BLM

# U.S. Department of the Interior
# Bureau of Land Management

Draft Environmental Assessment
DOI-BLM-UT-G020-2017-0032-EA

# MUDDY CREEK WILD HORSE HERD MANAGEMENT AREA GATHER PLAN


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NATIONAL SYSTEM OF PUBLIC LANDS

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# 1.0 PURPOSE & NEED FOR THE PROPOSED ACTION

## 1.1 Introduction

This Environmental Assessment (EA) has been prepared to analyze the Bureau of Land Management (BLM) Price Field Office's (PFO) proposal to gather and remove excess wild horses from within and outside the Muddy Creek HMA in or after Spring 2018. The wild horse gather plan would allow for an initial gather and follow-up maintenance gathers to be conducted over the next 10 years from the date of the initial gather operation to achieve and maintain appropriate management levels. The proposed gather would include removing excess wild horses from inside and outside the Muddy Creek HMA and treating mares with a fertility control vaccine.

This EA is a site-specific analysis of the potential impacts that could result from the implementation of the Proposed Action or alternatives to the Proposed Action. The EA assists the BLM PFO in project planning, ensuring compliance with National Environmental Policy Act (NEPA) and in making a determination as to whether "significant" impacts could result from the analyzed actions. An EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a statement of "Finding of No Significant Impact" (FONSI).

This document is tiered to the Price Field Office Resource Management Plan (PRMP)/Final EIS (RMP; 2008). Should a determination be made that implementation of the Proposed Action or alternative actions would not result in "significant environmental impacts" or "significant environmental impacts beyond those already addressed in the RMP/EIS and RMP Record of Decision" a FONSI would be prepared to document that determination and a Decision Record (DR) issued providing the rationale for approving the chosen alternative.

## 1.2 Background

Since the passage of the Wild Free-Roaming Horses and Burros Act (WFRHBA) of 1971, BLM has refined its understanding of how to manage wild horse population levels. By law, BLM is required to control any overpopulation, by removing excess animals, once a determination has been made that excess animals are present and removal is necessary. Program goals have always been to establish and maintain a "thriving natural ecological balance," which requires identifying the Appropriate Management Level (AML) for individual herds. In the past two decades, goals have also explicitly included conducting gathers and applying contraceptive treatments to achieve and maintain wild horse populations within the established AML, so as to manage for healthy wild horse populations and healthy rangelands. The use of fertility controls helps reduce total wild horse population growth rates in the short term, and increases gather intervals and the number of excess horses that must be removed from the range. Other management efforts include improving the accuracy of population inventories and collecting genetic baseline data to support genetic health assessments. Decreasing the numbers of excess wild horses

on the range is consistent with findings and recommendations from the National Academy of Sciences (NAS), American Horse protection Association (AHPA), the American Association of Equine Practitioners (AAEP), Humane Society of the United States (HSUS), Government Accountability Office (GAO), Office of Inspector General (OIG) and current BLM policy. BLM's management of wild horses must also be consistent with Standards and Guidelines for Rangeland Health.

Since 1992, approximately 516 wild horses have been gathered and removed from the Muddy Creek HMA. In 1995, 1999, 2000, 2001, 2008, and 2009 AML gathers were conducted in the HMA.

## 1.3 Appropriate Management Level

The Appropriate Management Level (AML) is defined as the number of wild horses that can be sustained within a designated HMA, which achieves and maintains a thriving natural ecological balance in keeping with the multiple-use management concept for the area. The AML was originally established for the San Rafael Planning unit which includes the Muddy Creek HMA as a population range of (75-125) wild horses in the San Rafael RMP ((SRRMP)1989, RMP-33). The 2008 Price Field Office RMP further defined that when it combined two Metapopulations; the original Muddy Creek HMA with the horse portion of the adjacent Sinbad HMA and set the AML at 75-125 head within the boundaries of the new Muddy Creek HMA(WHB-3, 4, 5, & 9, PRMP, P.87).

The estimated population of wild horses within the Muddy Creek HMA as of March 01, 2018 is 195 horses. This figure was calculated by adding a 15% foal increase to our April 2017 aerial population survey that was completed using the simultaneous-double count survey method[1]. This method is a form of mark-resight where three observers in an aircraft independently observe and record groups of wild horses. Sighting rates are estimated by comparing sighting records of the three observers. Those animals seen by one observer are the "marked" group and those that are also seen by the other observers are "resighted." The HMA was flown once with transects approximately one (1) mile or less apart. Photos of each band were not taken. The data has been statistically analyzed to estimate the number of wild horses (Appendix C). During ground inspections of water sources during the summer of 2017 records show that approximately 75 wild horses are staying on the McKay Flat area and approximately 40 horses are concentrating on the Link Flat area within the HMA.

The last gather of the Muddy Creek HMA occurred in July of 2009. At that time 86 wild horses were gathered, 86 removed and zero (0) released back to the range. Post-gather, estimates show that 75 wild horses with a sex ratio of 50/50 male to females remained within the HMA. Based on the most recent population inventory, the 2016 population estimation was low. Additional horses may occur in the herd area for several other reasons that include, but are not limited to the following: (1) wild horses may have been captured illegally by members of the public in other wild horse area and moved into this area (this illegal activity has been suspected in past years) and (2) domestic or estray horses may have been released into the HMA. During a gather conducted in 2009, a bay 2-year-old domestic gelding was gathered off the Muddy Creek HMA. In addition, BLM staff found a dead domestic horse that had been shot within the Muddy Creek HMA in 2009 (as identified by trimmed feet, bridle path and halter marks on head) prior to the gather. In February

[1] Estimate only includes horses one year of age or older, does not include foals born during the calendar year of the survey or after.

of 2014, three (3) domestic burros were illegally released just outside of the Sinbad HMA and were reported to the BLM. The Emery County Animal Control Officer removed these burros from public lands with assistance from the BLM. These are only a few cases throughout Utah where domestic horses or burros have been released onto public lands.

Table 1, Herd Management Area, Acres, AML, Estimated Population

| HMA | Total Acres | Appropriate Management Level | Estimated Population | % of AML | Removal |
|---|---|---|---|---|---|
| Muddy Creek HMA (March 01, 2018 | 283,400 | 75-125 | 195 | 156-260 | 70-120 |
| Muddy Creek HMA (end of Summer 2018) | 283,400 | 75-125 | 224* | 179-299 | 99-149 |

*This population estimate is based on adding 15% foal increase for 2017 (25 animals) & 2018 (29 animals) to the April 2017 population survey estimate.

Based upon all the information available at this time, the BLM has determined that 120 to 148 excess wild horses exist within the HMA (based on low end AML) and need to be removed beginning in 2018 in order to achieve the established AML, restore a thriving natural ecological balance, maintain multiple-use relationships, and prevent further degradation of rangeland resources resulting from the current overpopulation of wild horses. This assessment is based on the following factors including, but not limited to, the following:

- A population survey of wild horses in April 2017 showed the Muddy Creek HMA to have 170 adult wild horses, and by adding a 15% foal increase this number increases the estimated population to 195 horses (see Table 1 above).
- By Spring 2018 the use by wild horses would exceed the forage allocated for wild horses in that area by over 156%.
- By comparison, over the last 10 years livestock use has averaged 0% to 72% of that authorized depending on the allotment. With an overall average annual use of 51% (See Table 3, section 3.3.1)
- Utilization monitoring, completed in early summer of 2017, documents Moderate to Heavy utilization by wild horses on key forage species within the HMA. This monitoring data is on file within the BLM Price Field Office.
- BLM is not able to achieve the rangeland health standards for the public lands in and around the Muddy Creek HMA or ensure a thriving natural ecological balance without removing the excess wild horses.

## 1.4 Purpose and Need for the Proposed Action

The purpose of the Proposed Action is to remove excess wild horses from within and outside the HMA, to manage wild horses to achieve and maintain established AML ranges for the HMA and to reduce the wild horse population growth rate in order to prevent undue or unnecessary degradation of the public lands by protecting rangeland resources from

deterioration associated with an overpopulation excess wild horses within and outside the HMA, and to restore a thriving natural ecological balance and multiple use relationship on the public lands consistent with the provisions of Section 1333 (a) of the *Wild Free-Roaming Horses and Burros Act of 1971*.

The need for the Proposed Action is to protect rangeland resources and to prevent unnecessary or undue degradation of the public lands associated with excess populations of wild horses within the HMA and use of rangeland resources by horses outside the HMA boundaries.

## 1.5 Conformance with BLM Land Use Plan(s)

Plan Conformance: The proposed action and alternatives have been reviewed and found to be in conformance with one or more of the following BLM Land Use Plans and the associated decision(s):

Price Resource Management Plan (RMP) October 2008, which contains the following decisions that specifically apply to management of the Muddy Creek HMA:

- WHB-1; Manage populations for appropriate age and sex ratios, genetic viability, adaptability, and adoptability as well as to maintain AMLs on established HMAs
- WHB-2; Allow wild horse and burro research as long as other wild horse and burro program goals are met.
- WHB-3; HMA boundaries have been adjusted on the Range Creek, Muddy Creek and Sinbad HMAs to match the natural and manmade barriers that existed when the Wild Free-Roaming Horse and Burro Act was passed in 1971 that separate or restrict wild horse and burro movement.
- WHB-4; Wild horses and burros will be managed in three HMAs – Range Creek (horses), Muddy Creek (horses), and Sinbad (burros).
- WHB-5; The current portion of the Sinbad HMA that supports horses has been combined with the Muddy Creek HMA. The area of the Sinbad HMA that supports burros will remain the Sinbad HMA.
- WHB-7; The AML will be periodically evaluated and subject to adjustment in HMA plans and Environmental Assessments for gathers based on monitoring data and best science methods.
- WHB-9; Set management for a viable wild horse herd of 75 to 125 animals in the Muddy Creek HMA on 283,000 acres

The proposed action and alternatives are also consistent with the North San Rafael Swell Habitat Management Plan (NSRSHMP), approved in 1997.

The proposed action and alternatives are in conformance with the Fundamentals of Rangeland Health (43 Code of Federal Regulations (CFR) 4180) and Utah's Standards for Rangeland Health and Guidelines for Grazing Management which addresses watersheds, ecological conditions, water quality, and habitat for special status species.

## 1.6 Relationship to Statutes, Regulations, or other Plans

In conformance with the policy developed by the BLM's Utah State Director and approved by the Secretary of Interior, the Proposed Action Alternative would comply with the following:

Gathering excess wild horses complies with Public Law 92-195 (WFRHBA) as amended by Public Law 94-579; Federal Land Policy and Management Act (FLPMA), and Public Law 95-514 (Public Rangelands Improvement Act [PRIA] of 1978). WFRHBA, as amended, requires the protection, management, and control of wild free-roaming horses and burros on public lands. In addition, the preparation and transport of wild horses would be conducted in conformance with all applicable state statutes.

The Proposed Action is in conformance with all applicable regulations at 43 CFR 4700 and policies. The following are excerpts from 43 CFR relating to the protection, management, and control of wild horses under the administration of the BLM.

- **43 CFR 4700.0-2 Objectives**

Management of wild horses and burros as an integral part of the natural ecosystem of the public lands under the principle of multiple use.

- **43 CFR 4700.0-6(a-c) Policy**

Requires that BLM manage wild horses "…as self-sustaining populations of healthy animals in balance with other uses and the productive capacity of their habitat … consider comparably with other resource values …" while at the same time "…maintaining free-roaming behavior."

- **43 CFR 4700.06(e) Policy**

Healthy excess wild horses for which an adoption demand by qualified individuals exists shall be made available at adoption centers for private maintenance and care.

- **43 CFR 4710.3-1 Herd management areas.**

Herd management areas shall be established for the maintenance of wild horse and burro herds. In delineating each herd management area, the authorized officer shall consider the appropriate management level for the herd, the habitat requirements of the animals, the relationships with other uses of the public and adjacent private lands, and the constraints contained in 4710.4. The authorized officer shall prepare a herd management area plan, which may cover one or more herd management areas.

- **43 CFR 4710.4 Constraints on management.**

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

- **43 CFR 4720.1 Removal of excess animals from public lands.**

Upon examination of current information and a determination by the authorized officer that an excess of wild horses or burros exists, the authorized officer shall remove the excess animals immediately.

- **43 CFR 4740.1 Use of motor vehicles or aircraft.**

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

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

Section 106 of the National Historic Preservation Act requires federal agencies to determine the possible effects of their actions on historic properties (those archaeological or historic sites eligible for or listed on the National Register of Historic Places). See 36 CFR 800 for a description of this process.

The Proposed Action and alternatives are in conformance with Decision Records and Finding of No Significant Impacts for the EA#UT-067-94-29 Muddy HMA Wild Horse Gather, EA#UT-066-98-30 Muddy Creek Wild Horse Gather, EA#UT-070-2000-98 Sinbad Wild Horse Emergency Gather, DNA# UT-070-2008-082 Sinbad Emergency Wild Horse and Burro Gather, and EA# UTG022-2009-0076 Muddy Creek Wild Horse Gather 2009.

The proposed action and alternatives are in conformance with the Fundamentals of Rangeland Health (43 CFR 4180) and Utah's Standards for Rangeland Health and Guidelines for Grazing Management which addresses watersheds, ecological conditions, water quality and habitat for special status species.

The proposed action and alternatives are consistent with the Emery County General Plan update signed, May 2012, which generally supports multiple use-sustained yield concepts.

All federal actions must be reviewed to determine their probable effect on threatened and endangered plants and animals (the Endangered Species Act (ESA)).

Executive Order 13212 directs the BLM to consider the President's National Energy Policy and adverse impacts the alternatives may have on energy development.

The proposed action complies with the BLM Utah Riparian Management Policy (Instruction Memorandum [IM] UT-93-93, March 1993). This policy states that riparian areas will be maintained in or improved to "Proper Functioning Condition." In addition, the Proposed Action and No Action Alternative would comply with the following laws and agency regulations, other plans and are consistent with federal, state and local laws, regulations, and plans to the maximum extent possible.

- Taylor Grazing Act (TGA) of 1934
- FLPMA of 1976 (43 U.S.C. 1701 et seq.) as amended

- PRIA of 1978
- ESA of 1973, as amended
- Bald and Golden Eagle Protection Act of 1962
- BLM Manual 6840 – Special Status Species Management
- Migratory Bird Treaty Act
- Utah Comprehensive Wildlife Conservation Strategy (CWCS)
- Utah Partners in Flight Avian Conservation Strategy Version 2.0
- Birds of Conservation Concern 2002
- Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds
- IM 2008-50, Migratory Bird Treaty Act – Interim Management Guidance
- Protection, Management, and Control of Wild Free-Roaming Horses and Burros, Title 43 CFR 4700
- Standards of Quality for Waters of the State, R317-2-6, Utah Administrative Code, December, 1997.
- Utah BLM Riparian Management Policy (IM UT-93-93) of 1993
- National Environmental Policy Act of 1969, as amended
- American Indian Religious Freedom Act of 1979
- Archaeological Resource Protection Act of 1979
- National Historic Preservation Act of 1966, as amended
- Appropriations Act, 2001 (114 Stat. 1009) (66 Fed. Reg.753, January 4, 2001
- State of Utah Resource Management Plan, January 02, 2018

## 1.7 Decision to be Made

Based on the analysis presented in the EA, the authorized officer will select an alternative that meets the Purpose and Need for the Proposed Action. The BLM's authorized officer will decide whether to implement all, part, or none of the proposed action as described in section 2.2.1 to manage wild horses within the HMA. The authorized officer's decision would not adjust livestock use within the HMA, as this was set through previous decisions. The authorized officer's decision may set or adjust AML; select goals and objectives for management of wild horses within the Muddy Creek HMA; and select gather methods, timeframes of actions, and numbers of horses gathered, treated and released depending on the alternative or parts of any alternative chosen.

## 1.8 Scoping and Identification of Issues

The proposed action was reviewed by an interdisciplinary team composed of resource specialists from the PFO. This team identified resources within the Muddy Creek HMA, which might be affected and considered potential impacts using current office records and geographic information system (GIS) data. The result of the review is contained in the Interdisciplinary Team Checklist, Appendix A.

Consultation and coordination with BLM, State Historic Preservation Office (SHPO), the Utah Division of Wildlife Resources (UDWR), US Fish & Wildlife Service (USFWS), Native American Indian tribes and routine business contacts with livestock operators and

others, have underscored the need for the BLM to maintain wild horse and burro populations within the AML.

Public involvement was initiated on this Proposed Action on November 17, 2017 by posting on the ePlanning web page. The EA was made available to the public for a 30 day public comment period from April 20, 2018 until May 20, 2018 at the Price Field Office, on ePlanning and on-line at http://www.blm.gov/utah. A public notice was issued prior to the public comment period, which described the Proposed Action and solicited public input (see Appendix B). Refer to section 5.3, Public Involvement and Appendix J to see comments and interest from the public and organizations.

As required by regulation [43 CFR 4740.1(b)], a public hearing was held in the Fillmore BLM office for the State of Utah on December 12, 2017 discussing the use of helicopters and motorized vehicles in the management of Utah BLM's wild horses and burros.

The following issues were identified as a result of consultation/ coordination and internal scoping relative to the BLM's management of wild horses in the planning area:

### 1.8.1 Critical Elements of the Human Environment and other Resources/Areas of Concern

Identification of issues for this assessment was accomplished by considering the resources that could be affected by implementation of one of the alternatives, through involvement with the public and input from the BLM interdisciplinary team.

Critical elements of the human environment, as identified in BLM Handbook 1790-1, Appendix 5, must be considered. Resources within the project area that may be affected must also be discussed. Those critical elements of the human environment and resources which are not present, or are not affected by the Proposed Action or alternatives, are included as part of the Interdisciplinary team checklist (Appendix A). Rationale for dismissing specific resources or critical elements is also contained in Appendix A.

Those critical elements of the human environment and resources, which may be affected, by the Proposed Action and/or alternatives are carried forward throughout this analysis, and are discussed briefly as follows.

