kirkpatrick, (1997) Immunocontraception Limits Foal Production in Free Roaming Feral Horses in Wyoming, J. Wildl. Manage. 61 (3):873-880.

Turner, J.W., and J.F. Kirkpatrick. 2002. Effects of immunocontraception on population, longevity and body condition in wild mares (Equus caballus). Reproduction (Cambridge, England) Supplement, 60, pp.187-195.

Turner Jr., J.W., Lui, I.K.M., Flanagan, D.R., Rutberg, A.T., Kirkatrick J.F. (2007) Immunocontraception in Wild Horses: One Inoculation Provides Two Years of Infertility, J. Wildl. Manage. 71(2):662-667.

UNHP. 2008. Threatened, Endangered, Sensitive, Heritage, Locality GIS Database. Utah Natural Heritage Program, Salt Lake City, Utah.

USDA Natural Resources Conservation Service (USDA). 1998. Soil Survey of Iron – Washington Area, Utah (Natural Resource Conservation Service (NRCS), 1998). Available on the NRCS website at https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/utah/UT634/0/UT634.pdf.

USDI Bureau of Land Management. HMA Study file 4700 #UT-448. Available at the BLM Cedar City Field Office.

USDI Bureau of Land Management. Allotment Study files 1020, Atchison Creek, Bennion Spring, North Pine Valley, South Pine Valley, Indian Peak, Hamblin, Fairview and Stateline Allotments. Available at the BLM Cedar City Field Office.

USDI Bureau of Land Management. 1983. Pinyon Management Framework Plan. BLM, Cedar City, Utah. As amended.

USDI Bureau of Land Management. 2004-2008. 4700, Standards and Guidelines Study files 2004-2008. Available at the Cedar City Field Office.

USDI Bureau of Land Management. 2004. Land Use Plan Decisions, Implementation Decisions, and Administrative Remedies. Instruction Memo No. 2004-079. 1610(210) P.
USDI Bureau of Land Management. 2008. Programmatic biological assessment for grazing permit renewals for Utah prairie dog habitat in the Cedar City Field Office. Cedar City Field Office. Unpublished report. 50 pages.

USDI Bureau of Land Management. 2010. Wild Horses and Burros Management Handbook. H-4700-1. Bureau of Land Management, Washington, D.C. Available at https://www.blm.gov/sites/blm.gov/files/uploads/Media_Library_BLM_Policy_H-4700-1.pdf.

USDI Bureau of Land Management. Standards and Guidelines for Rangeland Health. Available at https://eplanning.blm.gov/eplanning-ui/project/1505407/570.

USDI Bureau of Land Management. 2020. Fillmore Data Summaries. Available at https://eplanning.blm.gov/eplanning-ui/project/1505407/570

USDI Bureau of Land Management. 2021. Data on allotments outside of HMA. Available at https://eplanning.blm.gov/eplanning-ui/project/1505407/570.

USDI Bureau of Land Management. 2021. Sulphur Monitoring Report. Available at https://eplanning.blm.gov/eplanning-ui/project/1505407/570.

USDI Bureau of Land Management. 2021. Wild Horse and Burro Comprehensive Animal Welfare Program (CAWP). BLM PIM 2021-002. Available at https://www.blm.gov/policy/instruction-memorandum.

USDI Bureau of Land Management. 2021. Monitoring Report for the Sulphur Monitoring Report May 2021

USDI Fish and Wildlife Service. 2007. Biological Opinion for the Existing Utah BLM Resource Management Plans (RMP). Memo to Director, BLM, Utah State Office. 255 pages.

USDI Fish and Wildlife Service. 2008. Programmatic Biological Opinion for the Grazing Permit Renewals for Utah Prairie Dog Habitat in the Cedar City Field Office, Bureau of Land Management, Utah. Memo to Field Office Manager, BLM, Cedar City Field Office. 38 pages.

USDI Fish and Wildlife Service. 2009. Endangered, Threatened, Proposed and Candidate Species, Utah Counties. http://www.fws.gov/mountain-prairie/endspp/CountyLists/Utah.pdf

US Government Accountability Office. 2008. Bureau of Land Management: Effective Long-term Options Needed to Manage Unadoptable Wild Horses (GAO-09-77). Available at https://www.gao.gov/assets/gao-09-77.pdf.

Utah Division of Wildlife Resources (UDWR). 2005. Utah Comprehensive Wildlife Conservation Strategy (CWCS). Publication Number 05-19.

Williams, R. E., B.W. Allred, R.M Denio, and H.A. Paulsen. 1968. Conservation, development, and use of the world's rangelands. Journal of Range Management. 21:355-360.

ZooMontana. 2000. Wildlife Population Growth Suppression: Fact and Fancy. ZooMontana Science and Conservation Biology Program, Billings, MT.