#### 1.8.1.1 Livestock Grazing

Portions of eleven (11) grazing allotments are part of the HMA. All of these allotments have livestock grazing privileges. All are cattle allotments (Lone Tree, Globe Link, South Sid & Charley, Mussentuchit, Last Chance, Red Canyon, Hondo, McKay Flat, Temple Mountain, Taylor Flat and Dry Wash). Overlap of areas of use between wild horses and livestock occurs on specific sites on all the allotments causing competition for forage, water, and forage resources. Yearlong wild horse grazing reduces forage availability for livestock. Grazing by excess wild horses during the critical growing season and during drought conditions can reduce forage production, vigor, reproduction, and availability for several years. Detailed information about the authorized livestock use within the HMA is provided in Term Grazing Permit Renewal EAs for these allotments.

### 1.8.1.2 Vegetation

Drought conditions in 2000, 2002, 2003, 2008, and 2012 have reduced forage production in some of the key wild horse habitat areas. Although livestock numbers were reduced and/or completely removed from the pastures of the allotments in the Muddy Creek HMA during these years excess wild horses overgrazed many areas during critical growth periods. This, along with the reduced vigor of the plants because of drought, caused mortality of key forage species throughout the HMA. Inadequate residual vegetation (forage) and litter remaining on certain key use areas allowed soil loss and erosion. As of June 24, 2017, the Palmer Drought Severity Index placed the entire Price Field Office in Extreme Drought. Utilization completed June 02, 2017 showed heavy use within 1 mile of water sources used by wild horses. The use on vegetation on the rest of the HMA ranges from light to moderate. These use levels normally occur on the HMA at the end of the summer and not the beginning.

### 1.8.1.3 Wild Horses and Burros

Rangeland resources and wild horse health have been and are currently being affected within the Muddy Creek HMA due to drought and overpopulation. The overpopulation of wild horses has reduced available water and forage, resulting in increased competition for available resources. The gather and removal of wild horses from the Muddy Creek HMA would have direct and indirect impacts to individual animals and the social structure of bands in the area.

Most impacts would be short term (under 1 year), but some would be long term (greater than a year). The following issues have been identified and will be discussed within this EA.

1. Sustainability of Healthy Populations of wild horses:
    - Adjustment of sex ratio to "natural" percentages
    - Age Distribution
    - Genetic mix (diversity)
    - Population control
    - Gather and Handling Methods
2. Impacts to individual wild horses and the herd. Measurement indicators for this issue include:
    - Projected population size and annual growth rate (Win Equus population modeling);
    - Expected impacts to individual wild horses from stress due to handling; darting stress
    - Expected impacts to herd social structure;
    - Expected effectiveness of proposed fertility control applications;
    - Potential effects to genetic diversity; and
    - Potential impacts to animal health and condition.

## 1.9 Issues Considered But Not Addressed Further

### 1.9.1 Cultural Resources

Previous review for Cultural Resources within the Muddy Creek HMA was completed for the 1995(EA#UT-067-94-29), 1999(EA#UT-066-98-30), 2000(EA#UT-070-2000-98), 2008(DNA# UT-070-2008-082), and 2009(EA# UTG022-2009-0076) wild horse gathers with appropriate consultation and NEPA, as well as the Lone Tree Allotment Grazing Permit Renewal (EA# UT-070-2005-021), and the Taylor Flat Allotment Grazing Permit Renewal (EA# UT-070-2007-016).

Prior to their use, each site (trap location, temporary holding facility, or camp location) would receive a class 3 cultural clearance. If during the course of the clearance, it is determined that there are cultural resource concerns, an alternate site would be chosen. There are one campsite, three trap locations and one temporary holding facility at present that have previously been cleared for Cultural Resources and used. If during the course of the gather a new trap location is determined to be needed a class 3 cultural clearance would be completed prior to use.

## 1.10 Summary

This chapter has presented the Purpose and Need of the proposed project, as well as the relevant issues, i.e., those elements that could be affected by the implementation of the proposed project. In order to meet the purpose and need of the proposed project in a way that resolves the issues, the BLM has developed a range of action alternatives. These alternatives, as well as a no action alternative, are presented in Chapter 2. The potential environmental impacts or consequences resulting from the implementation of each alternative are then analyzed in Chapter 4 for each of the identified issues.

# 2.0 Proposed Action and Alternatives

## 2.1 Introduction

This section of the EA describes the Proposed Action and alternatives, including any that were considered but eliminated from detailed analysis. Alternatives analyzed in detail include the following:

Alternative 1: No Action – Continue Existing Management. No Gather and Removal.

Alternative 2: Proposed Action – Selective Removal of excess horses to within AML range while maintaining a breeding population. Implement population growth suppression including sex ratio adjustment to reduce the annual population growth and maintain the population level at AML, once achieved for a 10-year period.

Alternative 3: Gather and Remove Excess Animals to within AML range without Population Growth Suppression or Sex Ratio Adjustment. Maintain the population level at AML once achieved for a 10-year period.

The Action Alternatives were developed to achieve and maintain the established AML so as to ensure a thriving natural ecological balance, remove excess wild horses from the range, prevent further deterioration to the range, and ensure the long-term health of wild horses within the HMA. Fertility control treatments and adjustments to the sex ratios when releasing animals would slow population growth. The No Action Alternative would not achieve the identified Purpose and Need; however, it is analyzed in this EA to provide a basis for comparison with the other action alternatives, and to assess the effects of not conducting a gather at this time.

## 2.2 Description of Alternatives Considered in Detail

### 2.2.1 Proposed Action and Alternatives

#### *Alternative 1: No Action Alternative – Continue Existing Management/No Gather and Removal*

Under this Alternative, the HMA would continue to be managed as it is now, including maintenance of an AML range of 75-125 animals. The HMA would continue to be managed under the objectives of the Price RMP and current regulations and policies. No additional objectives specific to the management of wild horses within the Muddy Creek HMA would be adopted or undertaken. Management would continue as follows:

- The sex ratio of animals released back to the range following future gathers will continue to be approximately 50% males and 50% females.

- Studies to determine and monitor mortality, age structure, sex ratio, productivity, population growth rate, habits, and movements will be continued
- Existing monitoring including utilization, forage condition, water availability, animal health, and periodic population census and sampling for genetic diversity would continue.
- AML would be adjusted, as needed.
- Fertility control would not be applied to animals released back to the range following future gathers.

## *Alternative 2: Proposed Action – Selective Removal of excess horses to within AML range and Implementation of Population Growth Suppression.*

The Proposed Action would gather and remove approximately 66% of the existing wild horses (approximately 148 animals—includes 2018 foal increase—in the initial gather) and return periodically to gather excess wild horses to maintain AML and administer or booster population control measures to the other gathered horses over a period of ten years from the date of the initial gather operation. After the initial gather, the target removal number would be adjusted accordingly based off population inventories for the HMA and the resulting projection of excess animals over AML. The principal management goal for the HMA would be to retain a core breeding population of 75 wild horses, which is the low end of AML. To help reduce population growth rates, the population would be managed to achieve a 60% male sex ratio and all mares released back to the HMA would be treated with fertility control vaccine (PZP-22, GonaCon$^{TM}$ or most current formulation). Fertility Control and sex ratio adjustment would not be implemented under the proposed action until the HMA is within AML. The combination of these actions should lower the population growth rate within the HMA.

Selective removal procedures would prioritize removal of younger excess wild horses after achieving AML within the HMA, and allow older less adoptable wild horses to be released back to the HMA. At the AML level established for the HMA and based on known seasonal movements of the horses within the HMA, sufficient genetic exchange should occur to maintain the genetic health of the population.

However, if gather efficiencies during the initial gather do not allow for the attainment of the Proposed Action during the initial gather (i.e., not enough horses are successfully captured to reach low AML), the Price Field Office (PFO) would return to the Muddy Creek HMA to remove excess horses above low AML and would conduct follow-up gathers over a 10 year period to remove any additional wild horses necessary to achieve and maintain the low range of AML as well as to allow BLM to gather a sufficient number of wild horses so as to implement the population control component of the proposed action for wild horses remaining in the HMA.

If gather efficiencies of the initial gather exceed the target removal number of horses necessary to bring the population within the AML range of 75-125 wild horses during the

initial gather, this would allow the BLM to begin implementing the population control components (PZP-22, GonaCon™ or most current formulation) of this alternative with the initial gather. Population inventories and routine resource/habitat monitoring would be completed between gather cycles to document current population levels, growth rates, and areas of continued resource concern (horses concentrations, riparian impacts, over-utilization, etc.) prior to any follow-up gather. The subsequent maintenance gather activities would be conducted in a manner consistent with those described for the initial gather and could be conducted during the period which provides maximum effectiveness for fertility control application. Funding limitations and competing priorities might impact the timing of maintenance gather and population control components of the Proposed Action.

The PFO also proposes to apply fertility control to select mares through the use of a single dose inoculation and the delivery system using dart guns. This would be done on the Muddy Creek HMA, through 2028 (or as long as it can be reasonably concluded that no new information and no new circumstances have substantially changed in the area of analysis) in order to help maintain adult wild horses within the AML range of 75-125 wild horses. If it is determined that a mare or mares cannot be approached within darting range on foot, then baiting would be used to invite the horses to within darting distance for treatment. Baiting would be with water, salt, mineral, or weed free hay in areas that horses utilize in their normal movements throughout the HMA. Horses may need to be trapped at bait stations, which would enable them to be darted and then released.

The expectations for the proposed action include: the short term goal is to bring growth rates to less than seven percent and the long-term goal is to reduce the need for gathers and removals, without jeopardizing the genetic health of the population.

Under the Proposed Action, a sufficient number of wild horses would be gathered from heavily concentrated areas within the project area to reduce resource impacts and all wild horses residing in areas adjacent to the HMA (outside-established boundaries) would be gathered and removed. Fertility control (PZP-22, GonaCon, most current formulation or other approved adjuvant) would be applied to all released mares to decrease the future population growth rate. It is anticipated that relatively few mares (10-20) would be treated with the first gather. The procedures to be followed for implementation of fertility control are discussed below and detailed in Appendix F. Stallions would be selected for release to adjust the sex ratio of the population to 60% male sex ratio. Every 4-5 years 1-3 studs or mares from a different HMA (or metapopulation within the HMA), with similar or desired characteristics of the horses within the Muddy Creek HMA would be released to maintain the genetic health on the HMA. All horses identified to remain in the HMA population would be selected to maintain a diverse age structure, herd characteristics and body type (conformation).

## Management Actions for Alternative 2 (Proposed Action) – With reference to Population Growth Suppression.

*BLMs Use of Contraception in Wild Horse Management*

Expanding the use of population growth suppression to slow population growth rates and reduce the number of animals removed from the range and sent to off-range pastures (ORPs) is a BLM priority. The WFRHBA of 1971 specifically provides for contraception and sterilization (section 3.b.1). No finding of excess animals is required for BLM to pursue contraception in wild horses or wild burros. Contraception has been shown to be a cost-effective and humane treatment to slow increases in wild horse populations or, when used with other techniques, to reduce horse population size (Bartholow 2004, de Seve and Boyles-Griffin 2013). All fertility control methods in wild animals are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception by itself does not remove excess horses from an HMA's population, so if a wild horse population is in excess of AML, then contraception alone would result in some continuing environmental effects of horse overpopulation. Successful contraception reduces future reproduction. Limiting future population increases of horses could limit increases in environmental damage from higher densities of horses than currently exist. Horses are long-lived, potentially reaching 20 years of age or more in the wild and, if the population is above AML, treated horses returned to the HMA may continue exerting negative environmental effects, as described in section 3.3.2 throughout their life span. In contrast, if horses above AML are removed when horses are gathered, that leads to an immediate decrease in the severity of ongoing detrimental environmental effects.

Successful contraception would be expected to reduce the frequency of horse gather activities on the environment, as well as wild horse management costs to taxpayers. Bartholow (2007) concluded that the application of 2 or 3-year contraceptives to wild mares could reduce operational costs in a project area by 12-20%, or up to 30% in carefully planned population management programs. He also concluded that contraceptive treatment would likely reduce the number of horses that must be removed in total, with associated cost reductions in the number of adoptions and total holding costs. If applying contraception to horses requires capturing and handling horses, the risks and costs associated with capture and handling of horses may be comparable to those of gathering for removal, but with expectedly lower adoption and long-term holding costs. Population suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000). Selectively applying contraception to older animals and returning them to the HMA could reduce long-term holding costs for such horses, which are difficult to adopt, and could reduce the compensatory reproduction that often follows removals (Kirkpatrick and Turner 1991). On the other hand, selectively applying contraception to younger animals can slow the rate of genetic diversity loss – a process that tends to be slow in a long-lived animal with high levels of genetic diversity – and could reduce growth rates further by delaying the age of first parturition (Gross 2000). Although contraceptive treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, detailed below, those concerns do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013).

The literature review is intended to summarize what is known and what is not known about

potential effects of treating mares with porcine zona pellucida (PZP) vaccine and GonaCon (GnRH). As noted below, some negative consequences of vaccination are possible. Fertility vaccines are administered only to females.

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

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

Alternative 2 (Proposed Action) incorporates the following actions and management requirements:

- Fertility control treatment would be conducted in accordance with the approved standard operating and post-treatment monitoring procedures. Breeding age mares selected for release back to the range would be treated with approved fertility control vaccines, which would slow reproduction of the treated mares for one to three breeding seasons.
- Any new fertility controls could be used as directed through the most recent direction of the National Wild Horse and Burro Program. The use of any new fertility controls would use the most current best management practices and humane procedures available for the implementation of the new controls.
- PZP mixing procedures would follow those listed in Appendix G. The PZP protocol would be examined annually, in line with any new instructions provided by SCC. The field use of GnRH does not require mixing of the adjuvant.
- Horse Immunocontraception Data Sheets would be prepared and updated as presented in Appendix H. An individual mare's previous records would be reviewed prior to any darting activity.
- Mares would be individually marked and/or be individually recognizable without error. No mares would be treated unless she has been identified for treatment.
- Fertility control would be administered once AML is reached and go through the life of the plan. If monitoring shows successful applications, no negative reactions and reduction in foaling rates, the fertility control treatments would continue beyond the life of the plan as long as it can be reasonably concluded that no new information and no new circumstances arise that need to be considered and those that are analyzed within this document have not substantially changed within the HMA. Fertility control applications would also depend on annual funding and the presence of qualified applicators.
- Ideal time to booster previously treated mares would be between February through April of each year. However, if a previously treated mare is missed, a booster shot could be administered at any time of the year. Each mare would have an identification sheet with pictures, describing any markings, brands, scars, or other distinguishing marks. At the beginning of each year, a list of mares identified for

treatment would be created. That information would be loaded into a format that is easy to use in the field (book or electronic device).

- New mares (over the age of 18 months) coming into treatment would be given the primer dose between November and January of each year. New mares would receive their booster between February and April. Age would be based on when the horses are observed being new herd foals. For older previously treated horses, it would come from the treatments data sheets. Aging older untreated horses would be based off of photographs or similar documentation provided by volunteers knowledgeable of the herd/bands. For an age of a mare that cannot be established that mare would be allowed to raise a foal to one year of age then begin treatment.
- Primer inoculations would be administered to mares that are at least 18 months old. Mares that are 2-4 years old would be treated. The 5 year old mares would be taken off the treatment schedule until they have produced at least one foal that lives to be one year old. After a mare produces one foal that survives for a year, she would be put back on fertility control treatments.
- Flexibility in determining which mares are selected for treatment is vital to the success of the fertility control program. Adjustments would be made if it is found that there is a severe reaction by an individual mare, that mare can contribute more to genetic diversity or a mare that might have a negative effect to the genetic diversity of the herd. This information would be documented on the Data Sheet.
- If timing or funding constraints arise, a treatment priority would consider the band or herd composition and priority would be given based on age class.
  Priorities would be established as follows:
  1) 2-4 year old mares,
  2) mares just coming back into treatment , and
  3) older mares that have received several treatments since producing a live foal.
- The annual treatment schedule, database and Data Sheets would be reviewed/approved by the authorized officer with the PFO wild horse specialist and/or darting specialist. An annual monitoring report would be prepared for the authorized officer and filed with the HMA records. This monitoring report would show PZP/GnRH orders placed/ costs, planned treatment schedule/actual treatments (number/dates of mares treated), lost darts, negative reactions/BLM action taken for that mare, number of new/current year foals counted/observed, unique circumstances, off road vehicular use, general rangeland condition/water availability, volunteer efforts, correspondence between/among SLFO and the Science and Conservation Center (SCC) and National Wild Horse and Burro Program (WH&B) Office and other pertinent information.

The field darting treatment protocol would take approximately two to three years after initiation to fully implement. Field darting would be conducted in an opportunistic manner while the specialist is conducting routine monitoring activities as part of normal duties in the field. Ordinarily, field darting activities would be conducted on foot. Access throughout the HMA would be achieved by use of 4X4 vehicles and other off-highway vehicles (OHVs). Vehicles would be utilized on existing roads and trails in the HMA. On a case by case basis, the use of OHVs off existing roads and trails may be allowed for administrative purposes; however such use shall be made only with the approval of the authorized officer.

Personnel authorized for field darting of the Muddy Creek horses must be trained for this task and certified by the SCC at Zoo Montana in Billings Montana. Additionally, all work would be conducted in accordance with the SOPs (Appendix F) and mixing procedures (Appendix G).

The PFO would work with the National WH&B Office in Reno, Nevada, and the SCC at Zoo Montana to order the PZP vaccine. The SCC then prepares and ships the order to the PFO. Each dose would consist of 100 micrograms of PZP in 0.5cc buffer (a phosphate buffered saline solution). Mixing the vaccine would be accomplished as described in the Wild Horse Contraceptive Training Manuel (mixing procedures in Appendix G). Remote application would be by means of 1.0cc Pneu-dart darts, with either 1.25 or 1.5 inch barbless needles, delivered by either Dan-inject or Pneu-dart CO2 powered or cartridge fired guns.

The PFO would work with the National WH&B Office in Reno, Nevada and the USDA to order the GnRH vaccine. The USDA would then prepare and ship the order to the PFO. Each dose of GonaCon (GnRH) would consist of 2 ml of liquid GonaCon, including 0.032% if mammalian GnRH. No mixing of the vaccine is required. Remote application would be by means of 'Slo-inject' TM Pneu-Dart darts, equipped with 3.81 cm 14 gage Tri-Port needles and a gel collar (McCann et al. 2007), delivered by either Dan-inject or Pneu-dart CO2 powered or cartridge fired guns. An attempt would be made to recover all darts (normally about a 98% recovery is expected).

PFO would be applying adaptive management principles. If policies change or the vaccine effects or effectiveness proves undesirable, then the application of the fertility control measures would be stopped, or reconsidered based on new scientific information. If a specific adjuvant is dropped from BLM use and is replaced by another drug or immunization for fertility control purposes, that method would be applied by the PFO in future treatments.

*Horse Identification*

The treated mares would be individually marked and/or be individually recognizable without error. During past treatments, mares have been freeze branded on the hip and the neck. These brands would help in the identification of the horses. During any future gathers, new brands would be put on mares released back to the HMA. Color, leg and face markings, and any other unique markings or scars would identify any mares without a brand. Once each horse is positively identified, their information would be compiled into a database along with photographs. Individual identification information (photographs and unique characteristics) would be compiled into books or put onto an electronic device that can be taken to the field. Individual numbers are assigned to each herd/band member based on these unique characteristics. Unique numbers would be assigned to all mares and documented on the Data Sheets. A filly under 18 months would be tracked on her mother's Data Sheet. A filly over 18 months of age would receive her own number and Data Sheet. Maternal kinship would be tracked or followed through Data Sheet notes.

*Record Keeping*

All darting, foaling, and health data would be recorded as per the Data Sheet (Appendix H). Data Sheets would be prepared and maintained in the PFO. Initially, copies of the data sheets would be sent to the National WH&B Program Office and to the SCC. Thereafter, only treatment updates or new mare Data Sheets would be sent annually.

*Regulatory Authorization*
The liquid PZP vaccine, known as ZonaStat-H is federally approved by the EPA registration number 86833–1. Training is required by the SCC to receive and/or administer PZP to wild horses.

The liquid GonaCon (GnRH) vaccine, known as GonaCon-Equine, is federally approved by the EPA registration number 56228-41. No specific training is required to administer GonaCon to wild horses, though a certified pesticide handler does need to receive shipments of the drug.

## *Alternative 3: Gather and Removal of excess without Population Growth Suppression or Sex Ratio Adjustment*

Under this Alternative, once BLM has met its objective of removing approximately 148 excess wild horses (including 2018 foal increase) the gather would conclude. Maintenance gathers would be required over the next ten years to keep population within the AML range as the population increases and again exceeds AML. There would be no use of population growth suppression measures taken for the wild horses remaining in the HMA. All wild horses residing outside the Muddy Creek HMA would be gathered and removed. All the wild horses would be transported to BLM holding facilities where they would be prepared for adoption and/or sale to qualified individuals who can provide them with a good home or to long term pastures or for any other disposition authorized by law. These actions would be the same as in the proposed action.

The Muddy Creek HMA would continue to be managed in accordance with the Price Resource Management Plan, current policies and regulations.

## Management Actions Common to Alternatives 2 & 3 for Gather and Removal

- Gather operations would be conducted in accordance with BLM Washington Office Instruction Memorandum (IM) 2015-151 and the Comprehensive Animal Welfare Program (CAWP) described in Appendix D. Previously used and authorized capture techniques include helicopter round up, roping, water and bait trapping, and other methods as approved by BLM Handbook H-4700-1 and the authorized officer, and would include multiple gather sites. Selection of capture techniques would be based on several factors including herd health and season of the year to maximize gather success and minimize herd impacts. Prior to their use, each site would receive a class 3 cultural clearance. If during the course of the clearance, it

is determined that there are cultural resource concerns, an alternate site would be chosen. To the extent possible, previously used and cleared sites would be selected.

- 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 operations. Included in the "capture and removal" operations would be sorting individual horses as to their age, sex, temperament and /or physical condition, and to return selected animals to the range.

- During gather operations, the Lead Contracting Officers Representative (COR), as delegated by the Authorized Officer (AO) prior to the gather, would authorize the release or euthanasia of any wild horse that they believe would not tolerate the handling stress associated with transportation, adoption preparation, or holding. No wild horse should be released or shipped to a preparation or other facility with a preexisting condition that requires immediate euthanasia as an act of mercy. The Incident Commander (IC) or COR should, as an act of mercy and after consultation with the on-site veterinarian, euthanize any animal that meets any of the conditions described in BLM Washington Office IM 2015-070.

- Wild horse herd data which may be collected during the gather operations includes data to determine population characteristics (age/sex/color/etc.), assess herd health (pregnancy/parasite loading/physical condition/etc.), and determine herd history and genetic profile (hair sampling, IM 2009-062).

- Best Management Practices would be followed prior to and during gather operations. All vehicles and equipment should be free of mud and debris prior to entering BLM administered lands, and weed free hay would be used in trap sites and temporary holding facilities located on BLM-administered lands.

- Selective removal procedures would prioritize removal of younger excess wild horses after achieving AML within the HMA, and allow older less adoptable wild horses to be released back to the HMA.

Additional design features are described in Appendix E. Standards from the Comprehensive Animal Welfare Program for wild horse and burro gathers are contained in Appendix D.

## Helicopter

If the local conditions require a helicopter drive-trap operation, the BLM would use a contractor or in-house gather team to perform the gather activities in cooperation with BLM and other appropriate staff. The contractor would be required to conduct all helicopter operations in a safe manner and in compliance with Federal Aviation Administration (FAA) regulations 14 CFR § 91.119 and BLM IM No. 2010-164.

Helicopter drive trapping involves use of a helicopter to herd wild horses into a temporary trap. The CAWP (Appendix D) would be implemented to ensure that the gather is conducted in a safe and humane manner, and to minimize potential impacts or injury to the wild horses. Traps would be set in an area with high probability of access by horses using the topography, if possible, to assist with capturing excess wild horses residing within the area. Traps consist of a large catch pen with several connected holding corrals, jute-covered wings and a loading chute. The jute-covered wings are made of material, not wire, to avoid injury to the horses. The wings form an alley way used to guide the horses into the trap. Trap locations are changed during the gather to reduce the distance that the animals must travel. A helicopter is used to locate and herd wild horses to the trap location. The pilot uses a pressure and release system while guiding them to the trap site, allowing them to travel at their own pace. As the herd approaches the trap the pilot applies pressure and a prada horse is released guiding the wild horses into the trap. Once horses are gathered they are removed from the trap and transported to a temporary holding facility where they are sorted.

If helicopter drive-trapping operations are needed to capture the targeted animals, BLM would assure that an Animal and Plant Health Inspection Service (APHIS) veterinarian or contracted licensed veterinarian is on-site during the gather to examine animals and make recommendations to BLM for care and treatment of wild horses. BLM staff would be present on the gather at all times to observe animal condition, ensure humane treatment of wild horses, and ensure contract requirements are met.

## Bait/Water Trapping

Bait and/or water trapping may be used if circumstances require it or best fits the management action to be taken. Bait and/or water trapping generally require a longer window of time for success than helicopter drive trapping. 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/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 acclimation of the horses creates a low stress trapping method. During this acclimation period the horses would experience some stress due to the panels being setup and perceived access restriction to the water/bait source.

When actively trapping wild horses, the trap would be staffed or checked on a daily basis by either BLM personnel or authorized contractor staff. Horses would be either removed immediately or fed and watered for up to several days prior to transport to a holding facility. Existing roads would be used to access the trap sites.

Gathering excess horses using bait/water trapping could occur at any time of the year and traps would remain in place until the target number of animals are removed. Generally,

bait/water 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 bait and/or water trapping in this area is a low stress approach to gathering wild horses, such trapping can continue into the foaling season without harming the mares or foals.

## Gather Related Temporary Holding Facilities (Corrals)

Wild horses that are gathered would be transported from the gather sites to a temporary holding corral in goose-neck trailers. At the temporary holding corral, wild horses would be sorted into different pens based on sex. The horses would be aged and provided good quality hay and water. Mares and their un-weaned foals would be kept in pens together. At the temporary holding facility, a veterinarian, when present, would provide recommendations to the BLM regarding care and treatment of the recently captured wild horses. Any animals affected by a chronic or incurable disease, injury, lameness or serious physical defect (such as severe tooth loss or wear, club foot, and other severe congenital abnormalities) would be humanely euthanized using methods acceptable to the American Veterinary Medical Association (AVMA).

## Transport, Off-range Corrals, and Adoption Preparation

All gathered wild horses would be removed and transported to BLM holding facilities where they would be inspected by facility staff and if needed a contract veterinarian to observe health and ensure the animals are being humanely cared for.

Those wild horses that are removed from the range and are identified to not return to the range would be transported to the receiving off-range corrals (ORC, formerly short-term holding facility) in a goose-neck stock trailer or straight-deck semi-tractor trailers. Trucks and trailers used to haul the wild horses would be inspected prior to use to ensure wild horses can be safely transported. Wild horses would be segregated by age and sex when possible and loaded into separate compartments. Mares and their un-weaned foals may be shipped together. Transportation of recently captured wild horses is limited to a maximum of 12 hours.

Upon arrival, recently captured wild horses are off-loaded by compartment and placed in holding pens where they are provided good quality hay and water. Most wild horses begin to eat and drink immediately and adjust rapidly to their new situation. At the off-range corral, a veterinarian provides recommendations to the BLM regarding care, treatment, and if necessary, euthanasia of the recently captured wild horses. Wild horses in very thin condition or animals with injuries are sorted and placed in hospital pens, fed separately and/or treated for their injuries.

After recently captured wild horses have transitioned to their new environment, they are prepared for adoption, sale, or transport to Off-Range pastures. Preparation involves freeze-marking the animals with a unique identification number, vaccination against

common diseases, castration, and de-worming. At ORC facilities, a minimum of 700 square feet of space is provided per animal.

## Adoption

Adoption applicants are required to have at least a 400 square foot corral with panels that are at least six feet tall. Applicants are required to provide adequate shelter, feed, and water. The BLM retains title to the horse for one year and inspects the horse and facilities during this period. After one year, the applicant may take title to the horse, at which point the horse becomes the property of the applicant. Adoptions are conducted in accordance with 43 CFR Subpart 4750.

## Sale with Limitations

Buyers must fill out an application and be pre-approved before they may buy a wild horse. A sale-eligible wild horse is any animal that is more than 10 years old or has been offered unsuccessfully for adoption at least three times. The application also specifies that buyers cannot sell the horse to slaughter buyers or anyone who would sell the animals to a commercial processing plant. Sales of wild horses are conducted in accordance with the 1971 WFRHBA and congressional limitations.

## Off-Range Pastures

When shipping wild horses for adoption, sale, or Off-Range Pastures (ORPs) the animals may be transported for up to a maximum of 24 hours. Immediately prior to transportation, and after every 24 hours of transportation, animals are offloaded and provided a minimum of 8 hours on-the-ground rest. During the rest period, each animal is provided access to unlimited amounts of clean water and two pounds of good quality hay per 100 pounds of body weight with adequate space to allow all animals to eat at one time.

Mares and sterilized stallions (geldings) are segregated into separate pastures, except at one facility where geldings and mares coexist. Although the animals are placed in ORP, they remain available for adoption or sale to qualified individuals; and foals born to pregnant mares in ORP are gathered and weaned when they reach about 8-12 months of age and are also made available for adoption. The ORP contracts specify the care that wild horses must receive to ensure they remain healthy and well-cared for. Handling by humans is minimized to the extent possible although regular on-the-ground observation by the ORP contractor and periodic counts of the wild horses to ascertain their well-being and safety are conducted by BLM personnel and/or veterinarians.

## Euthanasia or Sale without Limitations

Under the WFRHBA, healthy excess wild horses can be euthanized or sold without limitation if there is no adoption demand for the animals. However, while euthanasia and sale without limitation are allowed under the statute, these activities have not been permitted under current Congressional appropriations for over a decade and are consequently inconsistent with BLM policy. If Congress were to lift the current appropriations restrictions, then it is possible that excess horses removed from the HMA over the next 10 years could potentially be euthanized or sold without limitation consistent with the provisions of the WFRHBA.

Any old, sick or lame horses unable to maintain an acceptable body condition (greater than or equal to a Henneke BCS of 3) or with serious physical defects would be humanely euthanized either before gather activities begin or during the gather operations. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy (Washington Office Instruction Memorandum (WO IM) 2015-070 or most current edition). Conditions requiring humane euthanasia occur infrequently and are described in more detail in Washington Office Instruction Memorandum 2009-041.

### Public Viewing Opportunities

Opportunities for public observation of the gather activities on public lands would be provided, when and where feasible, and would be consistent with WO IM No. 2013-058 and the Visitation Protocol and Ground Rules for Helicopter WH&B Gathers. This protocol is intended to establish observation locations that reduce safety risks to the public during helicopter gathers. Due to the nature of bait and water trapping operations, public viewing opportunities may only be provided at holding corrals.

## 2.3 Alternatives Considered But Eliminated From Further Analysis

### Provide Supplemental Feed and Water

Providing supplemental feed (hay) or hauling water (other than during a short-term emergency situation) does not meet the definition of minimum feasible management and is inconsistent with current law, regulation and policy. Refer to 43 CFR 4710.4.

### Manage the Entire Population as a Non-Breeding Population of Geldings

One possible management alternative which has been suggested is to manage the Muddy Creek HMA in its entirety as a non-breeding population of geldings. This alternative could require a land use plan amendment or other possible regulatory changes. Therefore, it was not analyzed in detail at this time.

### Return the HMA to Herd Area Status with Zero AML

Another alternative which has been suggested is to return the Muddy Creek HMA to Herd Area status and establish the AML as "0" animals. This suggestion is made because the limited naturally occurring (undeveloped) water available to the Muddy Creek HMA wild horse population is not adequate to maintain the population in a thriving natural ecological balance and multiple use relationship without the need for continued supplementation during drought. With continued maintenance or reconstruction of the existing water developments, the available water is expected to be adequate to support a population of 75-125 animals and possibly more. Therefore this alternative was not considered in detail.

### Remove or Reduce Livestock within the HMA

This alternative would involve no removal of wild horses and instead address the excess wild horse numbers through the removal or reduction of livestock within the HMA. This

alternative was not brought forward for detailed analysis because it is outside of the scope of the analysis, is inconsistent with both the Price RMP and the WFRHBA, which directs the Secretary to immediately remove excess wild horses, and is inconsistent with multiple use management. Livestock grazing can only be reduced following the process outlined in the regulations found at 43 CFR Part 4100. Several reductions and changes have been made to livestock grazing within allotments associated to the Muddy Creek HMA through this process. The elimination of livestock grazing in an area would require an amendment to the Price RMP. Such changes to livestock grazing cannot be made through a wild horse gather decision.

Livestock permit renewals were completed from 2003 – 2010 on the allotments within and adjacent to the Muddy Creek HMA. Each of these renewals had Environmental Assessments and Decision Records completed. These decisions established stocking rates for livestock. The decisions also 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, salting and herding practices. Livestock grazing continues to be evaluated for allotments and use areas within the Muddy Creek HMA. Monitoring and evaluation of livestock grazing is in accordance with the Price RMP's Livestock Grazing Section, which states:

> GRA-1 Manage grazing and rangeland health according to the *Standards for Rangeland Health and Guidelines for Grazing Management for BLM Lands in Utah*, and in 43 CFR 4100 et seq. based on historical use and dependent on the availability of forage and water.
>
> GRA-2 Based on Taylor Grazing Act guidance that directs that public "land and its resources must be preserved from destruction or unnecessary injury," temporarily adjust forage allocations as needed during periods of forage depletion caused by severe drought or other natural causes such as fire. Additional guidance is found in the *Standards for Rangeland Health and Guidelines for Grazing Management for BLM Lands in Utah*. During times when extreme climatic conditions exist, the BLM will manage and adjust grazing practices to maintain and work toward meeting Standards for Rangeland Health for Public Lands in the PFO, see Appendix R-7.
>
> GRA-3 Base changes in levels of use or continuance of permitted use on current laws, policy, and monitoring data, analysis in accordance with NEPA. The analysis process will consider LUP program decision objectives and priorities in relation to livestock grazing and achievement of *Standards for Rangeland Health* on a case-by-case basis.

The BLM is currently authorized to remove livestock from the HMA, "if necessary to provide habitat for wild horses or burros, to implement herd management actions, or to protect wild horses or burros from disease, harassment or injury" under CFR 4710.5. This authority is usually applied in cases of emergency and not for general management of wild horses or burros in a manner that would be inconsistent with the land-use plan and the separate decisions establishing the appropriate levels of livestock grazing and wild horse

use, respectively. Available data also indicates that wild horse use – including where livestock use has been excluded – has resulted in excessive vegetative utilization.

## Gather the HMA to the AML Upper Limit

A post-gather population size at the upper level of the AML range would result in the AML being exceeded with the next foaling season. This would be unacceptable for several reasons.

The AML represents "that 'optimum number' of wild horses which results in a thriving natural ecological balance and avoids a deterioration of the range" (Animal Protection Institute, 109 Interior Board of Land Appeals (IBLA) 119; 1989). The IBLA has also held that, "Proper range management dictates removal of horses before the herd size causes damage to the rangeland. Thus, the optimum number of horses is somewhere below the number that would cause resource damage" (Animal Protection Institute, 118 IBLA 63, 75; 1991).

The upper level of the AML established within the HMA represents the maximum population for which thriving natural ecological balance would be maintained. The lower level represents the number of animals to remain in the HMA following a wild horse gather, in order to allow for a periodic gather cycle, and to prevent the population from exceeding the established AML between gathers.

Additionally, gathering to the upper range of AML would result in the need to follow up with another gather within one year (with resulting stress on the wild horse population), and could result in overutilization of vegetation resources and damage to the rangeland if the BLM is unable to gather the excess horses in the HMA on an annual basis. This alternative would not reduce the wild horse population growth rate of 20% in the Muddy Creek HMA and the BLM would not be able to conduct periodic gathers and still maintain a thriving natural ecological balance. For these reasons, this alternative did not receive further consideration in this document.

## Fertility Control Treatment Only Including Using Bait/Water Trapping To Dart Mares with PZP or Other Contraceptive Vaccine Remotely (No Removal)

Population modeling (Appendix I) was completed to analyze the potential impacts associated with conducting gathers about every 2-3 years over the next 20 year period to treat captured mares with fertility control. Under this alternative, no excess wild horses would be removed. While the average population growth would be reduced to about (11) % per year, AML would not be achieved and the damage to the range associated with wild horse overpopulation would continue. This alternative would not meet the Purpose and Need for the Action, and would be contrary to the WFRHBA, and was dismissed from further study.

The use of remote darting to administer PZP or other contraceptive vaccines within HMAs where the horses are not accustomed to human activity has been shown to be very difficult. In the Cedar Mountain HMA during a two year study where administration of PZP by

remote darting was to occur not a single horse was successfully darted. This method has been affective in some HMAs where the wild horses are more approachable but the Muddy Creek HMA is not such an area, so this method of administering PZP was dismissed from further study.

## Bait or Water Trap Only

An alternative considered but eliminated from detailed analysis was use of bait and/or water trapping as the primary gathering method. The use of bait and water trapping, though effective in specific areas and circumstances, would not be timely, cost-effective or practical as the primary gather method for this HMA due to the timing of the proposed gather. However, water or bait trapping may be used to achieve the desired goals of Alternatives 2-5 if gather efficiencies are too low using a helicopter or a helicopter gather cannot be scheduled. This alternative was dismissed from detailed study as a primary gather method for the following reasons: (1) the project area is too large to effectively use this gather method; (2) road access for vehicles to potential trapping locations necessary to get equipment in/out as well as safely transport gathered wild horses is limited; and (3) the presence of scattered water sources on both state and public lands inside the HMA would make it almost impossible to restrict wild horse access to the extent necessary to effectively gather and remove the excess animals through bait and/or water trapping to achieve management goals.

## Wild Horse Numbers Controlled by Natural Means

This alternative was eliminated from further consideration because it is contrary to the WFRHBA which requires the BLM to prevent the range from deterioration associated with an overpopulation of wild horses. It is also inconsistent with the Price RMP, which directs that Price Field Office BLM conduct gathers as necessary to achieve and maintain the AML. The alternative of using natural controls to achieve a desirable AML has not been shown to be feasible in the past. Wild horses in the Muddy Creek HMA are not substantially regulated by predators. In addition, wild horses are a long-lived species with documented foal survival rates exceeding 95% and they are not a self-regulating species. This alternative would result in a steady increase in numbers which would continually exceed the carrying capacity of the range until severe and unusual conditions that occur periodically-- such as blizzards or extreme drought-- cause catastrophic mortality of wild horses.

## Gather and Release Excess Wild Horses Every Two Years and Apply Two-Year PZP or Other Contraceptive Vaccine to Horses for Release

Another alternative to gather a substantial portion of the existing population (90%) and implement fertility control treatment only, without removal of excess horses was modeled using a two-year gather/treatment interval over a 10 year period, based on expected effectiveness of PZP-22 pellet vaccine. Based on WinEquus population modeling, this alternative would not result in attainment of AML for the HMA. The wild horse population would continue to have an average population growth rate of 2.3% to 13.7% adding to the current wild horse overpopulation, albeit at a slower rate of growth than the No Action Alternative. The modeling reflected an average population size in 11 years of 127 to 236 wild horses under a two-year treatment interval. In 90% of the trials, this alternative would

not decrease the existing overpopulation of wild horses, resource concerns and rangeland deterioration would continue, and implementation would result in substantially increased gather and fertility control costs relative to the alternatives that remove excess wild horses to the AML range. In addition to not achieving AML, the time needed to complete a gather would also increase over time, because the more frequently an area is gathered, the more difficult wild horses are to trap. They become very evasive and learn to evade the helicopter by taking cover in treed 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. It would become increasingly more difficult over time to repeat gathers every two years to successfully treat a large portion of the population. For these reasons, this alternative was dropped from detailed study.

## Use Alternative Capture Techniques Instead of Helicopters to Capture Excess Wild Horses

An alternative using capture methods other than helicopters to gather excess wild horses was suggested, other than bait/water trapping, through the public review process. As no specific alternative methods were suggested, the BLM identified chemical immobilization, net gunning, and wrangler/horseback drive trapping as potential methods for gathering horses. Net gunning techniques normally used to capture big games also rely on helicopters. Chemical immobilization is a very specialized technique and strictly regulated. Currently the BLM does not have sufficient expertise to implement either of these methods and they would be impractical to use given the size of the HMA, access limitations and approachability of the horses.

Use of wrangler on horseback drive-trapping to remove excess wild horses can be fairly effective on a small scale; but due to the number of excess horses to be removed, the large geographic size of the HMA, access limitations and approachability of the horses this technique would be ineffective and impractical. Horseback drive-trapping is also very labor intensive and can be very harmful to the domestic horses and the wranglers used to herd the wild horses. For these reasons, this alternative was eliminated from further consideration.

## Field Darting Fertility Treatment Only for Population Suppression

BLM would administer PZP in the one year dose inoculations by field darting the mares. This method is currently approved for use and is being utilized by BLM in other HMAs. This alternative was dismissed from detailed study for the following reasons: (1) the size of the area at 283,000 acres is to large to use this method; (2) the presence of water sources scattered throughout the HMA and a stream running through it, makes it almost impossible to restrict wild horse access to be able to dart horses consistently; (3) horse behavior limits their approachability/accessibility, so that the number of mares expected to be treated via darting would be insufficient to control growth; and (4) BLM would have difficulties keeping records of animals that have been treated due to common and similar colors and patterns. For these reasons, this alternative was determined to not be an effective or feasible method for applying PZP to wild horses from the Muddy Creek HMA.

## 2.4 Summary

The alternatives being addressed in this document cover a reasonable range of alternatives for meeting the purpose and need. No other alternatives have been developed by the public or the Price Field Office staff at this time.

# 3.0 AFFECTED ENVIRONMENT

## 3.1 Introduction

This chapter presents the potentially affected existing environment (i.e., the physical, biological, social, and economic values and resources) of the impact area as identified in the Interdisciplinary Team Analysis Record Checklist (found in Appendix A) and presented in Chapter 1 of this assessment. This chapter provides the baseline for comparison of impacts/consequences described in Chapter 4.

## 3.2 General Setting

The Muddy Creek HMA is approximately 283,400 acres of Federal and State lands located six miles southeast of the town of Emery, Utah *(Map* 1). It extends up to seven miles north and twenty miles south of I-70 from the Dutchman Arch to Fremont Junction. Access is provided to the HMA via Interstate 70 and then by county and BLM roads. Annual precipitation is approximately 8.5 inches, with an average 5 inches coming during the summer (May through September). Precipitation as of July 2017 was 4.07 inches or 47 percent of normal at the Ferron weather station, according to data collected since 1980. Temperatures in Ferron, Utah range from an average monthly high of 88 degrees Fahrenheit in the summer to 39 degrees in the winter (WRCC, 2009). Of the 283,400 acres in the HMA approximately 252,000 are public land acres and 31,400 acres are state and private lands. The topography of the HMA is typical of the San Rafael Swell area, varying from extremely rough to fairly level terrain on limestone benches. The steep sided mesas and deeply incised drainages in the northern and southeastern portions on the HMA could potentially create problems gathering horses. The wild horses primarily use the open benches and parks, but do use wooded areas occasionally.

The HMA ranges from 5,000 to 8,900 feet in elevation, and supports vegetation types ranging from pinyon and juniper woodland to salt desert shrub, and grasslands. The salt desert shrub vegetation type dominates the HMA. Primary forage species are Indian ricegrass, galletta, sand dropseed, winter fat, and fourwing saltbush.

The HMA has several undeveloped springs and seeps that are used as water sources by the wild horses, as well as 40 reservoirs and the Muddy Creek itself. Most of the developed water sources are in fair condition, with most in need of repair or general maintenance.

## 3.3 Resources/Issues Brought Forward for Analysis:

### 3.3.1 Livestock Grazing

The Lone Tree, Globe Link, South Sid & Charley, Mussentuchit, Last Chance, Red Canyon, Hondo, McKay Flat, Temple Mountain, Taylor Flat and Dry Wash Allotments encompass the Muddy Creek HMA. Livestock grazing use on most of the affected grazing allotments was held to less than 70 percent of permitted use during the 2016-2017 grazing period, due to drought conditions that limited forage and water sources. Overlap of areas of use between wild horses and livestock does occur on specific sites on all the allotments causing competition for forage, water and space. Wild horses, wildlife, and livestock compete directly for the same space, water and forage resources. Yearlong wild horse grazing reduces forage availability for livestock. Grazing by excess wild horses during the critical growing season and during drought conditions can reduce forage production, vigor, reproduction, and availability for several years.

The seasons of use and Animal Units Months (AUMs) for the affected allotments are listed below in Table 2.

TABLE 2. Grazing allotment numbers, season of use, and AUMs

| Allotment | Livestock | | Season of Use | | AUMs |
|---|---|---|---|---|---|
| | No. | Kind | From | To | |
| Dry Wash (25017) | 140 | C | 11/01 | 2/28 | 552 |
| Globe Link (35025) | 80 | C | 11/01 | 04/15 | 437 |
| Hondo (15099) | 40 | C | 10/16 | 03/31 | 220 |
| Last Chance (00605) | 148 | C | 11/01 | 05/31 | 1,036 |
| Lone Tree (35041) | 961 | C | 11/01 | 04/15 | 5,270 |
| McKay Flat (35043) | 285 | C | 10/16 | 03/31 | 1,270 |
| Mussentuchit (00608) | 286 | C | 11/01 | 5/31 | 1,994 |
| Red Canyon (35067) | 467 | C | 10/16 | 3/31 | 2,251 |
| South Sid & Charley (15082) | 135 | C | 11/16 | 6/15 | 945 |
| Taylor Flat (25087) | 208 | C | 10/01 | 4/30 | 1,449 |
| Temple Mountain (05089) | 103 | C | 10/16 | 4/15 | 616 |
| TOTAL | 2,853 | | | | 16,040 |

Utilization levels on the HMA have been moderate on most of the uplands and heavy near portions of the Muddy Creek as well as a few springs and reservoirs.

During years of drought, the reduction in the amount of available forage and the utilization of forage by wild horses caused some operators to place a substantial portion of their grazing preference in non-use, as approved by the BLM. Reasons for non-use vary with the operator and area, but often include recognition that either there is not sufficient forage for both the present numbers of wild horses and the preference level of livestock grazing, and the economics of the range livestock industry are down.

Although voluntary reductions in cattle AUMs have been taken by permittees, horse numbers have remained at or above the upper AML levels throughout most of the drought years.

Wild horses have been shown to compete with livestock and wildlife at watering and feeding areas (Miller, 1983). When these resources become depleted, wildlife and wild horses may move to a new location, while livestock must be removed. Overlap between horses and cattle have been shown to increase at higher stocking density. Large numbers of any two species (cattle or horses) increase the negative interactions (Smith 1986).

Table 3.

| Allotment | Pasture or All Allotment | 6 year Avg. AUMs* | Active AUMs | % Actual Use |
|---|---|---|---|---|
| Dry Wash | All | 152 | 552 | 28% |
| Globe Link | All | 64 | 437 | 15% |
| Hondo | All | 42 | 220 | 19% |
| Last Chance | All | ** | 1,036# | ** |
| Lone Tree | All | 3,766 | 5,270 | 72% |
| McKay Flat | All | 551 | 1,270 | 43% |
| Mussentuchit | All | ** | 1,994# | ** |
| Red Canyon | All | 1,051 | 2,251 | 47% |
| South Sid & Charley | All | 311 | 945 | 33% |
| Taylor Flat | All | 740 | 1,449 | 51% |
| Temple Mountain | All | 0 | 616 | 0% |
| | Average HMA use | 6,677 | 13,010 | 51% |

*As calculated from billings in RAS

** Allotment is managed by the Richfield Office, data was requested and not received.# Not included in Total.

Livestock in these allotments depend on reservoirs, springs, and water hauling during the periods they are on the allotment. Several small springs and seeps are scattered throughout the allotments and HMA. During normal precipitation years, these small springs and seeps disperse wild horse use throughout the HMA reducing competition between livestock and wild horses. During drought years, these small springs and seeps dry up and wild horses must move to other water sources. This increases competition between wild horses and livestock. The BLM has hauled water onto the HMA for wild horses several times during the past ten years.

Some fences have been damaged by wild horses in their natural movement and in their search for water. Most of these fences were in place before the passage of the Wild and Free Roaming Horse and Burro Act of 1971. These fences inhibit the natural and free roaming nature of the wild horses but are necessary for livestock management.

## 3.3.2 Vegetation

The HMA ranges from 5,600 to 8,900 feet in elevation, and supports vegetation types ranging from mixed conifer to salt desert shrub, and grasslands. The salt desert shrub vegetation type dominates the HMA. Primary forage species are Indian ricegrass, galletta, sand dropseed, winter fat, and fourwing saltbush.

Rangeland Health Studies have been completed on most of the livestock grazing allotments that are or have a portion of the allotment within the Muddy Creek HMA. These studies can be found within the allotment files at the BLM Price Field Office. The methodology of each study was completed using technical reference 1734-6. Vegetation production and vigor has been reduced by drought (Standard and Guideline Studies). Drought is defined as prolonged dry weather generally when precipitation is less than 75% of average annual amount (Society for Range Management 1974). Precipitation is the most important single factor determining the type and productivity of vegetation in an area. The Muddy Creek HMA averages less than 8 inches per year. During the period from 2006-2016 the precipitation was near normal for the area.

The current drought cycle has had a tremendous influence on rangeland vegetation. As described above, year-long grazing by wild horses has put additional stress on key forage species already affected by drought. Some key forage species have been lost. Recovery could take 5 to 15 years, depending on how severely the drought affected a particular area. Two or more years of drought have far greater impact on vegetation than one year of drought followed by normal or above-normal precipitation.

Rangeland resources are currently being affected within the herd area due to lower than normal precipitation 6 out of the last 10 years which has reduced vegetative growth and vigor. The western portion of the HMA is in severe vegetative stress, with huge areas containing decadent or dead Matt saltbush, Gardener saltbush and Castle Valley clover. Utilization of primary forage species over the majority of the HMA was nearly 90 percent for last year's growth with current growth having been utilized approximately 40 percent in June 2017.

The National Oceanic and Atmospheric Administration (NOAA), Long Term Palmer Drought Monitor (July 22, 2017) and Price Field Office precipitation data all place the HMA in a "Extreme Drought" condition class.

Monitoring data collected within the Muddy Creek HMA indicated the Utah BLM Standards and Guidelines for Healthy Rangelands were not being fully met and that causal factors for non-attainment of Standard 2 and 3 include excessive use by wild horses, historic livestock grazing and climatic conditions (drought).

Utilization studies that have been completed during the past 20 years, along with PFO staff observations, suggest that as wild horse populations increase they contribute to the decrease of forage species. This is especially true in grassland and sagebrush/grassland.

Utilization studies completed on the Red Canyon Allotment at the beginning of June 2017 showed that in an allotment used mainly by cattle the utilization on Indian Ricegrass was Slight (13%), while the adjacent McKay Flat Allotment that received use by cattle and wild horses was Moderate to Heavy use (41%-65%).

Twelve trend studies have been set up within the Muddy Creek HMA by the PFO, BLM. These studies describe the soils as being in a stable trend with browse trending slightly down and herbaceous species trending from slightly down to slightly up depending on location within the HMA. These Frequency trend studies suggest the trend is in general stable or static condition. Additional information on the vegetation studies have been summarized in Term Grazing Permit Renewal EAs for the allotments within the HMA.

Yearlong grazing by wild horses has been one contributing factor to the downward trend of the grasses and the change from cool season grasses to warm season grasses. Horses, because they are territorial, are grazing the same areas repeatedly throughout the spring during critical growing periods for grasses. High populations of wild horses can reduce the available forage for not only the year the grasses are grazed, but also for years to come. Horses will graze the most desirable forage plants first before grazing on other species. Wild horses are capable of cropping forage much more closely than wild or domestic ruminants, causing a loss of the most desirable forage species and reducing plant diversity.

From 1997 to 1999 and present, the excess number of wild horses (numbers over AML) within the HMA reduced the amount of available forage for all grazing animals.

### 3.3.3 Wild Horses

As described earlier, the current AML that is set for the area is 100 horses with no less than 75, and no more than 125 horses. There have been 7 gathers conducted in the mid 1980's, 1995, 1999, 2000, 2001, 2008, and 2009 on the current Muddy Creek HMA. Most recent was a scheduled gather in 2009. The Muddy Creek portion of the HMA was gathered in 2009; the Sinbad (McKay Flat) portion of the HMA was gathered in 2008. Fifty six head of wild horses were gathered, and fifty four head were removed in 2008. Eighty seven head of wild horses were gathered, and eighty five head were removed in 2009. Two horses were released back to the HMA during gather operations and two head (1 mare and 1 stud) were released a few weeks later. Six head (4 mares and 2 studs) were released in 2002 from the Cedar Mountain HMA for genetic purposes. The dominant color in the HMA is Bay, followed by Dun, and Black, with an increasing number of Pintos and Roans. Sorrels, Chestnuts, Browns and Grey's can also be found.

The wild horse herd size within the HMA was estimated to be 195 horses as of March 1, 2018. This number is based on an April 2017 aerial population inventory utilizing the Double Observer method, and allowing for population growth between April 2017 and March 1, 2018. A statistical analysis of the aerial survey data provided a 90% confidence interval around that herd size estimate of 170 adult horses on the HMA in April 2017, with a 90% confidence interval between 161-185 adult horses at that time (Lubow 2017). The HMA has an estimated average 15 percent annual reproductive rate as seen from past inventory and gather reports (BLM, 4700 files). Allowing for new foals that are expected to be born in spring and summer 2018, the projected number of horses present in the HMA by fall 2018 will be approximately 224.

BLM is not required by law to manage the herds found in any given HMA as if they were genetically isolated populations. A 2013 report from the National Academies of Sciences' national Research Council (NRC), commissioned by BLM, recommended that BLM consider genetic management of wild horses from the perspective of metapopulations. Under this framework, herds from individual HMAs should not be considered to be genetically isolated populations. Rather, BLM was encouraged to consider the historical and present connections between HMAs. Genetically, BLM was encouraged by NRC (2013) to maintain genetic variation across a number of potentially interconnected herds (i.e., many herds within a given metapopulation); the connections between herds may be maintained by natural emigration and immigration, or by human-assisted translocation. The AML in Muddy Creek HMA alone is not large enough to maintain genetic diversity, as measured by observed heterozygosity (Ho) without introduction of horses from outside the HMA. Heterozygostiy levels can be maintained and Inbreeding can be avoided through introductions of additional wild horses from other herds. The genetically effective breeding size of a herd, Ne, is a reflection of the number of individuals that are contributing to the maintenance of genetic diversity (reviewed in NRC 2013); this number can be difficult to measure directly, but is related to the numbers of breeding males and females in a herd. If a herd consists of 40 breeding mares and 60 breeding stallions, then a simplified calculation of Ne (Hartl and Clark 2007) would lead to an estimate of 96. However, actual Ne is usually lower than the numbers of breeding animals present would imply, so the BLM Wild Horse and Burro Handbook suggests considering other options for maintaining genetic diversity when herd size must be held at below about 150 animals due to habitat limitations or other considerations (BLM 2010). The handbook (BLM 2010) includes suggestions that can be considered for maintaining genetic diversity in small herds such as this one; these suggestions do not represent a specific, legally-binding, BLM policy. Two suggestions there are to introduce 1-2 mares every 10 years or so, and to increase the sex ratio in favor of males (which should increase the number of harems and the number of effectively breeding males). The preferred alternative includes even more frequent translocations (1-3 animals, every 4-5 years), which would be expected to reduce inbreeding to an even greater degree. In the

past, BLM has translocated wild horses into Muddy Creek HMA in order to improve genetic diversity there, and the preferred alternative would continue this practice. Increasing sex ratio is expected to increase the number of breeding males because competition between stallions is expected to reduce harem size.

Genetic sampling that is conducted during gathers allows BLM to gauge the genetic health of the herd, which allows BLM to identify whether and how much additional wild horses should be translocated into the HMA. Blood samples for genetic testing were taken in 2001 to create a baseline for the wild horses that occur within the Muddy Creek HMA. These samples were sent to Dr. Gus Cothran and Texas A&M. At that point in time the Muddy Creek HMA was managed as two separate units, the Sinbad and Muddy Creek HMAs. As such the horses were tested separately. Genetic analysis from 62 individuals gathered during the 2001 gather showed a very low Observed Heterozygosity (Ho) or individual variability at that time (Cothran, 2002). Doctor Cothran stated in his 2002 report that Ho in the Muddy Creek herd was below the proposed critical value for feral horse blood sample genetic marker variability of 0.31, and that there was a relatively high number of genetic variants found at low frequency. However, Cothran (2002) did not note any unique genetic markers in either separate unit: two of the unusual markers that were noted are, apparently, common in Tennessee Walking Horse and in the Quarter horse. Since that 2002 report, horses from other HMAs have been introduced to improve the genetic variability of the herd. Genetic monitoring that would take place as a result of any alternative with a gather would allow BLM to determine what the current status of genetic variability is in the herd, and whether additional introductions could be necessary.

Since the passage of the Wild Free-Roaming Horse and Burros Act of 1971 (WFRHBA) over 40 years ago, field observations, herd health monitoring and population inventories have recorded locations in and around the HMA where wild horses have occurred. Horses normally do not move outside the HMA unless the population is above AML and/or there are drought conditions.

As forage within close proximity of water sources is depleted the wild horses will need to range greater distances for forage. The distance the animals must travel over steep rugged terrain can result in rapid physical deterioration of the animals.

Rangeland resources and wild horse health have been and are currently being affected within the Muddy Creek HMA, due to drought and overpopulation. Excess wild horses above AML have reduced available water and forage, resulting in increased competition for available resources. The gather of wild horses from the Muddy Creek HMA would have direct and indirect impacts to individual animals and the social structure of bands in the area. Most impacts would be short term (less than 1 year), but some would be long term (greater than one year). These impacts are discussed within this EA.

The AML for the Muddy Creek HMA was set in the San Rafael Resource Management Plan (SRRMP) (1989) which allows for, "Wild equids would be allowed to increase until they reach the upper limit as shown below, and excess horses or burros would be removed until the lower limit is achieved." Under the SRRMP, the BLM would manage for 75 to 125 wild horses and 30 to 70 wild burros. The SRRMP also allocated forage for wild horses, livestock, and wildlife. The BLM PFO has attempted since the completion of the SRRMP in 1989 to maintain the wild horse population within the AML on the Muddy Creek HMA. Since 1989, four (4) gathers and removals have been conducted within the HMA in an attempt to keep the horse population within the AML. In 1996, 2002 and 2010 the population was down near the lower end of the AML. Gathers of wild horses within this HMA have proven difficult due to heavy tree cover, terrain, horse movement and

distance. As the population increases, it becomes harder to gather the number of horses needed to reduce the population to within the AML.

Wild horse populations above AML compete for forage, water, and cover allocated to wildlife and livestock. Chambers et al. (2017) reviewed some of the impacts that wild horses can have on rangeland ecosystems, including impacts on native wildlife. That review notes that wild horse grazing is associated with a lower overall plant cover, shrub cover, species richness, and biomass, but more unpalatable and grazing-tolerant plant species, that they may spread invasive species such as cheatgrass, and that they may have outsized effects on aquatic ecosystems and riparian communities. Kaweck et al. (2018) found that wild horses can have higher per-capita effects on riparian ecosystems than cattle. There are several recent studies that have documented wild horses excluding native wildlife from water sources (Ostermann-Kelm et al. 2008, Perry et al. 2015, Hall et al. 2016, Gooch et al. 2017, Hall et al 2018).

Because horses have a cecal digestive system and can cover longer distances than domestic ruminants, wild horses can remain in good health under forage conditions fatal to domestic ruminants (Holechek 1989). In 1997 through 1999, range conditions within the HMA became so bad that even though livestock use was reduced or eliminated on the BLM allotments and several hundred head of wild horses removed, health of some horses declined to critical conditions. Some horses were lost to starvation and dehydration during those years.

The overriding limiting factor for the carrying capacity of wild horses in the HMA is not the available forage, although this is a concern, but is the supply of reliable water during the summer months. Wild horses in this HMA congregate in portions of the HMA to stay close to available water sources. This concentration increases as drought reduces the available water in and around the HMA. Upland vegetation in proximity to water sources are used heavily by wild horses and wildlife, while vegetation in areas farther from water (i.e., greater than six miles) is used slightly too moderately.

The McKay Flat Reservoirs and an Unnamed Spring are two water sources that are heavily used by wild horses. Since 1999 the unnamed spring has been used by wild horses and wildlife exclusively. These water sources have been impacted heavily by this use.

The increased concentration of wild horses at all the reliable water sources in the HMA have reduced vegetation and caused soil compaction. Due to the high population of wild horses within the HMA, water hauling may need to occur before the proposed action to sustain the current population of wild horses.

It is anticipated that the age structure of the Muddy Creek HMA wild horses resemble a normal age structure with ages ranging from foals to animals in excess of 20 years of age. The sex ratio is estimated to be approximately 50% mares and 50% stallions with variations 10% below or above these levels.

Population modeling was completed for the Muddy Creek HMA using Version 1.4 of the WinEquus population model (Jenkins 2002) to analyze how the alternatives would affect the wild horse population (Appendix I). This modeling analyzed removal of excess wild horses with no fertility control, as compared to removal of excess wild horses with fertility control and sex ratio adjustments for released horses. The No Action (no removal) Alternative was also modeled. One objective of the modeling was to identify whether any of the alternatives "crash" the population or

cause extremely low population numbers or growth rates. Minimum population levels and growth rates were found to be within reasonable levels and adverse impacts to the population not likely. Graphic and tabular results are also displayed in detail.

# 4.0 ENVIRONMENTAL IMPACTS

## 4.1 Introduction:

This chapter will assess the environmental impacts (either positive or negative) on the components of the human environment either affected or potentially affected by the Proposed Action and alternatives. Direct impacts are those that result from the actual gather and removal of wild horses on the Muddy Creek HMA. Indirect impacts are those impacts that exist once the animals are gathered or removed. By contrast, cumulative impacts result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

## 4.2 Direct/Indirect Impacts:

### 4.2.1 Alternative 1: No Action - Continue Existing Management, No Gather and Removal.

The HMA would be managed under the objectives of the Price RMP, and current regulations and policies with no additional objectives specific to the management of wild horses within the Muddy Creek HMA.

#### 4.2.1.1 Livestock Grazing

Livestock would not be displaced or disturbed due to gather operations under the No Action Alternative. Direct impacts from not managing horses within the Muddy Creek HMA would have a negative effect on livestock grazing within the identified grazing allotments. Increased numbers of horses would adversely affect vegetative resources, which horses, livestock and wildlife compete for, as well as an increased competition for water resources and impact upon the springs and streams. This would result in a reduced carrying capacity. As wild horse numbers increase, livestock grazing within the HMA may have to be further reduced in an effort to slow the deterioration of the range to the greatest extent possible or because rangeland conditions do not support the multiple uses for which the public lands are being managed.

#### 4.2.1.2 Vegetation

Direct and Indirect impacts would include disturbance of native vegetation immediately around all waters sources, as well as across the entire HMA from an increase in horse use. Impacts would be created by hoof action as the horses travel to and from water as well as disturbance created by the foraging of the horses on individual plants. This is an ongoing impact to vegetation but would be increased exponentially by allowing the horse herd to regulate itself.

#### 4.2.1.4 Wild Horses

The HMA would be managed under the objectives of the Price RMP, and current regulations and policies with no additional objectives specific to the management of wild horses within the Muddy Creek HMA.

If the No Action Alternative is taken, excess wild horses would not be removed from within the Muddy Creek HMA at this time. The animals would not be subject to the individual direct or

indirect impacts as a result of a gather operation in Spring 2018. Over the short-term, individuals in the herd would be subject to increased stress and possible death as a result of increased competition for water and forage as the wild horse population continues to grow. The number of areas experiencing severe utilization by wild horses would increase over time. This would be expected to result in increasing damage to rangeland resources throughout the HMA. Trampling and trailing damage by wild horses in/around riparian areas and water sources would also be expected to increase, resulting in larger, more extensive areas of bare ground. Competition for the available water and forage between wild horses, domestic livestock, and native wildlife would increase.

Wild horses are a long-lived species with documented survival rates exceeding 92% for all age classes and do not have the ability to self-regulate their population size. Predation and disease have not substantially regulated wild horse population levels within the Muddy Creek HMA. Some mountain lion predation may occur, but does not spear to be substantial. Coyotes are not prone to prey on wild horses unless young or extremely weak. Other predators such as wolf, or bear do not exist within the HMA. As a result, there would be a steady increase in wild horse numbers for the foreseeable future, which would continue to exceed the carrying capacity of the range. Individual horses would be at greater risk of death by starvation and lack of water. The population of wild horses would compete for the available water and forage resources, affecting mares and foals most severely. Social stress would increase. Fighting among stud horses would increase as they protect their position at scarce water sources, as well as injuries and death to all age classes of animals.

Substantial loss of the wild horses in the HMA due to starvation or lack of water would have obvious consequences to the long-term viability of the herd. Continued decline of rangeland health and irreparable damage to vegetative, soil and riparian resources, would have obvious impacts to the future of the HMA and all other users of the resources, which depend upon them for survival. As a result, the No Action Alternative would not ensure healthy rangelands, would not allow for the management of a healthy, self-sustaining wild horse population, and would not promote a thriving natural ecological balance.

As populations increase beyond the capacity of the available habitat, more bands of horses would leave the boundaries of the HMA in search of forage and water. This alternative would result in increasing numbers of wild horses in areas not designated for their use, would be contrary to the Wild Free-Roaming Horse and Burro Act and would not achieve the stated objectives for wild horse herd management areas, to "prevent the range from deterioration associated with overpopulation," and "preserve and maintain a thriving natural ecological balance and multiple use relationship in that area."

## 4.2.1.5 Mitigation

None identified

## 4.2.1.6 Cumulative Impacts

Cumulative Impacts related to the No Action Alternative would be as stated above, as numbers of horses' increase it would adversely affect vegetative resources, which horses, livestock and wildlife compete for, as well as an increased competition for water resources and impact upon the springs and streams. This would result in a reduced carrying capacity of the area, as well as increased erosion and reduced functioning condition of the riparian and upland areas. The animals could very well eat themselves out of house and home, which would eventually be reflected in reductions to the grazing permits, as well as possible catastrophic die off of the wild horses and other wildlife in the area, from either drought or a harsh winter.

### 4.2.1.7 Monitoring Plan

None Identified.

## 4.2.2 Alternative 2 – Proposed Action – Implement Gather and Removal with Fertility Control over 6 to 10 years.

### 4.2.2.1 Livestock Grazing

The Proposed Action would not have any direct impacts to livestock grazing. Objectives that identify improvements to forage and water availability would reduce competition for these resources within the HMA, if they are accomplished.

Livestock located near gather activities may be temporarily disturbed or displaced by the helicopter and the increased vehicle traffic during gather operations. If the gather occurs during the permitted grazing period. This displacement would be temporary and the livestock would move back into the area once gather operations move. Past experience has shown that gather operations have little impact on grazing cattle. No adjustments in permitted livestock use, active AUMs, season of use and/or terms and conditions would occur as a result of the Proposed Action. Direct impacts of the gather activities itself would be minor and short-term.

Indirect impacts to livestock grazing would be an increase in forage availability and quality, reduced competition for water and forage, and improved vegetative resources that would lead to a thriving ecological condition over the course of 6 to 10 years. Water sources that are repaired for either livestock or wild horses would also benefit the other user group.

### 4.2.2.2 Vegetation

Direct impacts to the vegetation would include disturbance of native 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. Generally, these activity sites would be small (less than one half acre) in size. 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 transportation vehicles and logistical support equipment and would therefore generally be near or on roads, pullouts, water haul sites or other flat spots, which were previously disturbed. Generally, within one to two months of capture operations disturbance within the trap location is not visible. These common practices would minimize the cumulative effects of these impacts.

Indirect impacts would be associated with improvements in range and forage condition and long-term maintenance of habitat quality. A balanced demand for forage would help maintain the vigor of vegetation, allow for seedling establishment, maintain ground cover, and thereby maintain a thriving natural ecological balance. This would avoid range deterioration, particularly in future drought years.

### 4.2.2.3 Wild Horses

The Proposed Action would decrease the existing overpopulation of wild horses by approximately 148 wild horses. Each successive gather operation over a period of six to ten years and stallions would be selected for release with the objective of establishing a 60% male ratio within the population of 30-50/45-75 female/male horses on the range. The target population when the objectives of this alternative are reached would result in a total population at approximately low-range AML or 75 horses. Every 4-5 years 1-3 studs or mares from a different HMA, with similar or desired characteristics of the horses within the Muddy Creek HMA would be released to maintain the genetic health on the HMA. All animals selected to remain in the population would be selected to maintain a diverse age structure, herd characteristics and body type (conformation). The Proposed Action would not reduce all of the associated impacts to the wild horses and rangeland resources. Over the short-term, individuals in the herd would still be subject to increased stress and possible death as a result of continued competition for water and forage. Although lessened the areas experiencing heavy and severe utilization levels by wild horses would continue to be heavily impacted by horses but to a lesser extent, impacts to rangeland resources (concentrated trailing, increased bare ground, etc.) throughout the HMA would be expected to heal slowly once the AML has been reached.

It is a possibility that bands of horses could leave the boundaries of the HMA into areas not designated for their use in search of forage and water. If this should occur, the proposed action may not achieve the stated objectives for the wild horse herd management area, to "prevent the range from deterioration associated with overpopulation", and "preserve and maintain a thriving natural ecological balance and multiple use relationship in that area". Upon identification of horses outside the HMA future gathers would focus on those groups or individuals to ensure the herd stays within the HMA.

Removal of excess wild horses would improve herd health. Decreased competition for forage and water resources would reduce stress and promote healthier animals. This removal of excess animals coupled with anticipated reduced reproduction (population growth rate) as a result of fertility control 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, and would allow for healthy range conditions (and healthy animals) over the longer-term. Additionally, reduced population growth rates 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.

Bringing the wild horse population back to low range AML by achieving the proposed action would reduce damage to the range from the current overpopulation of wild horses and allow vegetation resources to start recovering, without the need for additional gathers in the interim. 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.

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. Mortality to individual animals from these impacts is infrequent but does occur in 0.5% to 1% of wild horses gathered in a given gather. 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.

The gathers would occur frequently making wild horses more difficult to trap. The horses would become very evasive and learn to evade the helicopter by taking cover in treed 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. It would become increasingly more difficult over time to repeat gathers if the gathers are within two year intervals to successfully treat mares with fertility control.

Stallions selected for release would be released to increase the post-gather sex ratio to approximately 60% stallions in the remaining herds. Stallions would be selected to maintain a diverse age structure, herd characteristics and body type (conformation). It is expected that releasing additional stallions to reach the targeted sex ratio of 60% males would result in smaller band sizes, larger bachelor groups, and some increased competition for mares. With more stallions involved in breeding it should result in increased genetic exchange and improvement of genetic health within the herd.

## *Fertility Control*

*Porcine Zona Pellucida (PZP) Vaccine*

The immune-contraceptive Porcine Zona Pellucida (PZP) vaccine is currently being used on over 75 areas managed for wild horses by the National Park Service, US Forest Service, and the Bureau of Land Management and 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 PZP was one of the preferable available methods for contraception in wild horses and burros (NRC 2013). PZP use can reduce or eliminate the need for gathers and removals (Turner et al. 1997). PZP vaccines meet most of the criteria that the National Research Council (2013) used to identify promising fertility control methods, in terms of delivery method, availability, efficacy, and side effects. It has been used extensively in wild horses (NRC 2013), and in a population of feral burros in territory of the US (Turner et al. 1996). PZP is relatively inexpensive, meets BLM requirements for safety to mares and the environment, and is commercially produced as ZonaStat-H, an EPA-registered product (EPA 2012, SCC 2015), or as PZP-22, which is a formulation of PZP in polymer pellets that can lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017). It can easily be remotely administered in the field in cases where mares are relatively approachable.

Under the Proposed Action, the BLM would return to the HMA as needed to re-apply PZP-22 and / or ZonaStat-H and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. Both forms of PZP can safely be reapplied as necessary to control the population growth rate. Even with repeated booster treatments of PZP, it is expected that most, if not all, mares would return to fertility. Once the population is at AML and population growth seems to be stabilized, BLM could use population planning software (WinEquus II, currently in development by USGS Fort Collins Science Center) to determine the required frequency of re-treating mares with PZP.

*PZP Direct Effects*

When injected as an antigen in vaccines, PZP causes the mare's immune system to produce antibodies that are specific to zona pellucida proteins on the surface of that mare's eggs. The antibodies bind to the mare's eggs surface proteins (Liu et al. 1989), and effectively block sperm binding and fertilization (Zoo Montana, 2000). Because treated mares do not become pregnant but other ovarian functions remain generally unchanged, PZP can cause a mare to continue having

regular estrus cycles throughout the breeding season. Research has demonstrated that contraceptive efficacy of an injected PZP vaccine is approximately 90% for mares treated twice in the first year and boostered annually (Kirkpatrick et al., 1992). Approximately 60% to 85% of mares are successfully contracepted for one year when treated simultaneously with a liquid primer and PZP-22 pellets (Rutberg et al. 2017). In addition, among mares, PZP contraception appears to be reversible, with most treated mares returning to fertility over time. PZP vaccine application at the capture site does not appear to affect normal development of the fetus or foal, hormone health of the mare or behavioral responses to stallions, should the mare already be pregnant when vaccinated (Kirkpatrick et al. 2002). The vaccine has no apparent effect on pregnancies in progress or the health of offspring (Kirkpatrick and Turner 2003).

The NRC (2013) criterion by which PZP is not a good choice for wild horse contraception was duration. The ZonaStat-H formulation of the vaccine tends to confer only one year of efficacy. Some studies have found that a PZP vaccine in long-lasting pellets (PZP-22) can confer multiple years of contraception (Turner et al. 2007), particularly when boostered with subsequent PZP vaccination (Rutberg et al. 2017). Other trial data, though, indicate that the pelleted vaccine may only be effective for one year (J. Turner, University of Toledo, Personal Communication).

Following a gather, application of PZP for fertility control would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011). Recruitment of foals into the population may be reduced over a three- year period. Gather efficiency would likely not exceed 85% via helicopter, and may be less with bait and water trapping, so there would be a portion of the female population uncaptured that is not treated in any given year. Additionally, some mares may not respond to the fertility control vaccine, but instead will continue to foal normally.

In most cases, PZP contraception appears to be temporary and reversible (Kirkpatrick and Turner 2002, Joonè et al. 2017), does not appear to cause out-of-season births (Kirkpatrick and Turner 2003), and has no ill effects on ovarian function if contraception is not repeated for more than five consecutive years on a given mare. Although the rate of long-term or permanent sterility following repeated vaccinations with PZP has not been quantified, it must be acknowledged that this could be a result for some number of wild horses receiving multiple repeat PZP vaccinations. Even though it is not the intent of PZP treatment, the permanent sterility of a fraction of treated mares is a potential result that would be consistent with the contraceptive purpose of applying the vaccine to wild mares.

Although most treatments with PZP will be reversible, repeated treatment with PZP may lead to long-term infertility (Feh 2012) and, perhaps, direct effects on ovaries (Gray and Cameron 2010). Bechert et al. (2013) found that ovarian function was affected by the SpayVac PZP vaccination, but that there were no effects on other organ systems. Mask et al. (2015) demonstrated that equine antibodies that resulted from SpayVac immunization could bind to oocytes, ZP proteins, follicular tissues, and ovarian tissues, but it is possible that result is specific to SpayVac, which may have lower PZP purity than ZonaStat or PZP-22 (Hall et al. 2016). Joonè et al. (2017) found effects on ovaries after SpayVac PZP vaccination in some treated mares, but normal estrus cycling had resumed 10 months after the last treatment. SpayVac is a patented formulation of PZP in liposomes that can lead to multiple years of infertility (Roelle et al. 2017) but which is not reliably available for BLM to use at this time. Kirkpatrick et al. (1992) noted effects on ovaries after three years of treatment with PZP. Observations at Assateague Island National Seashore indicate that the more times a mare is consecutively treated, the longer the time lag before fertility returns, but that even mares treated 7 consecutive years did return to ovulation (Kirkpatrick and Turner 2002). Other studies have reported that continued applications of PZP may result in decreased estrogen levels (Kirkpatrick et al., 1992) but that decrease was not biologically significant, as ovulation remained

similar between treated and untreated mares (Powell and Monfort 2001). Permanent sterility for mares treated consecutively 5-7 years was observed by Nunez et al. (2010, 2017). In a graduate thesis, Knight (2014) suggested that repeated treatment with as few as three to four years of PZP treatment may lead to longer-term sterility, and that sterility may result from PZP treatment before puberty.

If a mare is already pregnant, the PZP vaccine has not been shown to affect normal development of the fetus or foal, or the hormonal health of the mare with relation to pregnancy. In mice, Sacco et al. (1981) found that antibodies specific to PZP can pass from mother mouse to pup via the placenta or colostrum, but that did not apparently cause any innate immune response in the offspring: the level of those antibodies were undetectable by 116 days after birth. There was no indication in that study that the fertility or ovarian function of those pups was compromised, nor is BLM aware of any such results in horses or burros.

On-range observations from 20 years of application to wild horses indicate that PZP application in wild mares does not generally cause mares to foal out of season or late in the year (Kirkpatrick and Turner 2003). Nunez's (2010) research showed that a small number of mares that had previously been treated with PZP foaled later than untreated mares and expressed the concern that this late foaling "may" impact foal survivorship and decrease band stability, or that higher levels of attention from stallions on PZP-treated mares might harm those mares. However, that paper provided no evidence that such impacts on foal survival or mare well-being actually occurred. Rubenstein (1981) called attention to a number of unique ecological features of horse herds on Atlantic barrier islands, which calls into question whether inferences drawn from island herds can be applied to western wild horse herds. Ransom et al. (2013), though, identified a potential shift in reproductive timing as a possible drawback to prolonged treatment with PZP, stating that treated mares foaled on average 31 days later than non-treated mares. Those results, however, showed that over 81% of the documented births in this study were between March 1 and June 21, i.e., within the normal spring season. Ransom et al. (2013) advised that managers should consider carefully before using PZP in small refugia or rare species. Wild horses and burros in Utah do not generally occur in isolated refugia, and they are not a rare species. Moreover, an effect of shifting birth phenology was not observed uniformly: in two of three PZP-treated wild horse populations studied by Ransom et al. (2013), foaling season of treated mares extended three weeks and 3.5 months, respectively, beyond that of untreated mares. In the other population, the treated mares foaled within the same time period as the untreated mares. Moreover, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season.

Mares receiving the vaccine would experience slightly increased stress levels associated with handling while being vaccinated and freeze-marked. Newly captured mares that do not have markings associated with previous fertility control treatments would be marked with a new freeze-mark for the purpose of identifying that mare, and identifying her PZP vaccine treatment history. This information would also be used to determine the number of mares captured that were not previously treated, and could provide additional insight regarding gather efficiency.

Most mares recover from the stress of capture and handling quickly once released back to the HMA, and none are expected to suffer serious long term effects from the fertility control injections, other than the direct consequence of becoming temporarily infertile. Injection site reactions associated with fertility control treatments are possible in treated mares (Roelle and Ransom 2009, Bechert et al. 2013), but swelling or local reactions at the injection site are expected to be minor in nature. Roelle and Ransom (2009) found that the most time-efficient method for applying PZP is by hand-delivered injection of 2-year pellets when horses are gathered. They observed only two instances of swelling from that technique. Use of remotely delivered, 1-year PZP is generally limited to

populations where individual animals can be accurately identified and repeatedly approached. The dart-delivered formulation produced injection-site reactions of varying intensity, though none of the observed reactions appeared debilitating to the animals (Roelle and Ransom 2009). Joonè et al. (2017) found that injection site reactions had healed in most mares within 3 months after the booster dose, and that they did not affect movement or cause fever. The longer term nodules observed did not appear to change any animal's range of movement or locomotor patterns and in most cases did not appear to differ in magnitude from naturally occurring injuries or scars.

*Gonadotropin Releasing Hormone (GnRH) Vaccine*

The gonadotropin releasing hormone (GnRH) vaccine known as GonaCon is another existing vaccine that has been federally approved for use in wild horses as a contraceptive vaccine. Its use would be possible under alternatives 2 or 3. GonaCon could serve as the contraceptive vaccine for limiting population growth in this population. However, no mares would be treated with both PZP and GonaCon. Potential effects of GonaCon are analyzed below.

*Registration and safety of GonaCon-Equine*

The immune-contraceptive GonaCon-Equine vaccine meets most of the criteria that the National Research Council of the National Academy of Sciences (NRC 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 (NRC 2013). GonaCon-Equine has been used on feral horses in Theodore Roosevelt National Park and on wild horses in one BLM-administered HMA (BLM 2015). GonaCon-Equine can be remotely administered in the field in cases where mares are relatively approachable, using a customized pneumatic dart (McCann et al. 2017). Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010).

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 (NRC 2013). GonaCon-Equine vaccine is an EPA-approved pesticide (EPA, 2009a) 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 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-Chaill et al. 2017, *in press*).

Under the Proposed Action, the BLM would return to the HMA as needed to re-apply GonaCon-Equine and initiate new treatments in order to maintain contraceptive effectiveness in controlling population growth rates. GonaCon-Equine can safely be reapplied as necessary to control the

population growth rate. Even with one booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point, although the average duration of effect after booster doses has not yet been quantified. 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 could make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon, to maintain the number of horses within AML.

*GnRH Vaccine Direct Effects*

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

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

Adjuvants are included in vaccines to elevate the level of immune response, inciting recruitment of lymphocytes and other immune cells which foster a long-lasting immune response that is specific to the antigen. For some formulations of anti-GnRH vaccines, a booster dose is required to elicit at contraceptive response, though GonaCon can cause short-term contraception in a fraction of treated animals from one dose (Powers et al. 2011, Gionfriddo et al. 2011a, Baker et al. 2013, Miller et al 2013). The adjuvant used in GonaCon, Adjuvac, generally leads to a milder reaction than Freunds complete adjuvant (Powers et al. 2011). Adjuvac contains a small number of killed *Mycobacterium avium* cells (Miller et al. 2008, Miller et al. 2013). The antigen and adjuvant are emulsified in mineral oil, such that they are not all presented to the immune system right after injection; it is thought that the mineral oil emulsion leads to a depot effect and longer-lasting immune response (Miller et al. 2013). Miller et al. (2008, 2013) have speculated that, in cases where memory-B leukocytes are protected in immune complexes in the lymphatic system, it can lead to years of

immune response. Increased doses of vaccine may lead to stronger immune reactions, but only to a certain point; when Yoder and Miller (2010) tested varying doses of GonaCon in prairie dogs, antibody responses to the 200µg and 400µg doses were equal to each other but were both higher than in response to a 100µg dose.

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

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

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

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

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

*GnRH Vaccine Contraceptive Effects*

The NRC (2013) review pointed out that single doses of GonaCon-Equine do not lead to high rates of initial effectiveness, or long duration. Initial effectiveness of one dose of GonaCon-Equine vaccine appears to be lower than for a combined primer plus booster dose of the PZP vaccine Zonastat-H (Kirkpatrick et al. 2011), and the initial effect of a single GonaCon dose can be limited to as little as one breeding season. However, preliminary results on the effects of boostered doses of GonaCon-Equine indicate that it can have high efficacy and longer-lasting effects in free-roaming horses (Baker et al. 2017) than the one-year effect that is generally expected from a single booster of Zonastat-H.

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

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

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

In studies where mares were not exposed to stallions, the duration of effectiveness also varied. A primer and booster dose of Equity led to anoestrus for at least 3 months (Elhay et al 2007). A primer and booster dose of Improvac also led to loss of ovarian cycling for all mares in the short term

(Imboden et al. 2006). It is worth repeating that those vaccines do not have the same formulation as GonaCon.

Results from horses (Baker et al. 2017) and other species (Curtis et al. 2001) suggest that providing a booster dose of GonaCon-Equine would increase the fraction of temporarily infertile animals to higher levels than would a single vaccine dose alone.

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

Baker et al. (2017) observed a return to fertility over 4 years in mares treated once with GonaCon, but then noted extremely low fertility rates of 0% and 16% in the two years after the same mares were given a booster dose four years after the primer dose. These are extremely promising preliminary results from that study in free-roaming horses; a third year of post-booster monitoring is ongoing in summer 2017, and researchers on that project are currently determining whether the same high-effectiveness, long-term response is observed after boosting with GonaCon after 6 months, 1 year, 2 years, or 4 years after the primer dose. Four of nine mares treated with primer and booster doses of Improvac did not return to ovulation within 2 years of the primer dose (Imboden et al. 2006), though one should probably not make conclusions about the long-term effects of GonaCon-Equine based on results from Improvac.

It is difficult to predict which females will exhibit strong or long-term immune responses to anti-GnRH vaccines (Killian et al. 2006, Miller et al. 2008, Levy et al. 2011). A number of factors may influence responses to vaccination, including age, body condition, nutrition, prior immune responses, and genetics (Cooper and Herbert 2001, Curtis et al. 2001, Powers et al. 2011). One apparent trend is that animals that are treated at a younger age, especially before puberty, may have stronger and longer-lasting responses (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). It is plausible that giving ConaGon-Equine to prepubertal mares will lead to long-lasting infertility, but that has not yet been tested.

To date, short term evaluation of anti-GnRH vaccines, show contraception appears to be temporary and reversible. Killian et al. noted long-term effects of GonaCon in some captive mares (2009). However, Baker et al. (2017) observed horses treated with GonaCon-B return to fertility after they were treated with a single primer dose; after four years, the fertility rate was indistinguishable between treated and control mares. It appears that a single dose of GonaCon results in reversible infertility but it is unknown if long term treatment would result in permanent infertility.

Other anti-GnRH vaccines also have had reversible effects in mares. Elhay (2007) noted a return to ovary functioning over the course of 34 weeks for 10 of 16 mares treated with Equity. That study ended at 34 weeks, so it is not clear when the other six mares would have returned to fertility. Donovan et al. (2013) found that half of mares treated with an anti-GnRH vaccine intended for dogs had returned to fertility after 40 weeks, at which point the study ended. In a study of mares treated with a primer and booster dose of Improvac, 47 of 51 treated mares had returned to ovarian cyclicity within 2 years; younger mares appeared to have longer-lasting effects than older mares

(Schulman et al. 2013). In a small study with a non-commercial anti-GnRH vaccine (Stout et al. 2003), three of seven treated mares had returned to cyclicity within 8 weeks after delivery of the primer dose, while four others were still suppressed for 12 or more weeks. In elk, Powers et al. (2011) noted that contraception after one dose of GonaCon was reversible. In white-tailed deer, single doses of GonaCon appeared to confer two years of contraception (Miller et al. 2000). Ten of 30 domestic cows treated became pregnant within 30 weeks after the first dose of Bopriva (Balet et al. 2014).

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

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

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

*GnRH Vaccine Effects on Other Organ Systems*

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

Injection site reactions associated with immunocontraceptive treatments are possible in treated mares (Roelle and Ransom 2009). Whether injection is by hand or via darting, GonaCon-Equine is associated with some degree of inflammation, swelling, and the potential for abscesses at the injection site (Baker et al. 2013). Swelling or local reactions at the injection site are generally expected to be minor in nature, but some may develop into draining abscesses. When PZP vaccine was delivered via dart it led to more severe swelling and injection site reactions (Roelle and Ransom

2009), but that was not observed with dart-delivered GonaCon (McCann et al. 2017). Mares treated with one formulation of GnRH-KHL vaccine developed pyogenic abscesses (Goodloe 1991). Miller et al. (2008) noted that the water and oil emulsion in GonaCon will often cause cysts, granulomas, or sterile abscesses at injection sites; in some cases, a sterile abscess may develop into a draining abscess. In elk treated with GonaCon, Powers et al. (2011) noted up to 35% of treated elk had an abscess form, despite the injection sites first being clipped and swabbed with alcohol. Even in studies where swelling and visible abscesses followed GonaCon immunization, the longer term nodules observed did not appear to change any animal's range of movement or locomotor patterns (Powers et al. 2013, Baker et al. 2017).

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

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

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

*GnRH Vaccine Effects on Fetus and Foal*

Although fetuses are not explicitly protected under the WFRHBA of 1971, as amended, it is prudent to analyze the potential effects of GonaCon-Equine or other anti-GnRH vaccines on developing fetuses and foals. GonaCon had no apparent effect on pregnancies in progress, foaling success, or

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

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

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

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

*Indirect Effects of Fertility Control Vaccinations*
The following sections would be expected to apply to the application of both PZP and GnRH vaccines unless specifically identified.

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health. Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares, and their better health is expected to be reflected in higher body condition scores (Nunez et al. 2010). After a treated mare returns to fertility, her future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mares' milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition remains improved even after fertility resumes. PZP treatment may increase mare survival rates, leading to longer potential lifespan (Ransom et al. 2014a). To the extent that this happens, changes in lifespan and decreased foaling rates could combine to cause changes in overall age structure in a treated herd (i.e., Roelle et al. 2010). Observations of mares treated in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares. Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called a 'rebound effect.' More research is needed to document and quantify these hypothesized effects; however, it is believed that repeated contraceptive treatment may minimize this rebound effect.

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

Following resumption of fertility, the proportion of mares that conceive and foal could be increased due to their increased fitness; this has been called by some a 'rebound effect.' Elevated fertility rates have been observed after horse gathers and removals (Kirkpatrick and Turner 1991). More research is needed to document and quantify these hypothesized effects; however, it is believed that repeated contraceptive treatment may minimize this postulated rebound effect.

Because successful fertility control would reduce foaling rates and population growth rates, another indirect effect would be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. So long as the level of contraceptive treatment is adequate, the lower expected birth rates can compensate for any expected increase in the survival rate of treated mares. Also, reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to long term pastures (LTPs). A high level of physical health and future reproductive success of fertile mares within the herd would be sustained, as reduced population sizes would be expected to lead to more availability of water and forage resources per capita.

Reduced population growth rates and smaller population sizes would also allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse habitat quality. As the population nears or is maintained at the level necessary to achieve a thriving natural ecological balance, vegetation resources would be expected to recover, improving the forage available to wild horses and wildlife throughout the HMA. With a more optimal distribution of wild horses across the HMA, at levels closer to a thriving

ecological balance, there would also be less trailing and concentrated use of water sources, which would have many benefits to the wild horses still on the range. There would be reduced competition among wild horses using the water sources, and less fighting would occur among studs and individual animals to access water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas.

Should fertility treatment, including booster doses continue into the future, with treatments given on a schedule to maintain a lowered reproductive rate in the herd, the chronic cycle of overpopulation and large gathers and removals may no longer occur, but instead a consistent abundance of wild horses could be maintained resulting in continued improvement of overall habitat conditions and animal health. While it is conceivable that widespread and continued treatment with fertility control vaccines could reduce the birth rates of the population to such a point that birth is consistently below mortality, that outcome is not likely unless a very high fraction of the mares present are all treated with primer and booster doses, and perhaps repeated booster doses.

*Behavioral Effects of Fertility Control Vaccinations*

Behavioral differences should be considered as potential consequences of contraception. The NRC report (2013) noted that all successful fertility suppression has effects on mare behavior, mostly as a result of the lack of pregnancy and foaling and concluded that the use of PZP and GnRH was a good choice for use in the program.

*PZP Vaccine*

The result that PZP-treated mares may continue estrus cycles throughout the breeding season can lead to behavioral differences, when compared to mares that are fertile. Such behavioral differences should be considered as potential consequences of successful contraception.

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

In two studies involving a total of four wild horse populations, both 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). There was no evidence, though, that mare welfare was affected by the increased level of herding by stallions noted in Ransom et al. (2010). Nunez's later analysis (2017) noted no difference in mare reproductive behavior as a function of contraception history.

Ransom et al. (2010) found that control mares were herded by stallions more frequently than PZP-treated mares, and Nunez et al. (2009, 2014, 2017) found that PZP-treated mares exhibited higher infidelity to their band stallion during the non-breeding season than control mares. Madosky et al. (2010) and Knight (2014) found this infidelity was also evident during the breeding season in the same population that Nunez et al. (2009, 2010, 2014, 2017) studied; they concluded that PZP-treated mares changing bands more frequently than control mares could lead to band instability. Nunez et al. (2009), though, cautioned against generalizing from that island population to other herds. Nuñez et al. (2014) found elevated levels of fecal cortisol, a marker of physiological stress, in mares that changed bands. The research is inconclusive as to whether all the mares' movements between bands were related to the PZP treatments themselves or the fact that the mares were not nursing a foal, and did not demonstrate any long-term negative consequence of the transiently elevated cortisol levels. The authors (Nunez et al. 2014) concede that these effects "…may be of limited concern when population reduction is an urgent priority." In contrast to transient stresses, Creel et al (2013) highlight that variation in population density is one of the most well-established causal factors of chronic activation of the hypothalamic-pituitary-adrenal axis, which mediates stress hormones; high population densities and competition for resources can cause chronic stress. Creel also states that "…there is little consistent evidence for a negative association between elevated baseline glucocorticoids and fitness." Band fidelity is not an aspect of wild horse biology that is specifically protected by the WFRHBA of 1971. It is also notable that Ransom et al. (2014b) found higher group fidelity after a herd had been gathered and treated with a contraceptive vaccine; in that case, the researchers postulated that higher fidelity may have been facilitated by the decreased competition for forage after excess horses were removed. At the population level, available research does not provide evidence of the loss of harem structure among any herds treated with PZP. Long-term implications of these changes in social behavior are currently unknown, but no negative impacts on the overall animals or populations welfare or well-being have been noted in these studies.

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

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

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

*GnRH Vaccine*

The result that GonaCon treated mares may have suppressed estrous cycles throughout the breeding season can lead treated mares to behave in ways that are functionally similar to pregnant mares.

While successful in mares, GonaCon and other anti-GnRH vaccines are expected to induce fewer estrous cycles when compared to non-pregnant control mares. This has been observed in many studies (Garza et al. 1986, Curtis et al. 2001, Dalin et al. 2002, Killian et al. 2006, Dalmau et al.

2015). In contrast, PZP vaccine is generally expected to lead mares to have more estrous cycles per breeding season, as they continue to be receptive to mating while not pregnant. Females treated with GonaCon had less estrous cycles than control or PZP-treated mares (Killian et al. 2006) or deer (Curtis et al. 2001). Thus, concerns about PZP treated mares receiving more courting and breeding behaviors from stallions (Nunez et al. 2009, Ransom et al. 2010) are not generally expected to be a concern for mares treated with anti-GnRH vaccines (Botha et al. 2008).

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

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

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

Even in cases where there may be changes in band fidelity, the National Research Council's 2013 report titled *Using Science to Improve the BLM Wild Horse and Burro Program* ("NRC Report") found that harem changing was not likely to result in serious adverse effects for treated mares:

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

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

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

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

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

*Genetic Effects of Fertility Control Vaccinations*

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

Even if it is the case that repeated treatment with fertility control may lead to prolonged infertility, or even sterility in some mares, most HMAs have only a low risk of loss of genetic diversity if logistically realistic rates of contraception are applied to mares. Wild horses in most herd management areas are descendants of a diverse range of ancestors coming from many breeds of domestic horses. As such, the existing genetic diversity in the majority of HMAs does not contain unique or historically unusual genetic markers. Past interchange between HMAs, either through natural dispersal or through assisted migration (i.e. human movement of horses) means that many

HMAs are effectively indistinguishable and interchangeable in terms of their genetic composition. Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Their results show that the risk of the loss of genetic heterozygosity is extremely low except in case where starting levels of genetic diversity are low, initial population size is 100 or less, and the intrinsic population growth rate is low (5% per year), and very large fractions of the female population are permanently sterilized.

Many factors influence the strength of a vaccinated individual's immune response, potentially including genetics, but also nutrition, body condition, and prior immune responses to pathogens or other antigens (Powers et al. 2013). One concern that has been raised with regards to genetic diversity is that treatment with immunocontraceptives could possibly lead to an evolutionary increase in the frequency of individuals whose genetic composition fosters weak immune responses (Cooper and Larson 2006, Ransom et al. 2014a). This premise is based on an assumption that lack of response to PZP is a heritable trait, and that the frequency of that trait will increase over time in a population of PZP-treated animals. Cooper and Herbert (2001) reviewed the topic, in the context of concerns about the long-term effectiveness of immunocontraceptives as a control agent for exotic species in Australia. They argue that imunocontraception could be a strong selective pressure, and that selecting for reproduction in individuals with poor immune response could lead to a general decline in immune function in populations where such evolution takes place. Other authors have also speculated that differences in antibody titer responses could be partially due to genetic differences between animals (Curtis et al. 2001, Herbert and Trigg 2005). Although this topic may merit further study, lack of clarity should not preclude the use of immunocontraceptives to help stabilize extremely rapidly growing herds.

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

Magiafoglou et al. (2013) clarify that if the variation in immune response is due to environmental factors (i.e., body condition, social rank) and not due to genetic factors, then there will be no expected effect of the immune phenotype on future generations. It is possible that general health, as measured by body condition, can have a causal role in determining immune response, with animals in poor condition demonstrating poor immune reactions (NRC 2013).

Correlations between immune response and physical factors such as age and body condition have been documented; it remains untested whether or not those factors play a larger role in determining immune response to immunocontraceptives than heritable traits. Several studies discussed above noted a relationship between the strength of individuals' immune responses after treatment with GonaCon or other anti-GnRH vaccines, and factors related to body condition. For example, age at immunization was a primary factor associated with different measures of immune response, with young animals tending to have stronger and longer-lasting responses (Stout et al. 2003, Schulman et al. 2013). It is also possible that general health, as measured by body condition, can have a causal

role in determining immune response, with animals in poor condition demonstrating poor immune reactions (Gray 2009, NRC 2013). Miller et al. (2013) speculated that animals with high parasite loads also may have weaker immune reactions to GonaCon.

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

*Sex Ratio*

Population control methods including the adjustment of sex ratios to favor stallions would be expected to have relatively minor impacts to overall population dynamics. Under the Proposed Action and Alternative 4, impacts of additional stallions in the population could include: decreased band size, increased competition for mares, and increased size and number of bachelor bands. These effects would be slight, as the proposed sex ratio is not an extreme departure from normal sex ratio ranges. Conversely, a selection criterion, which leaves more mares than stallions, would be expected to result in fewer and smaller bachelor bands, increased reproduction on a proportional basis with the herd, and larger band sizes. With more stallions involved in breeding it should result in increased genetic exchange and improvement of genetic health within the herd.

*Water/Bait Trapping*

Bait and/or water 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/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 setup and perceived access restriction to the water/bait source.

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

Gathering of the excess horses utilizing bait/water trapping could occur at any time of the year and would extend until the target number of animals are removed to relieve concentrated use by horses in the area, reach AML, to implement population control measures, and to remove animals residing outside HMA boundaries. Generally, bait/water 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 bait and/or water trapping in this area is a low stress approach to gathering of wild horses, such trapping can continue into the foaling season without harming the mares or foals. Conversely, it has been documented that at times water trapping could be stressful to wild horses due to their reluctance related to 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.

The wild horses that are gathered would be subject to one or more of several outcomes listed below.

*Temporary Holding Facilities During Gathers*
Wild horses gathered would be transported from the trap sites to a temporary holding corral near the HMA in goose-neck trailers or straight-deck semi-tractor trailers. At the temporary holding corral, the wild horses will be aged and sorted into different pens based on sex. The horses will be provided ample supply of good quality hay and water. Mares and their un-weaned foals will be kept in pens together. All horses identified for retention in the HMA will be penned separately from those animals identified for removal as excess. All mares identified for release will be treated with fertility control vaccine in accordance with the SOPs for Fertility Control Implementation in Appendix F.

At the temporary holding facility, a veterinarian, when present, will provide recommendations to the BLM regarding care, treatment, and if necessary, euthanasia of the recently captured wild horses. Any animals affected by a chronic or incurable disease, injury, lameness or serious physical defect (such as severe tooth loss or wear, club foot, and other severe congenital abnormalities) would be humanely euthanized using methods acceptable to the American Veterinary Medical Association (AVMA).

*Transport, Short Term Holding, and Adoption Preparation*
Wild horses removed from the range as excess would be transported to the receiving short-term holding facility in a goose-neck stock trailer or straight-deck semi-tractor trailers. Trucks and trailers used to haul the wild horses will be inspected prior to use to ensure wild horses can be safely transported. Wild horses will be segregated by age and sex when possible and loaded into separate compartments. Mares and their un-weaned foals may be shipped together depending on age and size of foals. Mare and un-weaned foals are not separated for longer than 12 hours. Transportation of recently captured wild horses is limited to a maximum of 8 hours. 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.

Upon arrival, recently captured wild horses are off-loaded by compartment and placed in holding pens where they are fed good quality hay and water. Most wild horses begin to eat and drink immediately and adjust rapidly to their new situation. At the short-term holding facility, a veterinarian provides recommendations to the BLM regarding care, treatment, and if necessary, euthanasia of the recently captured wild horses. Any animals affected by a chronic or incurable disease, injury, lameness or serious physical defect (such as severe tooth loss or wear, club foot, and other severe congenital abnormalities) that was not diagnosed previously at the temporary holding corrals at the gather site would be humanely euthanized using methods acceptable to the AVMA. Wild horses in very thin condition or animals with injuries are sorted and placed in hospital pens, fed separately and/or treated for their injuries. 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.

After recently captured wild horses have transitioned to their new environment, they are prepared for adoption or sale. Preparation involves freeze-marking the animals with a unique identification number, vaccination against common diseases, castration, and de-worming. During the preparation process, potential impacts to wild horses are similar to those that can occur during transport. Injury or mortality during the preparation process is low, but can occur.

At short-term corral facilities, a minimum of 700 square feet is provided per animal. Mortality at short-term holding facilities averages approximately 5% (GAO-09-77, page 51), and includes animals euthanized due to a pre-existing condition, animals in extremely poor condition, animals that are injured and would not recover, animals which are unable to transition to feed; and animals which die accidentally during sorting, handling, or preparation.

*Adoption*
Adoption applicants are required to have at least a 400 square foot corral with panels that are at least six feet tall. Applicants are required to provide adequate shelter, feed, and water. The BLM retains title to the horse for one year and the horse and facilities are inspected. After one year, the applicant may take title to the horse at which point the horse becomes the property of the applicant. Adoptions are conducted in accordance with 43 CFR § 5750.

*Sale with Limitation*
Buyers must fill out an application and be pre-approved before they may buy a wild horse. A sale-eligible wild horse is any animal that is more than 10 years old; or has been offered unsuccessfully for adoption at least 3 times. The application also specifies that all buyers are not to sell to slaughter buyers or anyone who would sell the animals to a commercial processing plant. Sale of wild horses is conducted in accordance with the 1971 WFRHBA and congressional limitations.

*Long Term Pastures*
Since fiscal year 2008, the BLM has removed over 37,400 excess wild horses from the Western States. Most animals not immediately adopted or sold have been transported to long-term grassland pastures in the Midwest.

Potential impacts to wild horses from transport to adoption, sale or long-term grassland pastures (LTP) are similar to those previously described. One difference is that when shipping wild horses for adoption, sale or LTP, animals may be transported for up to a maximum of 24 hours. Immediately prior to transportation, and after every 24 hours of transportation, animals are offloaded and provided a minimum of 8 hours on-the-ground rest. During the rest period, each animal is provided access to unlimited amounts of clean water and two pounds of good quality hay per 100 pounds of body weight with adequate bunk space to allow all animals to eat at one time. The rest period may be waived in situations where the anticipated travel time exceeds the 24-hour limit but the stress of offloading and reloading is likely to be greater than the stress involved in the additional period of uninterrupted travel.

LTPs are designed to provide excess wild horses with humane, and in some cases, life-long care in a natural setting off the public rangelands. There, wild horses are maintained in grassland pastures large enough to allow free-roaming behavior and with the forage, water, and shelter necessary to sustain them in good condition. As of February 2012, about 31,400 wild horses that are in excess of the current adoption or sale demand (because of age or other factors such as economic recession)

are currently located on private land pastures in Oklahoma, Kansas, and South Dakota. Establishment of LTPs was subject to a separate NEPA and decision-making process. Located in mid or tall grass prairie regions of the United States, these LTPs are highly productive grasslands compared to the more arid western rangelands. These pastures comprise about 256,000 acres (an average of about 10-11 acres per animal).

Mares and sterilized stallions (geldings) are segregated into separate pastures except at one facility where geldings and mares coexist. Although the animals are placed in LTP, they remain available for adoption or sale to qualified individuals; and foals born to pregnant mares in LTP are gathered and weaned when they reach about 8-12 months of age and are also made available for adoption. The LTP contracts specify the care that wild horses must receive to ensure they remain healthy and well-cared for. Handling by humans is minimized to the extent possible although regular on-the-ground observation by the LTP contractor and periodic counts of the wild horses to ascertain their well-being and safety are conducted by BLM personnel and/or veterinarians. A small percentage of the animals may be humanely euthanized if they are in very poor condition due to age or other factors. Although horses residing on LTP facilities live longer, on the average, than wild horses residing on public rangelands, natural mortality of wild horses in LTP averages approximately 8% per year, but can be higher or lower depending on the average age of the horses pastured there (GAO-09-77, Page 52).

*Euthanasia and Sale Without Limitation*
While euthanasia and sale without limitation has been limited by Congressional appropriations, it is allowed under the WFRHBA. Neither option is available for horses under the Department of the Interior's fiscal year 20122017 budgetary appropriations. Although the appropriations restrictions could be lifted in future appropriations bills, it would be contrary to Departmental policy to euthanize or sell without limitations healthy excess wild horses.

*Wild Horses Remaining or Released into the HMA following Gather*
Under the Proposed Action, the post-gather population of wild horses would be about 75 wild horses, which is the low range of the AML for the Muddy Creek HMA under this alternative. Reducing population size would also ensure that the remaining wild horses are healthy and vigorous, and not at risk of death or suffering from starvation due to insufficient habitat coupled with the effects of frequent drought (lack of forage and water).

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, direct population wide impacts have proven, over the last 20 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 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 this proposed gather would be to herd population dynamics, age structure or sex ratio, and subsequently to the growth rates and population size over time.

The remaining wild horses not captured would maintain their social structure and herd demographics (age and sex ratios). No observable effects to the remaining population associated with the gather impacts would be expected except a heightened shyness toward human contact.

Impacts to the rangeland as a result of the current overpopulation of wild horses would be reduced under the two gather and removal alternatives. Fighting among stud horses would decrease since they would protect their position at water sources less frequently; injuries and death to all age classes of animals would also be expected to be reduced as competition for limited forage and water resources is decreased.

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 don't 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 mare rejects the foal. This occurs most often with young mothers or very young foals;
- The foal and mother become separated during sorting, and cannot be matched;
- The mare dies or must be humanely euthanized during the gather;
- The foal is ill, weak, or needs immediate special care that requires removal from the mother; or
- The mother does not produce enough milk to support the foal.

Often times, foals are gathered that were already orphans 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 SOPs as well and techniques used by the gather contractor help minimize the risks of heat stress. Heat stress does not occur often, but if it does, death can result.

Through the capture and sorting process, wild horses are examined for health, injury and other defects. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy. The BLM Euthanasia Policy (IM-2015-070) is used as a guide to determine if

animals meet the criteria and should be euthanized (refer to SOPs Appendix D). Animals that are euthanized for non-gather related reasons include those with old injuries (broken hip, leg) that have caused the animal to suffer from pain or which prevent them from being able to travel or maintain body condition; old animals that have lived a successful life on the range, but now have few teeth remaining, are in poor body condition, or are weak from old age; and wild horses that have congenital (genetic) or serious physical defects such as club foot, or sway back and should not be returned to the range.

### 4.2.2.4 Mitigation

The Proposed Action incorporates the Comprehensive Animal Welfare Program (CAWP) *(Appendix D*) which has been developed over time. The CAWP was developed as impacts were identified and represent the "best methods" for reducing impacts associated with gathering, handling, transporting and collecting herd data. All other mitigation measures were addressed previously in the proposed action. Additional mitigation measures are not warranted.

### 4.2.2.5 Cumulative Impacts

Cumulative impacts are impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively sizeable actions taking place over a period of time.

Past, present and reasonably foreseeable activities which would be expected to contribute to the cumulative impacts of implementing the Proposed Action include: Past wild horse selective removal gather which may have altered the structure and composition of the Muddy Creek HMA, continuing livestock grazing in the grazing allotments, continuing wildlife grazing, continuing wildlife management (adjustment of population numbers), and continued development of (mining/recreational) infrastructure. These past, present and reasonably foreseeable activities would be expected to generate cumulative impacts to the Proposed Action by influencing the habitat quality abundance and continuity for the Muddy Creek HMA wild horses.

The past events in these areas have created the current wild horse population with its associated structure and composition, and have shaped the patterns of use found today in the herd. Continued development of these parameters would be expected to result in small annual changes in herd structure and behavior with small changes in habitat use over time. These impacts would be expected to be marked by relatively large changes occurring rather slowly over time. The Price Field Office would continue to identify these impacts as they occur, and mitigate them as needed on a project specific basis to maintain habitat quality. At the same time, the horses in this HMA would be expected to continue to adapt to these small changes to availability and distribution of critical habitat components (food, water, shelter, space). The Proposed Action would contribute to the cumulative impacts of these past and foreseeable future actions by maintaining the herd at AML, and establishing a process whereby biological and/or genetic issues associated with herd or habitat fragmentation would become apparent sooner and mitigating measures implemented quicker.

The cumulative effects associated with the capture and removal of excess wild horses include gather-related mortality of less than 1% of the captured animals, about 5% per year associated with transportation, short term holding, adoption or sale with limitations and about 8% per year associated with long-term holding. These rates are comparable to natural mortality on the

range ranging from about 5-8% per year for foals (animals under age 1), about 5% per year for horses ages 1-15, and 5-100% for animals age 16 and older (Garrott and Taylor, 1990). In situations where forage and/or water are limited, mortality rates in the wild increase, with the greatest impact to young foals, nursing mares and older horses. Animals can experience lameness associated with trailing to/from water and forage, foals may be orphaned (left behind) if they cannot keep up with their mare, or animals may become too weak to travel. After suffering, often for an extended period, the animals may die. Before these conditions arise, the BLM generally removes the excess animals to prevent their suffering from dehydration or starvation.

While humane euthanasia and sale without limitation of healthy horses for which there is no adoption demand is authorized under the WFRHBA, Congress prohibited the use of appropriated funds between 1987 and 2004 and again in 2010 to present for this purpose. If Congress were to lift the current appropriations restrictions, then it is possible that excess horses removed from the HMA over the next 10 years could potentially be euthanized or sold without limitation consistent with the provisions of the WFRHBA.

The other cumulative effects which would be expected when incrementally adding either of the Action Alternatives to the cumulative study area would include continued improvement of upland and riparian vegetation conditions, which would in turn benefit permitted livestock, native wildlife, and wild horse population as forage (habitat) quality and quantity is improved over the current level. Benefits from a reduced wild horse population would include fewer animals competing for limited forage and water resources. Cumulatively, there should be more stable wild horse populations, healthier rangelands, healthier wild horses, and fewer multiple use conflicts in the area over the short and long-term. Over the next 15-20 years, continuing to manage wild horses within the established AML range would achieve a thriving natural ecological balance and multiple use relationship on public lands in the area. Native wildlife, and wild horse population as forage (habitat) quality and quantity is improved over the current level. Benefits from a reduced wild horse population would include fewer animals competing for limited forage and water resources. Cumulatively, there should be more stable wild horse populations, healthier rangelands, healthier wild horses, and fewer multiple use conflicts in the area over the short and long-term. Over the next 15-20 years, continuing to manage wild horses within the established AML range would achieve a thriving natural ecological balance and multiple use relationship on public lands in the area.

### 4.2.2.6 Monitoring Plan

Monitoring procedures to address specific habitat variables have been established in the Bureau's 4400 and 1734 series handbooks. These monitoring protocols are the accepted Bureau methodologies for collecting habitat based information to determine achievement of habitat based objectives and the standards for rangeland health as developed by the Utah Resource Advisory Council. Specific habitat monitoring procedures and key area selection has already occurred. These methodologies and sites would continue to be used under this Proposed Action. Species monitoring protocols and data collection methods have been established by equine professionals and researchers who initiated the first round of these studies (animal handling techniques). Bureau practices are based on these procedures which are incorporated into both the Proposed Action and alternatives as animal handling techniques. These animal handling techniques would be sufficient to determine the short- and long-term effects of implementing the Proposed Action or alternatives.

## 4.2.5 Alternative 3: Gather and Removal without Fertility

### 4.2.5.1 Livestock Grazing

Direct and Indirect impacts to Livestock under Alternative 3 will similar in nature to those addressed in Alternative 2 (Proposed Action).

### 4.2.5.2 Vegetation

Impacts of the gather and removal would be similar to Alternative 2; however, wild horse populations may increase at a faster rate and exceed the high end AML sooner. Increasing competition between livestock and wild horses sooner.

### 4.2.5.4 Wild Horses

Direct and Indirect impacts to Wild Horses under Alternative 3 will similar in nature to those addressed in Alternative 2 (Proposed Action). Fertility control would not be utilized, and the sex ratio would be maintained at approximately 50/50 male to female. Due to both of these agents not being utilized it is believed that the herd will grow at a faster rate than the proposed action which would lead to an increased gather schedule over the proposed action to maintain AML.

### 4.2.5.5 Mitigation

Same as the Proposed Action

### 4.2.5.6 Cumulative Impacts

Cumulative Impacts related to Alternative 3 would be similar in nature to those analyzed for the Proposed Action.

### 4.2.5.7 Monitoring Plan

Same as the Proposed Action

# 5.0 CONSULTATION AND COORDINATION:

The Utah State Office initiated public involvement at a public hearing about the use of helicopters and motorized vehicles to capture and transport wild horses (or burros) on December 12, 2017 at the BLM's Fillmore Office in Fillmore, Utah. This specific gather was not addressed at that public meeting, though other gathers that are planned within the state of Utah over the next 12 months were. This meeting was advertised in papers and radio stations statewide. During this meeting, the public is given the opportunity to present new information and to voice any concerns regarding the use of these methods to capture wild horses. This process has been in place for over 20 years, and relevant issues associated with these methods have been addressed in the CAWP *(Appendix D*).

Other public meetings have been held and public comment has been solicited on multiple occasions during the formulation of other documents related to the management of wild horses. This input has been carefully considered and has guided the development of this Proposed Action and alternatives. The following concerns were identified in these past meetings.

The capture methodologies currently employed, and proposed for continuation under the Proposed Action and alternatives, have been reviewed in detail. Comments pertaining to this aspect of wild horse management have included concerns over the rate at which horses are herded to the trap site, the timing of the gather, the methods for transporting animals, and the numbers of horses which are captured using various types of capture. BLM developed policy and practices which addressed each of these concerns. These policies/practices have become standard procedure.

## 5.1 Introduction:

The issue identification section of Chapter 1 identifies those issues analyzed in detail in Chapter 4. Appendix A provides the rationale for issues that were considered but not analyzed further. The issues were identified through the public and agency involvement process described in sections 5.2 and 5.3 below.

PUBLIC NOTICE AND AVAILABILITY

Public involvement was initiated on this Proposed Action on November 17, 2017 by posting on the ePlanning web page and in the public rooms in the Price Field Office and Utah State BLM Office. The Notice described the Proposed Action and solicited public input.

## 5.2 Persons, Groups, and Agencies Consulted:

**Table 5-2:**
**List of all Persons, Agencies and Organizations Consulted for Purposes of this EA**

| Name | Purpose & Authorities for Consultation or Coordination | Findings & Conclusions |
|---|---|---|
| Native American Tribes interested in projects within the Price Field Office: Northwestern Band of Shoshoni Nation, Paiute Indian Tribe of Utah, Navajo Nation, Ute Indian Tribe, Hopi Tribe, Southern Ute Tribe, Ute Mountain Ute Tribe, Pueblo of Zuni, Pueblo of Jemez, Shoshone Bannock Tribes, Eastern Shoshone Tribe | Consultation for undertaking, as required by the *Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act*, and various executive orders (e.g., Executive Order 13007) | Identified tribes were notified by letter dated June 22, 2017 to describe the proposed action and find out if the tribes have any issues concerning the proposed action. None of the tribes have responded identifying any concerns. Lack of response is interpreted by BLM to indicate that the tribes have no concerns relative to the proposed action |
| State of Utah, State and Institutional Trust Lands Administration, Renewable Resource Specialist | Consult with SITLA as the agency in control of state lands within the project area | |
| Emery County Commissioners | Consult with County | |
| Utah Div. of Wildlife Resources | Consult with UDWR as the agency with expertise on impacts on game species | Data and analysis regarding big game species incorporated into Chapters 3 and 4. |
| Deniz Bolbol, American Wild Horse Preservation Campaign / Wild Horse Defenders | Consult with identified Interested Publics | |
| Neda Demayo, Return to Freedom | Consult with identified Interested Publics | |
| Mathew Dillon, Pryor Mountain Wild Mustang Center | Consult with identified Interested Publics | |
| Kathy Greg | Consult with identified Interested Publics | |
| D.J. Schubert, Animal Welfare Institute | Consult with identified Interested Publics | |
| Ginger Kathrens, Cloud Foundation | Consult with identified Interested Publics | |
| Courtney McVean, Friends of Animals | Consult with identified Interested Publics | |
| Grazing Permittees | Consult with identified Interested Publics | |

## 5.3 Summary of Public Participation

During preparation of the EA, the public was notified of the proposed action by posting on the ePlanning web page on November 17, 2017.

A Draft Environmental Assessment (EA) for the Muddy Creek Wild Horse Gather DOI-BLM-UTG020-2017-0032-EA was made available to the public at the Price Field Office and on-line at http;//www.blm.gov/programs/wild-horse-and-burro/herd-management/gathers-and-removals or on the e-Planning web page at: https://eplanning.blm.gov/epl-front-office/eplanning/nepa/nepa_register.do; for a 30-day review/comment period beginning on April 20, 2018 and Ending May 20, 2018.

### 5.3.1 Comment Analysis
Comments received during the 30-day public comment period are addressed in Appendix J.

## 5.4 List of Preparers
### 5.4.1 BLM

| Name | Title | Responsible for the Following Section(s) of this Document |
|---|---|---|
| Mike Tweddell | Range Management Specialist/Wild Horse and Burro Specialist, (PFO). | Project lead and provided information on plan conformance, Environmental Justice, Livestock Grazing, Rangeland Health, Socio-Economic, Vegetation and Wild Horse issues |
| Jacob Palma | Environmental Coordinator, (PFO). | Reviewed this document for the format and National Environmental Policy Act (NEPA) conformance |
| Stephanie Bauer | Range Management Specialist, (PFO). | Contributed information pertaining to Invasive Species/Noxious Weeds, Woodland/Forestry |
| Nicole Lohman | Archaeologist, (PFO). | Contributed information pertaining to Cultural and Native American Religious Concerns |
| Ben Kraja | Recreation Planner, (PFO). | Contributed information on ACEC, BLM Natural Areas, Recreation, Wild and Scenic Rivers, and Areas with Wilderness Character. |
| Dana Truman | Wildlife Biologist (PFO) | Contributed information pertaining to BLM Sensitive Animal Species, BLM Sensitive Plant Species, Fish and Wildlife, Migratory Birds, Threatened and Endangered Plants, Threatened and Endangered Animals. |
| Jeffery Brower | Hydrologist (PFO) | Contributed information on Air Quality, Greenhouse Gas Emissions, Farmlands, Floodplains, Hydrologic Conditions, Soils, Wastes (hazardous of solid), and Water Quality. |
| Karl Ivory | Range Management Specialist, (PFO) | Contributed information on Wetlands/Riparian Zones. |
| Dan Dull | Recreation Planner (PFO) | Contributed information on Wilderness/WSA |
| Mike Glasson | Natural Resource Specialist (PFO) | Contributed information on Geology/ Mineral Resources |
| Michael Knight | GIS Specialist (PFO) | Contributed information on Visual Resources. |
| Mike Leschin | Paleontologist (PFO) | Contributed information on Paleontological resources |
| Stuart Bedke | Fuels Coordinator (PFO) | Contributed information on Fuels / Fire Management |
| Connie Leschin | Realty Specialist (PFO) | Contributed information on Lands / Access |
| V. Gus Warr | Wild Horse and Burro Specialist, Utah State Office (USO) | Consult with USO for program conformance and coordination within State and with Washington |
| Paul Griffin | Wild Horse and Burro Specialist, Washington Office, (WO) | Contributed information on fertility control. |

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## 6.2 Glossary:

Appropriate Management Level - The number of wild horses and burro which can be sustained within a designated herd management area which achieves and maintains a thriving natural ecological balance keeping with the multiple-use management concept for the area.

Authorized Officer - An employee of the BLM to whom has been delegated the authority to perform the duties described in these Standard Operating Procedures. See BLM Manual 1203 for explanation of delegation of authority.

Census - The primary monitoring technique used to maintain a current inventory of wild horses and burros on given areas of the public lands. Census data are derived through direct visual counts of animals using a helicopter.

Contracting Officer (CO) - Is the individual responsible for an awarded contract, deals with claims, disputes, negotiations, modifications, payments and appoints COTRs and PIs.

Contacting Officers Technical Representative (COTR) - Acts as the technical representative for the CO on a contract ensures that all specifications and stipulations are met. Reviews the contractor's progress, advises the CO on progress, problems, costs, etc., is responsible for review, approval, and acceptance of services.

Evaluation - A determination based on studies and other data that are available as to if habitat and population objectives are or are not being met and where an overpopulation of wild horses and burros exists and whether actions should be taken to remove excess animals.

Excess Wild Horses or Burros - Wild free-roaming horses or burros which have been removed from public lands or which must be removed to preserve and maintain a thriving ecological balance and multiple-use relationship.

Gather Research Coordinator (GRC)- A BLM employee that is designated by the Field Office Manager prior to each gather, who identifies potential problem areas in research data collection, determines need for additional field assistance to meet sampling requirements, ensures compliance with all data sampling, and communicants and coordinates all data gather during a gather with the Field Office Manager, WO260 National Research Coordinator, Colorado State University Center of Veterinary Epidemiology and Animal Disease and Surveillance Systems (CSU-CVEADSS), and Animal Plant Health Inspection Service (APHIS).

Genetically Viable - Fitness of a population as represented by its ability to maintain the long-term reproductive capacity of healthy, genetically diverse members.

Health Assessment - Evaluation process based on best available studies data to determine the current condition of resources in relation to potential or desired conditions.

Healthy Resources - Resources that meet potential or desired conditions or are improving toward meeting those potential or desired conditions.

Herd Area - The geographical area identified as having been used by wild horse and burro populations in 1971, at the time of passage of the Wild Free-roaming Horse and Burro Act.

Herd Management Area - The geographical area as identified through the land use planning process established for the long-term management of wild horse and burro populations. The boundaries of the herd management area may not be greater than the area identified as having been used by wild horse and burro populations in 1971, at the time of passage of the Wild Free-roaming Horse and Burro Act.

Invasive Weeds - Introduced or noxious vegetative species which negatively impact the ecological balance of a geographical area and limit the areas potential to be utilized by authorized uses.

Metapopulation: Two or more local breeding populations which are linked to one another by dispersal activities of individual animals (Coates-Markle, 2000).

Monitoring - Inventory of habitat and population data for wild horses and burros and associated resources and other authorized rangeland uses. The purpose of such inventories is to be used during evaluations to make determinations as to if habitat and population objectives are or are not being met and where an overpopulation of wild horses and burros exists and whether actions should be taken to remove excess animals.

Multiple Use Management - A combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals watershed, domestic livestock, wild horses, wild burros, wildlife, and fish, along with natural, scenic, scientific, and historical values.

Refugia – In biology, a refugium (plural: refugia) is a location which supports an isolated or relict population of a once more widespread species. (Wikipedia)

## 6.3 List of Acronyms Used in this EA:

AML – Appropriate Management Level
APHIS – Animal and Plant Health Inspection Service
AUM – Animal Unit Month
BLM – Bureau of Land Management
CFR – Code of Federal Regulations
CWCS - Utah Comprehensive Wildlife Conservation Strategy
DR – Decision Record
EA – Environmental Assessment
EIS – Environmental Impact Statement
FLPMA – Federal Land Policy & Management Act
FONSI – Finding of No Significant Impact
GRC – Gather Research Coordinator
He – Expected Heterozygosity
Ho – Observed Heterozygosity
HMA – Herd Management Area
IBLA – Interior Board of Land Appeals
IM – Information Memorandum
MFP – Management Framework Plan
NEPA – National Environmental Policy Act
NOAA – National Oceanic and Atmospheric Administration
PFO – Price Field Office
PRIA – Public Rangelands Improvement Act
PZP – Porcine Zona Pellucidae
RMP – Resource Management Plan
SOP – Standard Operating Procedures
SRRMP – San Rafael Resource Management Plan
TGA – Taylor Grazing Act
UDWR – Utah Division of Wildlife Resources

USFWS – United States Fish & Wildlife Services
USO – Utah State Office
WFRHBA – Wild Free Roaming Horse & Burro Act
WHB – Wild Horse and Burro

## APPENDICES:

**APPENDIX A: - Interdisciplinary Team Analysis Record Checklist**
**APPENDIX B: - Public Notice describing the Proposed Action**
**APPENDIX C: -Wild Horse Aerial Inventory of the Muddy Creek HMA (08-23-2017)**
**APPENDIX D: - Comprehensive Animal Welfare Program (Welfare Assessment Standards for Gathers)**
**APPENDIX E: - Additional Design Features**
**APPENDIX F: - Standard Operating and Post-Treatment Monitoring Procedures**
**APPENDIX G: - PZP Mixing Procedures**
**APPENDIX H: - Immunocontraception Data Sheet**
**APPENDIX I: - Population Modeling for Muddy Creek HMA**
**APPENDIX J: - Comment Response**

**MAPS**
**Map 1**